COUNTY OF SARASOTA, FLORIDA

ECOLOGICAL STATUS OF LITTLE SARASOTA BAY

with reference to

MIDNIGHT PASS

FEBRUARY 1985

COASTAL ZONE MANAGEMENT DIVISION

OF

NATURAL RESOURCES MANAGEMENT

Sauers, Steven

County of Sarasota, Florida

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ACKNOWLEDGEMENTS

The technical information assembled in this report represents an important function of the Natural Resources Management Department (NRMD) in bringing scientifically based facts to bear on the decision making process. It is the primary purpose of our Department to preserve, protect, and enhance the resources of the coastal zone. These objectives are realized through rational planning that utilizes the best available information. Baseline studies such as this report are necessary for providing a high level of understanding of our natural resources.

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Program funding was made available by the Board of County Commissioners.

SUMMARY AND RECOMMENDATIONS

1. Little Sarasota Bay as a whole did not deteriorate significantly during 1984 as a result of closure of Midnight Pass.

   - The record of State water quality violations for the Bay during 1984 indicated bacterial and dissolved oxygen levels occasionally exceeded Class III water quality criteria. These conditions are consistent with recent historical trends for the Bay.
   - More significant water quality impacts resulting from runoff are expected to occur when rainfall amounts return to normal levels.

2. Little Sarasota Bay was found to exhibit ecologically distinct regions. The immediate vicinity of Midnight Pass in the area surrounding the Bird Keys was found to be ecologically distinct from the Bay as a whole.

   - A null zone of no distinct water movement was identified in the central region of the Bay which was associated with low salinities, wide dissolved oxygen ranges, and high color values.
   - Nutrient levels exhibited a north to south gradient in the Bay with elevated nitrogen, silicate, and chlorophyll levels in the vicinity of Midnight Pass.
   - Phytoplankton abundance and macroalgae populations paralleled nutrient trends with a north to south gradient, except for peak abundance near Midnight Pass.

3. The bay-side vicinity of Midnight Pass exhibited poorer ecological conditions than the gulf-side vicinity of the former inlet.

   - Larval pelagic fishes were poorly represented on the bay-side as compared to the gulf-side of Midnight Pass. The lack of a "corridor" for direct access was implicated in reducing the nursery and shelter value of the Bay.
   - Lack of tidal exchange resulted in the trapping of freshwater runoff within the middle region of the Bay, which led to eutrophic conditions (i.e., nutrient enriched waters subject to plankton blooms).

4. Based upon limited historical information, the ecological character of Little Sarasota Bay as a whole and the Gulf of Mexico in the vicinity of the former inlet has not changed significantly over the past decade.

5. The immediate bay-side vicinity of Midnight Pass has been affected by inlet closure. This area represents thirty percent (30%) of the total Little Sarasota Bay area.

6. Probable trends for the Midnight Pass/Little Sarasota Bay area were identified if the Pass remains closed or is opened. If the Pass is left closed, poor ecological conditions within the Bay will persist. If the Pass is opened, poor ecological conditions will be displaced to other regions of the Bay or adjacent bays (i.e., shift in null circulation zones).

7. The results of this ecological monitoring program support the findings of the Blue Ribbon Panel (Appendix) which concluded, in part:
   - Midnight Pass is a mediating factor in diluting pollutants in Little Sarasota Bay.
   - The Midnight Pass/Little Sarasota Bay area is an altered system in a semi-natural state.
   - Pollution impact on Little Sarasota Bay will be exacerbated by the lack of exchange with the Gulf of Mexico.

Recommendations-

1. In view of the fact that ecological benefits as well as navigational and recreational benefits of Little Sarasota Bay are maximized by Midnight Pass, the inlet should be reopened.

2. Recommended safeguards identified and elaborated upon elsewhere in this report (i.e., Chapter IX) should be implemented. These include:
   - Stormwater and groundwater controls.
   - Continued ecological monitoring.
   - Habitat restoration.
   - Limited channel improvements and maintenance.

3. Potential improvements in circulation should be modeled in order to assess their design capacity to provide net circulation enhancement.

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I. INTRODUCTION

Background

The ecological monitoring program of the Midnight Pass/Little Sarasota Bay area was initiated in May 1984 at the urging of County staff and Blue Ribbon Panel members. The Blue Ribbon Panel was convened in November 1983 prior to the closing of Midnight Pass. The Panel's purpose was to consider options and to make recommendations associated with long range management of the Pass area. The local issue of what to do with the Midnight Pass area had simmered for years since the early 1970's and was suddenly thrust into the fire when the migration of the Pass threatened to destroy two private homes fronting on the Gulf of Mexico.

During the Panel's deliberations on questions of altering or not altering Midnight Pass, the Pass was inadvertently closed as a consequence of an unsuccessful attempt by the threatened property owners to relocate the inlet channel. The channel relocation had been authorized by a local ordinance passed October 4, 1983. The extent of alteration (i.e., total inlet closure) cast a new light on the recommendations of the Blue Ribbon Panel, which included:

> "... that the following courses of action be taken, independent of any action to open the Pass... That action be taken to monitor the present and future water quality and biota in Little Sarasota Bay, inlet and bay hydraulics, and the position of the beach in the vicinity of the Pass, so that future decisions can be made with a better understanding of actual conditions." (1)

A monitoring program was justified by Panel members in that a lack of detailed information about the Pass and Bay area had hampered the Panel in their efforts. After the inlet was closed, the Panel considered it imperative to follow the response of Little Sarasota Bay to inlet closure. There was no preconceived notion that the Bay would change immediately or over a longer period; the Panel's feeling was that additional technical information would support any attempt at future management regardless of the nature of decisions to be made.

Scope

The monitoring program was devised under a cooperative effort by Mote Marine Laboratory and the Sarasota County Coastal Zone Management Division. The contract scope of work involved eleven (11) task elements which were designed to assess the ecological status of Little Sarasota Bay. A tabular summary of the task elements and work schedule appears in Table 1. Sampling stations are shown in Figures 1 and 2. The Coastal Zone Management Division (CZM) and the University of South Florida Geology Department (USF) each undertook specific tasks while the bulk of the work effort on remaining tasks was conducted by Mote Marine Laboratory (MML).

The report summarizes the findings of the monitoring program in order to create a context easily understandable by the concerned citizen. While the information generated by this monitoring program will be used as the basis for continued technical investigation and long-range planning and resource management, it will also serve to reveal the present ecological status of Little Sarasota Bay.

II. GEOGRAPHICAL SETTING

Little Sarasota Bay is a seven (7) mile long, narrow embayment (i.e., lagoon) separated from the Gulf of Mexico by two barrier islands, Siesta Key and Casey Key. Until recently, it was directly connected to the Gulf of Mexico by Midnight Pass between these islands. Little Sarasota Bay has secondary (indirect) connections with the Gulf of Mexico via the Intracoastal Waterway (ICW) through Roberts Bay and Big Pass to the north and through Dryman/Blackburn Bays and Venice Inlet to the south. Historically, there were other locations for direct Gulf connection with Little Sarasota Bay, namely Little Sarasota Pass (1883) and Muskateers Pass (1921).

The drainage basin of Little Sarasota Bay encompasses a land area of 15.0 square miles. Several tidal creeks flow relatively short distances into Little Sarasota Bay, e.g.: Matheny Creek, Elligraw Bayou, Clower Creek, Catfish Creek, and North Creek. While the drainage basin is approximately 30 percent developed, development is proceeding throughout the remaining portions of the basin at a rapid pace.

Table 1. Midnight Pass/Little Sarasota Bay Ecological Monitoring Program
1984 SAMPLING SCHEDULE SUMMARY

Contract Scope of Work	May		June		July		August		September		October		November
	Sampling Episode												
TASKS	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	...
1) Bathymetry				6/26-28									
2) Hydrography	5/16		6/11		7/18		8/14		9/11			10/25	
3) Water Quality	5/16		6/11		7/18		8/14		9/11			10/25	
4) Dye Release	. . .	. . .	. . .	Task	Abandoned	. . .	. . .	. . .	. . .	. . .	. . .	. . .	
5) Sediment Mapping (USF)	5/16 5/17		6/13				8/6 8/7			9/25		10/30	11/8
6A) Phytoplankton	5/16	5/31	6/11	6/25	7/18	7/26	8/8	8/14	9/5	9/11	10/4	10/25	
6B) Ichthyoplankton/ Zooplankton	5/17	5/31	6/13	6/25	7/13 7/19	7/26	8/8	8/21	9/5	9/19 9/20	10/4	10/17	
7) Macroalgae	5/17 5/21	5/31 6/2	6/12	6/29	7/12 7/26	7/27 7/30	8/9	8/23 8/24	9/6 9/10	9/20	10/4 10/5	10/18 10/19	
8) Seagrasses (CZM)		5/31 6/1	6/19		7/5	7/17	8/2	8/21	9/7	9/21	10/5	10/24	11/8
9) Benthic Infauna	5/17		6/12		7/16			8/16		9/18		10/24	
10) Crab Migration	. . .	. . .	. . .	Task	Abandoned	. . .	. . .	. . .	. . .	. . .	. . .	. . .	

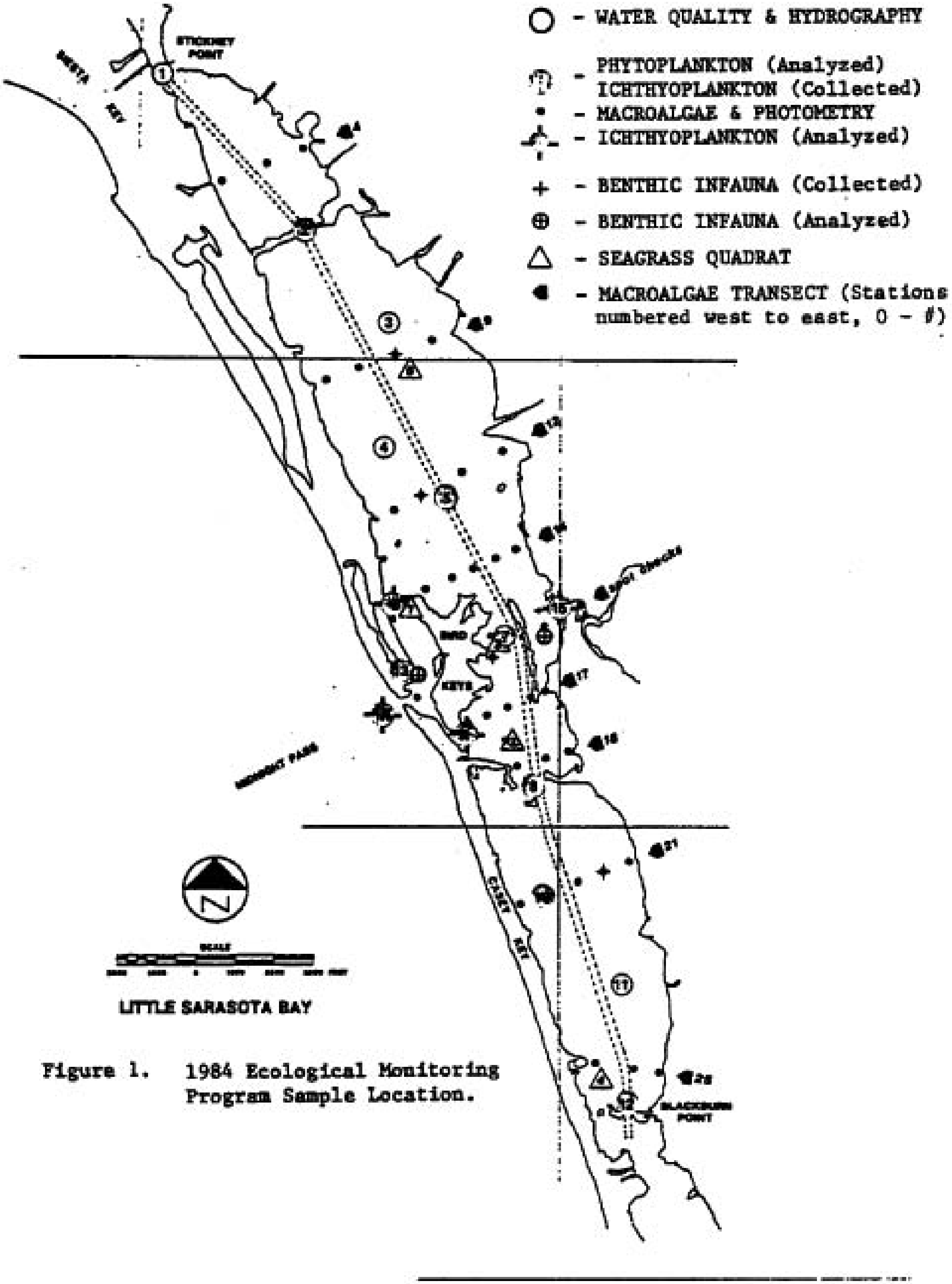


Figure 1. 1984 Ecological Monitoring Program Sample Location.

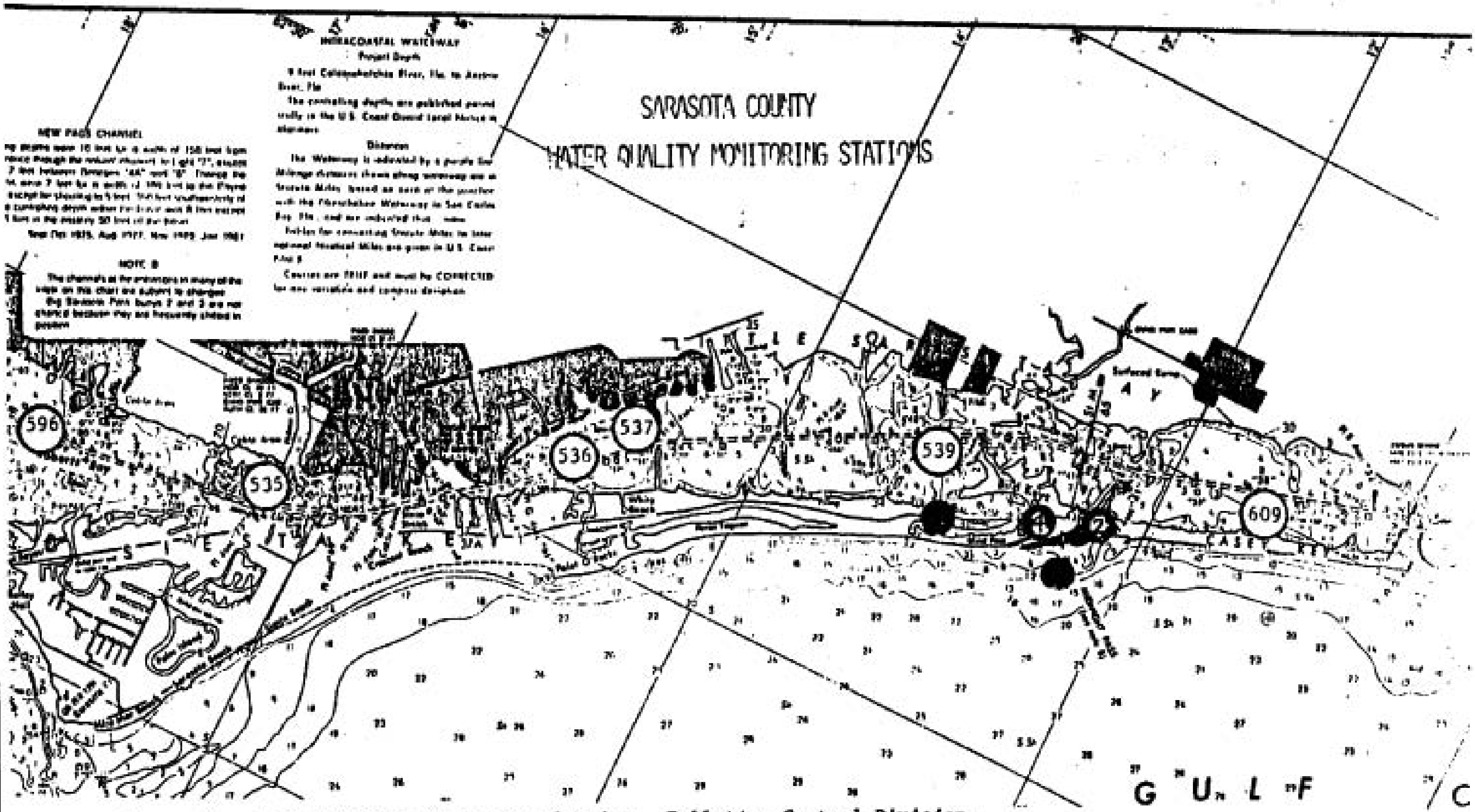


Figure 2. Water Quality Monitoring Stations, Pollution Control Division.

Stations 1, 2, 3, and 4 sampled 12/19/83 through 8/22/84 only, all others approximately monthly.

Rainfall is highly seasonal in nature, averaging about 53 inches annually. About 65 percent of the annual rainfall occurs in the four month period June through September. Historically, annual average rainfall has ranged from a minimum of 34 inches to a maximum of 93 inches.(3) Analysis has shown that 14.8 inches of rainfall excess or runoff over this drainage basin is equivalent to the entire volume of the Bay.(4) Single rainfall events of one half this volume occur frequently. These amounts can have a significant effect on salinity and the water quality of the Bay as well as having a major impact on channel scouring within the inlet. The potential wasteloads from septic tank systems, waterfront marinas, improved and unimproved pastureland, roadways, and land development activities are significant but not well documented in Little Sarasota Bay.

Approximately 80 percent of the natural shores have been altered by dredging, filling, or the construction of seawalls and revetments.(5) Manmade drainage networks (i.e., canals, pipes, ditches) have altered the historical patterns of surface water runoff. Natural shores and flood prone upland areas are critical in the overall biological treatment and assimilation of waste.

Little Sarasota Bay is designated as Class III State waters.(6) Shellfish harvesting is not approved for these waters due to concentrations (both real and potential) of fecal coliform bacteria and fecal viruses from human waste.

III. BAY CONDITION DURING 1984

Did the condition of Little Sarasota Bay deteriorate during 1984? In order to create a context for comparison, we examined basic hydrographic parameters for Little Sarasota Bay during 1984. Figure 3 depicts the 1984 record of precipitation averaged from four stations within Sarasota County. Monthly totals ranged from 6.6 inches in July to 0.2 inches in December. The annual total precipitation averaged 33.9 inches. This relatively low annual rainfall amount is nearly a record minimum since 1944. Less than half (45%) of the total rainfall occurred during June through September. This period normally accounts for two-thirds of the annual rainfall. In sum, the year 1984 was dry with little seasonal variation in rainfall amounts.

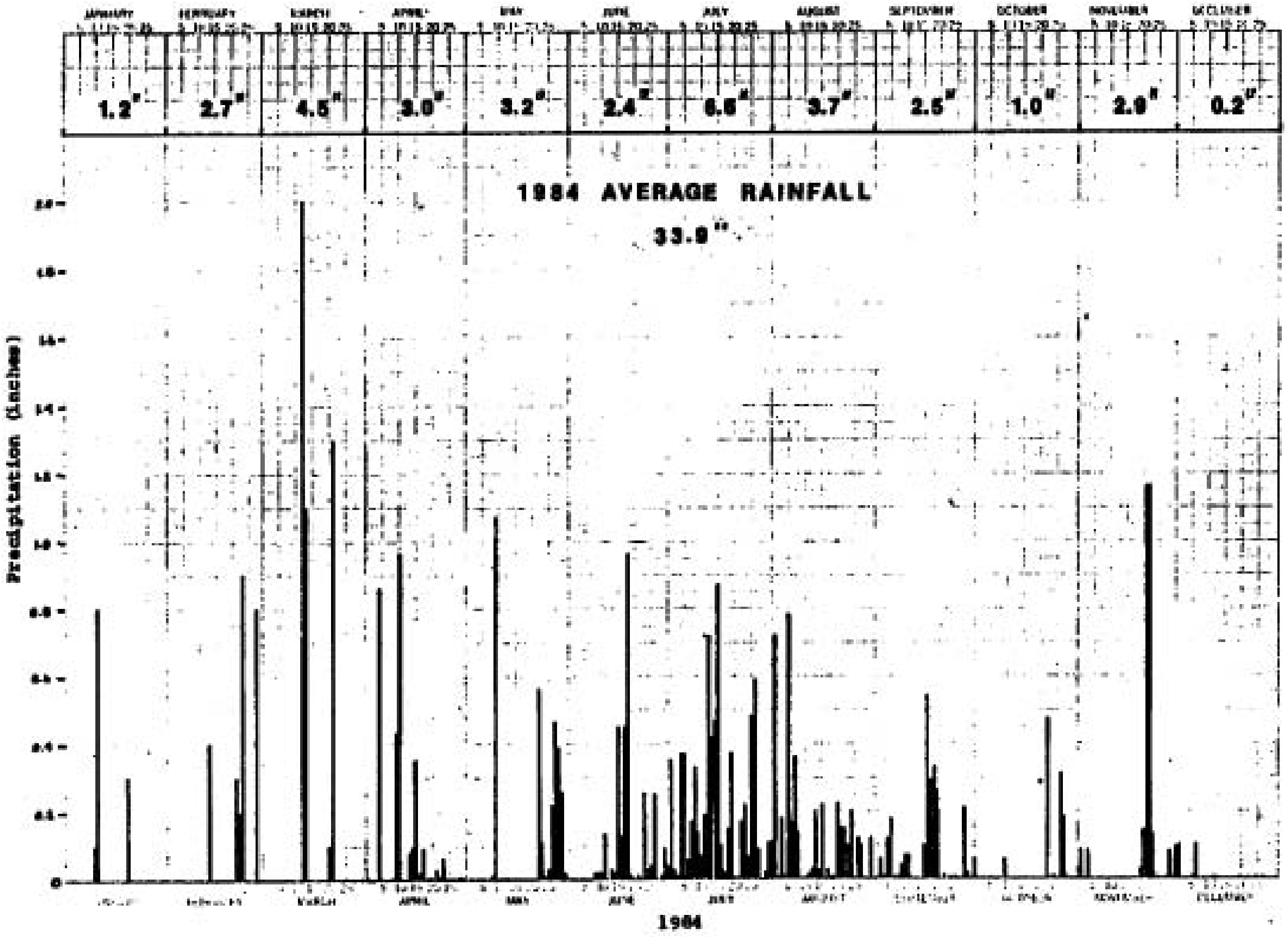


Figure 3. Average Daily, Monthly, and Annual Precipitation for 1984 in Sarasota County.

Data compiled from Pollution Control Division Monthly Reports for four (4) rain gauge locations within County.

The consequences of low rainfall are revealed in salinity trends in Little Sarasota Bay during 1984. Salinity in the Bay ranged from a maximum of 35.7 parts per thousand (o/oo) to a minimum of 23.4 o/oo (Figures 10 and 26). Average salinity varied spatially throughout the Bay from 29.6 to 31.2 o/oo. Comparable 1984 monitoring by Sarasota County Pollution Control (SCPC) revealed salinities of 32.0 o/oo maximum to 15.0 o/oo minimum. In comparison, 1983 SCPC data ranged from 30.0 o/oo to 16.0 o/oo. On a bay-wide basis salinities were depressed for periods of time following rainfall events but recovered to recent average conditions quickly. Maximum salinities were somewhat higher than previous years due to the low, uniform monthly rainfall.

The sampling program was designed to bracket the warm wet season (May-October) which would likely show the most significant impacts. Because 1984 was a dry year, little seasonal variation in rainfall was apparent. Given this condition, the analysis of Bay quality was simplified since the temporal data base was more directly comparable and representative of annual average conditions.

A summary of violations of State water quality standards is shown in Tables 2 and 3. Water quality standards for Little Sarasota Bay have been established according to its classification as Class III State waters. This classification is based upon public benefit. Class III State waters are used for recreation, as well as the propagation and maintenance of healthy, well balanced populations of fish and wildlife. Class II State waters are used for shellfish propagation or harvesting, while Class I State waters are used as potable water supplies. Each higher class has more stringent water quality standards than the next lower class.

During the 1984 Little Sarasota Bay monitoring program, nine (9) violations of the dissolved oxygen standard were reported during twelve sampling dates (173 observations). Considering SCPC monitoring for ten other sampling dates, three (3) additional dissolved oxygen violations were reported in 1984 (50 observations). In comparison, SCPC monitoring revealed fourteen (14) dissolved oxygen violations during 1983 for ten sampling dates (50 observations). The number of violations in 1984 are considered few, although we recognize that most measurements were made in daylight so that nighttime oxygen minima were not observed.

Table 2. Water Quality Violations Summary - Little Sarasota Bay (LSB) Vicinity. Data supplied by Sarasota County Pollution Control Lab based on approximate bimonthly sampling. Revised 1/31/85.

Station Number	Location	Violations n=10 1984	n=10 1983	n=6 1982	n=8 1981	n=10 1980	n=10 1979
535	Phillippi Creek (mouth)	0	000 000#XXX	#	X	0###	0
536	LSB #57 (ICW)	X	000XX			0	#
537	Coral Cove (canal mouth)	00XXX	00000X	0	00		000
539	LSB #48 (ICW)						
609	LSB #38 (ICW)						

0 Indicates single Dissolved Oxygen determination below State standards (< 4.0 ppm).

\# Indicates single total coliform bacteria determination above State standards (≥ 2,400 colonies/100 ml).

X Indicates single fecal coliform bacteria determination above State standards (≥ 800 colonies/100 ml).

Table 3. 1984 Water Quality Violations Summary - Little Sarasota Bay Ecological Monitoring Program. Twelve sample dates.

Station Number	Violations	Date
1	0	8/8
5	0	9/11
6	00	6/25, 8/8
9	00	8/8, 8/14
13	000	8/8, 8/14, 9/11

0 Indicates single Dissolved Oxygen determination below State standards (< 4.0 ppm).

Regarding bacteriological quality, Pollution Control reported four (4) fecal coliform violations during 1984 for ten sampling dates. Similar monitoring in 1983 revealed six (6) fecal coliform violations and one (1) total coliform violation for ten sampling dates. In general, the observed trend of 1984 water quality violations was consistent with recent historical trends for the Bay.

Color is one of the most visually apparent water quality parameters of those tested in 1984. The casual visitor to the bay perceives not just the degree of clarity or murkiness, but the shades of light or dark and the tint from green or blue to red or brown. A comparison of color values for the waters of Little Sarasota Bay is shown in Table 4. Color values are determined on a scale that ranges from clear to tea colored. As perceived visually from shore, 40-50 color units appears tea colored, while 5-10 units appear clear. The color is produced by leachate from vegetation, debris, and soils during rainfall. From May through October 1984 color ranged throughout the Bay from 28 units maximum to 5 units minimum with an overall average of 14 units. Comparable data for the entire year from Pollution Control monitoring indicated a slightly wider range for two mid-Bay stations (#539 and #609) of 45 units maximum to 10 units minimum with an average of 23 units. Monitoring during 1983 indicated a slightly higher set of ranges and means for these stations of 50 units maximum to 15 units minimum with an average of 26 units. From this analysis we conclude that color values for Little Sarasota Bay as a whole during 1984 were approximately the same if not slightly lower than 1983. This finding is consistent with the low average rainfall during 1984, since color values tend to increase with increased runoff to the Bay via tidal creeks and upland drainage networks.

Several geographic areas of Little Sarasota Bay have been identified as "hotspots" or areas of relatively poor water quality. Stations 1, 5, 6, 9 and 13 violated State water quality standards for dissolved oxygen. A rank order of dissolved oxygen ranges reveals that these same stations experienced some of the largest variations of dissolved oxygen over the tidal cycles investigated (Table 5).

Table 4. Summary of Color Values for Little Sarasota Bay at Selected Stations in 1983 and 1984.

Station[a]	1984[b] Color Units Max.	Mean	Min.	1983[c] Color Units Max.	Mean	Min.
#539 (PC)	40	(24)	10	45	(27)	15
#609 (PC)	45	(22)	10	50	(26)	15
#5 (MML)	24	(16)	10	ND		
#10 (MML)	18	(13)	9	ND		
All Stations (MML)	28	(14)	5	ND		

a) PC = Pollution Control Monitoring
MML = Mote Marine Lab Monitoring

b) Sample dates span 12/83 - 12/84 for PC stations and 5/84 - 10/84 for MML stations.

c) Sample dates span 2/83 - 11/83 for PC stations and No Data (ND) for MML stations.

Table 5. Station rank order of maximum-minimum ranges of dissolved oxygen (D.O.).

Station Rank Order:	(5)	(6)	(1)	2	(13)	3	(9)	7	8	12	10	4	11	14
D.O. Range Max-Min. (mg/l):	9.5	7.5	6.5	6.2	6.0	5.7	5.5	4.5	4.2	4.0	3.5	2.7	2.5	1.4

Note: Circled stations indicate locations of dissolved oxygen violations.

Table 6. Station rank order of mean surface-bottom differences of dissolved oxygen (D.O.).

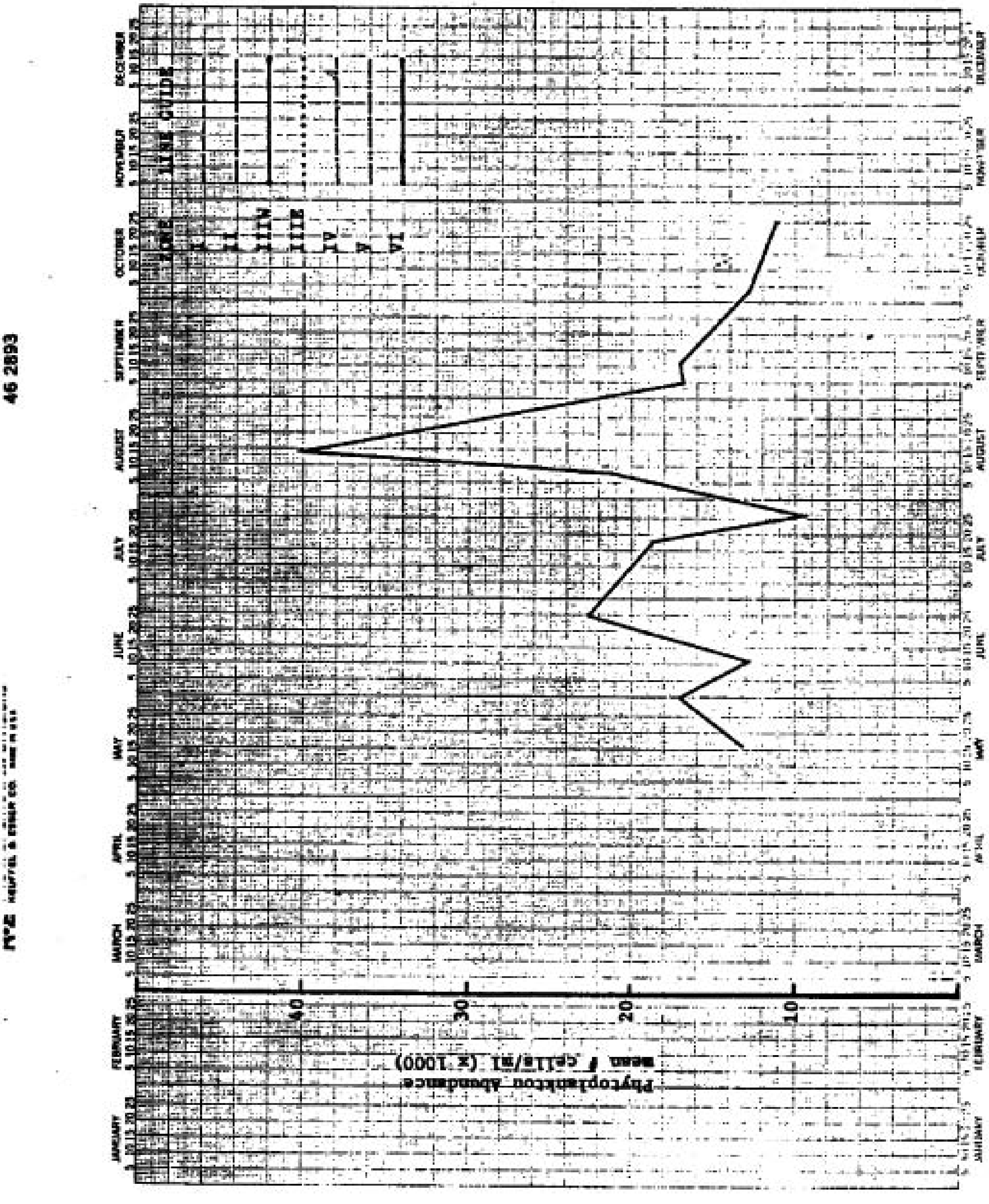
Station Rank Order:	[8]	[7]	[(5)]	(6)	(13)	2	[12]	10	4	[(1)]	(9)	11	14	3
Mean (mg/l) Difference:	1.45	1.25	1.21	0.85	0.56	0.43	0.39	0.38	0.37	0.14	0.13	0.13	0	-0.43
Maximum (mg/l) Difference:	4.1	2.6	5.1	3.2	3.6	1.2	1.7	1.5	1.2	0.6	0.3	1.0	0.1	-2.3

Note: Squares indicate ICW channel locations.
Circles indicate dissolved oxygen violations locations.

The association of dissolved oxygen violations with relatively large ranges of dissolved oxygen is a partial function of depth since deeper stations exhibit larger differences due to low light levels and high benthic oxygen demand near the bottom. Table 6 shows that the deepest stations (e.g., along the Intracoastal Waterway) exhibited no consistent trend toward dissolved oxygen stratification. However, a trend toward dissolved oxygen stratification at stations in the vicinity of the former inlet is evident (e.g., Stations 8, 7, 5, 6, and 13).

Heavy accumulations of drift macroalgae were observed in several locations in Little Sarasota Bay during 1984. Such accumulations produce odor and oxygen deficits in quiet bay areas and may compete with seagrasses for light. These locations included Stations 4-2, 12-4, and 31-1 (14-2 in Figure) as shown in Figure 1. These hotspots should be investigated regularly in order to assess future conditions. Significant losses of seagrass cover were observed at two of five permanent reference stations in Little Sarasota Bay. Declines in shoot density, blade length or area, and blade density at Stations 1 and 4, and to a lesser degree at Station 5 were observed. Losses at Stations 1 and 4 were attributable to floating mats of macroalgae which colonized the permanent quadrats and vicinity and then grew to proportions of near total cover. Seagrass beds were consequently smothered and shaded by the macroalgae which led to the demise of the aboveground leafy portion of the plants. Further monitoring can reveal whether this decline is a permanent impact or if regrowth will occur in the absence of the algal mat. Due to lack of recent historical data, it is difficult to assess the extent to which this represents an abnormal condition.

An analysis of the phytoplankton community in Little Sarasota Bay during 1984 revealed two bloom periods. A bloom is a condition in which cell densities exceed average conditions by one or more orders of magnitude. Blooms create odors, discolor the water or cause oily films, and cause oxygen deficits. Figure 4 depicts these peaks in abundance averaged for all stations during the June 25 - July 18 and August 8-14 sample dates. Low average species richness, density and equitability occurred at all stations during these periods, which further indicated phytoplankton bloom conditions. Species richness (i.e., Margalef's Index) is a relative measure of the number


Phytoplankton Abundance
mean # cells/ml (x 1000)
40
30
20
10
ZONE LINE GUIDE
I
II
IIIN
IIIS
IV
V
VI
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
46 2893

of species present in a sample population. Equitability (i.e., Pielou's Index) is a relative measure of the evenness of the distribution of all individuals among the species present.

Two hotspots in terms of phytoplankton abundance were noted during 1984 at Stations 9 and 13. As depicted in Figure 5, high average abundance (i.e., number of cells) over time was indicated at these stations, while an overall trend toward decreasing abundance was observed from north to south in the Bay. Station 13 experienced a continual state of bloom from the August 8 sampling period until the end of sampling, which was not indicated at other stations. Low equitability (i.e., evenness) for this period indicated that the bloom was composed of a disproportionate abundance of one or few species. Table 14 confirms this indication in that 70 percent of the species composition during this time was attributable to one species of centric diatom.

Conclusion

In summary, the condition of Little Sarasota Bay as a whole did not deteriorate significantly during 1984. Bacteriological and dissolved oxygen conditions were equal to or slightly better than 1983. Color values were similarly equal to or slightly improved over 1983 conditions. Although two of five seagrass stations exhibited cover losses associated with macroalgae, and relatively high phytoplankton abundance was experienced at two locations in the vicinity of Midnight Pass, it is not possible to say that this represents a deterioration over recent historical conditions. Overall, the Bay experienced abnormally low rainfall during 1984 and consequently associated impacts were lessened. A normal rainfall event (i.e., greater than 1 inch in 24 hours) following such an extended dry period may be expected to increase wasteloads to the Bay resulting in more significant impacts. Additionally, it must be remembered that recent historical conditions for Little Sarasota Bay included a tidal inlet (i.e., Midnight Pass) with a diminished capacity relative to flow and flushing ability, as related to diminished cross sectional area. Only sixteen percent of the tidal prism volume of the entire Bay was being contributed by Midnight Pass in 1982. Therefore, the expected immediate impact on the Bay resulting from inlet closure was found to be slight.

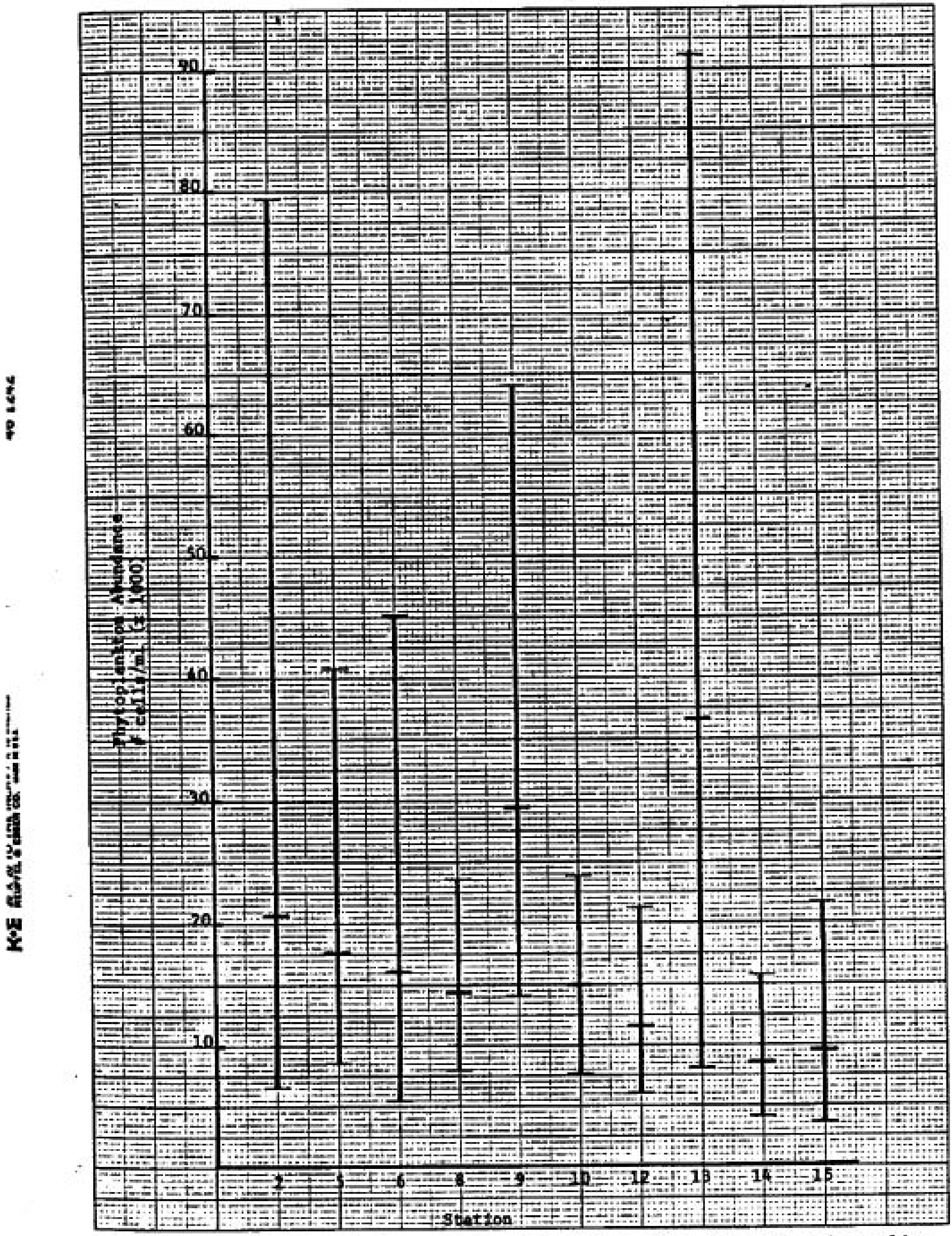


Figure 5. Phytoplankton abundance averaged for all sampling dates at each sampling station at Little Sarasota Bay, 1984.

IV. SPATIAL VARIATION IN THE BAY

Are other areas of Little Sarasota Bay different than the immediate vicinity of Midnight Pass?

In order to facilitate this analysis Little Sarasota Bay was subdivided into zones based upon hydrographic features. Information used to delimit the zones came principally from current velocity profiles of the Bay. The profiles included both observed and simulated current velocities for a variety of tidal conditions. The actual data were collected during the monitoring program in 1984 as well as in 1982. The simulated velocities were taken from a hydrodynamic numerical model of Little Sarasota Bay calibrated with 1982 data. Simulated current velocity profiles were examined for the nearly closed inlet condition which existed in September 1983.

Figure 6 defines tidal current zones for the simulated condition of near total inlet closure and shows three areas with distinct movement and one null zone. Figure 7 defines zones based on observed current velocities recorded during semidiurnal tides under a condition of total inlet closure. An expanded null zone is evident with two zones of distinct movement.

Figures 1 and 8 were prepared to overlay physiographic features and the existing network of sample locations of the Bay on the tidal current zones. Five geographic zones were generated along the longitudinal axis of the Bay with Zone III (Midnight Pass area) divided into east and west components (Figure 9). Zone VI is the Gulf of Mexico in the vicinity of the former inlet.

Figures 10 and 11 show a zonal summary of the mean values and ranges for several water quality parameters monitored throughout the study. Although water temperature variation was nearly equal throughout the Bay, salinity values indicated a small difference between the Midnight Pass area and the Bay as a whole. Lowest salinities were encountered near the former inlet and near the north end (i.e., Stickney Point), while higher salinities were usually encountered near the southern end (i.e., Blackburn Point). This pattern is consistent with the location of the tidal creeks in the northern and central

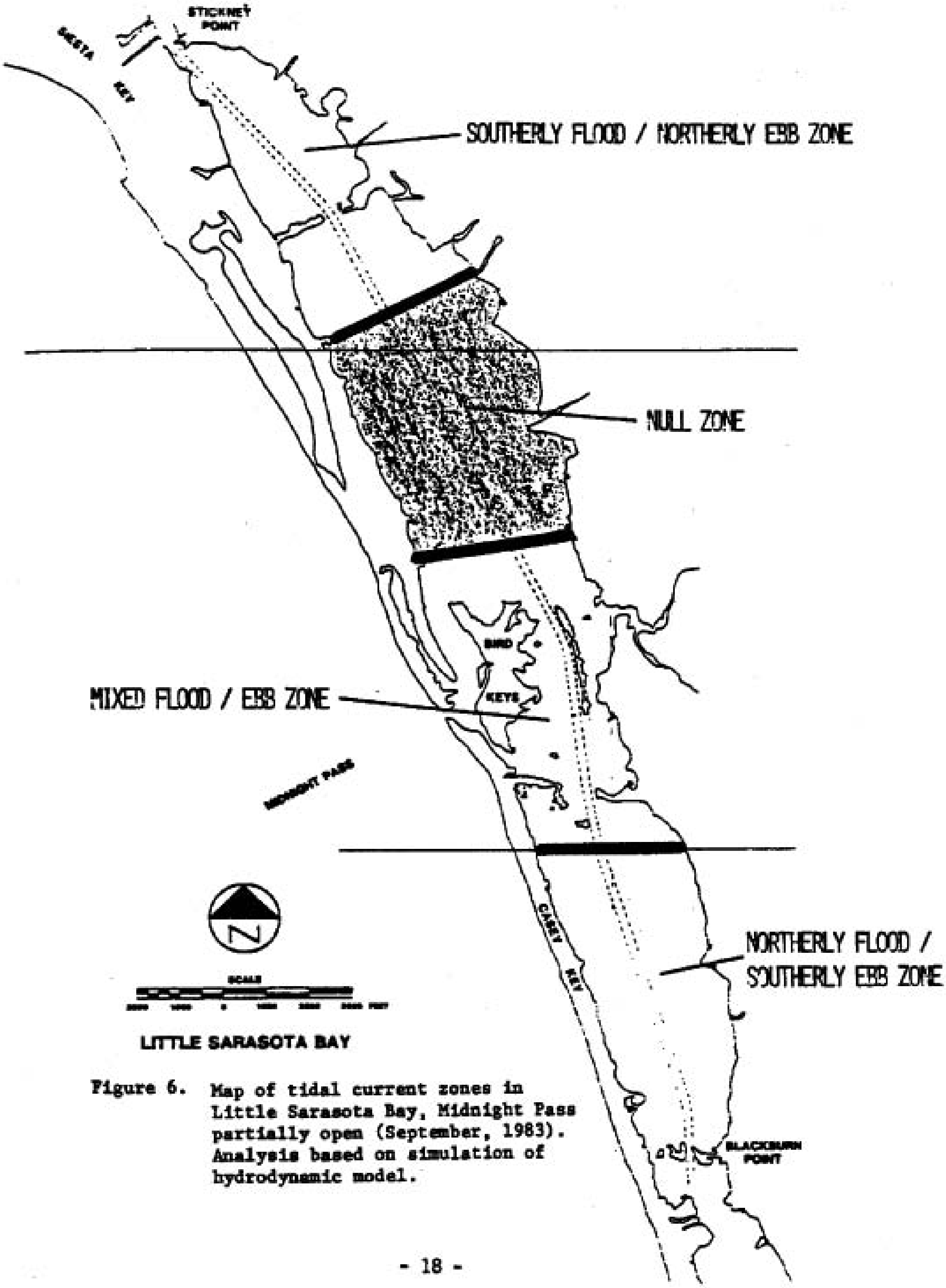


Figure 6. Map of tidal current zones in Little Sarasota Bay, Midnight Pass partially open (September, 1983). Analysis based on simulation of hydrodynamic model.

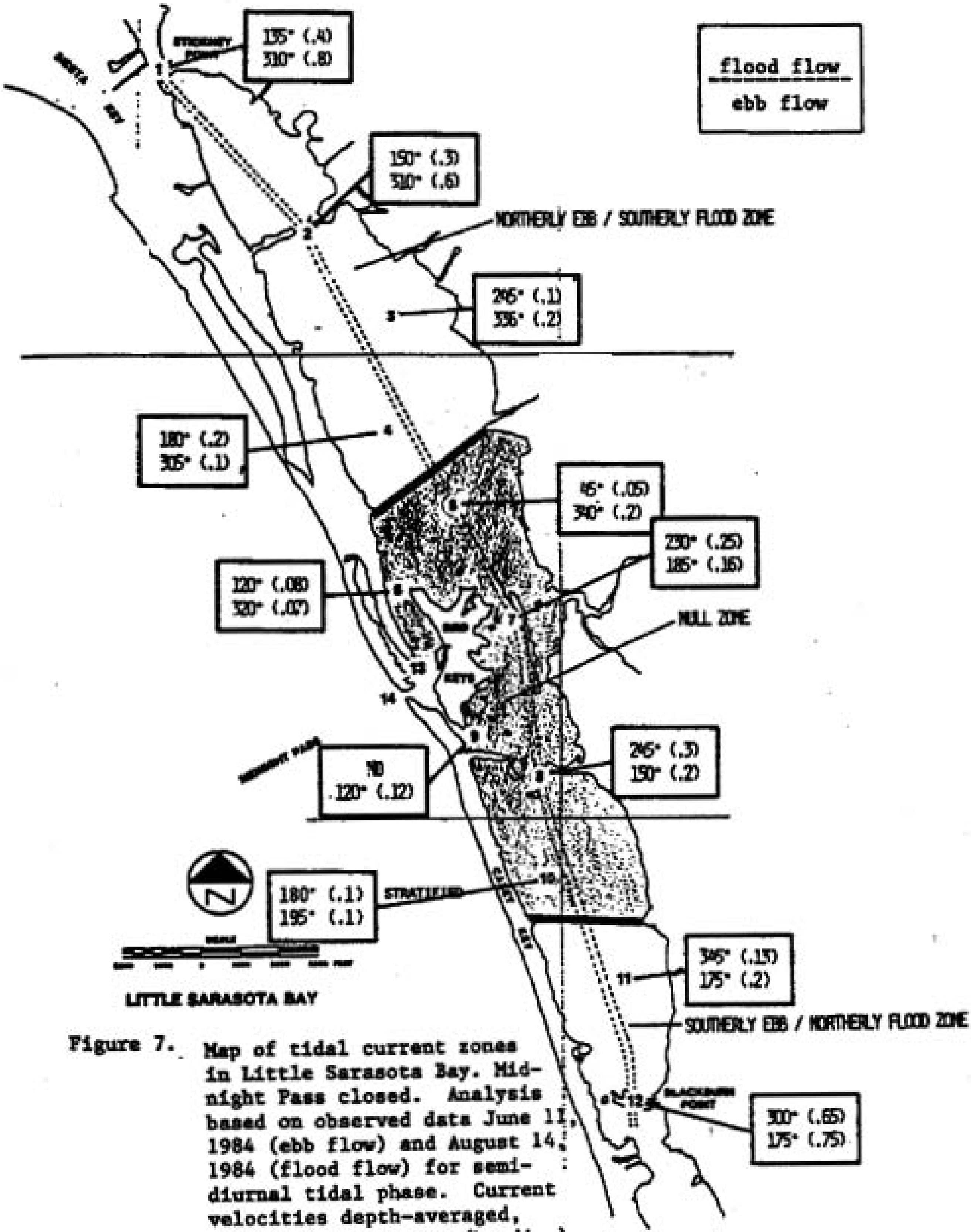


Figure 7. Map of tidal current zones in Little Sarasota Bay. Midnight Pass closed. Analysis based on observed data June 11, 1984 (ebb flow) and August 14, 1984 (flood flow) for semi-diurnal tidal phase. Current velocities depth-averaged, direction in degrees (heading) and speed in knots.

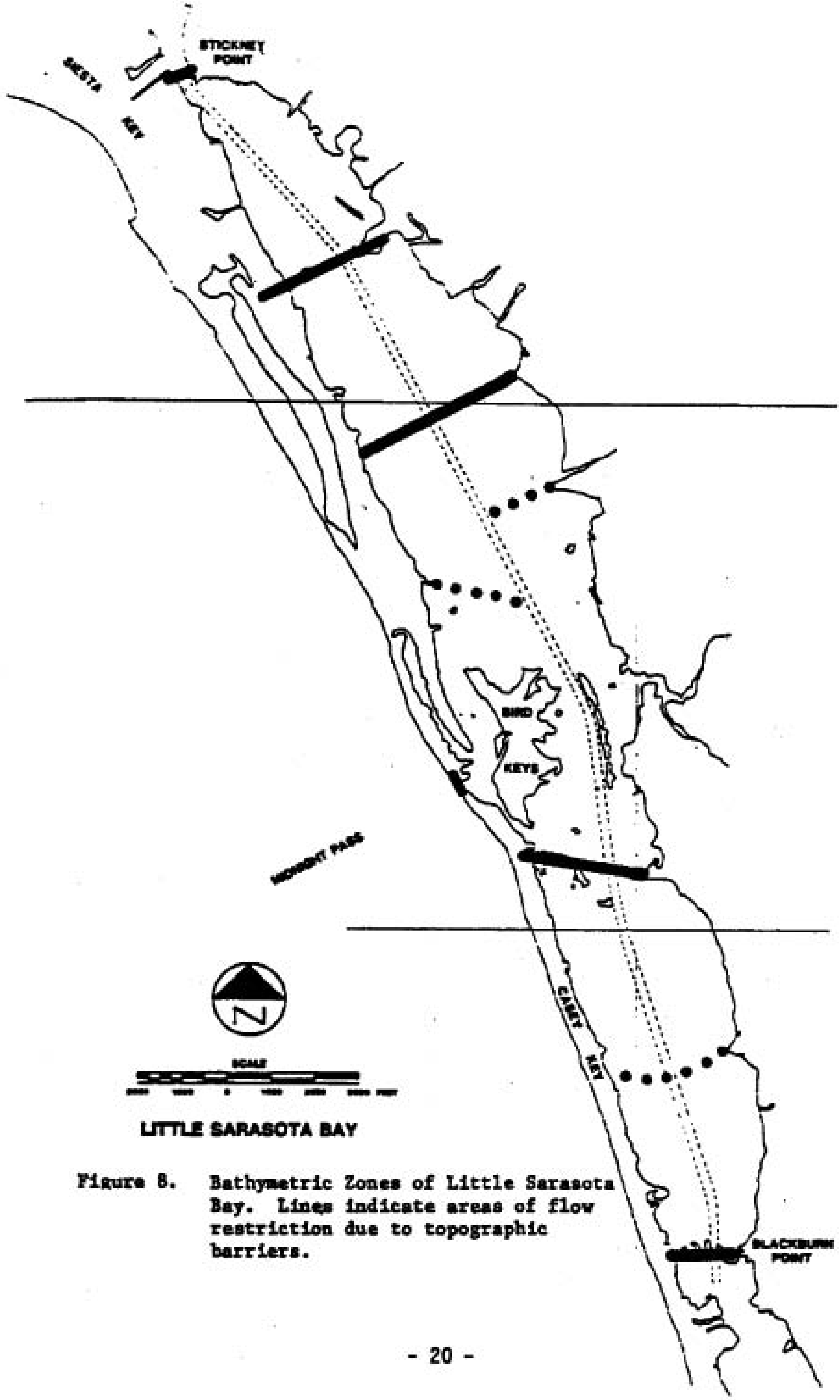


Figure 8. Bathymetric Zones of Little Sarasota Bay. Lines indicate areas of flow restriction due to topographic barriers.

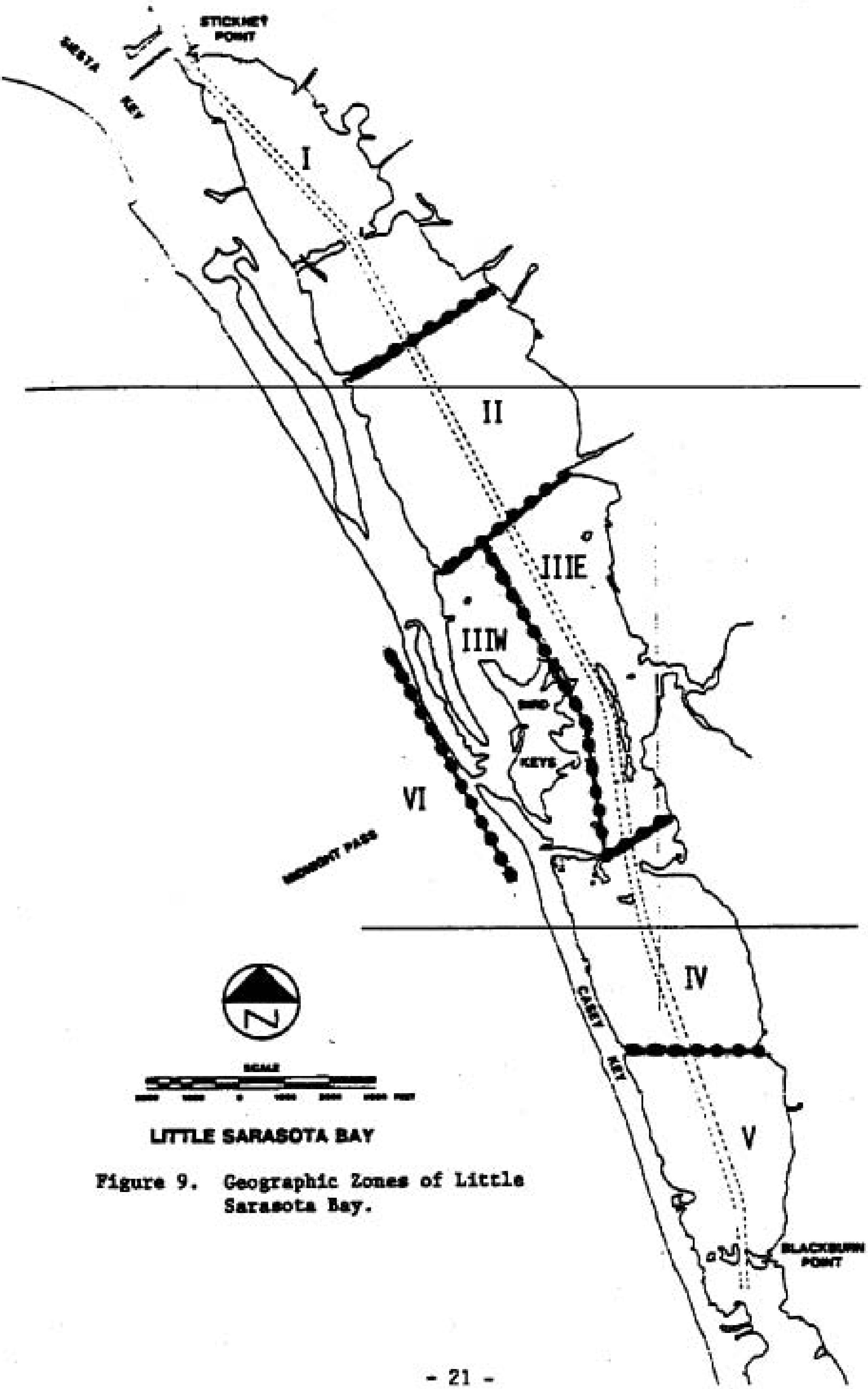


Figure 9. Geographic Zones of Little Sarasota Bay.

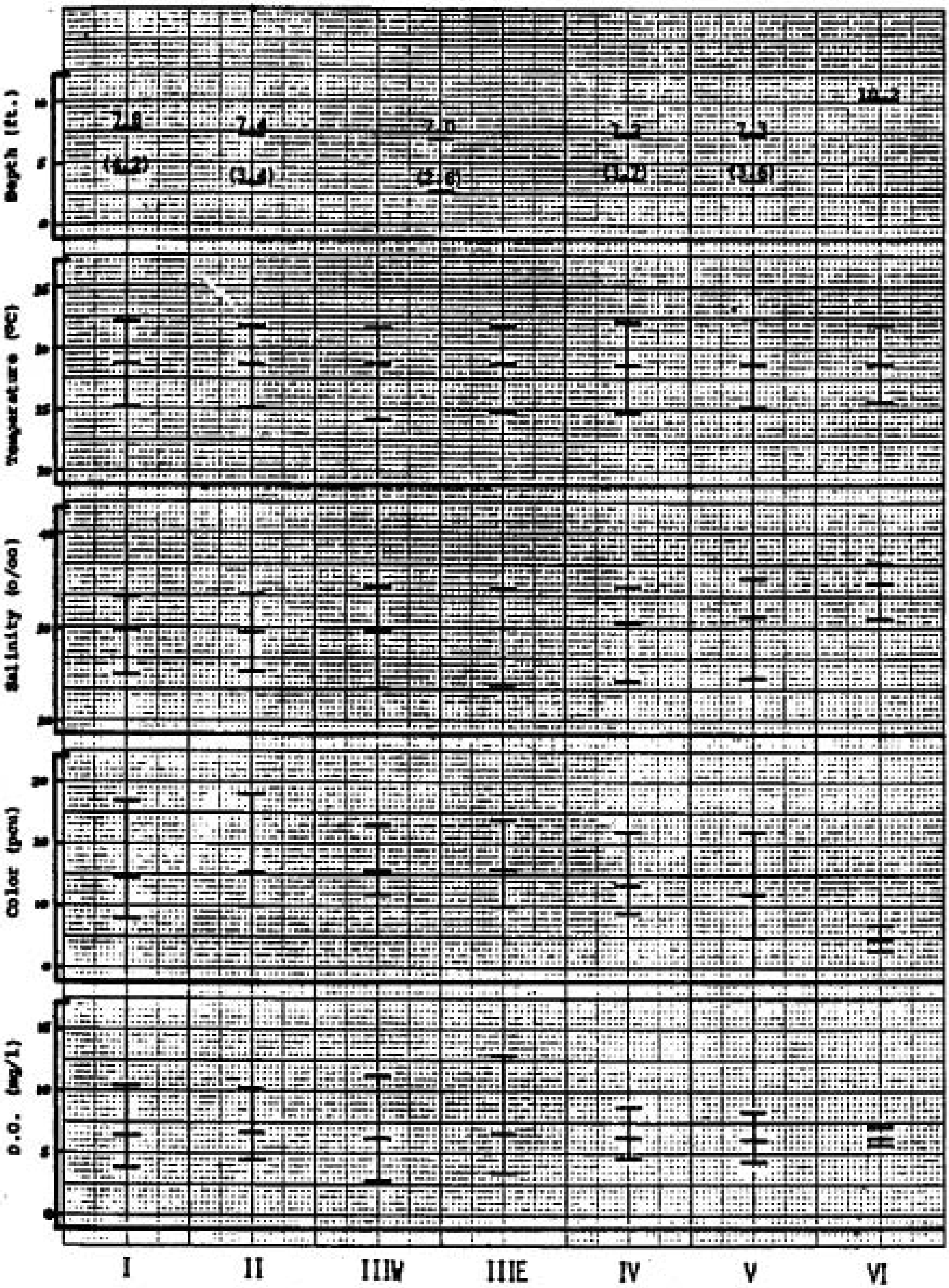


Figure 10. Summary of Hydrographic Parameters by Zone for all sample dates in 1984. Maximum, mean, and minimum values.

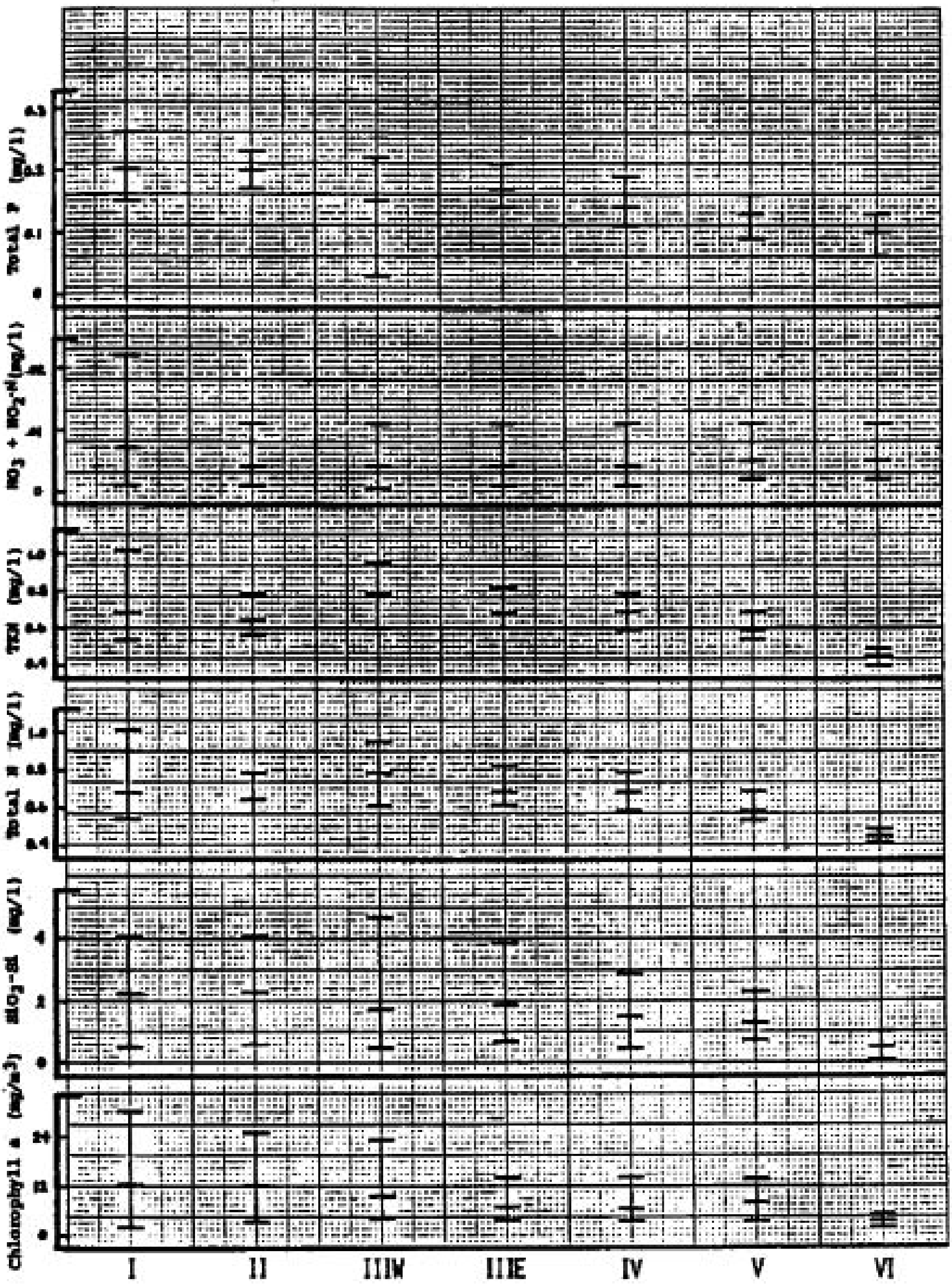


Figure 11. Summary of Water Quality Parameters by Zone for all sample dates in 1984. Maximum, mean, and minimum values.

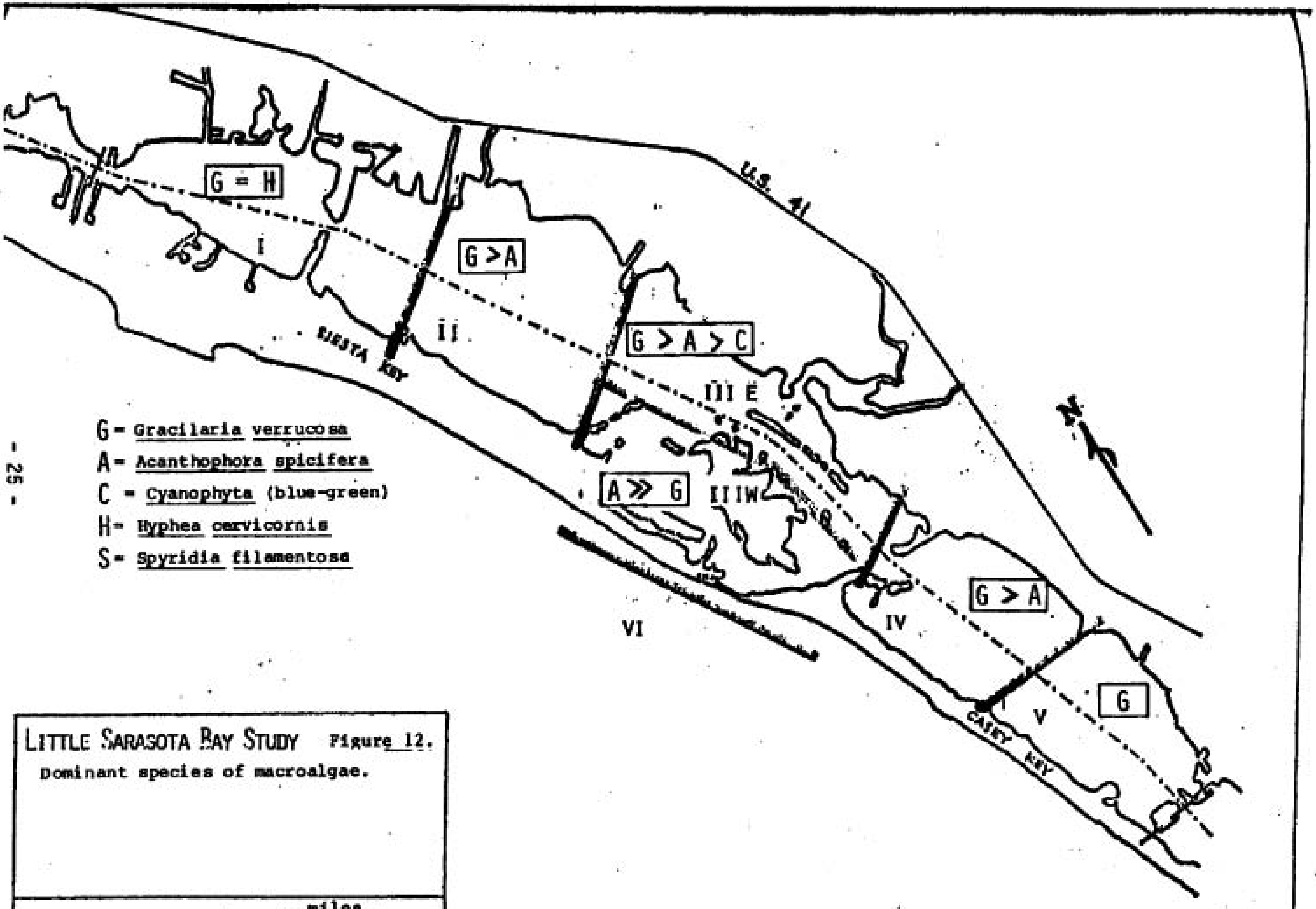
region of Little Sarasota Bay (e.g., Phillippi Creek, Matheny Creek, Elligraw Bayou, Catfish Creek, and North Creek) which contribute fresh water to those regions.

Although the average dissolved oxygen condition did not indicate any clear zonation of the Bay, an analysis of mean surface-bottom differences of dissolved oxygen was quite revealing (Table 6). Stations 8, 7, 5, 6, and 13 exhibited the largest surface-bottom difference in dissolved oxygen. These results clearly distinguish the water area surrounding the Bird Keys of the Midnight Pass area from the rest of the Bay, which is consistent with the finding that the water mass in this area exhibited no distinct flushing. The null zone identified in Figure 7 is thereby reflected by the data on dissolved oxygen stratification.

Color values paralleled the salinity trends by zone throughout the Bay, which would be expected due to the association of freshwater runoff with colored water. Average color values were higher in the central region of the Bay near the former inlet and North Creek while peak values occurred in the north Bay near Stickney Point, reflecting the influence of Phillippi Creek in that zone.

Nutrient data indicated a trend of higher average nutrient levels in the north end with lower average nutrient levels toward the south end. The trend of decreasing total phosphorous levels from north to south was quite consistent. A trend toward decreasing nitrogen levels from north to south in the Bay was also evident. For total nitrogen, the trend was slightly obscured in the vicinity of the former inlet where consistently high levels of nitrogen were found, indicating a possible source of nitrogen input in this area. Reactive silicate levels also decreased from north to south in the Bay, but high silicate levels were occasionally encountered in the Midnight Pass area. Nutrient levels usually did not change as a function of tidal stage. Chlorophyll <u>a</u> content of the water (an indication of phytoplankton abundance) peaked in the north end of the Bay and decreased consistently to minimum levels at the south end of the Bay.

Analysis of macroalgal populations throughout the Bay over time revealed a dominance by two species, <u>Gracilaria verrucosa</u> and <u>Acanthophora spicifera</u> (Figure 12). These species and <u>G. verrucosa</u> in particular are



LITTLE SARASOTA BAY STUDY Figure 12.
Dominant species of macroalgae.

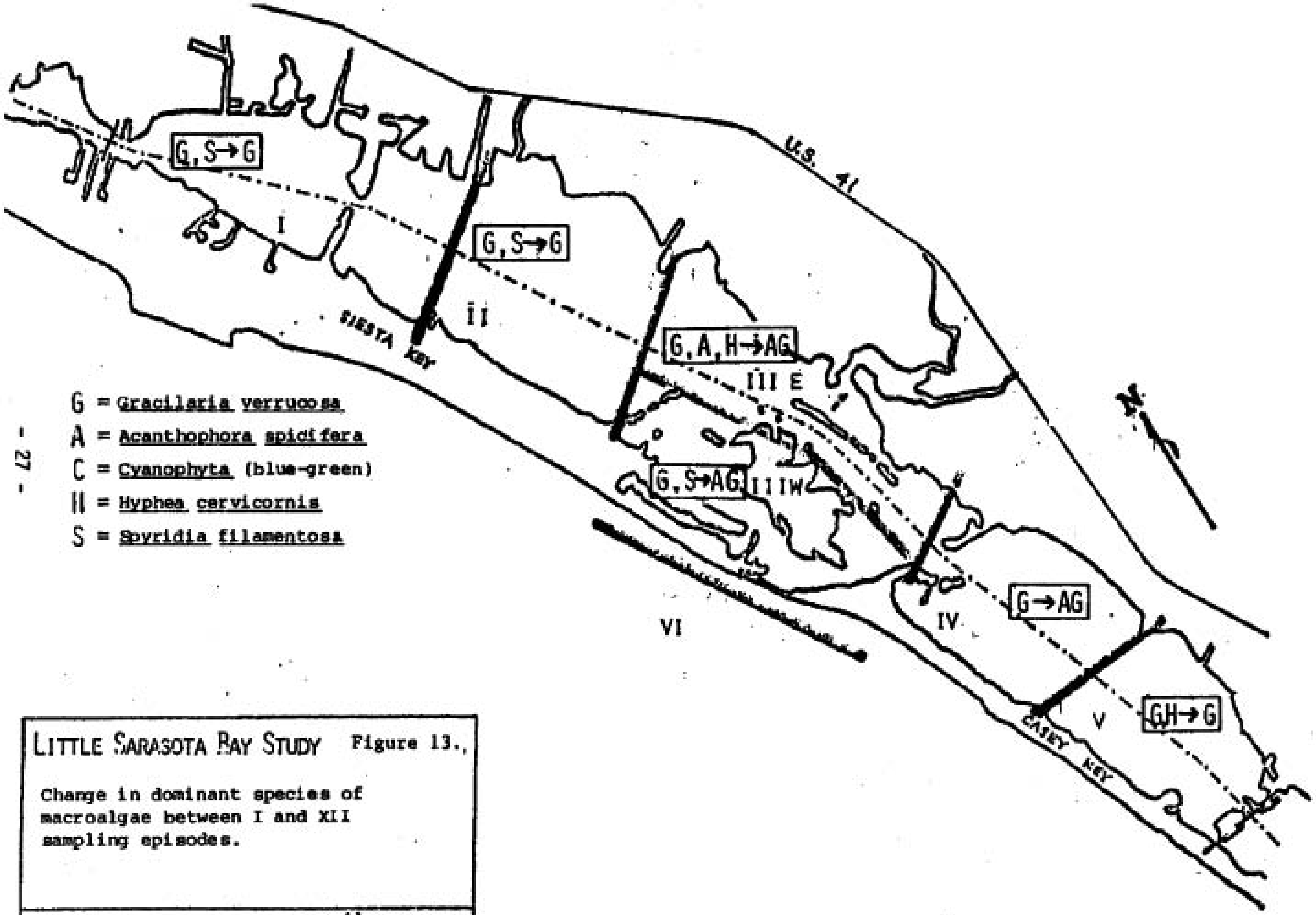
SCALE: 1:40,000

considered to be indicators of eutrophic (over-nutrified) conditions, and are undesirable in large quantity. In Zone I, Gracilaria approximately equalled Hypnea cervicornis as a dominant. In Zone II Gracilaria showed dominance over Acanthophora and Spyridia filamentosa, two lesser dominants. In Zone IIIW, Acanthophora much exceeded Gracilaria spp., while in Zone IIIE Gracilaria dominated over Acanthophora, which in turn was dominant over blue-green algae (Cyanophyta). In Zone IV, Gracilaria was dominant over Acanthophora, while in Zone V Gracilaria was dominant over all other occasional forms.

Some seasonality in dominance by species was observed during 1984 as exhibited by Figure 13. In general, mixed populations dominated by Gracilaria verrucosa which were evident during the initial phases of the monitoring program were succeeeded by slightly less diverse populations dominated by Gracilaria verrucosa and Acanthophora spicifera.

There was a gradient of high to low algal cover values from north to south in the Bay (Figure 14). This trend was seen for both total percent cover (Figure 14) and percent cover of dominant species (Figure 15) and may reflect nutrient trends previously identified for the Bay. Over the period of study, percent cover by macroalgae increased significantly in the mid-region of the Bay or Zones II, IIIW, and IV (Figure 16). A similar trend was evident for the change in percent cover by dominant species (Figure 17). This high growth area of the Bay is associated with low current velocity profiles and distinct surface-bottom dissolved oxygen differences identified previously in this report.

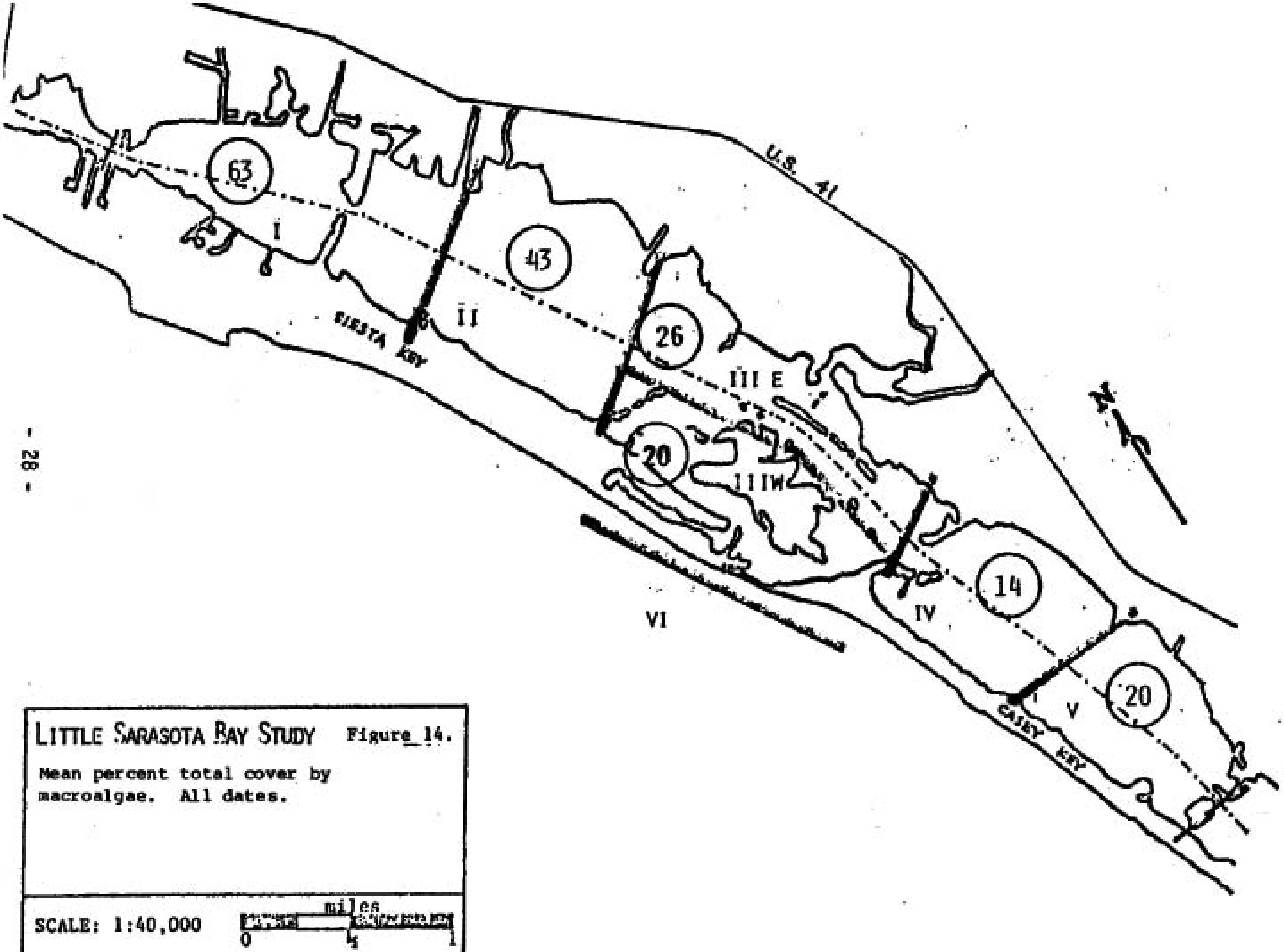
Since light is a limiting factor for macroalgae, it is interesting to note trends in transparency for the Bay during 1984, as measured by secchi depth and the extinction coefficient (Ke). Secchi depth may be interpreted as the depth of water in which the bottom is clearly visible, and the extinction coefficient as a number describing the rate at which light is attenuated while passing through water. Figure 18 indicates a decline in transparency based on extinction coefficients for Zone V during 1984, while all other zones show a slight increase in transparency (e.g., 0-28%). Although the mean extinction coefficients for all zones in the Bay were approximately equal and indicated similar conditions of transparency bay-wide throughout the sampling period, slightly higher maximum values of Ke (lower transparency) were evident in the



LITTLE SARASOTA BAY STUDY Figure 13.

Change in dominant species of macroalgae between I and XII sampling episodes.

SCALE: 1:40,000 miles 0 ½ 1



LITTLE SARASOTA BAY STUDY Figure 14.

Mean percent total cover by macroalgae. All dates.

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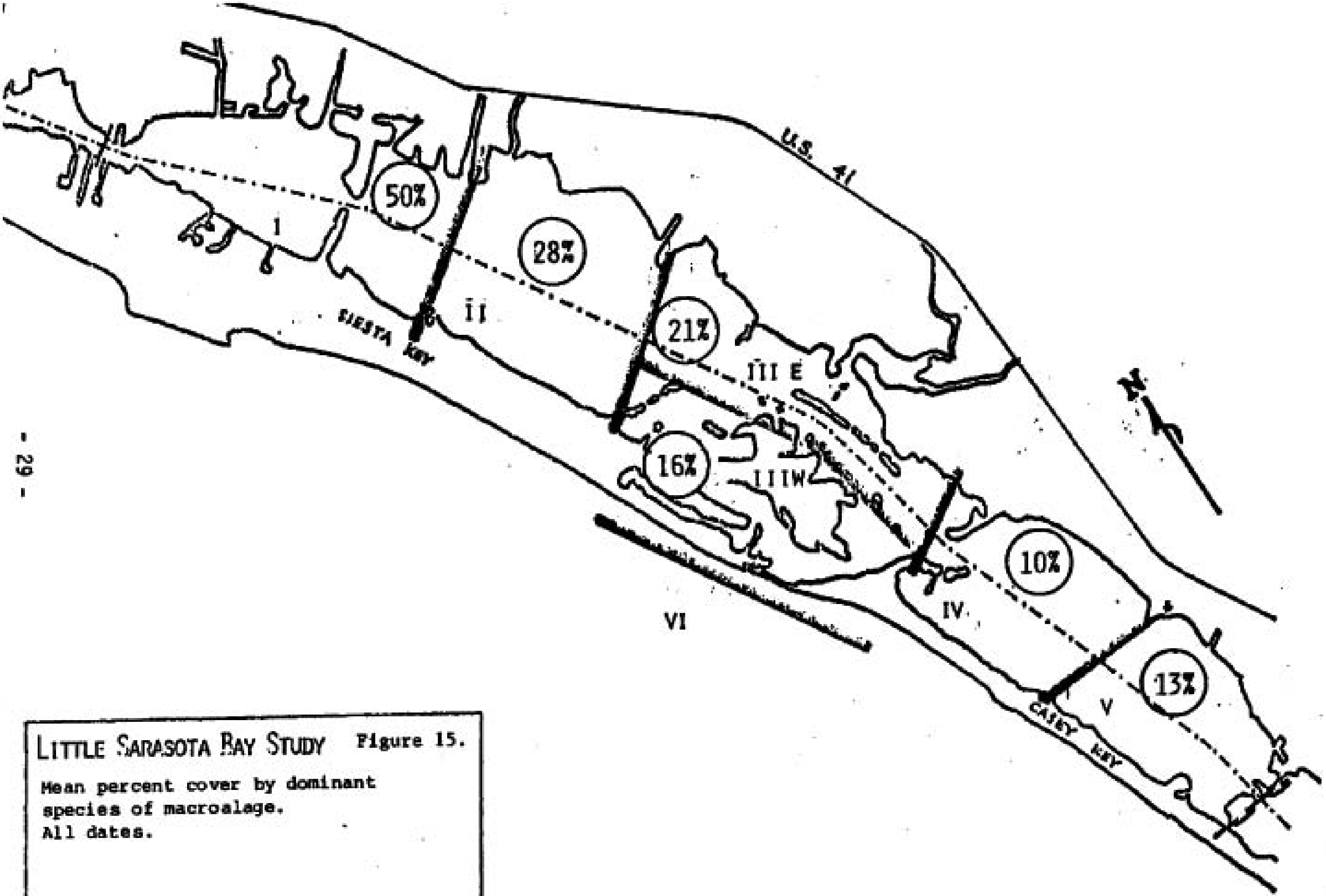
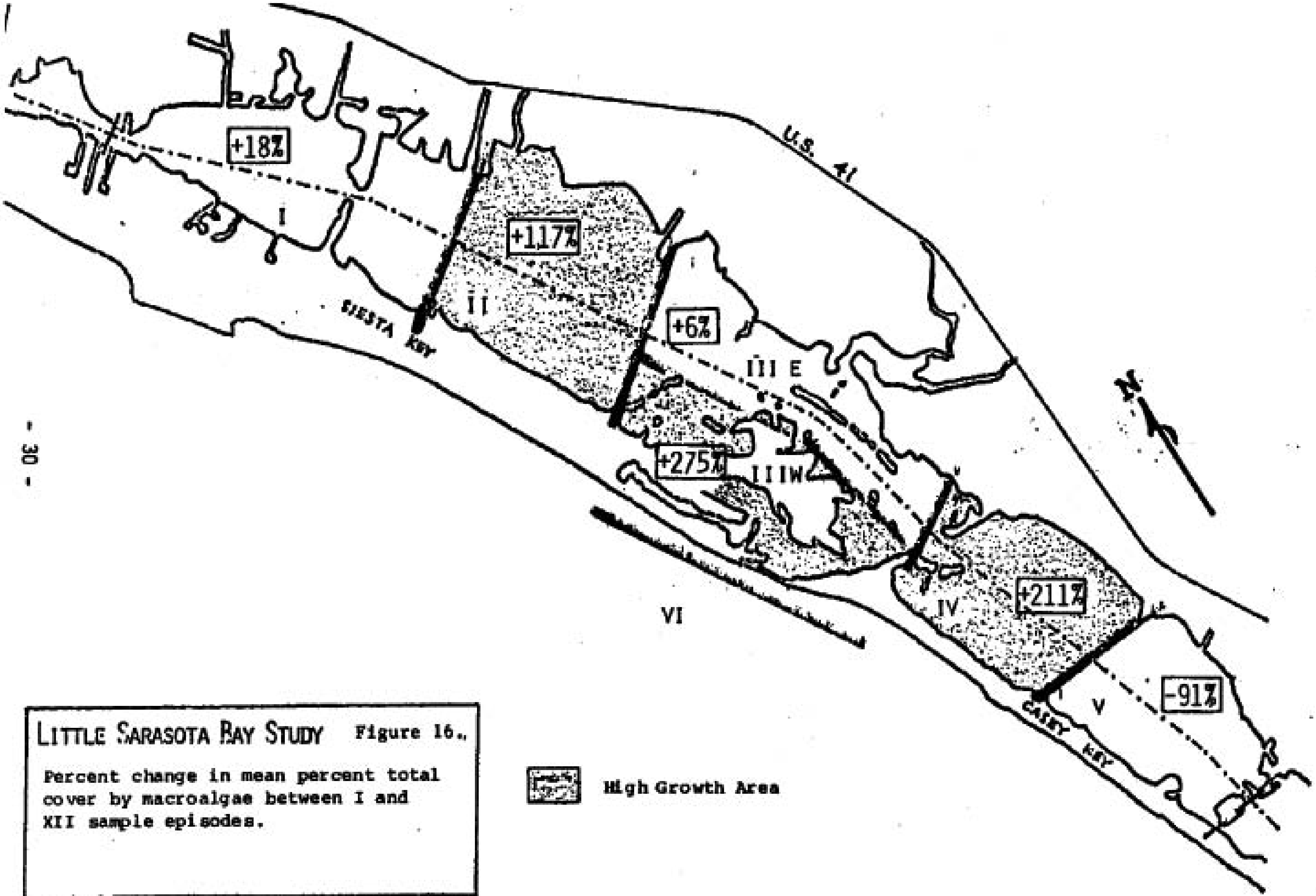


LITTLE SARASOTA BAY STUDY — Figure 15.

Mean percent cover by dominant species of macroalage. All dates.

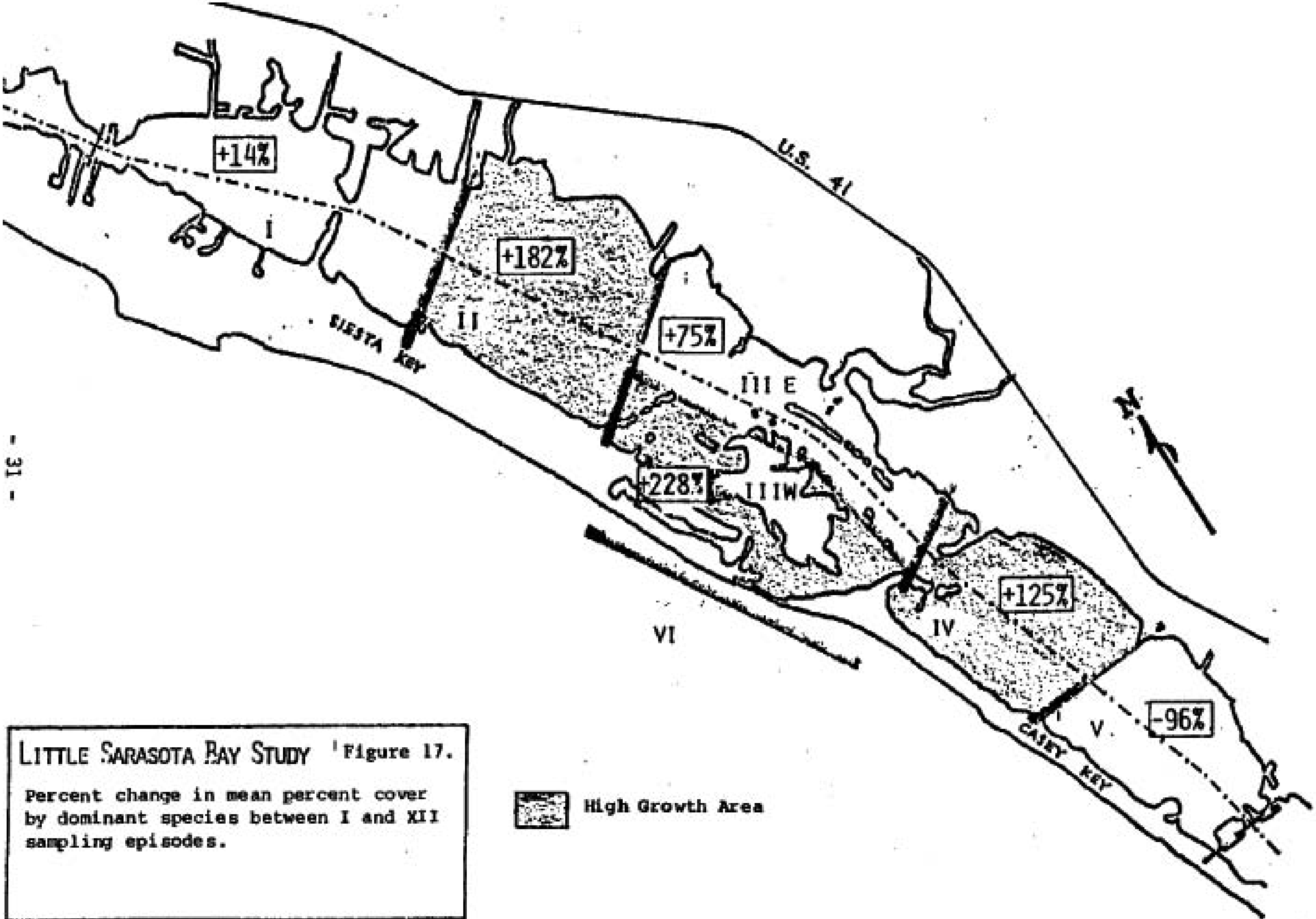
SCALE: 1:40,000 — miles 0 ½ 1



LITTLE SARASOTA BAY STUDY Figure 16.

Percent change in mean percent total cover by macroalgae between I and XII sample episodes.

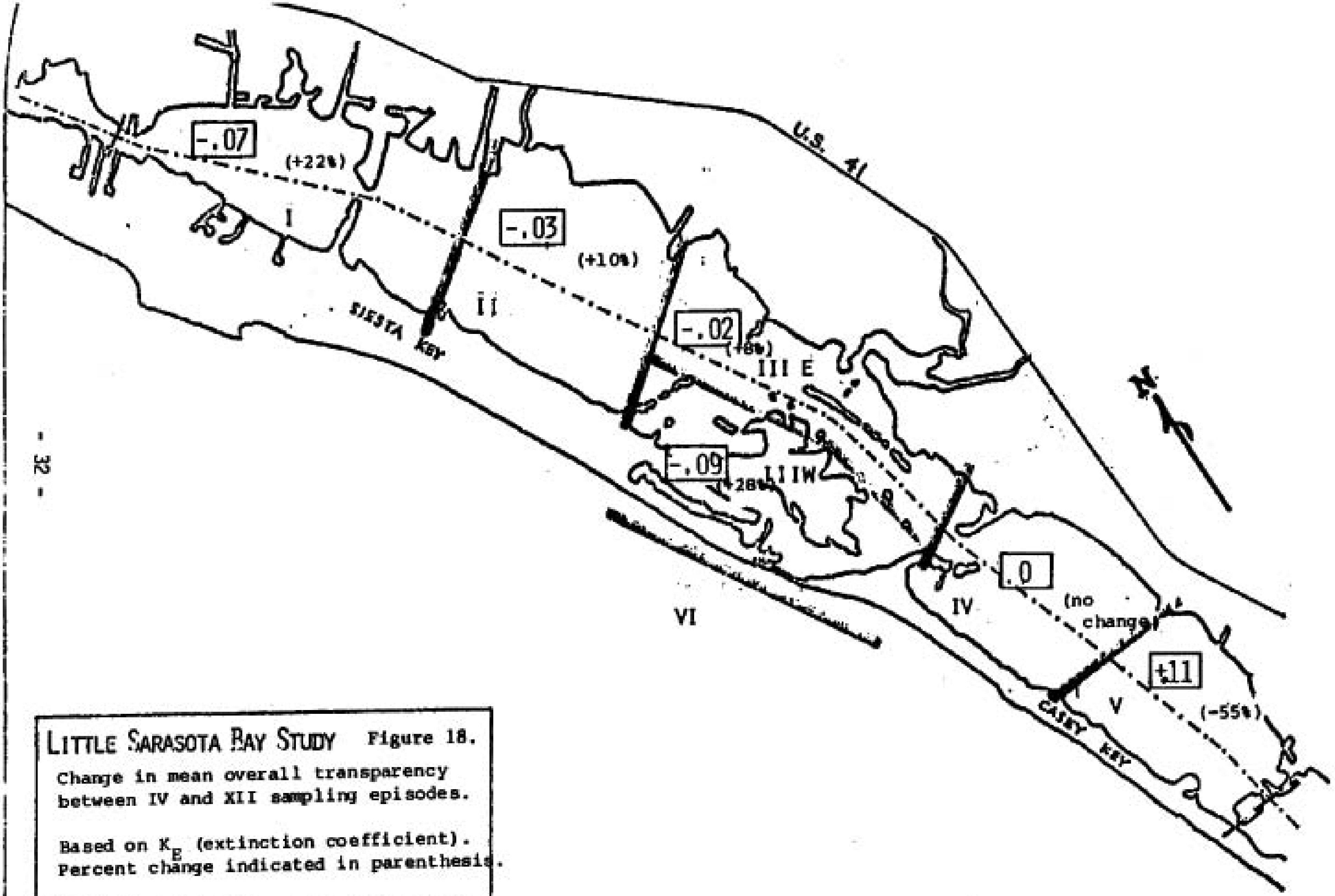
SCALE: 1:40,000 miles 0 ½ 1



LITTLE SARASOTA BAY STUDY Figure 17.

Percent change in mean percent cover by dominant species between I and XII sampling episodes.

SCALE: 1:40,000 miles 0 ½ 1



LITTLE SARASOTA BAY STUDY Figure 18.

Change in mean overall transparency between IV and XII sampling episodes.

Based on K_E (extinction coefficient). Percent change indicated in parenthesis.

SCALE: 1:40,000

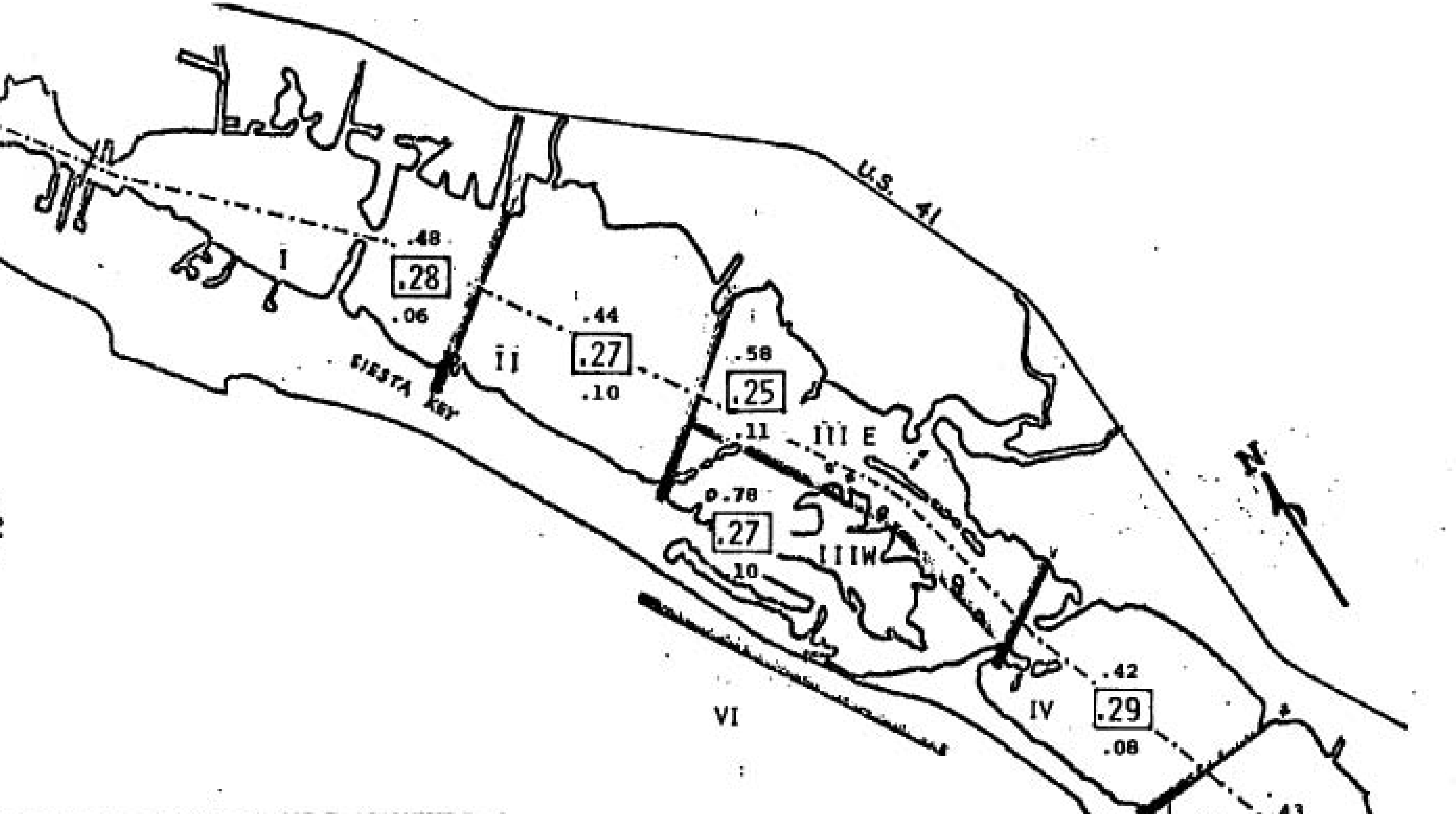
miles: 0, ½, 1

mid-region of the Bay (Figure 19). This finding was correlated with relatively high phytoplankton densities in this zone of the Bay.

Table 7 illustrates zonal variation of phytoplankton abundance averaged over all sample dates in 1984. It is evident that Zone IIIW was characterized by the highest mean phytoplankton abundance in terms of number of cells per milliliter (# cells/ml). In fact, mean phytoplankton abundance in Zone III exceeded maximum phytoplankton abundance in all zones except Zones I and II. A trend of decreasing phytoplankton abundance from north to south in the Bay was previously identified in this report. It is apparent that Zones I, II, and IIIW exhibited the widest ranges of phytoplankton abundance including the largest average phytoplankton populations (i.e., number of cells) throughout the monitoring period.

Phytoplankton communities within each zone were compared to determine if differences in community structure existed within the Bay.(12) The analysis revealed north and south assemblages which overlapped in the vicinity of Midnight Pass (Figure 20). Some variability in similarity existed during the first few sampling dates, whereas the later sampling dates revealed a more consistent pattern of community divergence. Differences in phytoplankton assemblages were due to variations in abundance based on percent composition (i.e., shifts in degree of dominance by species), while the dominant species identities remained fairly constant.

Similarity values were divided into five percentage groups which describe the communities comparisons: very high (100-80%); high (79-60%); moderate (59-40%); low (39-20%) and very low (19-0%). Zones I, II, and IIIE were highly similar overall and represented the northern phytoplankton community, as shown in Table 8. Zones II and IIIE were also highly similar to Zones IV and V; together these four zones comprised the southern community. Zones II and IIIW were also highly similar overall; however, Zone IIIW community structure did diverge during later sampling dates. Zone IIIW phytoplankton communities did not display a high similarity to any Bay zone during five of the last six sampling events. The northern and southern phytoplankton communities overlapped around Midnight Pass (Zones II and IIIE) in Figure 20, an area which coincides with the hydrographic null zone (Figure 7). The fact that the southern assemblage encompassed more zones than the



LITTLE SARASOTA BAY STUDY Figure 19.

Mean overall transparency based on extinction coefficient (K_E).

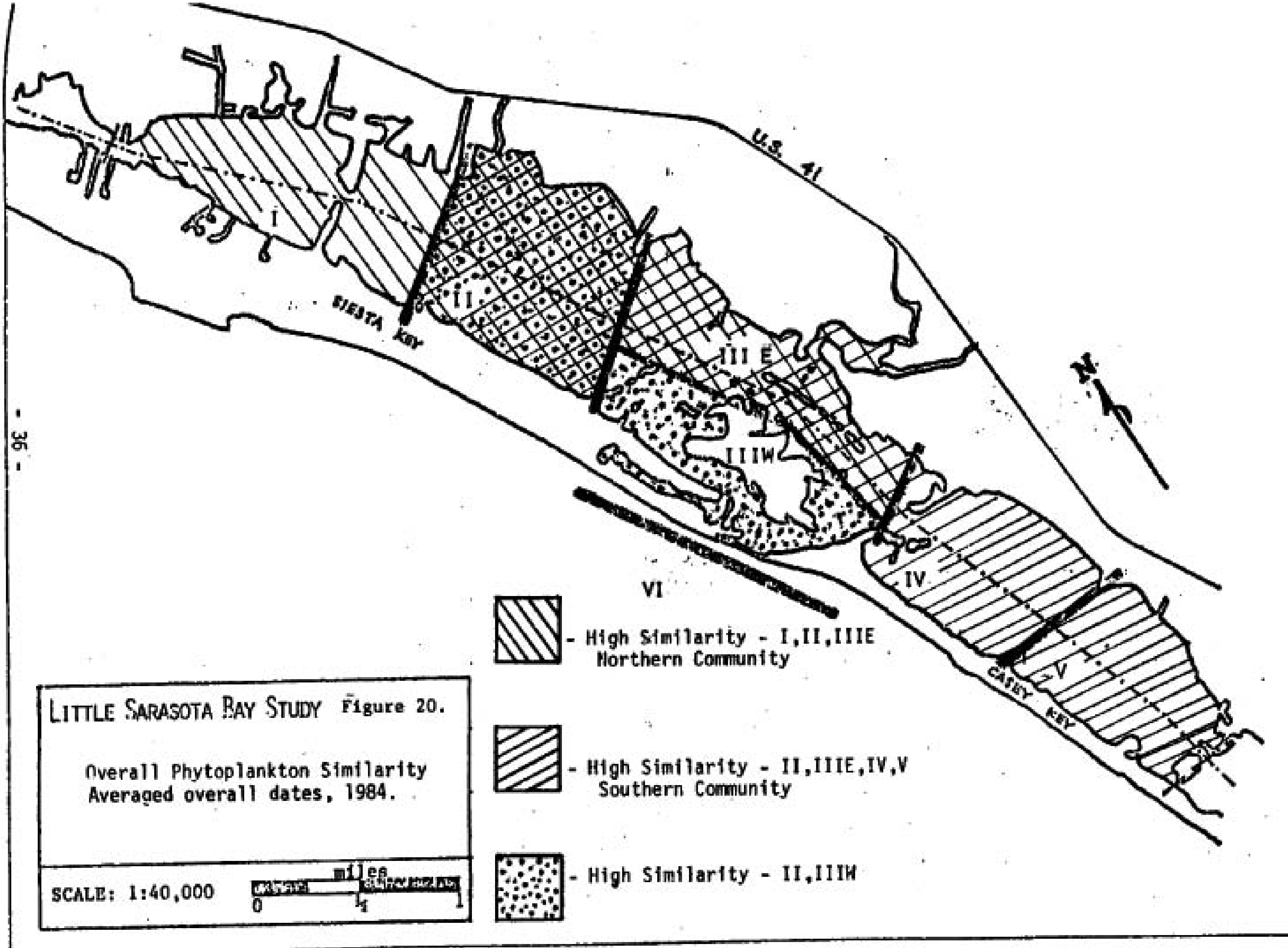
All sample dates. Maximum-minimum K_E in lower case numerals.

SCALE: 1:40,000 miles 0 ½ 1

Table 7. Bay Zone Summary of Phytoplankton Population Statistics. Maximum, Means*, and Minimum Values for All Sample Dates, May - October, 1984.

Zones / Parameter	I (2)	II (5)	IIIW (6,9,13)	IIIE (8,15)	IV (10)	V (12)	VI (14)
N (sample number)	12	12	36	24	12	12	11
# of species	31 (21.9) 11	33 (22.1) 16	44 (35.1) 25	37 (27.5) 19	26 (18.8) 13	30 (19.8) 15	35 (23.9) 12
# cells/ml	79,426 (20,552) 6,635	40,504 (17,572) 8,379	66,858 (27,391) 9,826	19,945 (11,760) 6,280	23,804 (14,736) 7,572	21,165 (11,759) 5,935	15,866 (8,658) 4,216
Margalef's Richness	6.85 (4.96) 2.59	7.33 (5.08) 3.69	9.96 (7.79) 4.97	9.08 (6.59) 4.25	6.12 (4.28) 2.98	6.92 (4.64) 3.49	8.19 (5.82) 3.03
Diversity	2.65 (1.78) 1.31	2.42 (1.79) 1.12	2.36 (1.97) 1.23	2.54 (1.92) 1.07	2.24 (1.74) 1.31	2.66 (1.77) 1.24	2.60 (2.00) 1.18
Equitability	1.92 (1.34) 1.08	2.01 (1.34) 0.88	1.58 (1.28) 0.86	1.65 (1.34) 0.82	1.60 (1.38) 1.10	1.80 (1.36) 1.05	1.82 (1.46) 1.09

* mean values in parentheses.



LITTLE SARASOTA BAY STUDY Figure 20.

Overall Phytoplankton Similarity
Averaged overall dates, 1984.

Table 8. Mean percent similarity values between zone pairs using Czekanowski's Index on phytoplankton data base. Values interpreted as: Very High (100-80%), High (79-60%), Moderate (59-40%), Low (39-20%), and Very Low (19-0%).

	ZONE					
ZONE	I	II	IIIE	IIIW	IV	V
II	.6763					
IIIE	.6056	.6888				
IIIW	.5820	.6135	.5063			
IV	.5918	.6861	.7094	.5902		
V	.5685	.6341	.7220	.5157	.7270	
VI	.4294	.4702	.5234	.3324	.4744	.5684

northern supports the concept of a larger tidal prism coming through Blackburn Point. The zone in the immediate area of Midnight Pass has developed a distinctive phytoplankton community. This community developed slowly and by August had diverged sufficiently to be considered dissimilar to the other Bay zones. The northern zones of the Bay (I and II) exhibited a slightly higher mean number of species, species richness, and diversity value than the southern zones (IV and V) (Table 7). However, the southern zones displayed a slightly higher equitability (evenness) value. The middle zones (IIIE and IIIW) had higher mean number of species and diversity than the other zones, but this is probably an artifact of pooling multiple stations in these zones.

Conclusion

In summary, the immediate vicinity of Midnight Pass is ecologically distinct from the Bay as a whole. Geographic zones constructed for the Bay, based on tidal current conditions, exhibited ecological conditions which further support a conclusion that the Bay is composed of distinct regions. A null zone of no distinct water motion was identified in the central region of the Bay which exhibited low salinities, wide dissolved oxygen ranges and high color values in comparison to other Bay zones. Nutrient levels exhibited a north to south gradient, but this trend was broken by elevated nitrogen and silicate levels in the vicinity of Midnight Pass. While phytoplankton abundance and chlorophyll a values also exhibited a north to south gradient, the phytoplankton community in the vicinity of the former inlet was shown to be distinct from other Bay zones. Macroalgae conditions paralleled nutrient trends, indicating a percent cover gradient in the Bay from north to south. Again, the central region of the Bay proved to be a high growth area for macroalgae. Slightly reduced transparency was also noted for this midsection of the Bay.

V. GULF-BAY CONDITIONS AT MIDNIGHT PASS

Is the bay-side vicinity of the Midnight Pass area different than the gulf-side vicinity of Midnight Pass?

This analysis was undertaken by relying upon a comparison of Zones IIIW and Zones VI defined in the preceding section. Zone IIIW encompasses the water area surrounding the Bird Keys at the mouth of the former inlet and Zone VI represents the Gulf of Mexico (Figure 9).

A review of basic water quality parameters indicates that bay-side water quality was generally nutrient-enriched in comparison to the gulf-side. For essentially all chemical parameters investigated, gulf-side values were substantially lower over time than mean bay-side values (Figure 11). This was true of total phosphorus (TP), total Kjeldahl nitrogen (TKN), and reactive silicates (SiO_2-Si), while nitrate-nitrite nitrogen (NO_3+NO_2-N) levels were equally low in Bay and Gulf (Figure 21 through 24). The maximum gulf-side values for TP, TKN and SiO_2-Si throughout the monitoring period were approximately less than or equal to the minimum values encountered on the bay-side of the former inlet (Figure 11). This trend was also noted for chlorophyll a and color (Figures 10 and 11).

Water temperature was identical in the Gulf and Bay zones (Figure 25). Minimum gulf-side salinities were higher or approximately equal to the mean salinities which occurred on the bay-side (Figure 10). In general, however, the Gulf exhibited higher salinities over time than the Bay (Figure 26). This condition represents the holding of freshwater in the Bay as a result of inlet closure. Dissolved oxygen conditions on the average were similar in Gulf and Bay due to temperature and depth similarities. However, the Gulf exhibited narrower dissolved oxygen ranges than the bay-side vicinity of Midnight Pass, which exhibited some of the largest dissolved oxygen ranges encountered during the study (Figure 10 and Table 5).

The phytoplankton community exhibited relatively low abundance in the Gulf compared to the bay-side vicinity of Midnight Pass (Figure 5). However, the gulf-side exhibited relatively high community diversity and equitability. An analysis of community similarity between zones for each sampling date indicated that the phytoplankton community in the Gulf exhibited an overall

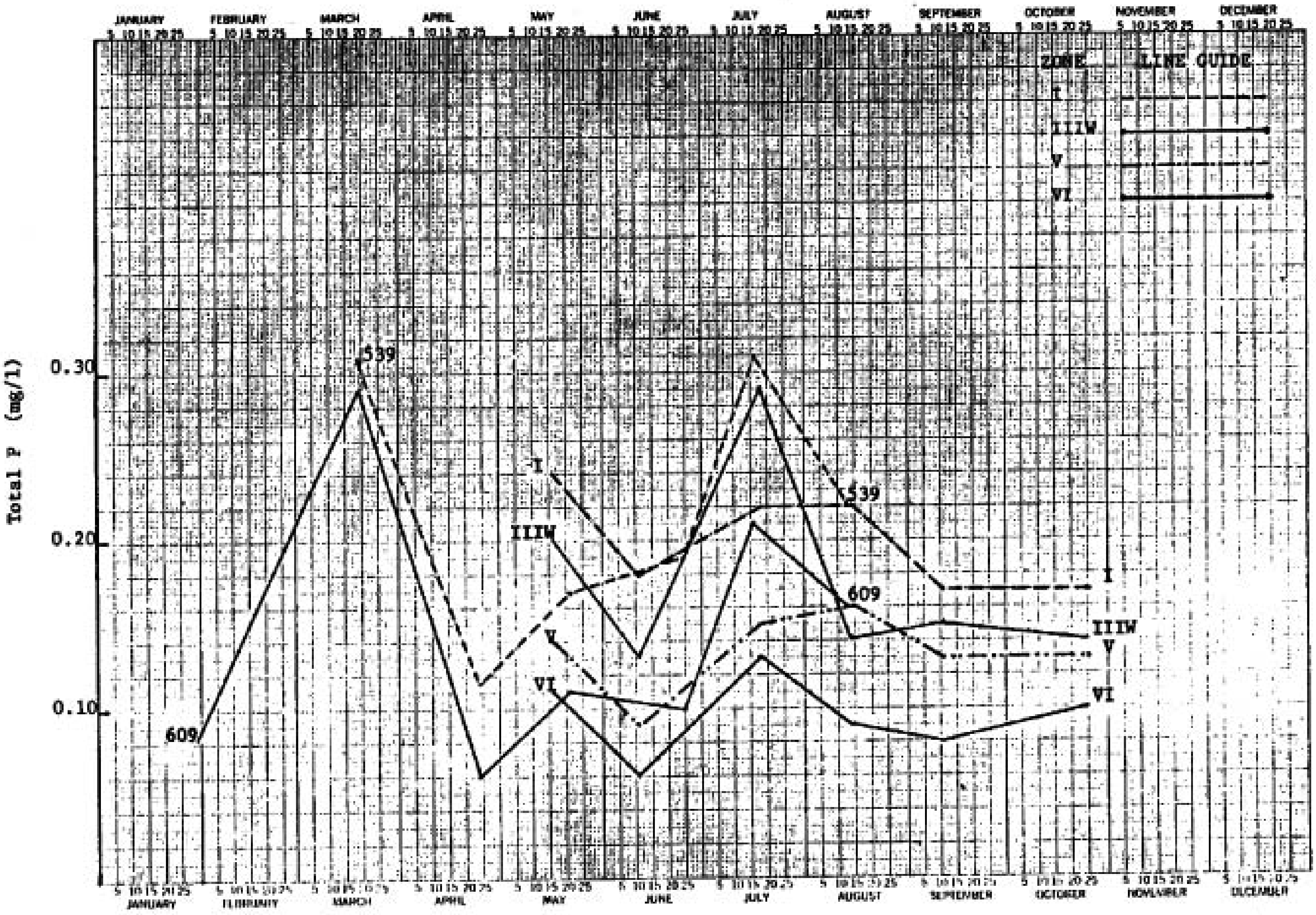


Figure 21. Total phosphorus (TP) levels at Little Sarasota Bay during 1984. Zones I, IIIW, V and VI. Stations #539 and #609 from Pollution Control (SCPC) monitoring.

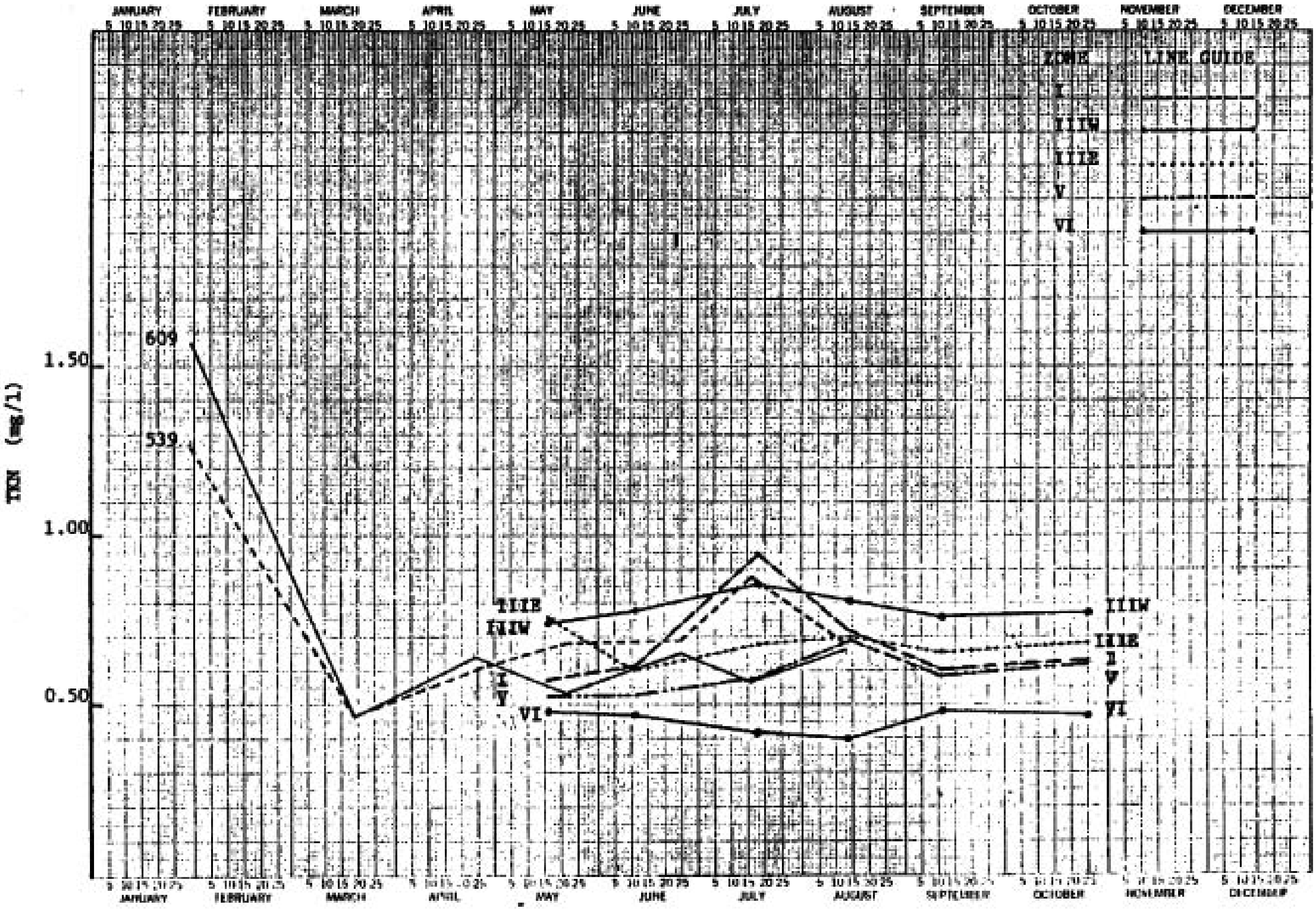


Figure 22. Total kjeidahl nitrogen (TKN) levels at Little Sarasota Bay during 1984. Zones I, IIIW, IIIE, V, and VI. Stations #539 and #609 from Pollution Control (SCPC) monitoring.

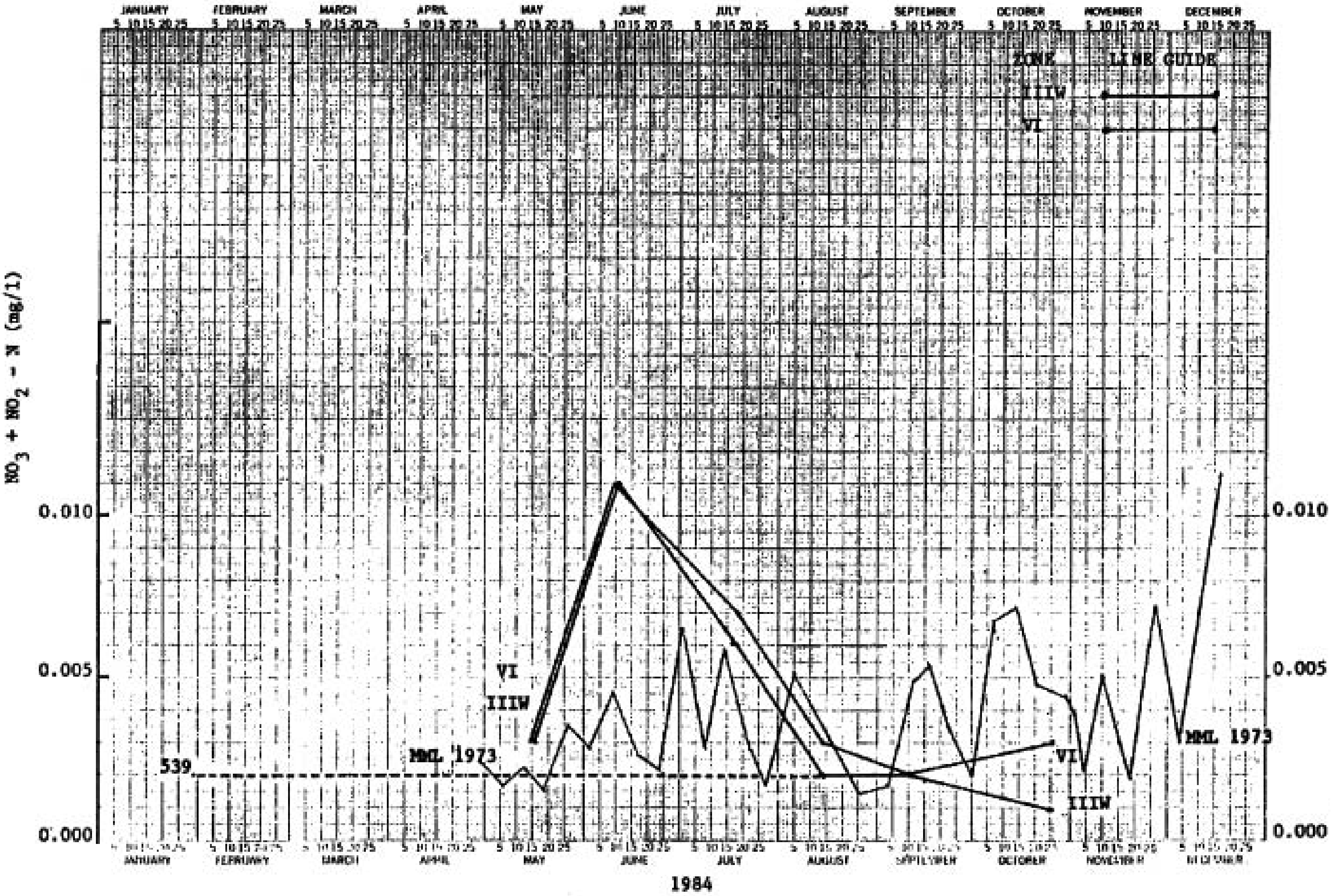


Figure 23. Nitrate + Nitrite nitrogen (NO_3 + NO_2-N) levels at Little Sarasota Bay during 1973 and 1984. Zones IIIW and VI. Station #539 from Pollution Control (SCPC) monitoring. 1973 data at Midnight Pass by Mote Marine Lab.

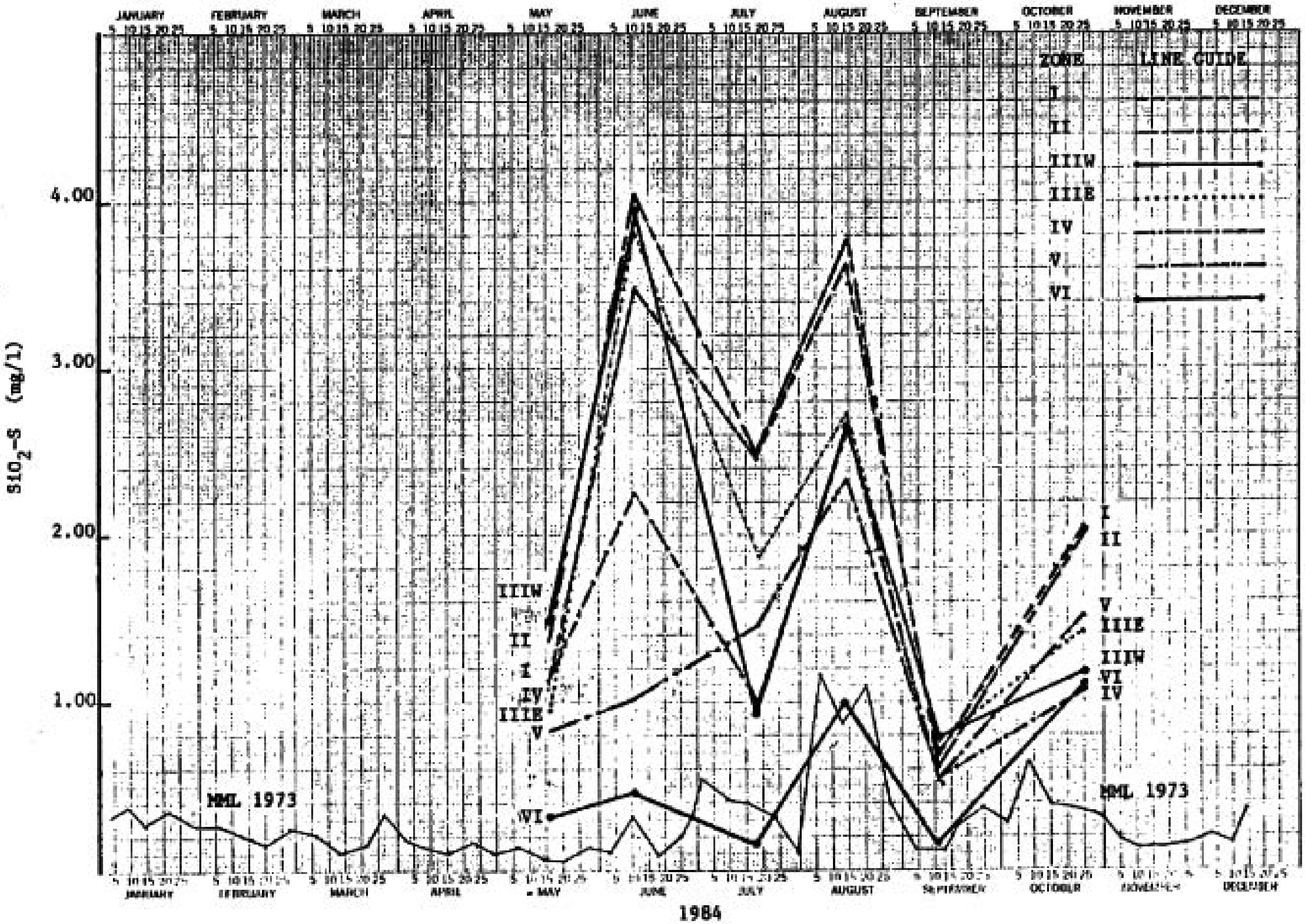


Figure 24. Reactive silicate (SiO_2-Si) levels at Little Sarasota Bay during 1973 and 1984. Zones I, II, IIIW, IIIE, IV, V, and VI. 1973 data at Midnight Pass by Mote Marine Lab.

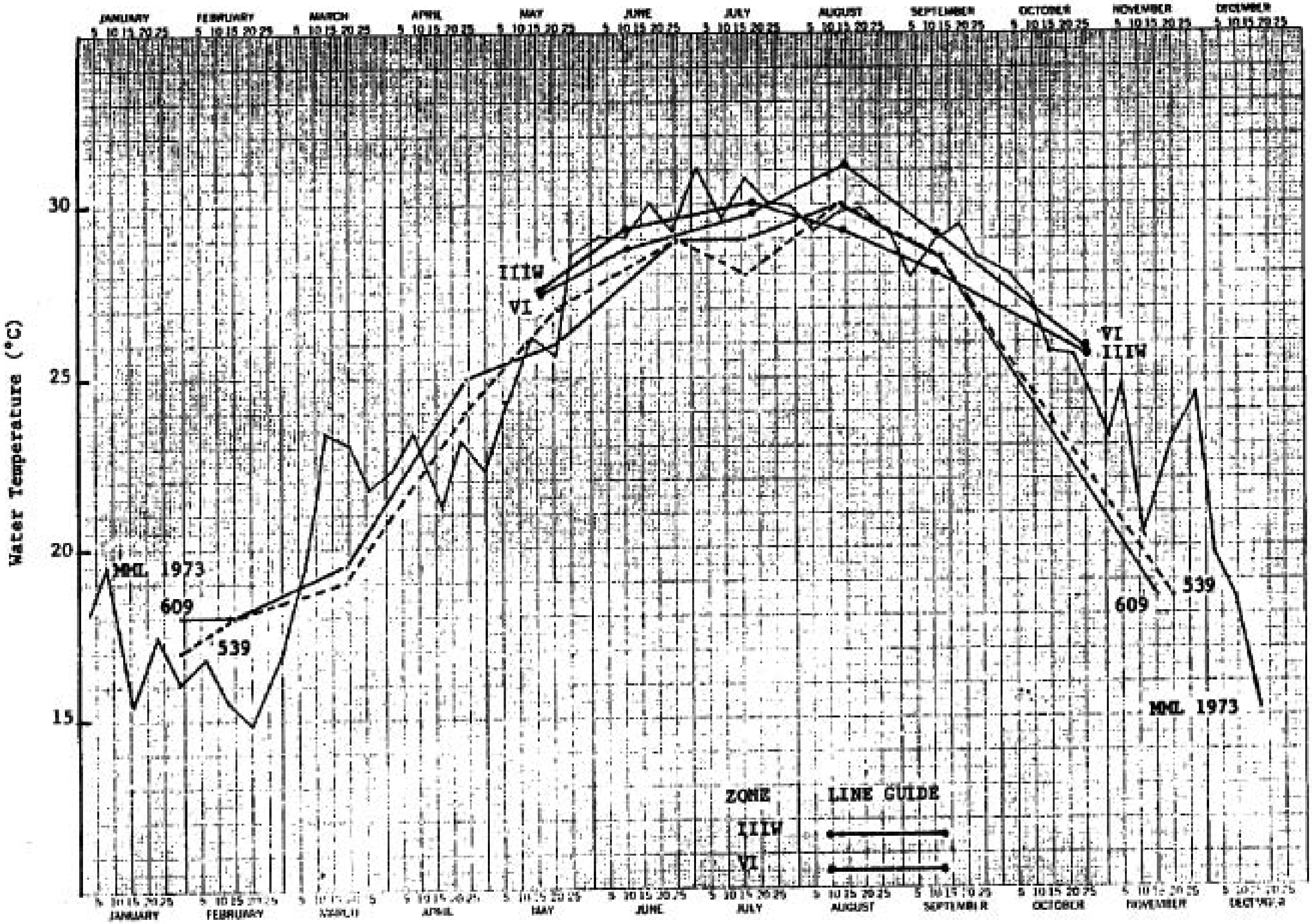


Figure 25. Water temperature variations in Little Sarasota Bay during 1973 and 1984. Zones IIIW and VI. Stations #539 and #609 from Pollution Control (SCPC) monitoring, 1984. 1973 data at Midnight Pass by Mote Marine Lab.

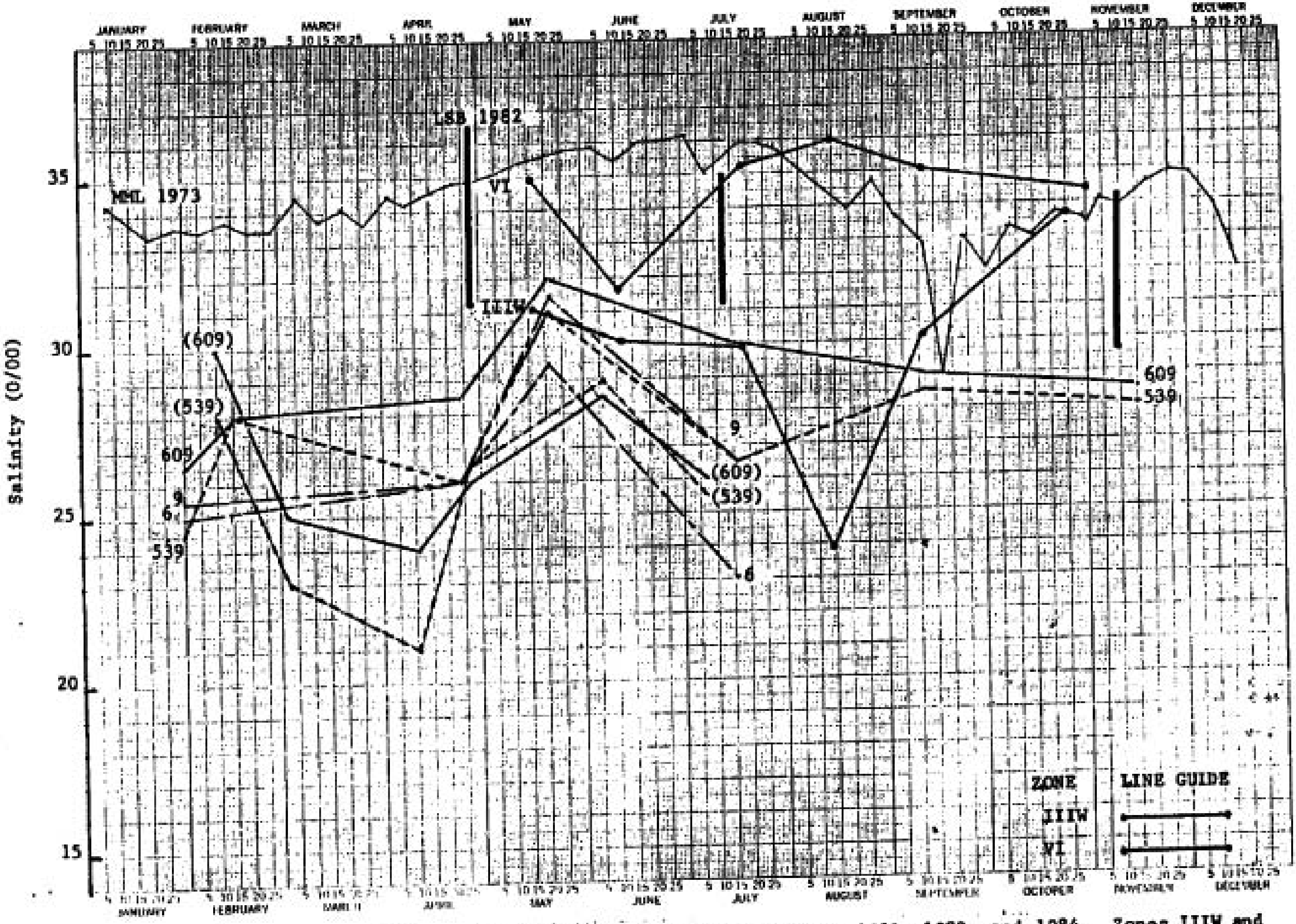


Figure 26. Salinity variations at Little Sarasota Bay during 1973, 1982, 1983, and 1984. Zones IIIW and VI. Stations #6, #9, #539 and #609 in 1984 and (#539) and (#609) in 1983 from Pollution Control (SCPC) monitoring. 1982 data indicate diurnal range at Zone II and IV equivalents. 1973 data at Midnight Pass by Mote Marine Lab.

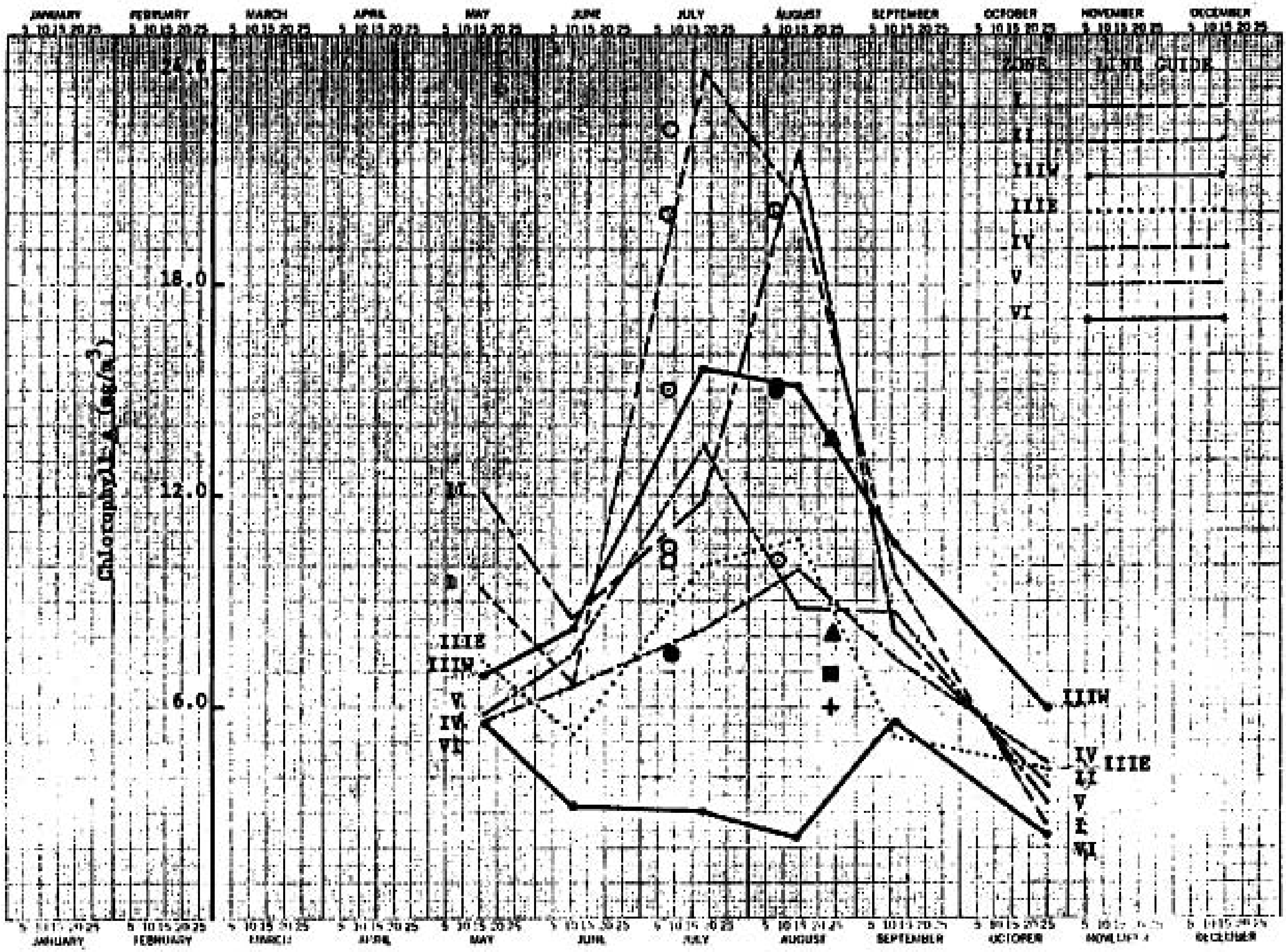


Figure 27. Chlorophyll-a levels at Little Sarasota Bay during 1972 and 1984. Zones I, II, IIIW, IIIE, IV, V, and VI. Symbols indicate individual samples taken during 1972: O Roberts Bay, ● Little Sarasota Bay Zone I equivalent, + Gulf of Mexico 2 miles out, ■ Midnight Pass, △ Little Sarasota Zone I equivalent, ▲ Little Sarasota Bay Zone II equivalent.

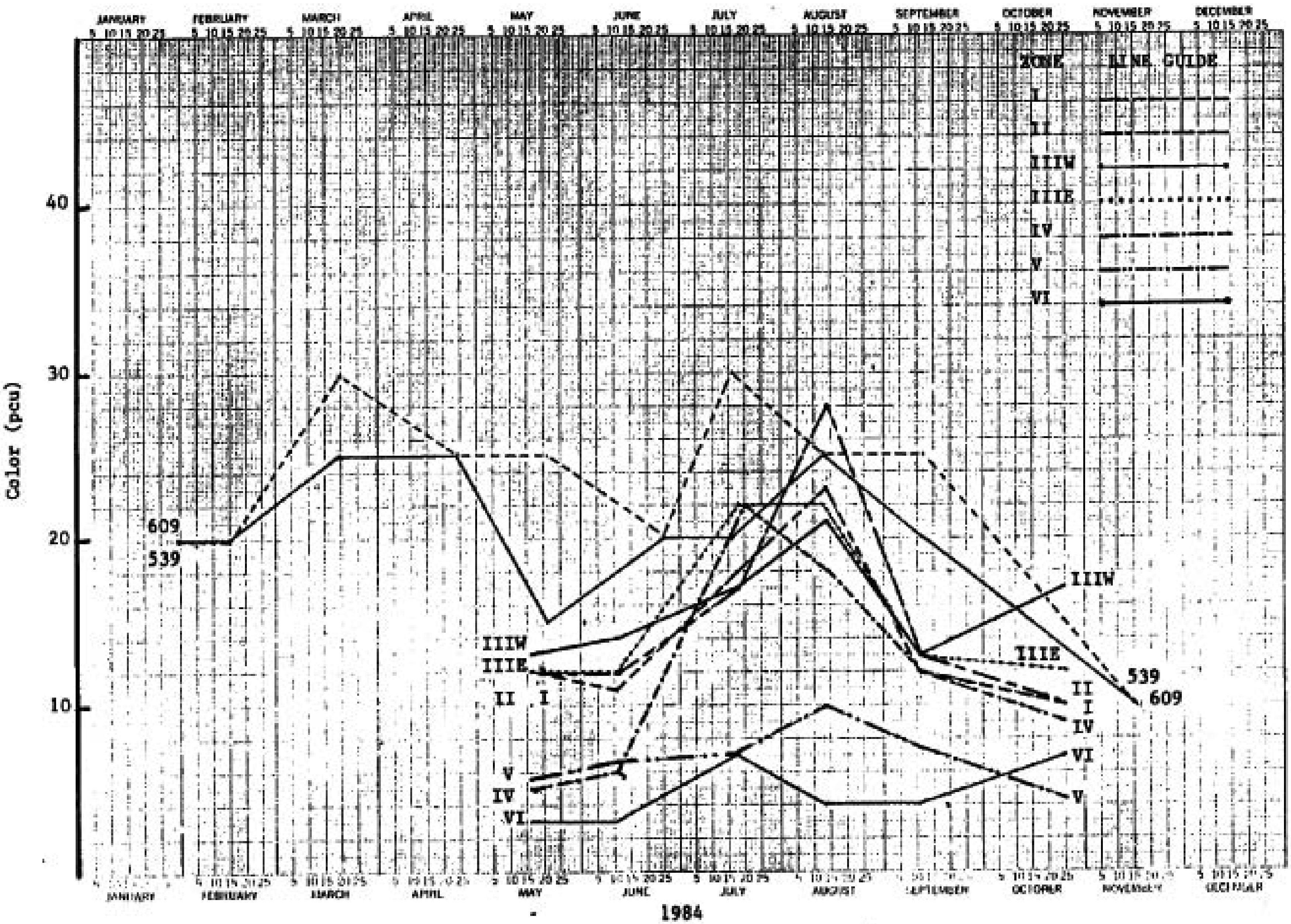


Figure 28. Color values at Little Sarasota Bay during 1984. Zones I, II, IIIW, IIIE, IV, V, VI. Stations #539 and #609 from Pollution Control (SCPC) monitoring.

low similarity (approximately 33%) to Zone IIIW (Table 8). The dissimilarity of the Gulf and Zone IIIW became increasingly apparent during the later sampling events when the last six comparisons revealed five low similarity values and one very low similarity value. The gulf-side phytoplankton exhibited no overall high similarity to any Bay zone but on two of the twelve sample dates displayed high similarity to the Bay (except Zone IIIW).

One of the most striking indications of differences between Gulf and Bay was revealed by the ichthyoplankton analysis. Although it was not possible to identify bay-wide variations due to the limited number of samples which could be processed, the data indicate that the bay-side assemblage of eggs and larval forms of fish and shellfish was affected adversely by inlet closure. Table 9 is a list of ichthyoplankton taken from three stations in Zone III (Bay) and a single station in Zone VI (Gulf). Thirteen species of fishes (out of a total of thirty two species identified) were not shared between the Bay and Gulf. Eight species which occurred in the Gulf did not show up in the Bay, primarily the pelagic species. Five other species which occurred in the Bay did not occur in the Gulf, primarily the gobies, pipefishes, and silversides. The gulf-side of the former inlet was significantly different in species composition of ichthyoplankton than the bay-side zone. The Gulf exhibited higher numbers of species than the Bay and also showed the highest number of individuals when Bay Zone III was averaged overall (Table 10).

Eggs of the herrings, sardines, drums and anchovies were much more abundant than larvae but, except for anchovies, the bay-side egg populations of these species were less abundant than on the gulf-side (Table 11). Larval forms of the stone crab, gobies, blennies and anchovies were most abundant of all the bay-side species. In the Gulf, larval forms of stone crab, herrings, soles, bumpers, sardines, and anchovies were most abundant. Although this analysis does not account for seasonality, it is apparent that the lack of a tidal inlet corridor disrupted migratory habits of fish and shellfish and reduced access to areas which their eggs, larvae and juveniles would have utilized for nursery and shelter.

Table 9. Species List of Ichthyoplankton Collected in Little Sarasota Bay in 1984. Lines indicate no occurrence in Bay or Gulf with total number of species enumerated at bottom of Table.

		BAY	GULF
ISH EGGS:			
upeidae	Herring		
arengula jaguana	Scaled sardine	—	
nchoa mitchilli	Bay anchovy		
iaenidae	Drums		
oleidae/Triglidae	Soles/Searobins		
ISH LARVAE:			
lupeidae	Herring	—	
arengula jaguana	Scaled sardine		
Opisthonema oglinum	Spanish sardine		
nchoa mitchilli	Bay anchovy		
nchoa sp.	Anchovy		
obiesox strumosus	Skilletfish	—	
Atherinidae	Silversides		—
ippocampus zosterae	Dwarf seahorse		—
ygnathus scovelli	Gulf pipefish		—
Chloroscombrus chrysurus	Atlantic bumper		
ligoplites saurus	Leatherjacket	—	
ucinostomus sp.	Mojarra		
Sciaenidae	Drums		
Bairdiella chrysoura	Silver perch		
ynoscion nebulosus	Spotted seatrout		
enticirrhus sp.	Kingfish (i.e., whiting)	—	
Chaetodipterus faber	Spadefish	—	
lenniidae	Blennies		
obiidae	Gobies		—
Bathygobius soporator	Frillfin goby		
Gobiosoma robustum	Code goby		
icrogobius gulosus	Clown goby		—
Soleidae/Triglidae	Soles/Searobins		
Achirus lineatus	Lined sole		
Prionotus sp.	Searobin	—	
Symphurus plagiusa	Blackcheek tonguefish	—	
INVERTEBRATES:			
Menippe mercenaria	Stone crab		
Penaeus duorarum	Pink shrimp		
	TOTAL SPECIES (not represented)	8	5

Table 10. Summary of Ichthyoplankton Population; statistics averaged over all sample dates. Maximum, Mean, and Minimum values as indicated.

	Station 6 (N=8)	Station 9 (N=2)	Station 14 (N=6)	Station 15 (N=4)	Bay (N=14)
	Maximum (Mean) Minimum				Average of Stations 6, 9, and 15
Number of Species	10 (8.3) 6	12 (11) 10	20 (15.3) 3	15 (10.5) 7	15 (9.3) 6
Number of Individuals Per 100 M^3	3,129.9 (430.4) 7.4	243.2 (236.0) 228.7	23,657.0 (4,885.8) 216.3	28,762.4 (7,324.7) 44.4	28,762.4 (2,356.8) 7.4
Margalef's Richness	6.290 (4.128) 1.265	4.663 (4.218) 3.772	6.425 (4.932) 0.816	5.464 (3.787) 3.093	6.290 (4.044) 1.265
Pielou's Equitability	1.992 (1.566) 0.682	1.425 (1.132) 0.839	1.768 (0.991) 0.094	1.548 (1.105) 0.337	1.992 (1.372) 0.337
Diversity (H')	1.992 (1.422) 0.651	1.425 (1.165) 0.905	2.129 (1.210) 0.045	1.458 (1.073) 0.396	1.992 (1.285) 0.396
Simpson's Dominance	0.688 (0.354) 0.161	0.600 (0.463) 0.325	0.986 (0.478) 0.183	0.789 (0.484) 0.317	0.789 (0.407) 0.161

Table 11. Summary of Ichthyoplankton Abundance Averaged over all sample dates.

	Frequency of Occurence (%)		Mean Number of Individuals Per 100 m^3		Importance Value (Dominance)	
	Bay	Gulf	Bay	Gulf	Bay	Gulf
FISH EGGS:						
Herrings	7	100	<0.1	302.1	<0.1	7.6
Scaled sardine	0	17		3243.8		13.7
Bay anchovy	79	17	2005.6	4.4	20.7	2.0
Drums	79	100	248.7	792.5	15.1	35.5
Soles/Searobins	79	50	2.1	0.4	3.8	<0.1
Unidentified	29	50	0.3	0.4	0.9	0.1
FISH LARVAE:						
Herrings	0	67		18.0		7.4
Scaled sardine	7	33	0.1	7.7	0.7	2.9
Spanish sardine	7	67	0.1	39.0	<0.1	0.3
Bay anchovy	50	83	24.5	23.0	1.4	3.6
Anchwoy	86	83	5.2	32.1	2.8	1.9
Skilletfish	0	17		0.1		<0.1
Silversides	7	0	0.3		1.0	
Dwarf seahorse	14	0	0.1		0.2	
Gulf pipefish	43	0	0.3		0.5	
Atlantic bumper	14	83	0.1	32.0	0.1	1.8
Leatherjacket	0	33		0.3		0.1
Mojarra	7	50	0.1	0.8	<0.1	0.1
Drums	14	33	0.1	4.2	0.1	0.3
Silver perch	7	33	0.1	0.3	0.2	0.1
Spotted seatrout	14	50	0.4	0.6	< 0.1	0.2
Kingfish (i.e. whiting)	0	83		4.5		0.6
Spadefish	0	50		0.6		0.2
Blennies	64	50	1.4	0.4	2.1	0.1
Gobies	14	0	1.0		2.2	
Frillfin goby	7	17	0.1	0.1	< 0.1	< 0.1
Code goby	100	50	13.9	4.0	18.8	0.8
Clown goby	36	0	1.4		2.6	
Sole/Searobin	0	17		0.3		0.1
Lined sole	36	100	0.5	10.5	0.4	1.3
Blackcheek tonguefish	0	17		0.1		< 0.1
Unidentified	43	83	0.9	2.7	1.5	1.1
INVERTEBRATES:						
Stone crab	79	83	65.3	361.0	20.5	18.3
Pink shrimp	7	17	0.1	0.1	0.3	< 0.1
TOTAL			2372.7	4886.0		

Conclusion

The bay-side vicinity of the former inlet is different than the gulf-side. The lack of a corridor means a lack of tidal exchange in this region of the Bay as well as a lack of direct access by organisms between the Gulf and Bay. The relatively stagnant nature of the water mass gives rise to wide dissolved oxygen fluctuations, decreased salinities, and elevated nutrient levels as a result of trapping of runoff within the Bay. The phytoplankton community reacts to these conditions with high cell counts and low similarity as compared to the gulf-side. The larval fishes were poorly represented in the bay-side as compared to the gulf-side due to the lack of direct access. Many of these species depend upon the nursery and shelter aspects of the Bay for growth and maturation.

VI. ECOLOGICAL TRENDS IN RECENT YEARS

Was the Midnight Pass/Little Sarasota Bay area different in 1984 than in the recent past?

The geological history of Midnight Pass has been reviewed elsewhere (7; 9). Recent hydrological conditions have also been addressed(2). Little information is available regarding the water quality of the Bay over the past 10 years and even less is known of past biological relationships in the Bay. Even so, an attempt to synthesize available information is instructive.

The obvious fact about the Midnight Pass area today is that the inlet is closed to tidal current. However, in 1955 the tidal prism of Midnight Pass was determined to be about $2.7 \times 10^8 ft^3$ (Figure 29). Data collected in 1982 by Camp Dresser & McKee, Inc. (2) indicated that the tidal prism of Midnight Pass was, at maximum, about $5.4 \times 10^6 ft^3$ and at minimum about $1.4 \times 10^6 ft^3$. The change between 1955 and 1982 represented a decrease of two orders of magnitude. The change was quite gradual owing in part to the flood dominated nature of Midnight Pass. All data on tidal currents show that maximum flood velocities were greater than maximum ebb velocities. Such tidal characteristics resulted in net sand transport into the inlet; contributed to a reduced tidal prism, and caused Midnight Pass to atrophy markedly during the past two decades. In 1982 Midnight Pass was accommodating only 16% of the total prism of Little Sarasota Bay while the major conduit of tidal flow was the Intracoastal Waterway through the Stickney Point (north) and Blackburn Point (south) ends of the Bay. By December 1983, just prior to when the inlet was closed, the tidal prism had been reduced even more.

It follows from this background that complete closure of Midnight Pass would be expected to have relatively insignificant <u>hydrologic</u> impact upon the circulatory characteristics of the Bay compared to nearly closed conditions. Simulated results of a hydrodynamic model for a completely closed scenario were shown to marginally increase the volume exchanged through Stickney Point and Blackburn Point.(8) When compared to 1984 hydrographic data collected during this monitoring program (Figure 7), it is evident that the maximum tidal current velocities did not increase measurably but that the nodal points shifted slightly to create an expanded null zone of no distinct water movement

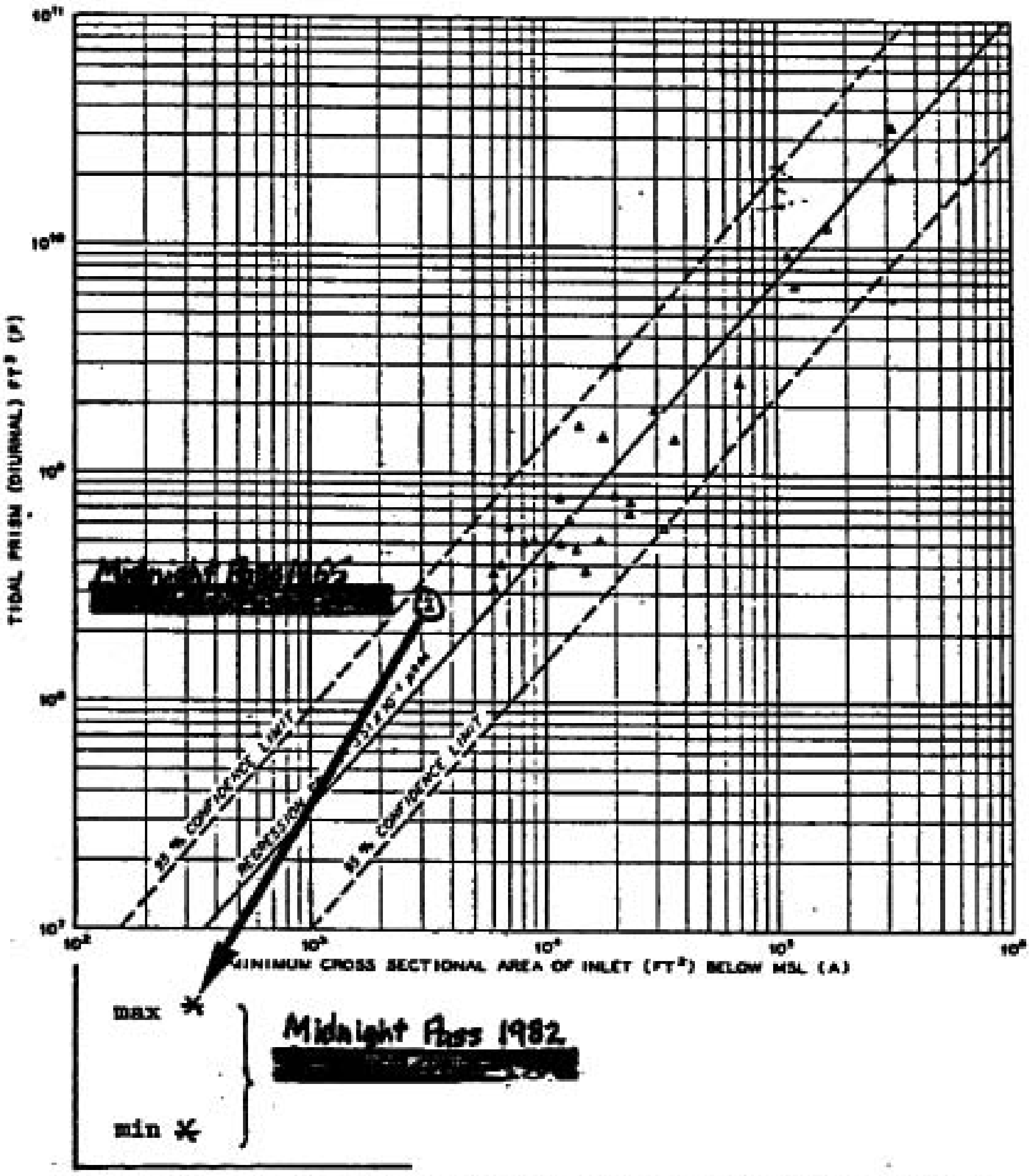


Figure 29. Diagram depicting significant reduction of inlet size and tidal prism from 1955 to 1982.

NOTE: REGRESSION CURVE WITH 95 PERCENT CONFIDENCE LIMITS

FROM: Jarrett, J. T., 1976, Tidal prism - inlet area relationships: GITI Rept. #3, U. S. Army Engineers, 32 p.

TIDAL PRISM VS CROSS-SECTIONAL AREA

INLETS ON GULF COAST WITHOUT JETTIES

in the central region of the Bay. This zone is essentially the same as that which was under direct Gulf influence when the inlet was partially open as late as September 1983. The result is that tidal flushing in the immediate vicinity of Midnight Pass ceased but this did not markedly influence other regions of the Bay in terms of circulatory characteristics.

Water quality and biological conditions in the vicinity of the former inlet must be expected to react to this cessation of direct Gulf influence. While it was shown in the previous section that chemistry and biology in the bay-side vicinity of the former inlet was different than the gulf-side during 1984, what longer term changes are evident for the Midnight Pass area? Figure 25 illustrates the water temperature trend during 1973 and 1984 and reveals essentially identical conditions. Salinity data (Figure 26) indicate that the Gulf experienced similar annual ranges for 1973, 1982, and 1984 while the Bay at Zones II and IV experienced similar but lower annual salinity ranges than the Gulf in 1983 and 1984. Table 12 shows conductivity trends between 1980 and 1984. The gradual diminishing of Gulf influence on the Bay is remarkable: annual mean conductivities for these two stations decreased from 1980 to 1984 while both the maximum and minimum values for each year showed similar trends toward lower conductivities. Figure 26 further supports the conclusion that salinity conditions on the Bay side of Midnight Pass diminished as a result of inlet closure (e.g., Zone IIIW vs. Zone VI).

Nutrient levels in the Midnight Pass vicinity during 1984 are compared to 1973 data in Figures 21 through 24. Nitrate + nitrite nitrogen (NO_3+NO_2-N) shows a similar range in values during 1973 and 1984. Nitrate-nitrite levels were usually less than 0.005 ppm in both 1973 and 1984. The 1984 bay-side and gulf-side values covaried while the bay-side was generally 0.010 - 0.015 ppm higher than the Gulf side, perhaps indicating an interesting case of subsediment water exchange across the narrow bar that currently plugs the inlet. The bar is composed primarily of coarse shell which may be presumed to be extremely porous. Both total phosphorus (TP) and reactive silicates (SiO_2-Si) covaried in similar fashion. Bay-side concentrations of these nutrients were roughly two to three times the levels encountered on the gulf-side. Reactive silicates in the Gulf showed nearly identical ranges in 1973 and 1984 (Figure 24).

Table 12. Annual Summaries of Maximum, Mean, and Minimum Conductivity values at select locations in Little Sarasota Bay. Data from Pollution Control Division.

Bay Zone	PC Station	Conductivity (µmho/cm) 1984	1983	1982	1981	1980
III	#539	48000	49146	49400	54800	53000
		(40478)	(39287)	(42700)	(50013)	(48720)
		32000	29442	37400	41200	38000
IV	#609	49000	50434	51300	56200	53000
		(42636)	(41100)	(45000)	(51775)	(50370)
		36000	31701	37200	41300	41000

Although little historical data are available concerning chlorophyll a levels in the Gulf and Bay or the character of the phytoplankton community, Figure 27 was prepared to indicate chlorophyll a ranges encountered in 1972 and 1984. Areas monitored in 1972 included the Gulf of Mexico (2 miles out), Midnight Pass, and northern Little Sarasota Bay (i.e., Zone I and Zone II equivalents). It is apparent that chlorophyll a levels were similar in 1972 and 1984.

The ten most abundant phytoplankton species identified for Little Sarasota Bay in 1972 (10) were also represented in 1984 collections (Tables 13 and 14) but not in similar proportions based on percent composition. However, this comparison is confounded by differences in identification and sample size, making further elaboration inappropriate.

Conclusion

In summary, if the obvious difference at Midnight Pass is ignored (i.e., a closed tidal inlet), Little Sarasota Bay has not changed measurably over the recent past in relation to the select ecological parameters which were investigated in this study. That is, ambient conditions which existed in 1972 and 1973 were essentially the same in 1984. Water temperature and salinity ranges in Gulf and Bay encountered in 1984 were similar to 1973 conditions. Limited nutrient level comparisons suggested that nitrogen conditions have not changed significantly since 1973. Even phytoplankton abundance, as indicated by chlorophyll a values, seemed to be well within the ranges encountered in 1972 and 1973. Dominant phytoplankton species encountered in 1972 were also collected in 1984. All this suggests that the ecological character of the Little Sarasota Bay area, as influenced from land and sea, has not shifted over the past decade.

Table 13. Percent composition of the ten most abundant phytoplankton in plankton collections from the Heron Lagoon System, June 27, 1972 (from Morrill et.al., 1974).

Phytoplankton Species	Station Number					
	1	3	4	5	6	8
Flooding Tide (0700) - Dawn						
Skeletonema costatum	51.3%	89.1%	91.0%	79.0%	93.3%	86.6%
Chaetoceros sp.	28.3	7.0	7.3	17.1	5.7	10.2
Rhizosolenia setigera	4.0	0.9	0.4	0.1	0.1	0.3
Thalassionema nitzchiodes	5.0	0.2	*	0.1	*	0.4
Nitzchia closterum	2.7	0.6	0.4	1.9	0.2	0.8
Nitzchia longissima	1.2	0.1	*	-	*	*
Nitzchia pangens	*	1.0	0.7	-	-	-
Paralia sulcata	4.4	*	*	*	*	*
Gonyaulax polyramma	2.3	0.1	0.1	*	*	-
Peridinium conicum	0.8	-	0.1	*	*	*
Ebbing Tide - (1800) - Dusk						
Skeletonema costatum	83.2	91.4	68.5	89.2	82.0	88.5
Chaetoceros sp.	12.2	3.8	28.8	9.4	10.9	8.1
Rhizosolenia setigera	1.0	0.3	0.2	0.1	0.1	0.1
Thalassionema nitzchiodes	*	0.6	*	0.2	0.1	0.4
Nitzchia closterum	2.6	0.3	0.2	0.3	1.5	0.3
Nitzchia longissima	0.7	0.1	-	*	0.1	-
Nitzchia pangens	-	2.6	1.6	0.8	4.8	2.4
Paralia sulcata	*	*	-	*	-	-
Gonyaulax polyramma	*	0.4	0.1	0.1	*	-
Peridinium conicum	*	*	0.1	0.1	*	*

Table 14. Comparisons of sample parameters and percent occurrence of dominant phytoplankton species between Zones IIIW and VI by sampling date. (-)indicates species not present.

SAMPLE PARAMETER & TAXA	SAMPLING DATE/ZONE 5/16/84		5/31/84		6/11/84		6/25/84	
	IIIW	VI	IIIW	VI	IIIW	VI	IIIW	VI
No. of Species	43	27	42	32	27	34	29	
No. of Individuals	19.3	6.4	21.3	13.3	12.1	15.9	23.8	
(X 1000)								NO DATA
Shannon-Weaver Diversity	2.37	2.59	1.88	2.57	2.21	2.02	1.73	
Equitability (H'/log spp.)	0.63	0.79	0.50	0.74	0.67	0.57	0.51	
PHYLUM CHRYSOPHYTA								
Bacteriastrum sp.	5.6	-	0.1	0.4	-	1.2	-	
Cerataulina pelagica	-	-	-	-	-	-	-	
Chaetoceros diversus	-	-	1.4	3.7	-	-	-	
Chaetoceros lasciniosus	1.5	-	0.5	1.6	-	54.3	-	
Chaetoceros muelleri	0.2	-	1.1	1.9	10.5	1.8	1.8	
Chaetoceros radicans	33.9	-	56.3	67.2	-	1.8	-	
Chaetoceros simplex	3.0	0.5	0.2	-	0.1	1.4	-	
Chaetoceros subtilis	1.0	-	0.1	-	-	0.8	0.2	
Chaetoceros sp. A	16.3	-	9.5	2.5	22.6	3.7	2.1	
Chaetoceros sp. C	3.0	4.3	0.2	-	-	-	-	
Leptocylindrus danicus	-	-	0.1	-	-	0.6	-	
Leptocylindrus minimus	1.1	1.9	2.0	1.4	0.2	-	-	
Nitzschia closterium	0.7	5.3	0.1	1.7	0.8	2.5	0.3	
Nitzschia pungens	1.2	1.9	-	3.3	-	-	0.2	
Rhizosolenia minimus	0.3	-	2.2	1.0	6.4	-	10.6	
Rhizosolenia setigeri	0.8	1.0	-	1.2	-	0.2	-	
Rhizosolenia stolterfothii	-	-	-	-	-	-	-	
Skeletonema costatum	14.2	20.8	0.3	1.7	0.3	4.5	-	
Thalassiosira aestivalis	0.1	1.4	0.1	-	-	-	-	
Centric sp. A	4.3	24.6	6.9	4.8	25.5	7.0	45.7	
Centric sp. B	0.3	1.4	3.2	4.0	2.1	0.4	4.5	
Centric sp. C	0.8	2.4	0.5	1.0	0.4	-	0.1	
Centric sp. D	0.3	9.7	4.2	0.6	5.6	0.4	2.4	
Pennate sp. A	2.9	0.5	0.8	-	0.8	-	24.0	
Pennate sp. C	0.2	1.9	-	-	-	-	-	
Pennate sp. D	-	1.4	0.4	-	0.2	1.2	0.1	
PHYLUM EUGLENOPHYTA								
Phacus sp.	0.4	4.3	0.5	0.4	4.7	0.2	0.9	
PHYLUM PYRROPHYTA								
Dinoflagellates unident.	0.1	-	0.7	1.2	0.3	1.0	0.3	
PHYLUM CYANOPHYTA								
Trichodesmium sp.	-	-	-	-	-	-	-	
Phytoflagellates unident.	2.1	2.9	4.4	5.0	13.7	7.4	4.2	

Table 14. Continued.

SAMPLE PARAMETER & TAXA	SAMPLING DATE/ZONE 7/18/84 IIIW	7/18/84 VI	7/26/84 IIIW	7/26/84 VI	8/8/84 IIIW	8/8/84 VI	8/14/84 IIIW	8/14/84 VI
No. of Species	43	26	27	12	37	17	25	23
No. of Individuals (X 1000)	23.4	6.6	9.8	4.2	40.0	5.5	66.9	8.4
Shannon-Weaver Diversity	2.14	2.50	2.26	1.18	1.23	1.70	1.34	1.59
Equitability (H'/log spp.)	0.57	0.77	0.69	0.47	0.37	0.60	0.42	0.51
PHYLUM CHRYSOPHYTA								
Bacteriastrum sp.	-	-	-	-	-	-	-	-
Cerataulina pelagica	-	-	-	-	-	-	-	2.6
Chaetoceros diversus	0.6	-	-	-	-	-	-	-
Chaetoceros lasciniosus	0.2	6.5	-	-	-	-	-	-
Chaetoceros muelleri	13.1	0.5	2.6	-	0.2	3.4	4.9	2.9
Chaetoceros radicans	4.5	9.8	-	-	-	-	-	-
Chaetoceros simplex	0.1	-	-	-	-	1.1	-	-
Chaetoceros subtilis	0.1	1.4	-	-	-	-	-	-
Chaetoceros sp. A	7.6	0.5	9.9	-	-	1.1	3.8	0.7
Chaetoceros sp. C	0.3	1.9	-	-	-	-	-	-
Leptocylindrus danicus	-	7.5	-	1.4	0.1	-	-	-
Leptocylindrus minimus	0.5	2.8	0.4	-	1.6	-	3.3	0.4
Nitzschia closterium	-	-	0.1	0.5	0.1	3.9	0.1	1.8
Nitzschia pungens	0.4	2.8	-	5.3	-	1.1	-	-
Rhizosolenia minimus	13.1	-	14.7	-	9.8	-	8.4	0.4
Rhizosolenia setigeri	0.2	0.5	3.5	-	-	0.6	-	-
Rhizosolenia stolterfothii	-	-	-	-	-	-	-	-
Skeletonema costatum	0.3	-	4.2	-	1.2	-	-	-
Thalassiosira aestivalis	-	-	-	-	-	-	-	-
Centric sp. A	37.7	22.4	27.8	63.2	70.4	52.8	67.5	56.8
Centric sp. B	3.1	2.3	1.6	2.7	2.4	-	1.8	0.7
Centric sp. C	-	1.4	-	-	0.4	-	0.2	0.4
Centric sp. D	2.5	0.9	2.2	-	1.2	-	2.2	1.8
Pennate sp. A	0.4	2.3	2.7	-	0.1	-	0.3	-
Pennate sp. C	0.3	-	0.1	1.4	0.7	-	1.3	-
Pennate sp. D	-	-	-	-	0.1	2.2	0.3	2.6
PHYLUM EUGLENOPHYTA								
Phacus sp.	1.0	0.5	2.9	-	0.9	-	0.3	2.9
PHYLUM PYRROPHYTA								
Dinoflagellates unident.	0.1	0.9	1.8	0.9	2.3	2.8	0.1	0.4
PHYLUM CYANOPHYTA								
Trichodesmium sp.	-	-	-	-	-	-	-	-
Phytoflagellates unident.	10.1	22.0	20.0	22.5	6.9	18.0	5.2	20.7

Table 14. Concluded.

SAMPLE PARAMETER & TAXA	SAMPLING DATE/ZONE 9/5/84 IIIW	9/5/84 VI	9/11/84 IIIW	9/11/84 VI	10/4/84 IIIW	10/4/84 VI	10/25/84 IIIW	10/25/84 VI
No. of Species	35	14	39	35	40	20	44	23
No. of Indiviuals (X 1000)	29.8	7.9	32.0	14.2	29.4	7.1	20.9	5.7
Shannon-Weaver Diversity	1.85	1.58	2.12	2.58	2.16	1.66	2.32	1.99
Equitability (H'/log spp.)	0.52	0.60	0.58	0.72	0.58	0.55	0.61	0.63
PHYLUM CHRYSOPHYTA								
Bacteriastrum sp.	0.3	-	3.1	2.0	-	-	5.9	-
Cerataulina pelagica	-	-	-	-	-	-	-	-
Chaetoceros diversus	-	-	-	-	-	-	-	-
Chaetoceros lasciniosus	-	-	-	1.1	-	-	-	-
Chaetoceros muelleri	2.6	1.2	10.1	2.0	3.8	1.8	12.7	4.9
Chaetoceros radicans	0.3	-	0.1	5.9	0.2	-	1.0	-
Chaetoceros simplex	-	-	0.1	-	-	-	0.1	-
Chaetoceros subtilis	2.2	-	0.4	1.3	0.2	-	1.3	-
Chaetoceros sp. A	1.2	-	1.6	0.2	1.8	-	0.5	-
Chaetoceros sp. C	-	-	0.3	28.3	0.2	-	-	-
Leptocylindrus danicus	0.2	2.3	0.3	0.9	-	-	0.4	-
Leptocylindrus minimus	11.4	2.0	0.7	3.5	3.8	-	0.4	-
Nitzschia closterium	0.4	5.9	0.2	3.1	0.1	3.1	0.1	7.0
Nitzschia pungens	0.2	1.6	0.1	4.8	0.9	-	2.0	5.4
Rhizosolenia minimus	2.4	1.2	3.0	0.7	0.3	1.3	0.1	-
Rhizosolenia setigeri	-	-	0.8	0.2	-	0.4	0.1	-
Rhizosolenia stolterfothii	-	-	-	-	-	2.6	-	-
Skeletonema costatum	0.3	-	3.1	2.0	-	-	5.9	-
Thalassiosira aestivalis	-	-	-	-	2.0	0.4	1.3	0.4
Centric sp. A	52.0	44.9	39.0	14.5	36.4	36.4	15.4	40.8
Centric sp. B	1.0	0.4	1.4	1.1	-	-	0.5	0.4
Centric sp. C	0.3	-	0.1	0.4	-	-	0.1	-
Centric sp. D	9.2	-	13.4	0.7	3.4	-	1.1	1.2
Pennate sp. A	-	-	0.1	-	14.5	2.2	1.5	0.8
Pennate sp. C	0.4	2.7	0.3	-	0.1	0.4	0.5	1.6
Pennate sp. D	1.2	-	5.0	-	4.0	1.3	31.8	0.4
PHYLUM EUGLENOPHYTA								
Phacus sp.	2.3	0.8	2.2	-	1.9	0.9	1.4	2.1
PHYLUM PYRROPHYTA								
Dinoflagellates unident.	0.3	0.8	1.0	0.2	0.5	0.9	0.4	3.7
PHYLUM CYANOPHYTA								
Trichodesmium sp.	-	-	-	4.6	-	-	-	-
Phytoflagellates unident.	8.6	31.6	13.7	13.6	14.8	41.7	14.1	23.5

VII. IMPACT OF INLET CLOSURE

What is the total area of the Bay now affected by inlet closure?

In order to assess the total area of the Bay now affected by inlet closure, we must recognize that over the past decade the influence of Gulf water on the Bay has diminished gradually as Midnight Pass has narrowed and closed. This protracted period of closure has allowed the ecological system to adjust and respond. This change has not been a catastrophic or traumatic event. In fact, the process has been scarcely perceptible. The important lesson here is that when inlet closure finally occurred (i.e., January 1984) Gulf influence on the Bay via Midnight Pass had already been reduced. Based on the condition of the Pass at that time, inlet closure was expected to have relatively insignificant impact on the Bay as a whole.

Figure 30 shows the extent of the water mass (i.e., tidal prism) entering Midnight Pass from the Gulf in 1976. This representation was constructed from semiquantitative monitoring conducted at that time. Figure 31, which is based on 1982 quantitative analysis (i.e., dye release and current velocity profiles) shows a diminished area of influence. This area corresponds to the tidal current zones identified in Figure 6 for the 1983 period. Figure 7 identifies a null zone of no distinct water movement following inlet closure in 1984. The 1976 area of influence and the 1984 null zone are approximately equal and represent 38% of the total Bay area. The 1982 tidal prism zone represents 21% of the Bay area.

When the ecological information collected during this 1984 study is examined, the area of influence of the inlet is modified somewhat. Dissolved oxygen data indicated stratification at Stations 5, 6, 7, 8 and 13. This area corresponds to 1982-83 tidal current zones. Phytoplankton data revealed Zone IIIW of the Bay to be most dissimilar to other Bay zones. This area is somewhat less than the 1982-83 tidal current zones. Data for macroalgae indicated high growth areas in Zones II, IIIW, and IV. This area is roughly equal to the null zone.

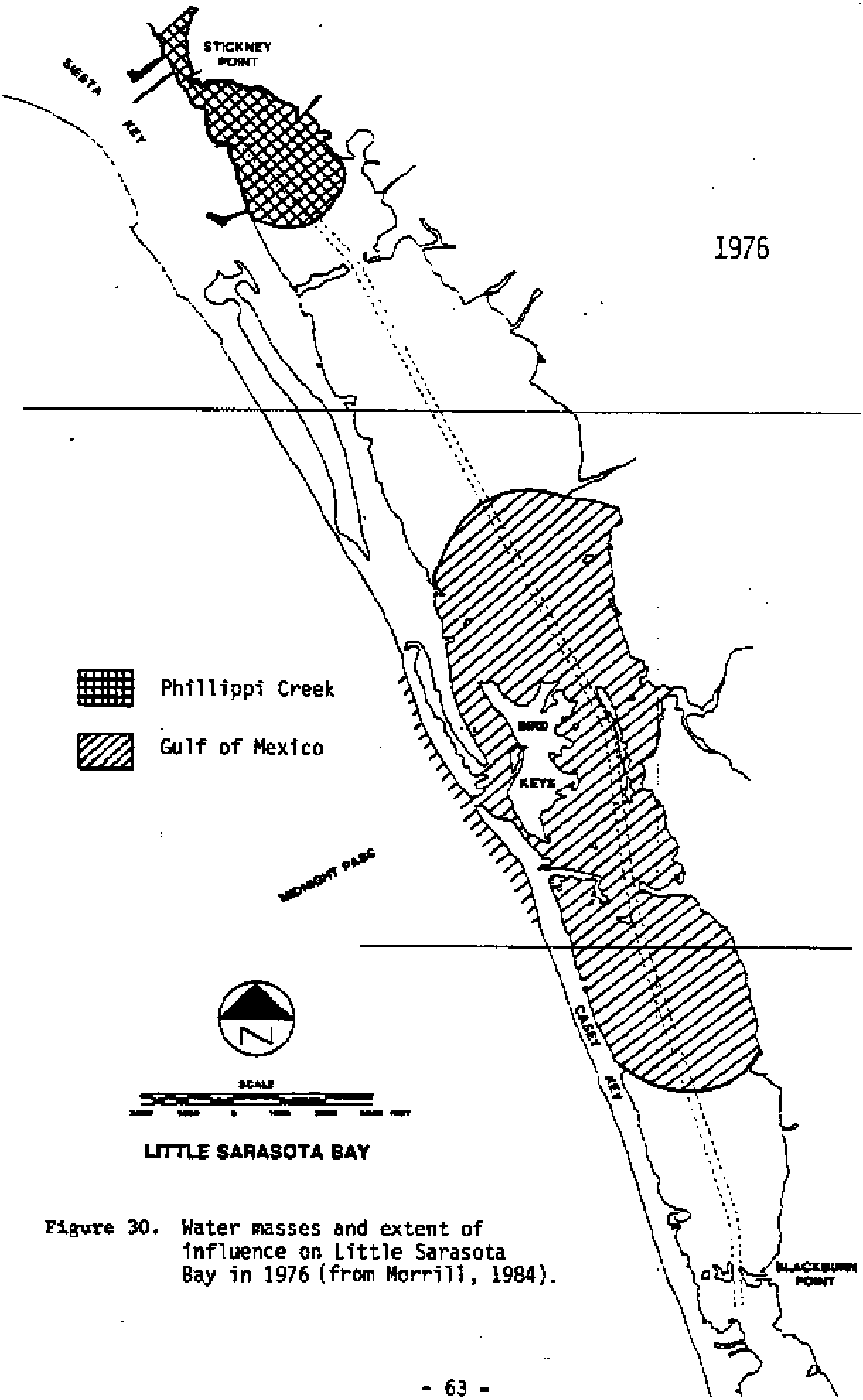
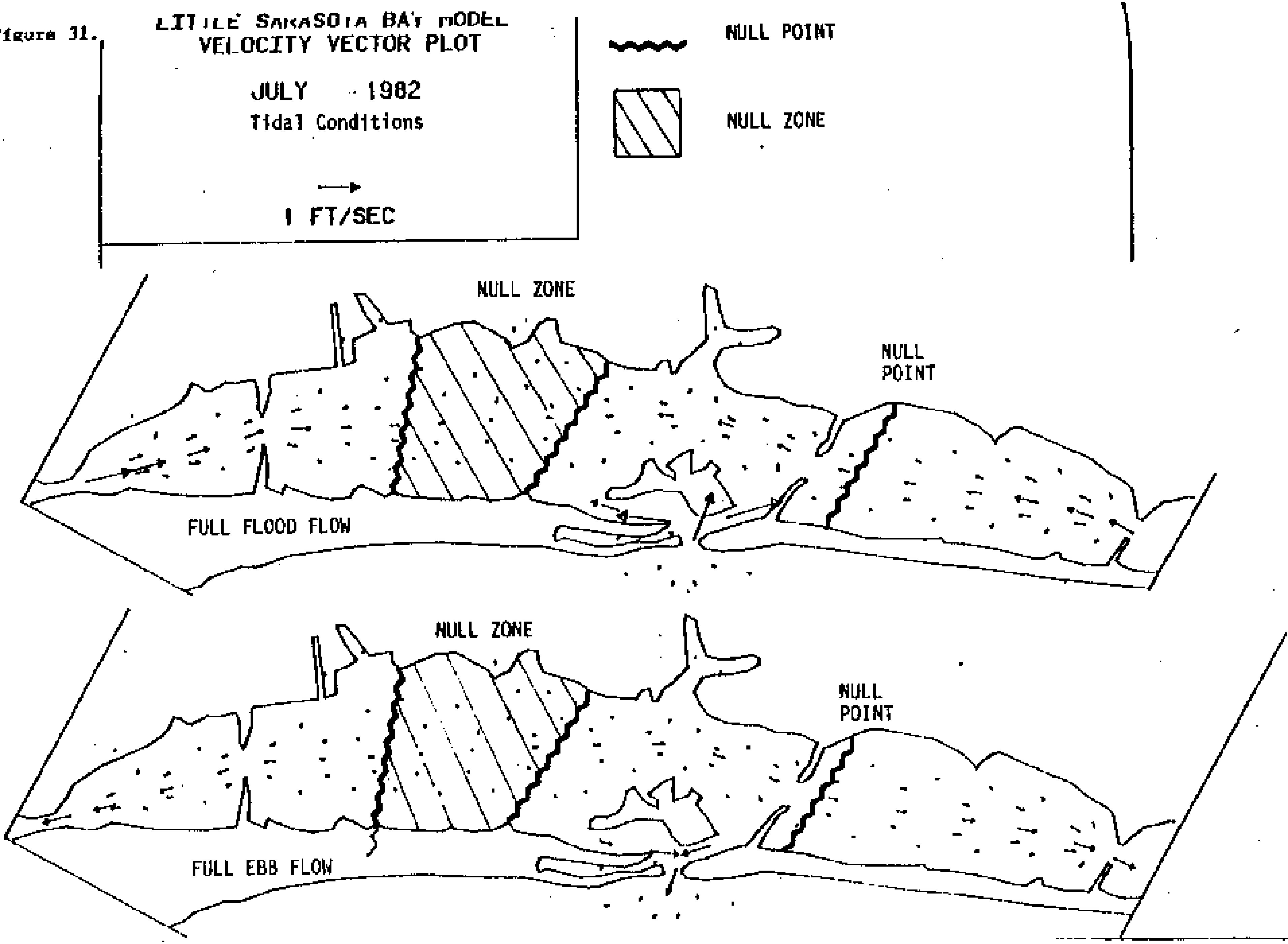


Figure 30. Water masses and extent of influence on Little Sarasota Bay in 1976 (from Morrill, 1984).

Figure 31.


LITTLE SARASOTA BAY MODEL
VELOCITY VECTOR PLOT
JULY 1982
Tidal Conditions
1 FT/SEC
NULL POINT
NULL ZONE
NULL ZONE
NULL POINT
FULL FLOOD FLOW
NULL ZONE
NULL POINT
FULL EBB FLOW

Conclusion

In summary, based on tidal current zones and various water quality and biological indicators investigated during 1984, thirty percent (30%) of the Little Sarasota Bay area has been affected by inlet closure.

VIII. FUTURE TRENDS

What are probable trends for Midnight Pass and Little Sarasota Bay with (a) the Pass closed? (b) the Pass opened?

If Midnight Pass is left closed the ecological condition of the inlet and Bay will continue to exhibit 1984 trends documented in this report. It has been noted that the closed inlet condition gave rise to a null zone in the central region of the Bay. A lack of flow and mixing of Gulf waters, coupled with retention of freshwater entering the Bay as runoff will continue to dominate the character of the inlet area and Bay. Increased runoff and associated pollutants can be expected to enter Little Sarasota Bay in the future because (a) rainfall will probably return to average conditions; (b) the watershed is being developed rapidly; and (c) County stormwater provisions only address new development.

The inlet area will experience more seasonal variability with respect to water quality as a result of increased runoff residence times. Turbidity, color, and suspended solids will increase, while transparency will decrease during plankton blooms as a result of lack of mixing with Gulf waters. Since color is derived from tannic and humic acids leached by rainfall from decaying organic matter and transported to the Bay as runoff, it can be considered a tracer or indicator of other associated pollutants. Salinity will decrease commensurate with seasonal freshwater runoff. Low flow conditions will create low dissolved oxygen conditions near the bottom, since organic matter and algal populations will exert a profound oxygen demand in the area. Bacterial populations may increase the potential hazard of human contact with the waters.

Accumulations of epiphytic and drift algae will continue to inundate and shade seagrass beds near the former inlet. However, seagrass colonization may increase over the inlet area bottom sediments. The nursery value of seagrasses will increase if cover expands, but seagrass production could be limited by diminished light availability if transparency decreases (i.e., plankton blooms). The benthic infauna will change character with clam populations, giving way to a community dominated by worms and other detritus feeders. Ichthyoplankton normally introduced from the Gulf would mature prior to completing a long journey through adjacent inlets to the vicinity of the former inlet. This will diminish recruitment of fish species to the area. An overall decrease in numbers of adult sport and commercial fishes is probable, especially with increasing catch effort. The lack of a corridor between Gulf and Bay would continue to disrupt the important functional linkage that maintains a unique biological community associated with tidal inlets.

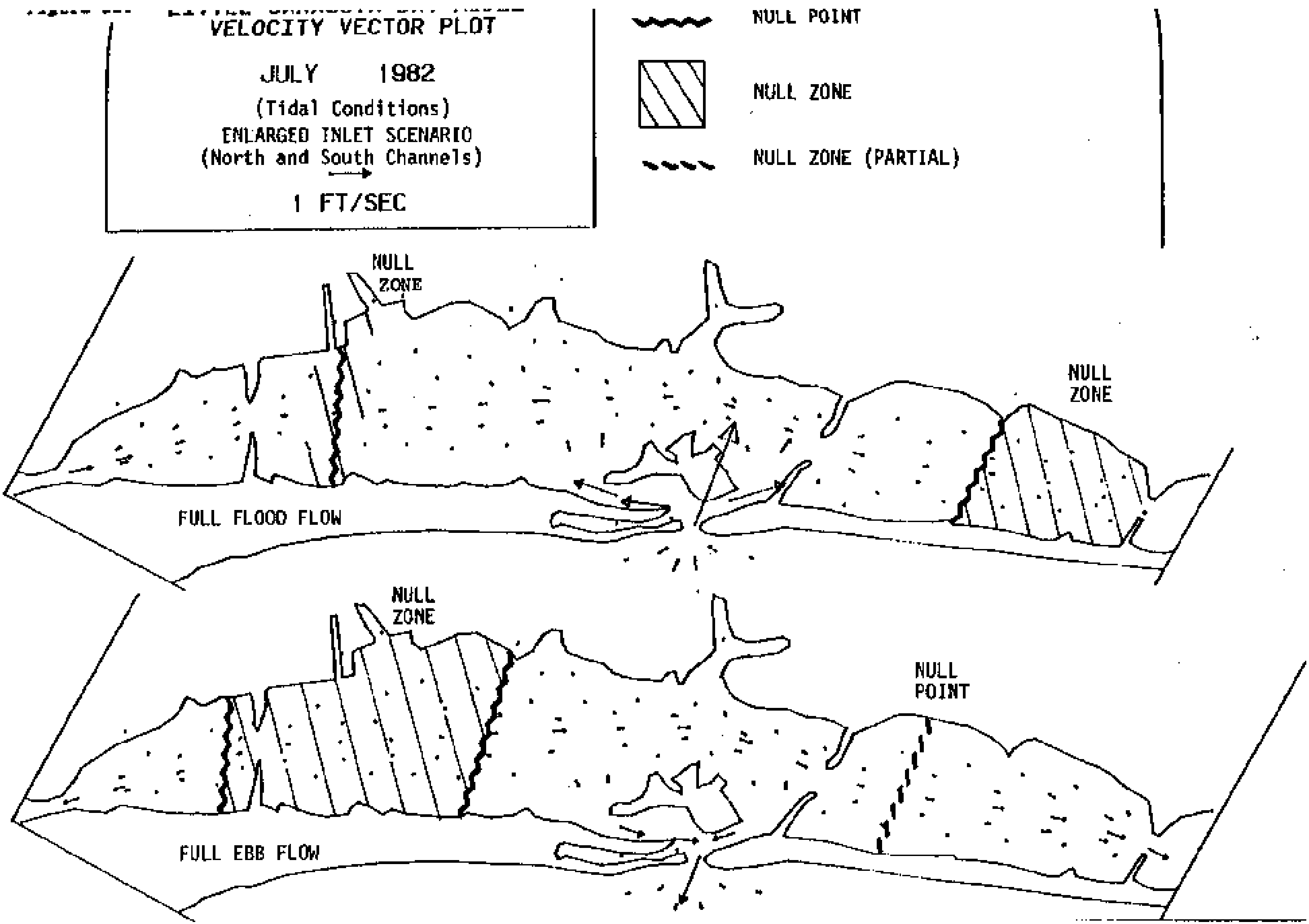
From a bay-wide perspective, inlet closure will perpetuate an ecological condition that existed for many years when influence of Midnight Pass was minimal. Since only the vicinity of the former inlet has been significantly impacted by closure, the Bay as a whole will experience little additional change if closure persists.

Evidence suggests that Little Sarasota Bay prehistorically was a shallow, brackish water lagoon with minor tidal influence.(11) Oyster bars, which flourish in brackish water, formed at sedimentation boundaries of wind-driven circulation cells and tended to retain freshwater within the Bay for longer periods of time than is now possible. These oyster bar "dams" were breached by the Intracoastal Waterway. Indian mound collections provide an additional clue in that vast quantities of oyster, clam, whelk, and other brackish water species were present. From this perspective, inlet closure would restore the Bay to some semblance of its "natural state".

However, the Bay was probably less turbid than now because of low nutrient levels in runoff and coastal waters, long term stabilization of bottom sediments by plants, and absence of dredging. The opening of temporary inlets by hurricanes caused brief interludes of more saline water in an otherwise brackish system.

Today, the Bay system is altered and is best described as marine with a brackish phase. Drainage of interior lands has lowered the water table (3' or more). Drainage has been so efficient that runoff cascades into the Bay in flash flood proportions rather than being released slowly over long periods from a network of sloughs, ponds, and other wetlands. The stronger tidal component added by the Intracoastal Waterway ensures rapid mixing and disposal of freshwater. The result has been a drastic alteration of the kinds of plants and animals and their numbers living in the Bay. These conditions have existed since the early 1900's to present. It is instructive to consider this condition when comparing future conditions under various scenarios of inlet alteration.

If Midnight Pass is opened, conditions in the Bay as a whole would be quite different. The most significant point is that the zones of no distinct water movement will shift in the Bay. The null zones will develop in areas not currently impacted as such (Figure 32). Impacts associated with these low flow zones will be similar to those identified to date. Dissolved oxygen decreases associated with oxygen demand of organic matter and algal populations will now occur in new locations within the Bay. While increased Gulf influence will increase salinity and decrease color, background transparency will increase bay-wide. However, if phytoplankton blooms occur and chlorophyll levels increase in the null zones, seasonal transparency could decrease bay-wide. Increased salinity intrusion to the Bay will dampen and diminish the natural brackish water condition at the mouths of tidal creeks. A greater suspended sediment load will be generated within the Bay as a result of wave and current-induced resuspension of fine and flocculent material released during dredging for channel improvements. This may decrease transparency bay-wide during moderate wind conditions. Bacteria and nutrient levels will likely decrease somewhat due to dilution and mixing with Gulf waters. To the extent that water flow is enhanced and null zones diminished in size, nuisance populations of macroalgae might decrease bay-wide. A reestablished corridor between Gulf and Bay will likely increase the recruitment to the ichthyoplankton community but also red tide blooms. Benthic fauna and seagrasses will change little bay-wide as long as the character of the suspended solids component of the water column is not changed



VELOCITY VECTOR PLOT
JULY 1982
(Tidal Conditions)
ENLARGED INLET SCENARIO
(North and South Channels)
1 FT/SEC
NULL POINT
NULL ZONE
NULL ZONE (PARTIAL)
NULL ZONE
NULL ZONE
FULL FLOOD FLOW
NULL ZONE
NULL POINT
FULL EBB FLOW

significantly.

Inlet opening will reestablish Midnight Pass and restore the values and functions associated with a tidal inlet. While the conditions in the inlet area will generally be improved (e.g., color, bacteria, nutrients, etc.), transparency will likely decrease due to high suspended sediment loads carried into the inlet. This will decrease seagrass production in the immediate area. Also, channel scouring by currents will erode bottom areas suitable for seagrass growth. Increased flows of high salinity Gulf water will be the dominant character of the inlet area. However, decreased flows and diminished mixing will occur bay-wide at locations distant from the inlet vicinity. In general, the corridor will provide access by a variety of organisms (e.g. fishes) to an area not presently accessible. The character of the benthic infauna community will be reestablished near the inlet, giving rise to clam populations.

IX. RECOMMENDED SAFEGUARDS

What recommended safeguards can be built into various inlet management alternatives to minimize adverse ecological impacts?

Regardless of inlet condition, a variety of actions should be taken to improve conditions in the Midnight Pass/Little Sarasota Bay area. Relatively small amounts of nutrients are required in subtropical waters to sustain excessive organic production (i.e., eutrophication). Coastal lagoons are natural accumulators of nutrients in runoff and are prone to excessive plankton blooms. In order to reduce nutrient loading of coastal waters, consideration should be given to the following.

- Groundwater storage within interior lands (i.e., upland watershed) should be restored to as high a level as possible. A slow release of stored water to the bays via the tidal creeks should be encouraged. New drainage canals should be avoided and flow restrictions should be installed in already channelized systems.
- Stormwater discharge systems should be monitored to ensure optimal functioning for water quality improvement. Older, direct discharge drainage systems should be upgraded to provide retention/detention prior to discharge.

- The quality of sewage effluent discharges should be closely controlled. Both treatment plants and septic tank systems should be upgraded to minimize discharge of untreated waste.

The ecological monitoring program has provided information that more clearly describes the structure and function of Little Sarasota Bay than any other source available to date. This information has proven effective in guiding and preserving management options for the Bay. County efforts at monitoring Bay conditions should be expanded to include several parameters and analyses investigated in this report. New water quality parameters should include: dissolved oxygen (time and depth-varied), nutrients, reactive silicates, and chlorophylls. Biological monitoring should include algal and seagrass cover. Frequent checks of hotspots identified in this report should be made. Such a program needs to be applied County-wide. Bacterial conditions in Blind Pass Lagoon (i.e., Turtle Beach Park) should be intensively monitored in order to assess the safety of human contact with the water at this recreational beach.

The water quality, fisheries, and wildlife values of the Bay can be enhanced through habitat restoration and creation. Habitat restoration programs should be applied to areas within the Bay where previously productive wetland habitats once existed. Spoil material deposits from prior dredging actions can be removed. These habitats (e.g., mangrove swamps, seagrass beds, and marshes) can be recreated within the Bay. The flood tidal delta of Midnight Pass provides an excellent opportunity for such efforts. Existing shorelines should be similarly restored by revegetating with native wetland plants.

If the Pass is reopened, the recommendation of the Blue Ribbon Panel to avoid a course of action leading to continual maintenance of an inlet that may not be able to sustain itself should be heeded. Major channel dredging is so disruptive that it should be held to a minimum. The purpose of reopening Midnight Pass would be to restore direct exchange between Gulf and Bay in a manner that does not foreclose future options nor compromise the natural character and values of the Pass area. Therefore, the project should not be portrayed as a beach nourishment or navigational project. In addition, channel widths and depths should be designed to accommodate the minimal cross-sectional area necessary to provide hydraulic conditions conducive to inlet stability. Shallow, wide channels are preferable to deep, narrow channels when ecological conditions are considered. This is because light penetration should reach the bottom in order to avoid oxygen deficits along the channel.

If the Pass is left closed, the recommended safeguards previously described should be enforced. These recommendations reflect the intent of the Blue Ribbon Panel (see Appendix). In particular, Blue Ribbon Panel had recommended that the hydrodynamic model be used to examine what effect flow restrictions at Stickney Point and Blackburn Point might have on hydraulic conditions and the stability of Midnight Pass. Additionally, a culverted connection between Blind Pass Lagoon and Little Sarasota Bay (opposite Turtle Beach Park) designed to improve exchange of waters should be investigated.

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APPENDIX

Figure A1.	Tide curves for sampling dates.
Table A1.	Benthic infauna species list.
Figure A2.	Log-normal plots of benthic data.
Attachment.	Summary Report of Blue Ribbon Panel

Note: For benthic profiles, sediment mapping results, and raw data sets for all parameters, contact author.

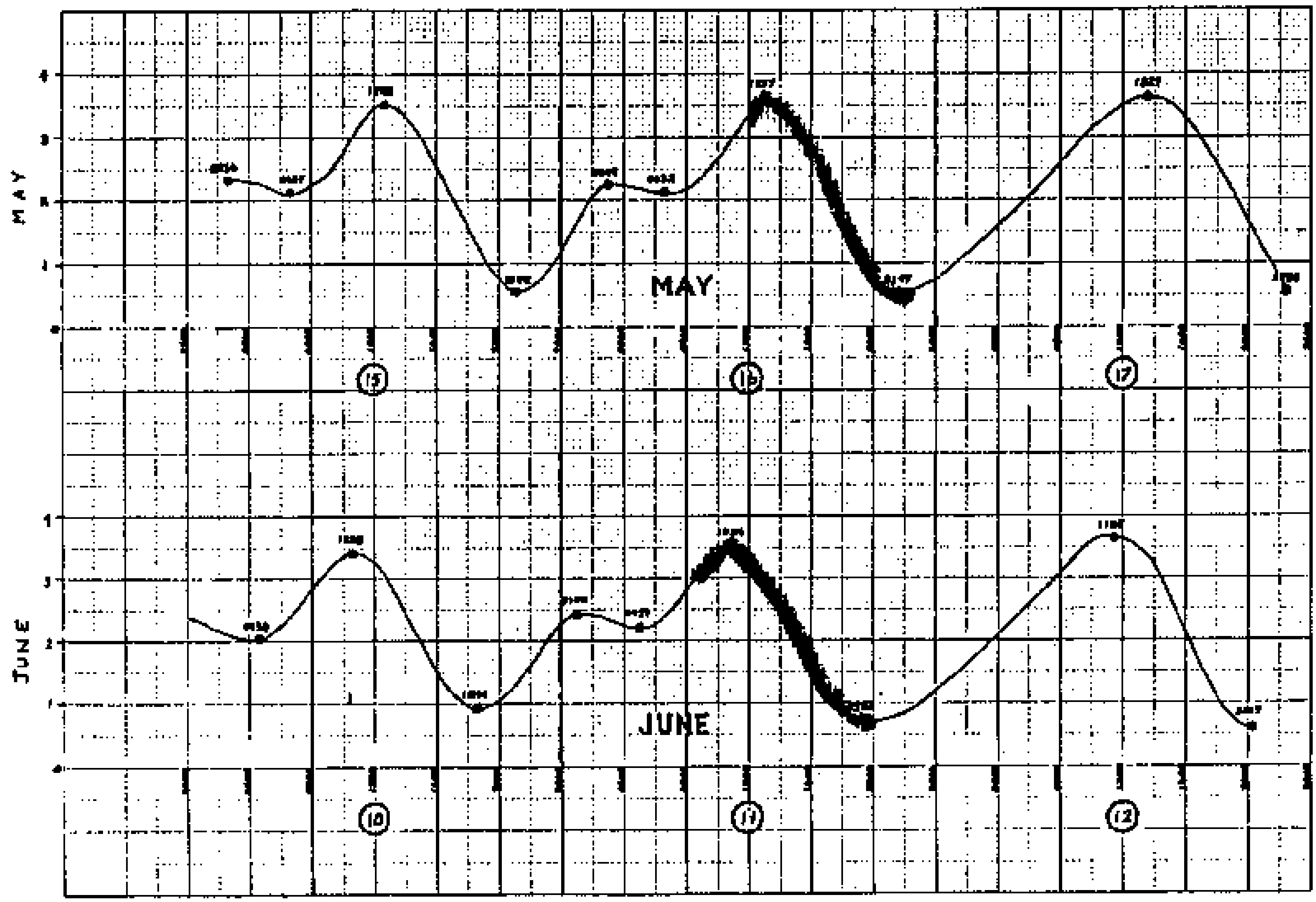


Figure A1. Tide Curves for Dates of Water Quality Sampling Periods. Shaded bar on curve denotes period of sample collection. Tide curves based on NOAA Tide Tables for predicted tides at Sarasota Bay corrected for time lags on St. Petersburg, Florida.

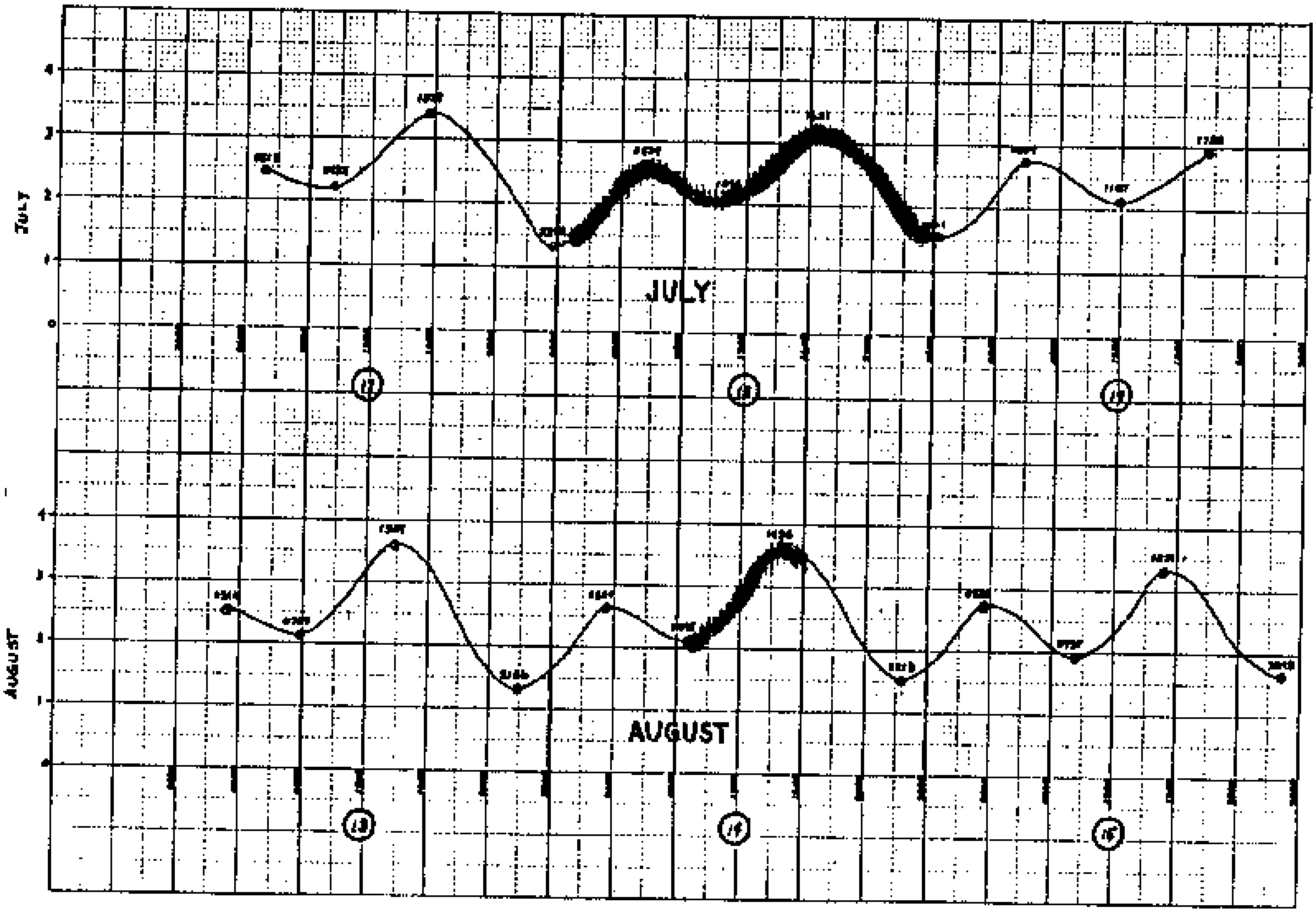


Figure A1. (continued) Tide Curves for Dates of Water Quality Sampling Periods. Shaded bar on curve denotes period of sample collection. Tide curves based on NOAA Tide Tables for predicted tides at Sarasota Bay corrected for time lags on St. Petersburg, Florida.

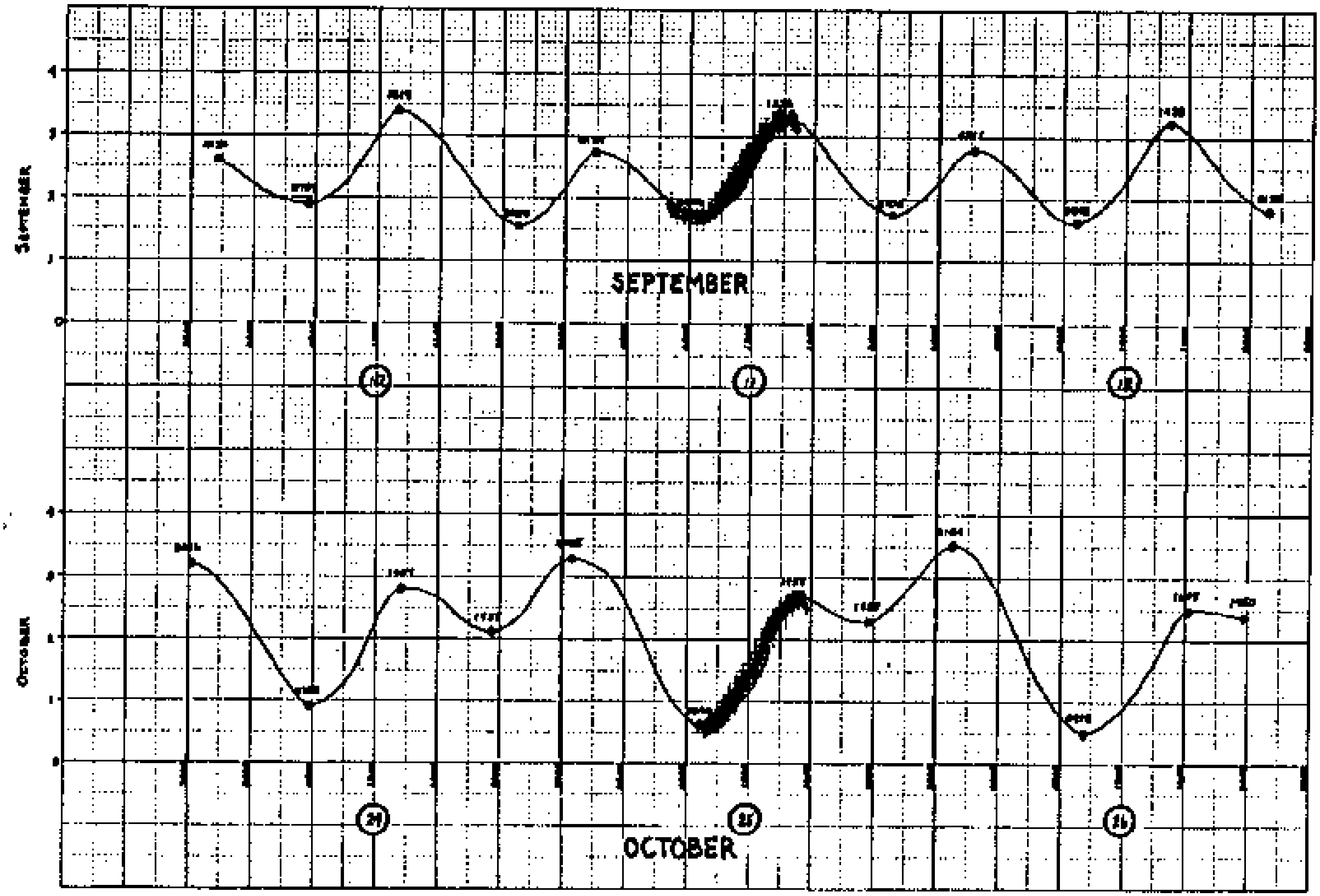


Figure A1. (continued) Tide Curves for Dates of Water Quality Sampling Periods. Shaded bar on curve denotes period of sample collection. Tide curves based on NOAA Tide Tables for predicted tides at Sarasota Bay corrected for time lags on St. Petersburg, Florida.

318.173 BENTHIC TASK
BENTHIC INFAUNAL SPECIES FOUND AT STATIONS NEAR MIDNIGHT PASS (SARASOTA COUNTY, FLORIDA)

Taxonomic Categories or Sample Parameters	INLET B36-May 17, 1984		CREEK B46-May 17, 1984		Samples INLET B36-Oct. 23, 1984		CREEK B46-Oct. 23, 1984	
	No./m2	Percent	No./m2	Percent	No./m2	Percent	No./m2	Percent
ber of species	60.0		106.0		54.0		51.0	
ber of individuals	1575.0		1300.0		269.0		465.0	
ple size (/m2)	0.0936		0.0936		0.0936		0.0936	
ber of individuals/m2	16826.9		13888.9		2873.9		4967.9	
versity - H' log e	2.3363		3.6107		3.3717		3.2920	
versity - H' log 10	1.0146		1.5681		1.4643		1.4297	
uitability (H'/log spp.)	0.5706		0.7742		0.8453		0.8008	
aled Evenness (EH'-Hmin)/(Hmax-Hmin)	0.5350		0.7372		0.7718		0.7437	
YLUM Cnidaria								
CLASS Anthozoa								
Anthozoa spp.			11	0.0769				
Athenaria sp.					11	0.3717		
Cerianthus sp.			21	0.1538				
YLUM Platyhelminthes								
CLASS Turbellaria								
Euplana gracilis					11	0.3717		
YLUM Nemertina								
Nemertinea spp.	75	0.4444	160	1.1538	182	6.3197	85	1.7204
YLUM Nematoda								
Nematoda spp.	11	0.0635	545	3.9231	118	4.0892	192	3.8710
YLUM Annelida								
CLASS Polychaeta								
Amaeana trilobata	128	0.7619			11	0.3717		
Amphicteis gunneri			21	0.1538				
Aricidea philbinae			299	2.1538	107	3.7175	355	7.5570
Aricidea taylori			53	0.3846			11	0.2151
Armandia elongata			11	0.0769				
Axiothella mucosa	1293	7.6825	310	2.2308	21	0.7435	85	1.7204
Brania clavata	11	0.0635	11	0.0769			11	0.2151
Brania wellfleetensis	11	0.0635			32	1.1152		
Capitella capitata	726	4.3175	32	0.2308	21	0.7435	85	1.7204
Caulleriella alata							160	3.2258
Caulleriella sp.			11	0.0769				
Ceratonereis irritabilis	11	0.0635						
Chaetozone setosa			11	0.0769				
Cirratulidae spp.							21	0.4301
Cirriformia sp. A			53	0.3846	11	0.3717	160	3.2258
Cirrophorus sp.			11	0.0769				
Diopatra cuprea			32	0.2308	21	0.7435	11	0.2151
Drilonereis longa			53	0.3846				
Ehlersia cornuta	11	0.0635			11	0.3717		
Eteone heteropoda	21	0.1270	64	0.4615	11	0.3717		
Eteone lactea			32	0.2308				
Exogone dispar			32	0.2308	11	0.3717	96	1.9355
Fabricia sp. A			652	4.6923			11	0.2151
Glycera americana							11	0.2151

Taxonomic Categories or Sample Parameters (continued)	B36-May 17,1984 No./m2	B36-May 17,1984 Percent	B46-May 17,1984 No./m2	B46-May 17,1984 Percent	B36-Oct. 23,1984 No./m2	B36-Oct. 23,1984 Percent	B46-Oct. 23,1984 No./m2	B46-Oct. 23,1984 Percent
Glycinde solitaria					11	0.3717	118	2.3656
Byptis brevepalpa			53	0.3846	11	0.3717	64	1.2903
Heteromastus filiformis			53	0.3846			85	1.7204
Kinbergonuphis simoni	53	0.3175	556	4.0000	11	0.3717	85	1.7204
Laeonereis culveri	96	0.5714	118	0.8462	224	7.0067	246	4.9462
Leitoscoloplos foliosus			75	0.5385				
Leitoscoloplos fragilis			21	0.1538			53	1.0753
Mediomastus ambiseta			556	4.0000	11	0.3717	128	2.5806
Mediomastus californiensis	459	2.7302						
Mediomastus sp.	1485	8.8254			96	3.3457		
Megalomma bioculatum			32	0.2308			21	0.4301
Melinna maculata							11	0.2151
Minuspio cirrifera	32	0.1905	11	0.0769			11	0.2151
Mooreonuphis nebulosa			64	0.4615	21	0.7435		
Neanthes acuminata					21	0.7435	118	2.3656
Neanthes succinea	11	0.0635						
Notomastus hemipodus	64	0.3810						
Onuphidae spp.					75	2.6022		
Parahesione luteola							11	0.2151
Paraonis fulgens					21	0.7435		
Paraprionospio pinnata							21	0.4301
Pectinaria gouldii			21	0.1538				
Phyllodoce arenae	21	0.1270						
Phyllodoce castanea			11	0.0769				
Pista cristata			107	0.7692				
Podarke obscura			11	0.0769			43	0.8602
Polycirrus sp.			43	0.3077				
Polydora ligni					21	0.7435		
Polydora socialis			267	1.9231				
Prionospio cristata					118	4.0892		
Prionospio heterobranchia	11	0.0635	278	2.0000			150	3.0108
Prionospio sp.			21	0.1538				
Schistomeringos rudolphi			11	0.0769			32	0.6452
Scololepis squamata							11	0.2151
Scololepis texana			118	0.8462				
Scoloplos rubra			21	0.1538				
Sphaerosyllis longicauda							11	0.2151
Spiochaetopterus oculatus			21	0.1538				
Spiophanes bombyx	11	0.0635						
Spirorbis spirillum			11	0.0769			11	0.2151
Streblosoma hartmanae			11	0.0769	53	1.8587	150	3.0108
Streblospio benedicti			32	0.2308				
Syllides floridanus			11	0.0769				
Tharyx cf. dorsobranchialis	11	0.0635	1688	12.1538			835	17.2043
Tharyx sp.			11	0.0769				
Travisia hobsonae	1990	11.8730			53	1.8587		
Typosyllis cf. lutea							11	0.2151
CLASS Oligochaeta								

Taxonomic Categories or Sample Parameters (continued)	B36-May 17,1984		B46-May 17,1984		B36-Oct. 23,1984		B46-Oct. 23,1984	
	No./m2	Percent	No./m2	Percent	No./m2	Percent	No./m2	Percent
Oligochaeta spp.			278	2.000			589	11.8280
PHYLUM Mollusca								
CLASS Bivalvia								
Abra aequalis	11	0.0435						
Anadara transversa			21	0.1538				
Amygdalum papyrium			235	1.6923			11	0.2151
Anomalocardia auberiana			32	0.2308	11	0.3717		
Bivalvia spp.							21	0.4301
Carditamera floridana			11	0.0769				
Chione cancellata	11	0.0635			11	0.3717		
Crassinella lunulata	11	0.0635						
Diplodonta punctata	53	0.3175			21	0.7435		
Laevicardium mortoni			11	0.0769				
Lucina nassula			256	1.8462				
Lucina radians					214	7.4349		
Lucina sp.	43	0.2540						
Lyonsia hyalina floridana			85	0.6154	32	1.1152		
Macoma sp.							21	0.4301
Macoma tenta			11	0.0769				
Mercenaria campechiensis			11	0.0769				
Mysella planulata	171	1.0159	75	0.5385	11	0.3717		
Mesoromya floridana			662	4.7692			11	0.2151
Parastarte triquetra			203	1.4615			11	0.2151
Periploma margaritaceum					11	0.3717		
Semele nuculoides	11	0.0635						
Tagelus divisus			128	0.9231				
Tagelus plebeius			11	0.0769	54	2.2305	43	0.8602
Tellina sp.			11	0.0769				
Tellina tampaensis			32	0.2308	11	0.3717		
Tellina texana			43	0.3077				
Tellina versicolor	171	1.0159	11	0.0769				
CLASS Gastropoda								
Acteocina canaliculata	21	0.1270	96	0.6923			85	1.7204
Acteon punctostriatus	32	0.1905	160	1.1538	32	1.1152		
Batillaria minima	11	0.0635						
Caecum strigosum	11	0.0635						
Cerithium muscarum			11	0.0769				
Crepidula maculosa			64	0.4615			32	0.6452
Crepidula plana			11	0.0769				
Granulina ovuliformis			11	0.0769			11	0.2151
Haminoea succinea			43	0.3077				
Nassarius vibex							11	0.2151
Odostomia bisuturalis			43	0.3077				
Olivella pusilla			107	0.7692				
Olivella sp.			21	0.1538				
Turbonilla hemphilli							11	0.2151
Turbonilla sp.	11	0.0635						
PHYLUM Arthropoda								

Taxonomic Categories or Sample Parameters (continued)	B36-May 17,1984		B46-May 17,1984		B36-Oct. 23,1984		B46-Oct. 23,1984	
	No./m2	Percent	No./m2	Percent	No./m2	Percent	No./m2	Percent
SUBPHYLUM Crustacea								
CLASS Ostracoda								
Haplocytherida setipunctata	374	2.222	32	0.2308				
Myodocopa spp.	11	0.0635	75	0.5385				
CLASS Copepoda								
Calanoid copepoda					21	0.7435		
Cyclopoid copepoda							11	0.2151
CLASS Malacostraca								
SUBCLASS Phyllocardia								
SUPERORDER Periccardia								
ORDER Amphipoda								
Acanthohaustoris millsi	6816	40.5079			192	6.6914		
Acuminodeutopus naglei	11	0.0635	21	0.1538				
Ampelisca abdita			502	3.6154			21	0.4301
Ampelisca holmesi	214	1.2698	844	6.0769	128	4.4610		
Ampelisca sp. B			32	0.2308				
Batea cf. catharinensis			11	0.0769	85	2.9740		
Corophium tuberculatum			11	0.0769				
Cymadusa compta	11	0.0635	43	0.3077	53	1.8587	75	1.5054
Elasmopus levis	11	0.0635						
Ericthonius brasiliensis			21	0.1538	363	12.6394		
Eudevenopus honduranus			11	0.0769				
Gammarus mucronatus			11	0.0769				
Grandidierella bonnieroides	43	0.2540	128	0.9231			150	3.0108
Lembos rectangulatus							11	0.2151
Lembos setosus			11	0.0769				
Lembos smithi					128	4.4610		
Listriella cf. barnardi	214	1.2698						
Luconacia incerta					11	0.3717		
Lysianopsis alba	11	0.0635			11	0.3717		
Melita quinquiesperforata	21	0.1270						
Microdeutopus myersi	64	0.3810						
Microprotopus raneyi	21	0.1270			11	0.3717		
Paracaprella tenuis			11	0.0769				
Rhepoxynius cf. epistomus	160	0.9524						
Synchelidium americanum							11	0.2151
ORDER Isopoda								
Apanthura magnifica	278	1.6508			53	1.8587		
Cymodoce faxoni			11	0.0769			21	0.4301
Edotea triloba			85	0.6154				
Erichsonella cf. attenuata			21	0.1538				
Xenanthura brevitelson			64	0.4615			150	3.0108
ORDER Tanaidacea								
Halmyrapseudes cf. cubanensis			32	0.2308				
Hargeria rapax	107	0.6349	1656	11.9231			11	0.2151
Kalliapseudes sp. A	32	0.1905	524	3.7692	11	0.3717		
ORDER Cumacea								
Cyclaspis sp. A	11	0.0635	118	0.8462	32	1.1152		

Taxonomic Categories or Sample Parameters (continued)	836-May 17,1984 No./m2	836-May 17,1984 Percent	846-May 17,1984 No./m2	846-May 17,1984 Percent	836-Oct. 23,1984 No./m2	836-Oct. 23,1984 Percent	846-Oct. 23,1984 No./m2	846-Oct. 23,1984 Percent
Oxyurostylis smithi	171	1.0159	128	0.9231				
SUPERORDER Eucarida								
ORDER Decapoda								
SUBORDER Reptantia								
FAMILY Mysidacea								
Mysidopsis almyra					11	0.3717		
Mysidopsis bigelowi	53	0.3175	53	0.3846	11	0.3717	11	0.2151
Bowmaniella sp.	21	0.1270						
Taphromysis bowmani			32	0.2308	11	0.3717		
PHYLUM Sipuncula								
Phascolion sp.			32	0.2308			11	0.2151
Sipuncula spp.	11	0.0635						
PHYLUM PHORONIDA								
Phoronis architecta			21	0.1538				
PHYLUM Ecinodermata								
CLASS Stelleroidea								
SUBCLASS Ophiuroida								
Amphiuridae sp.							11	0.2151
CLASS Holothuroidea								
Holothuroidea spp.	11	0.0635						
Leptosynapta sp.	11	0.0635						
PHYLUM Chordata								
SUBPHYLUM Cephalochordata								
Branchiostoma spp.	1025	6.0952					43	0.8602

LOG-NORMAL PLOTS OF BENTHIC INFAUNA DATA

Log-normal plots are plots of the cumulative percentage of species against the geometric class of the number of individuals per species. When this information is plotted on probability paper, it can reveal the presence of stress (i.e. pollution) on a benthic community. This plot is prepared by taking a large sample from a heterogeneous population, identifying and enumerating the number of individuals by species, grouping the species by geometric class, and plotting this information against the cumulative percent of species. Log-normal distributions result from the fact that populations tend to increase geometrically, rather than arithmetically, because environmental factors act multiplicatively on populations (13).

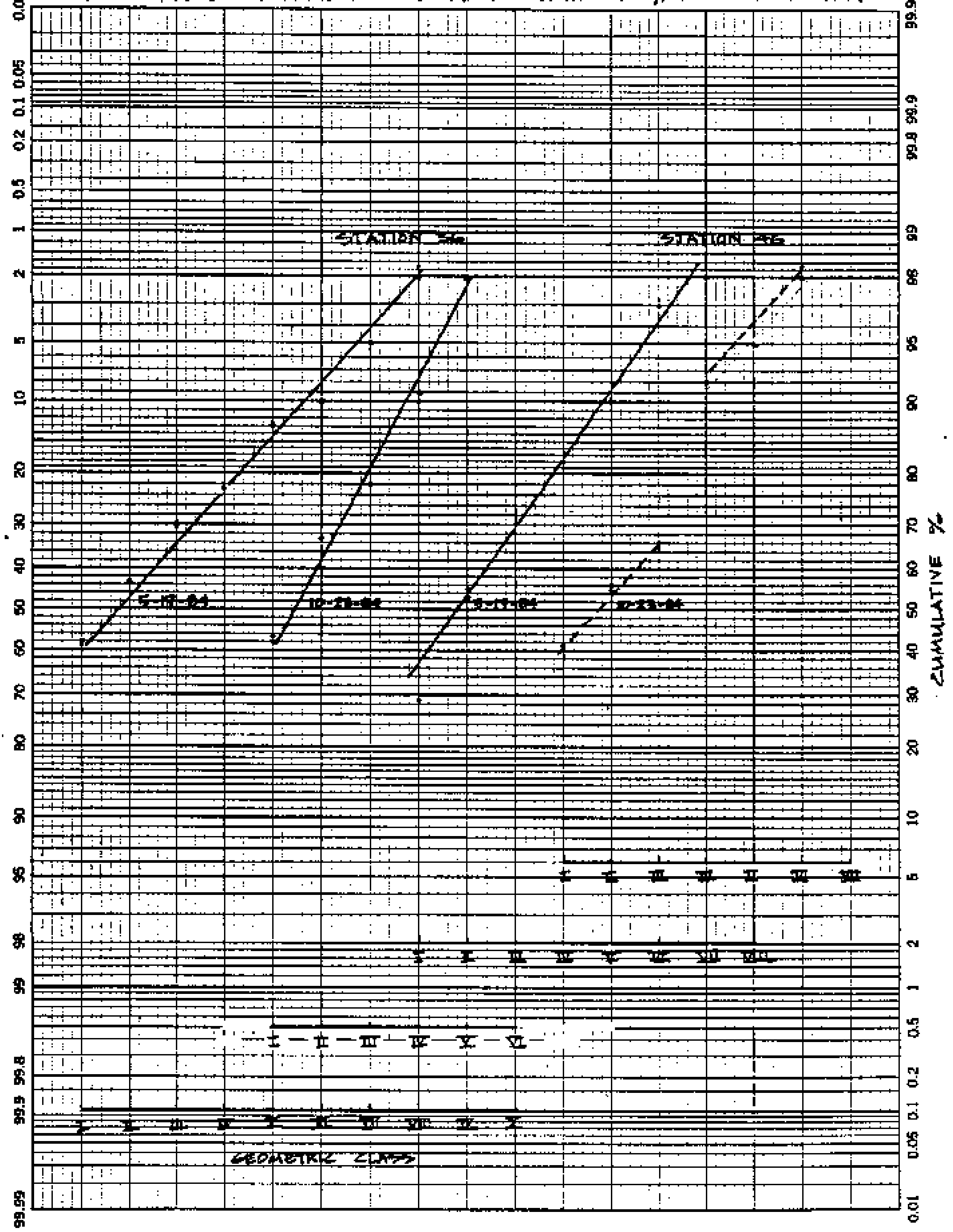
The log-normal plots tend to fall into three categories; natural, transitory, and stressed or polluted. In the natural phase, the data follow a log-normal distribution with the data spanning only a few geometric classes. During the transitory phase there is a characteristic bend or break in the straight, log-normal distribution, line and an increase in the number of geometric classes spanned. The polluted phase returns to a straight line log-normal distribution, but the slope of the line is at a shallower angle because the data extend over more geometric classes.

The natural log-normal distribution pattern represents a community at equilibrium, where immigration and emmigration have stabilized as have the number of individuals per species. The transitory, slight pollution, phase represents a disturbed equilibrium community where some species become more dominant and cause the bend in the log-normal distribution. Given adequate time, a polluted community will regain equilibrium and return to a log-normal distribution, however, the slope of the plot will be less steep because the data span more geometric classes. The stressed and polluted communities are typified by high degrees of dominance.

The benthic infauna data, collected as part of this study, is difficult to interpret because there is no information, about the natural benthic community, with which to make comparisons. The data collected will, however, serve as good background data for comparisons to future samplings. Species in geometric classes 5 - 9 are the obvious ones to watch because breaks in the log-normal distribution usually occur there.

CORRECTED VERSION

FIGURE A2. LOG-NORMAL PLOTS OF BENTHIC DATA - LOB/MIDNIGHT PASS STUDY



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APR 1984
RECEIVED
CLERK, WATER AND NAVIGATION CONTROL AUTHORITY

April 19, 1984

Board of County Commissioners
Sarasota County Courthouse
Sarasota, Florida 33577

Re: Blue Ribbon Committee for the study of Midnight Pass

Dear Commissioners:

You will please find enclosed the Report of the Blue Ribbon Committee appointed by you to study the Midnight Pass conditions. The Report is structured in three sections. Section I deals with findings of fact established by the Committee. Section II is the Committee's vision of the most desirable conditions in the Midnight Pass area in the year 2004. Section III contains the conclusions and recommendations of the Committee.

All members of the Committee agree that this has been a very interesting and informative assignment. Depite the diversity of disciplines represented on the Committee, the meetings were extremely harmonious, and the conclusions were reached with surprising unanimity. All of us have enjoyed the experience.

I wish to especially commend the assistance and extremely vital input of Rob Patton, Steve Sauers, Jeff Lincer and others on the County staff, and from Jim Armstrong of the WCIND. Without their vital assistance and coordination, the task would have been extremely difficult and much more time consuming.

Thank you again for this opportunity to be of service to the County.

Respectfully submitted,

William M. Hereford

WMH/cs
Enclosures a/s

SARASOTA COUNTY

BLUE RIBBON PANEL FOR MIDNIGHT PASS

FINAL REPORT
APRIL 24, 1984

William Hereford, Chairman
William Taft
David Levin
Mike Stuart
Albert Hine
Tom Cross
Jono Miller
Chris Jones
William Korp
Don Scherston
John Morrill

Ex-Officio

Robert Patten
Jeff Lincer
Steve Sauers
James Armstrong

I

FINDINGS OF FACT

a. For many years, Midnight Pass was functioning as a navigational pass between the Gulf of Mexico and Little Sarasota Bay for both commercial and recreational boating interests, and more recently was a mediating factor in diluting pollutants in Little Sarasota Bay.

b. Natural changes (such as variation in sea level and wave climates) and catastrophic natural events (such as hurricane and red tides) have altered the configuration and biota of the Midnight Pass area.

c. Human efforts have altered the natural dynamics of the pass and bay systems, contributing to the reduced stability of Midnight Pass, and altering the extent of natural communities within Little Sarasota Bay. Dredging of the Intracoastal Waterway, disposal of dredged material on Bird Island and other northern portions of Little Sarasota Bay, and alterations to the upland areas draining into Little Sarasota Bay are found to be factors causing the changes.

d. After studying historical facts and photographs, along with limited hydraulic data, this Committee finds that the Pass had become unstable and was near closure, even before the channel relocation effort in December 1983.

e. If the Pass remains closed, historical evidence from similar passes has shown that a straightening of the shoreline can be expected. The straightening can be expected to have an impact which will affect property on either side of the Pass.

f. The closure of Midnight Pass will likely change the biota of Little Sarasota Bay. Pollution impact on Little Sarasota Bay will be exacerbated by the lack of exchange with the Gulf of Mexico.

g. If the Pass is opened, and the contributing factors listed in "C" above are not reversed, this Committee finds that reclosure can be expected.

h. This committee finds that structural controls such as jetties and pass stabilization are inappropriate at Midnight Pass because they 1)will not eliminate a need for dredging, 2)interfere with the longshore transport of sand, and 3)compromise the natural character and values of the Pass area.

II

MIDNIGHT PASS IN THE YEAR 2004 - BLUE RIBBON COMMITTEE VISION

On March 12, 1984 the Midnight Pass Blue Ribbon Committee members participated in an exercise designed to reveal what members hoped the Pass area would be like twenty years from now.

Midnight Pass in the year 2004 seems to be as it was in 1965--the Pass is open, and knowledgeable boaters can navigate the Pass with cooperating tides. Boaters can pull their boats up and easily walk to the beach -- the Pass continues to function as a place to go, a destination. The entire area is a publicly owned marine park. The Mote shark tanks are gone and the park includes the southern tip of Siesta Key. No docks, boat ramps, or new structures are evident. Structures that existed in 1984 were not replaced when damaged by storms or erosion. All facilities require minimal upkeep. Although Australian Pines have been dramatically reduced since the 1980's, one can still stand in their shade and watch rare birds feeding and resting on the flood tidal shoals. Good exchange with the Gulf, unpolluted Bay waters, and a natural biological community characterize Little Sarasota Bay.

III

CONCLUSIONS AND RECOMMENDATIONS

To begin with, the Committee notes that it was asked to evaluate options "which will produce the greatest long range environmental benefits in the Midnight Pass area". We have interpreted "environmental benefits" broadly -- as those free benefits afforded the community by natural systems. Our deliberations have revealed that, despite the importance of the Midnight Pass area to the community, relatively little is known about the area. Our technical recommendations therefore are based upon what is known about other passes and our own experience with Midnight Pass.

The Committee is in agreement that a natural open Pass would provide more environmental benefits than the current closed Pass. In our efforts to return to a natural open Pass we must recognize that reopening the pass has the potential of reducing, rather than increasing, environmental benefits. The cure could be worse than the illness. Our concern is amplified by our finding that the Pass is likely to close if reopened. Thus, the only prudent approach to long range benefits is one that will optimize benefits in the Pass area, whether the Pass is open or not. Consequently, we recommend that the following courses of action be taken, independent of any action to open the Pass:

1) That the County Commission commit funds adequate to model the potential improvement in the stability of the Pass if flow restrictions could be implemented at Blackburn Point and Stickney Point;

2) That such action be taken as may be necessary to prevent the construction, protection or reconstruction of private structures that may interfere with the movement of the Pass in the future, which action may include public acquisition;

3) That action be taken to monitor the present and future water quality and biota in Little Sarasota Bay, inlet and Bay hydraulics, and the position of the beach in the vicinity of the Pass, so that future decisions can be made with a better understanding of actual conditions;

4) That the County improve the quality and timing of water reaching Little Sarasota Bay from Eligraw, Catfish and North Creek basins;

5) That the remains of the former Mote Marine shark tanks and other structures should be declared a public nuisance and should be removed from the Pass area;

6) That additional colonization of publicly owned lands by Australian Pine be halted, and the County devise a plan for gradual reduction in the extent of this noxious exotic.

The Committee has set aside consideration of cost, public opinion, and various permitting requirements in its deliberations regarding reopening of the Pass. We have concluded that only large scale channel relocation and restoration will provide benefits that will be measured in years rather than days or weeks. Small scale relocations, as have already been attempted, are unlikely to result in long term benefits. Repeated dredging efforts are costly in monetary and environmental terms. A major pass dredging operation is so disruptive (problems include spoil disposal, increased turbidity, and accidents) that it should be held to a minimum. The Committee should not embark on a long term course of action resulting in frequent dredging of a Pass that may not be able to sustain itself.

The Committee recommends a major one-time dredging from the Gulf of Mexico toward the Intracoastal Waterway, with the resulting unstabilized channel or channels approximately equalling the channel cross section as it was in 1955. The Committee believes this recommendation can best be achieved by restoration of the historical northern and southern channels. The purpose of this one time dredging is to restore direct exchange between the Gulf of Mexico and Little Sarasota Bay in a manner that does not foreclose future options. Consequently, it is important that this project not be portrayed as a beach restoration project or a navigational project imposing continuing maintenance obligations.

We expect that this course of action would result in five to twenty years of exchange before closure. If the Pass closes gradually, (or remains open) over a long period of time, then this approach will be effective with minimum environmental disruption. On the other hand, if the Pass closes quickly, the public and elected officials will be afforded a clear choice between 1) leaving the Pass closed, (which would be the Committee recommendation); 2) stabilizing the Pass; or, 3) undertaking an ongoing channel maintenance program. Either way -- tomorrow's Sarasotans will be inheriting an unstabilized Midnight Pass area full of potential environmental benefits without the expense and side effects of a less reversible course of action.

GLOSSARY

Ammonia Nitrogen (NH_3-N) - Measured in milligrams per liter (mg/l). The most reduced form of nitrogen, a metabolic byproduct of many organisms and sometimes accepted as chemical evidence of sanitary pollution.

Bathymetry - A measurement of water depth. Bathymetric transects reveal the contour of the bottom and the general characteristics of the sediments.

Benthic Infauna - The organisms that live within the sediments at the sea bottom. Their density is measured in number per square meter ($\#/m^2$). The relative proportion of these invertebrate organisms can provide information about the stress (i.e., pollution) on the benthic community.

Chlorophyll - Measured in milligrams per cubic meter (mg/m^3). A photosynthetic pigment and a measure of the amount of phytoplankton in the water. Indicative of the basic productivity and degree of eutrophication of a water body.

Coliform, total - Measured in number of colonies per 100 milliliters (#/100 ml). A measure of bacterial populations in water.

Color - Measured in platinum cobalt units (pcu). A measure of the intensity of water color.

Conductivity - Measured in micromhos per centimeter (umho/cm) (i.e., inverse of resistance as measured in ohms). It is a measure of electrical conductivity and a raw expression of salinity used to distinguish water masses.

Dissolved Oxygen (D.O.) - Measured in milligrams per liter (mg/l) in parts per million (ppm). A measure of oxygen gas concentration available in the overall cycle of production and consumption in the estuarine system. An indicator of the relative health of the system.

Extinction Coefficient (K_E) - Measured in arbitrary units. A measure of the degree of light absorption through the water column.

Fecal Coliform - Measured in number of colonies per 100 milliliters (#/100 ml). Indicates bacterial populations derived from wastes of warm blooded animals.

Ichthyoplankton - The eggs and larval stages of fish species which are distributed by currents. Measured in number per 100 cubic meters (#/100m^3), these members of the plankton use the currents as a dispersal mechanism and will settle out to colonize appropriate habitats where they function as consumers of phytoplankton, zooplankton or detritus (i.e., organic matter).

Macroalgae - The macroscopic members of the green, red, and brown algae plant divisions. This algae can be attached or free floating. When abundant, these plants can indicate eutrophic conditions and influence dissolved oxygen conditions.

Nitrate + Nitrite Nitrogen (NO_3+NO_2-N) - Measured in milligrams per liter (mg/l). Oxidation states of nitrogen which are important nutrients assimilated by organisms; limiting nutrient to phytoplankton and other photosynthetic organisms.

pH - Measured in pH units. A standard measure of the relative acidity or basicity of water.

Phytoplankton - The photosynthesizing microorganisms of the plankton (diatoms, dinoflagellates, e.g. red tide). Under eutrophic conditions (i.e., high nutrient levels) the phytoplankton reach large cell counts (#/ml) which are called "blooms". The "blooms" result in a decrease in water transparency and can cause fish kills by reducing the dissolved oxygen level.

Phosphorus, Total (TP) - Measured in milligrams per liter (mg/l). An element essential to all living organisms. A measure of the degree of eutrophication of a water body.

Photometry - Measured in microeinsteins per square meter per sec (uE/m^2/sec). A measure of light intensity.

Plankton - Organisms in the water column with little or no locomotory ability which drift passively with the currents.

Primary Productivity - The creation of high energy organic material and oxygen from carbon dioxide, water, and nutrients via photosynthesis. Seagrasses, algae, and phytoplankton are capable of photosynthesis and produce organic matter which is passed along to higher trophic levels in the food web.

Reactive Silicates (SiO_2-Si) - Measured in milligrams per liter (mg/l). A measure of the amount of silicon dioxide (silica) derived from soils and an essential compound for certain living organisms, particularly diatoms. Varies with quantity and quality of runoff.

Salinity - Measured in parts per thousand (o/oo), a raw expression of dissolved salts in water (i.e., ionic strength) to which all living organisms maintain a sensitive balance.

Secchi Depth - Measured in feet (ft) or meters (m), a measure of water transparency.

Seagrasses - A group of marine flowering plants which are completely submerged by seawater. Seagrass beds provide habitat and nursery areas for many fish and invertebrate species, stabilize the sediment, and provide a valuable food source for many marine organisms.

Temperature - Measured in degrees centigrade (^{o}C), it gives basic information about water masses and mixing processes.

Total Kjeldahl Nitrogen (TKN) - Measured in milligrams per liter (mg/l). Organic form of nitrogen that is metabolic byproduct of many organisms. May indicate levels of sanitary waste.

Total Suspended Solids (TSS) - Measured in milligrams per liter (mg/l). A measure of solids suspended in water.

Turbidity - Measured in nephelometric turbidity units (NTU). A measure of the light scattering particles suspended in water.

Volatile Suspended Solids (VSS) - Measured in milligrams per liter (mg/l). A measure of combustible or oxidizable solids suspended in water.

Zooplankton - The animal members of the plankton. These organisms may reside permanently in the plankton or just spend a certain part of their life cycle (larval stages) there. They are a major consumer of phytoplankton and provide an important link in the food web.