The
Midnight Pass
SOCIETY, INC. "MIDNIGHT PASS – PASS IT ON!"

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MIDNIGHT PASS POSITION PAPER

RESEARCH COMMITTEE
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SALINITY OF LITTLE SARASOTA BAY
RAINFALL- PAST, PRESENT & FUTURE

SYNOPSIS

The deepening of the Intracoastal Waterway in the early 1960's together with the improper deposition of the resultant spoils caused Midnight Pass to become unstable and to eventually migrate northward. Some twenty years later the inlet was threatening the property of two homeowners; it was artificially closed in 1983.

With inlet instability came an ever-lessening exchange of the salty Gulf waters with the fresher waters of Little Sarasota Bay. The diminished tidal flow resulted in a gradual declination in Bay salinity. Pass closure interrupted tidal circulation for a significant part of Little Sarasota Bay. Consequently, there's been a marked diminution of salinity levels in the "null zone" that was created.

The salinity level for Little Sarasota Bay used to average approximately 32+ ppt; it now averages about 27 ppt. Of greater consequence is the fact that, during major rainfall events, the salinity depressions experienced in Little Sarasota Bay are now much deeper than they used to be... and it takes the embayment longer to recover to even the reduced salinity levels.

These salinity depressions and elongated recovery periods associated with rainy seasons have made environmental conditions intolerable for many of the marine plants and animals that had **historically** inhabited Little Sarasota Bay. They either migrated from the embayment that had been their home... or died.

Since the 1983 closure of Midnight Pass, average annual rainfalls have been well below average. We're experiencing **record drought conditions.** Only in 1987 did total rainfall approach the annual average... and that's the year in which we witnessed a **major fish kill.** When annual rainfalls return to normal as anticipated, we can expect much greater salinity depressions than we've experienced thus far. We can also expect the embayment to stay fresher... longer. These adverse environmental conditions can only compound the survival problems for the marine communities that remain in Little Sarasota Bay.

BACKGROUND

The history of Midnight Pass is well documented in the **Safety Valve** paper and the cause for decline in the **Intracoastal** paper. There's no

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question that the diminution in tidal flow through the constricted inlet resulted in a decline in the historic salinity levels of Little Sarasota Bay. The evident degradation in this water quality value subsequent to the closure of Midnight Pass is by far the easiest to relate to tidal flow interruption on a cause-effect basis.

The ECOLOGICAL STATUS OF LITTLE SARASOTA BAY (Sauers & Serviss, 1985) includes a graphic depiction of salinity readings for Pass-related monitoring stations over many years (see **Exhibit #1**). Salinity levels for 1973 (well before Pass closure) were just somewhat higher than the 1982 readings. However, they were demonstrably higher than the salinities charted for 1983 and 1984. While Midnight Pass was open in 1983, its tidal flow was severely restricted. 1983 rainfall was also well above average (71.4"). By 1984 the Pass was closed, stopping all tidal flow. 1984 rainfall (47.9") is quite comparable to 1973 rainfall (43.1"). Clearly, the cause for the salinity decline in 1984 was the lack of tidal exchange through the inlet.

CONDUCTIVITY

In **Exhibit #2** the conductivity values (maximum, minimum and mean) for two Pass-related water monitoring stations are reported for 14 of the years between 1973 and 1988. Station #539 (ICW marker #48) is in the Intracoastal Waterway about ½ mile north of Midnight Pass. Station #609 (ICW marker #38) is also in the Intracoastal, about ½ mile south of the Pass. Conductivity values (stated in umho/cm) are closely related to salinity levels.

For the period 1973-1981 no trend is evident for either station. Average conductivity was about 50,000 (equivalent to a salinity level of 33 ppt). A very minor difference is noted in comparing the highs and lows between stations. Station #609 is marginally higher, reflecting some minor tidal influence from the Venice Inlet.

However, from 1982 (two years **before** Pass closure) through 1988 there was a significant change in conductivity for these stations compared to themselves and to each other. Mean conductivity for Station #539 plummeted to under 40,000 (a salinity level of 26.5 ppt), with a low of 27,000 (a salinity of just 17.8 ppt) and a high which never reached the **median** for the years 1973-1981! Station 609's mean conductivity value dropped to under 45,000, with highs about the same as the previous period's **average**. The lows, while far below the prior period, were consistently higher than those for Station #539. In the later period the tidal influence of the Venice Inlet on the southern station is much more pronounced.

Two factors may tend to distort the Exhibit #2 data. Because there were relatively few water samples taken during the review period, the phase of the tide cycle at the time the sample was taken could well have skewed the results. In fact some anomalous readings were obviously due to either tide cycle or sampling error. The other factor, however, is consistent for both stations and tends to report

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consistently higher conductivity (salinity) values as a result. That factor is the location of these stations in the Intracoastal Waterway. The deeper water of the ICW will tend to be saltier the deeper down you sample. Boat traffic will also tend to churn and mix these waters. Also, the Middle regions of the Bay would benefit from any north-south tidal exchange that did exert itself far more than the near-shore areas. Accordingly, those shallower near-shore areas of the Bay where less mixing takes place may well exhibit significantly lower conductivity (salinity) values than the established monitoring stations in the middle of the Bay. Of extreme relevance is the fact that it's **the shallow areas that contain the seagrass meadows and the productive marine community.**

SOCIETY MONITORING RESULTS

Since June, 1988, the Society has been monitoring the waters of Little Sarasota Bay. See the **Water Monitoring** section for a description of the program, the station locations and the data sheets generated.

In **Figure #1** following, we contrast the closed Pass situation of today against the open Pass environment of fifteen years ago. Depicted are the 20 months of readings from our Station #1 for the period June, 1988 through January, 1990. We chose this Station to represent current conditions because it had the most salinity samples and was in line with the other stations. To represent the past we've graphed salinity sampling data from the Mote Marine Lab for the 20 month period June, 1973 through January, 1975. Mote took bi-weekly water samples during this period from their Little Sarasota Bay location on southern Siesta Key.

The salinity comparison... open Pass to closed Pass... is strikingly evident. Salinity levels were, as you'd expect, substantially higher when regular tidal exchange took place. During the first rainy season comparison, the 1973 salinity level broke just below 30 ppt for a short time. However, in 1988 the salinity plummeted to 15 ppt and stayed down far longer! In fact, 1988's high salinity during the rainy season approximated 1973's low reading for the same season. The rainfall for the July-October rainy season was about the same for both years.

The rainy season comparison between 1974 and 1989 is just as significant. In late June, early July, 1974 salinity fell to about 22 ppt while 1989 levels held at 30. This is certainly a contra-indication of what one would expect... until one reviews the rainfall records. In the June-July period, 1974 had almost a foot more rain than 1989! Later in the 1974 rainy season, two salinity spikes down to 28 ppt are shown. However, in the latter part of the 1989 rainy season a much wider, deeper salinity spike is depicted. Bay salinity declined to 20 ppt and was depressed for nearly two months. In the latter part of the rainy season the rainfall totals were about the same. So, for the same approximate amount of rainfall, the "closed Pass" salinities fell much farther and lasted much longer than the "open Pass" salinities.

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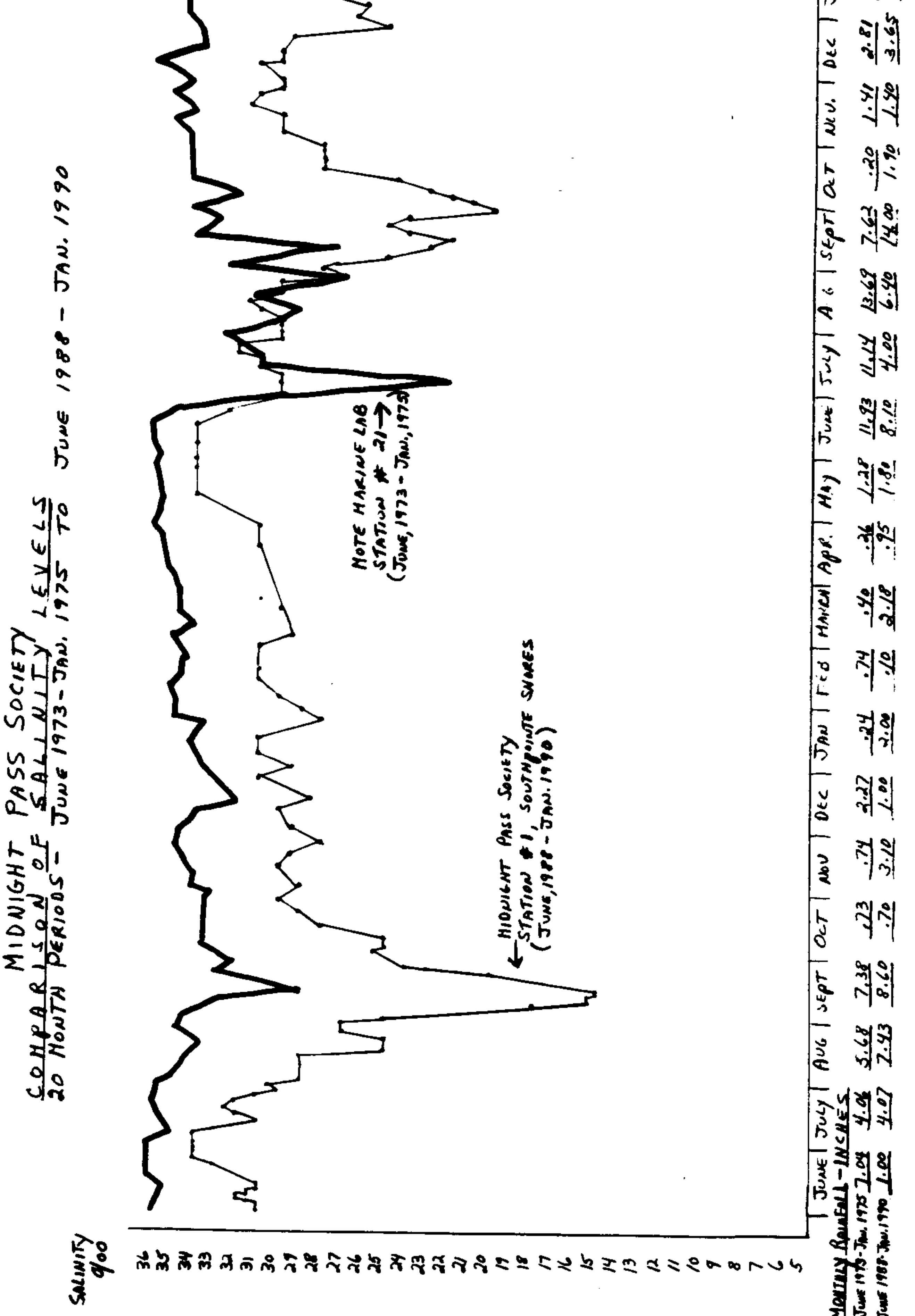
FIGURE #1
SALINITY LEVEL COMPARISON



We were sufficiently intrigued with the comparison of the open Pass Vs. closed Pass period to depict it in another fashion. **Figure #2** on the following page is a **salinity depression chart.** It shows the **extent** to which current salinity levels have fallen from historic salinities. On average, Bay salinity today is 5 ppt **below** what it was when Midnight Pass was open. More significantly, heavy rainfall events cause large salinity depressions and it takes the embayment quite some time before salinity levels rebound.

In the first rainy season comparison (1973 to 1988), current period salinities fell to 18 ppt **below** historic salinity levels... and the rainfall for each period was the same! In the second rainy season (1974 to 1989), the historic period actually experienced lower salinity levels (by 9 ppt) for a short period. This anomaly was due to **11 extra inches of rain** over two months in the prior period. But the situation quickly reversed itself and current salinities fell by as much as 15 ppt below the open Pass conditions. The current salinity levels were much lower than historic levels... and far more rain fell during the earlier rainy season!

In **Exhibit #3**, the salinity results for each Society monitoring station are charted. While the monitoring stations are spread out across approximately six miles of embayment, the salinity readings pretty much tell the same tale. After a certain amount of rainfall the salinities rapidly decline and, once down, are slow to recover. It would appear that the slow recovery period is related to groundwater levels and seepage. Early in the rainy season the water table is able to take up much of the rainfall. However, later in the season the water table is higher and more rainfall becomes surface runoff. With the higher water table, more groundwater seeps into the canals and tributaries. These nutrient-enriched waters find their way into the Bay.

At Station #2, at one point salinity declined to just 7 ppt! This is the only Society station influenced, to a degree, by Phillippi Creek. Station #3, by the Bird Islands, reported a low salinity of 12 ppt. Station #4, at Tropical shores on the mainland side of the Bay, reported salinity levels of 14 to 16 ppt for about a month. The other stations all reported similar results. The raw monitoring data is included in this presentation in the **Monitoring** section.

We did note that salinity changes at barrier island sampling stations seemed to lag a bit behind mainland-based stations. This would confirm the influence of mainland runoff on Bay salinity. Station #7 (a recent addition), near South Creek, reported somewhat higher salinities than the other monitoring stations. This would suggest that some tidal influence from the Venice Inlet extends northward to this part of the Bay.

SALINITY SUMMARY

The constriction of historic tidal flow followed by the actual closing of Midnight Pass caused a diminution of the usual salinity regimes for Little Sarasota Bay. Following major storm events, salinity levels are

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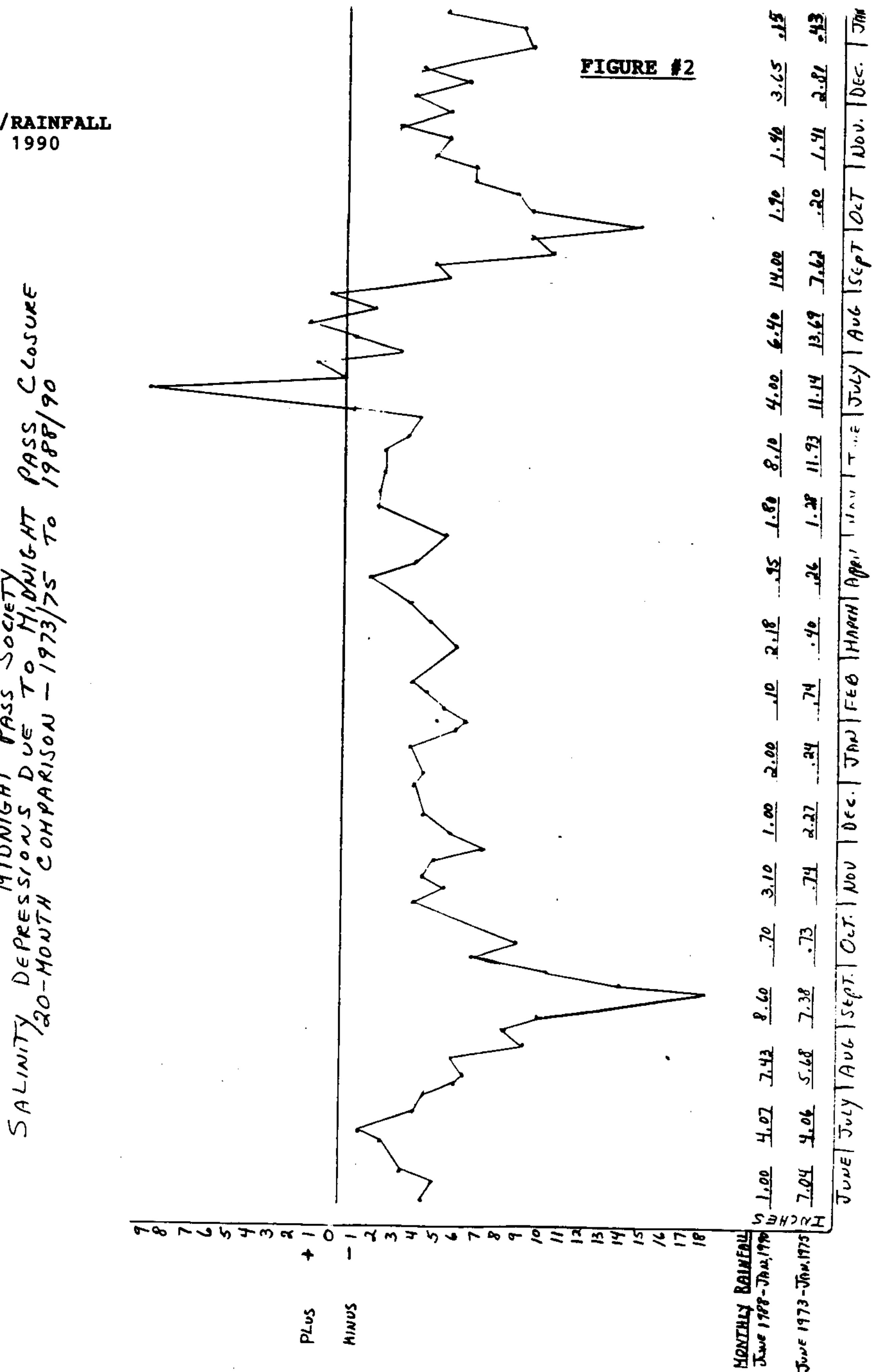
MIDNIGHT PASS SOCIETY
SALINITY DEPRESSIONS DUE TO MIDNIGHT PASS CLOSURE
20-MONTH COMPARISON — 1973/75 TO 1988/90
PLUS
MINUS
+
−
9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
MONTHLY RAINFALL
JUNE 1988-JAN. 1990
JUNE 1973-JAN. 1975
1.00 4.07 7.43 8.60 .70 3.10 1.00 2.00 .10 2.18 .95 1.80 8.10 4.00 6.40 14.00 1.90 1.40 3.65 .15
7.04 4.06 5.68 7.38 .73 .74 2.27 .34 .74 .40 .26 1.28 11.93 11.14 13.69 7.62 .20 1.41 2.81 .43
JUNE JULY AUG SEPT. OCT. NOV DEC. JAN FEB MARCH APRIL MAY JUNE JULY AUG SEPT OCT NOV. DEC. JAN

FIGURE #2

now much lower than they had been when the Pass was open... and these salinity depressions last longer, too. What had been mere "pulses" of low salinity after rainstorms, even major ones, have now become extended periods of low salinity.

Much of the marine community that historically inhabited these waters could not tolerate the altered environment. See the **Seagrass** paper for the effect on the Bay bottom plants... the foundation for Bay marine life. See the **Clam** and **Fish Kills** papers for the effect on these past inhabitants. See the **Benthic Animals** paper for what has happened to them. Simply put, much of the historic marine community was forced to migrate to other areas... or they died. One can only imagine what will happen when the current drought conditions are over and we experience normal amounts of rainfall.

RAINFALL

GENERAL

Fresh rainwater finds its way into Little Sarasota Bay by various means: direct from rainfall itself; runoff from the margins of the Bay; runoff into creeks and tributaries, many of which have been channelized; stormwater runoff deliberately directed into the Bay; and from groundwater seepage. As already described, **Midnight Pass played a very important functional role as a mitigator of the effects rainfall had on the ecosystem of the Bay.**

With direct tidal exchange (through an open Midnight Pass), the impact of even **major** rainfall events is relieved through the flushing action of a functioning inlet. There's just a "pulse" of low salinity which soon disappears... diluted by direct tidal circulation with the Gulf of Mexico. In developing the area we put this function to use... by shunting stormwater runoff into the Bay where, it was thought, tidal exchange would eliminate it. The premise was... **"The solution to pollution is dilution."**

But when tidal exchange is limited to indirect means (with Midnight Pass closed), rainfall-related fresh water remains in the embayment far longer. This results in the salinity depressions earlier described and the adverse impacts on the marine community covered in other chapters of this presentation. The false premise..."The solution to pollution is dilution"... has caused great harm to our waters in its implementation. The ill effects are far worse when the flushing mechanism upon which it was based was rendered inoperable.

A Sarasota County model revealed that, with Midnight Pass closed, a 15" rainfall event could, in theory, displace the waters of Little Sarasota Bay. Turn it fresh! Since 1983 we've experienced severe drought conditions. In only one year was rainfall average... the year of the major fish kill! When normal rainfalls return to this area, their effect on Little Sarasota Bay will be much greater than we've experienced thus far.

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PATTERNS

We actually have two rainy seasons. The first extends from February through April. Rainfall events typically last from 1 to 3 days and result in from 3" to 9" of rain. These rains are associated with cold fronts from the northwest. Because they follow the dry season when the water table (the groundwater) is at its lowest, their impact on the Bay tends to be minimized. The rains are absorbed into the ground, raising the water table. The volume of stormwater runoff/groundwater seepage in the spring tends to be less and of shorter duration than the volumes associated with the summer/fall rainy season.

RAINFALL EFFECTS

When the water table is low, more rain is absorbed into the ground. Later in the rainy season(s) with a higher water table, more rainfall is converted to surface runoff and groundwater seepage. Rainfall events later in the season tend to have a greater impact on the Bay.

Besides lowering salinity levels, runoff and seepage waters carry nutrients along on their trip to the Bay. The increase in nutrient levels tends to encourage phytoplankton blooms... especially in those areas with little tidal circulation. The blooms, in turn, tend to cause dissolved oxygen "spikes"... an abundance of oxygen during the day, but ever more serious oxygen depletions over night. The balance of nature goes out of balance.

Two added factors can make a bad situation a potential disaster. The temperature of the water and the dissolved oxygen therein have an inverse ratio: the higher the temperature, the lower the dissolved oxygen capacity of the water. The other factor is the cloud cover that comes with a multi-day storm event. While the "lights are out" during such a storm, the seagrasses, algae and phytoplankton in the Bay produce far less oxygen... they can even become net users of oxygen. Anoxic conditions caused by one or more of these factors spells certain trouble...even death...for the entire oxygen-dependent marine community. And, as marine plants and animals begin to die, the breaking down of the organisms creates additional oxygen demand!

So, a high water table will result in more water from a rainfall entering the Bay. Salinities will be lowered, but nutrient levels increased. Excess nutrients can encourage extreme plant growth... even phytoplankton and algae blooms. Oxygen levels which had modulated within a narrow, safe range will swing wider and wilder. A large storm will add more runoff to the Bay and "turn the lights out" for a time, pushing dissolved oxygen levels closer to lethal anoxic conditions.

When Little Sarasota Bay enjoyed historic tidal exchange through the Pass, such out-of-balance conditions were minimized, ameliorated or even avoided. High salinities were soon restored. Excess nutrients were flushed into the Gulf to benefit the near-shore marine community. Algae and phytoplankton build-ups were flushed out, too.

MONITORING

As part of the Society's monitoring program, daily rainfalls have been taken since June, 1988, on the mainland side of Little Sarasota Bay.

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Exhibit #4 compares the monthly rainfall observed here to the Sarasota Herald-Tribune published records. As expected, the general trends mirror one another. However, monthly rainfall totals were, at times, quite different... in one instance by more than 5"! The differences were even greater when comparing individual rainfall events which just confirms the varied patterns of local rainfall.

Exhibit #5 charts the ten day, monthly and annual rainfall observed at the Society's monitoring station from June, 1988 through January, 1990. While annual rainfall was well **below** average for this period, three substantial rainfall events were experienced:

RAINFALL PERIOD	# INCHES
First 10 days 9-88	7.55
First 10 days 9-89	6.65
Last 10 days 9-89	6.45

These are significant rainfall periods by any measure. It would appear that the drought-like conditions surrounding these heavy rains tended to minimize their effect on the waters of the Bay. With a lower water table, more of the rainfall was taken up as groundwater... less was converted to surface runoff or groundwater seepage.

Exhibit #6 is a ten day, monthly and annual rainfall chart for the Little Sarasota Bay area (Venice Station) for the 20 months from June, 1973 through January, 1975. While annual rainfalls were **below** average for this period too, nearly 9% **more** rain fell than in the comparable 1988-1990 period. More significantly, there were more major rainfall events, especially in 1974. This explains the "reverse depression" depicted on the salinity depression chart, page six (Figure #2).

MAJOR RAINFALL EVENTS

The major rainfall events in the Little Sarasota Bay locale from 1972 through 1989 are listed in **Exhibit #7**. The dates, duration and total rainfall data are reported for each storm event. Also shown is the total annual rainfall during much of this period.

This data clearly shows the extent of the drought conditions. The present dry period has lasted for most of the past 18 years. Since Hurricane Agnes in 1972, there have been no major hurricanes and few tropical storms to hit this part of the Florida coast. There's a clear correlation between drought conditions and the absence of major storms.

A comparison was made between the major storm events cataloged in Exhibit #7 and the Storet data for this area. It is most significant to note that, **of 26 major rainfall events between 1972 and 1989, the storet data reflected just four of them... four!**

Not reflected in the data bank is the huge impact of 1972's Hurricane Agnes. It missed the no-name storm of 1982; the fish kills of 1987; the water conditions that killed the clams by the Jim Neville Marine Preserve... midway between two of the monitoring stations! If the data fail to mirror known events of major import, it cannot be relied upon

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to reflect more subtle environmental changes. While some indications may be teased from these records, the **absence** of a trend means little... it could easily be due to faulty or missing data!

There are at least two weaknesses in the available Storet data. The most obvious has to do with the **number** of samples taken. There are large gaps of time between sampling dates (likely due to budgetary constraints). But with few available samples, tidal distortions and/or sampling errors would be greatly magnified. The other weakness appears to be the **fair weather** aspect of gathering samples. Sampling runs appear to be conducted in nice weather. They aren't run during storms or high winds or inclement weather. Few samples were taken after major rainfall events. Tests aren't run at dawn. "Fair weather testing" tends to report fair weather statistics. The marine community may well be adversely affected by transient conditions not reflected in fair weather statistics. The point isn't to criticize the sampling but to caution on the sole use of these statistics to assess Bay conditions. It is imperative that substantial attention be focused on biological indicators as well, to get a clear picture of environmental conditions in the Bay.

Hurricanes and tropical storms have major impacts on embayments and the marine communities residing therein. Each major storm brings with it: abnormally high tides, heavy rains which reduce salinities, cloud cover which can greatly reduce available daylight and winds that stir the water and roil the bottom sediments... which increases the nutrients in the water column and reduces light penetration.

Exhibit #8 is a chronological list of hurricanes passing within 100 miles of Sarasota since 1900. In 73 years (1900-1972) there were 29 hurricanes... one every 2½ years on average. A major storm occurred at least every five years. From the 20's through the 40's, a hurricane hit just about every other year. But in the 17 years since 1972, only **one** hurricane came close to Sarasota... 1986's Hurricane Elena...which most people consider a near miss. Judging from history, we're **clearly overdue** for a major storm event.

<u>THE FUTURE</u>

If we try to gauge what will happen in the future by reviewing the events of the past, a hurricane is likely to be upon us in the near future... but when? Meteorologists and environmental quality experts agree that we've been experiencing an elongated dry cycle. At least one national meteorological forecaster believes this dry cycle is about to end. They've predicted that Florida will experience more hurricanes and receive above average annual rainfalls over the next few years. The basis for the forecast is related to the African Sahara returning to a wet cycle.

If the local rainfall pattern does return to a wet cycle, it would be good for our water supplies but would prove devastating for Little Sarasota Bay. In the absence of tidal circulation through the historic

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inlet, above average rainfall and related runoff would accumulate within the embayment. Brackish water conditions in the Bay could even turn fresh! **All of the marine and higher salinity-dependent organisms that historically inhabited Little Sarasota Bay would either die or be forced to migrate.**

CONCLUSIONS

1. Reduced tidal flow through Midnight Pass associated with the ICW project reduced the historic salinity levels in Little Sarasota Bay.
2. The artificial closing of the inlet in 1983 further reduced historic salinity levels and created a zone of little water circulation... a null zone.
3. Since Pass closure, average salinities have declined approximately 15-20%.
4. After heavy rainfall events, severe salinity depressions occur in Little Sarasota Bay. These salinity depressions are much deeper and last longer due to the absence of tidal circulation through Midnight Pass.
5. Many of the marine plants and animals that had historically inhabited Little Sarasota Bay found the significantly lowered salinity regimes beyond their tolerance level; they either migrated or died.
6. Midnight Pass played a very important functional role as a mitigator of the effects rainfall had on the ecosystem of Little Sarasota Bay.
7. Annual rainfall since the closure of Midnight Pass has been well below average. As a result, the full effects of Pass closure have not, as yet, been witnessed.
8. When rainfall totals return to average or above average levels, the impact of the trapped fresh water in this embayment will be significantly increased. All the historic higher salinity-dependent plants and animals will be killed if they don't migrate to more saline waters.
9. The available Storet data is incomplete and is potentially misleading. The absence of water quality trends could well be due to missing and/or misleading data.

REFERENCES

A. Ecological Status of Little Sarasota Bay, 1985. Sauers & Serviss.
B. Storet data obtained from Dr. T. Fraser.
C. Mote Marine Laboratory, Station #21 water monitoring data. 1972 through 1975.
D. Midnight Pass Society monitoring data, 1988 through (Jan.) 1990.
E. Venice Station rainfall records. 1972-1976; 1983-1989.

MIDNIGHT PASS SOCIETY-- SALINITY/RAINFALL

EXHIBIT #1

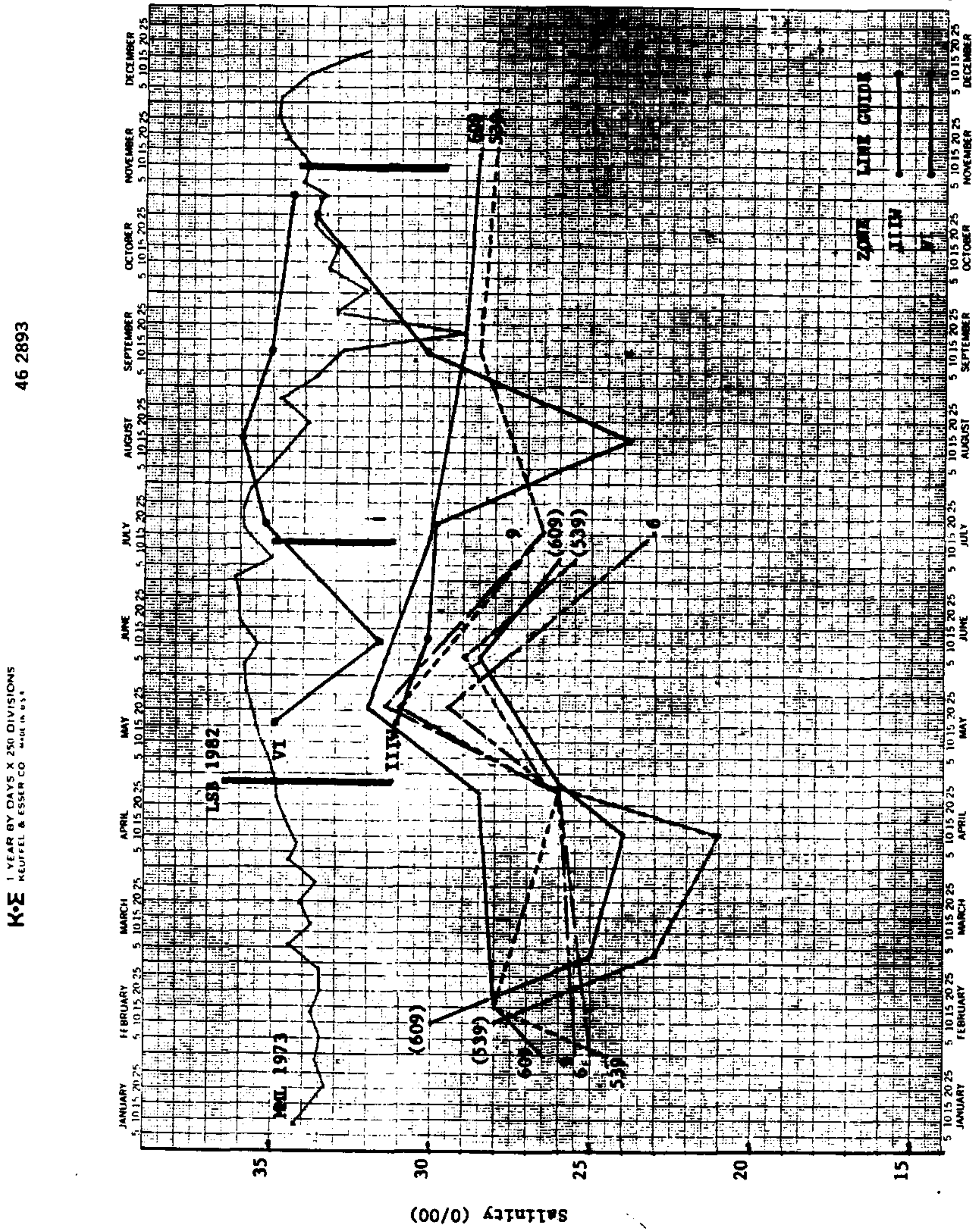


Figure 26. Salinity variations at Little Sarasota Bay during 1973, 1982, 1983, and 1984. Zones IIIW and VI. Stations #6, #9, #539 and #609 in 1984 and (#539) and (#609) in 1983 from Pollution Control (SCPC) monitoring. 1982 data indicate diurnal range at Zone II and IV equivalents. 1973 data at Midnight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

Annual Summaries of Maximum, Mean, and Minimum
Conductivity values at two W.Q. Stations
(Sarasota County #539 and #609) in Little Sarasota
Bay. Data from STORET and Sauers and Serviss (1985, p. 56).

Conductivity (umho/cm)

Bay Zone	W.Q. Station	1973	1975	1976	1978	1979	1980	1981
III	#539	69000 (53583) 48000 N = 6	52000 (46400) 38000 (10/23) N = 5	53000 (51333) 50000 N = 3	55000 (51500) 49000 N = 4	56000 (51130) 35000 (12/20) N = 10	53000 (48720) 38000 (9/11) N = 8	54800 (50013) 41200 N = 6
IV	#609	51000 (50000) 49000 N = 4	53000 (41667) 41667 (10/16) N = 3	55000 (51500) 48000 N = 2	55500 (53925) 52000 N = 4	57000 (47527) 39000 (12/20) N = 11	53000 (50370) 41000 N = 9	56200 (51775) 41300 N = 5

Midnight Pass Closed December 1983

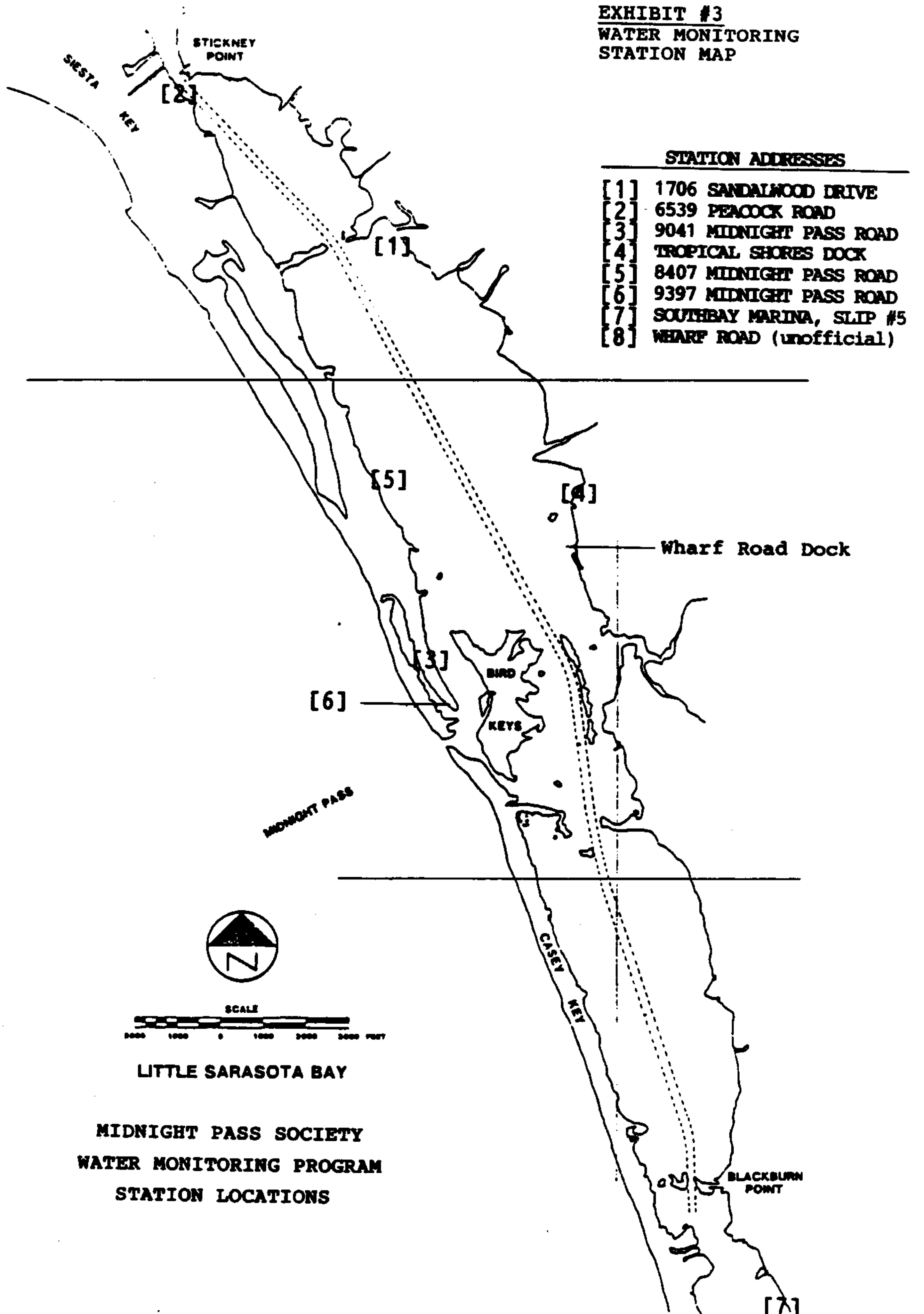
Bay Zone	W.Q. Station	1982	1983	1984	1985	1986	1987	1988
III	#539	49400 (42700) 37400 N = 6	43940 ** (37346)** 27000 ** N = 10**	39500 (35833) 32000 N = 3	42060 (38387) 34100 N = 6	44710 (41283) 36100 N = 7	45790 (38843) 27680 (8/4) N = 10	46160 (41336) 33670 N = 7
IV	#609	51300 (45000) 37200 N = 4	50434 (41100) 31701 N = 10	49000 (42636) 36000 N = 4	41200 (37583) 34620 N = 6	48170 (42319) 37500 N = 7	49500 (45370) 42550 N = 7	

** Corrected values per Morrill/Herbert
using actual sampling results.

MIDNIGHT PASS SOCIETY--RAINFALL/SALINITY

EXHIBIT #2

EXHIBIT #3
WATER MONITORING
STATION MAP

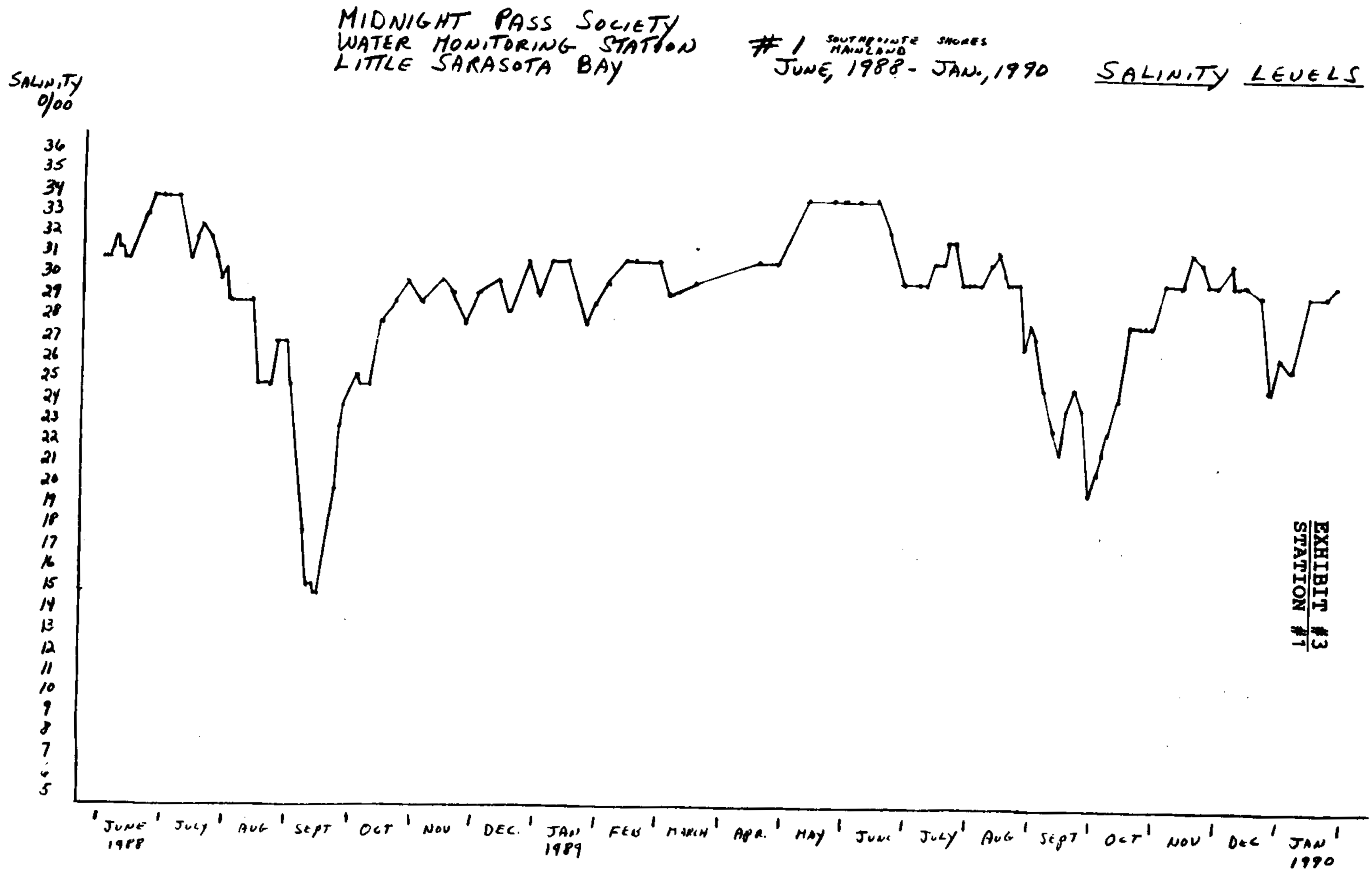


STATION ADDRESSES

[1]	1706 SANDALWOOD DRIVE
[2]	6539 PEACOCK ROAD
[3]	9041 MIDNIGHT PASS ROAD
[4]	TROPICAL SHORES DOCK
[5]	8407 MIDNIGHT PASS ROAD
[6]	9397 MIDNIGHT PASS ROAD
[7]	SOUTHBAY MARINA, SLIP #5
[8]	WHARF ROAD (unofficial)

LITTLE SARASOTA BAY

MIDNIGHT PASS SOCIETY
WATER MONITORING PROGRAM
STATION LOCATIONS


MIDNIGHT PASS SOCIETY
WATER MONITORING STATION
LITTLE SARASOTA BAY
#1 SOUTHPOINTE SHORES MAINLAND
JUNE, 1988 - JAN., 1990
SALINITY LEVELS
SALINITY 0/00
36
35
34
33
32
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JUNE 1988
JULY
AUG
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DEC.
JAN 1989
FEB
MARCH
APR.
MAY
JUNE
JULY
AUG
SEPT
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DEC
JAN 1990
EXHIBIT #3
STATION #1

MIDNIGHT PASS SOCIETY
WATER MONITORING STATION #2 STICKNEY PT. SIESTA KEY
LITTLE SARASOTA BAY
JUNE, 1988 - JAN., 1990

SALINITY LEVELS

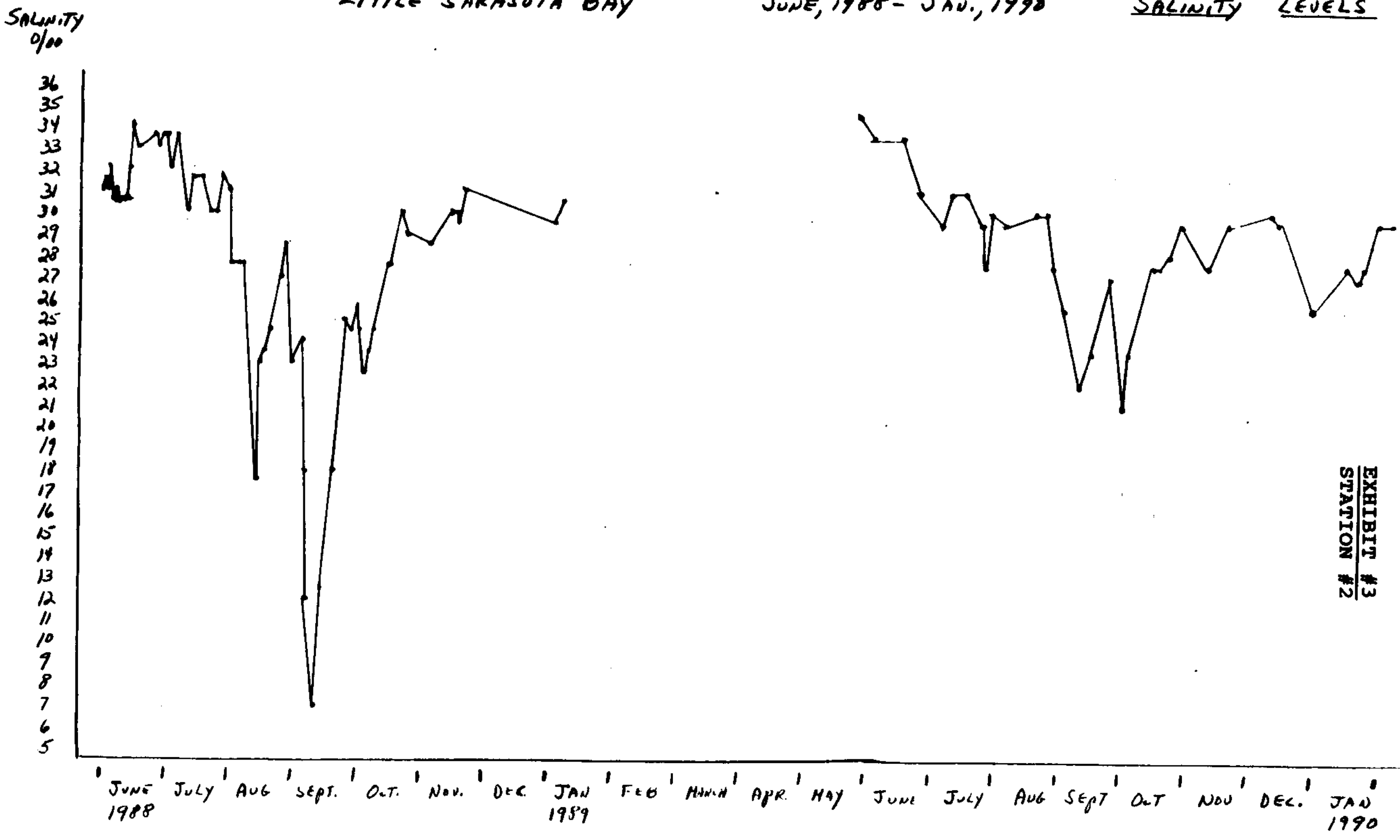


EXHIBIT #3
STATION #2

MIDNIGHT PASS SOCIETY
WATER MONITORING STATION #3 9041 MIDNIGHT PASS RD. SIESTA KEY
LITTLE SARASOTA BAY
JUNE, 1988 – JAN. 1990 SALINITY LEVELS

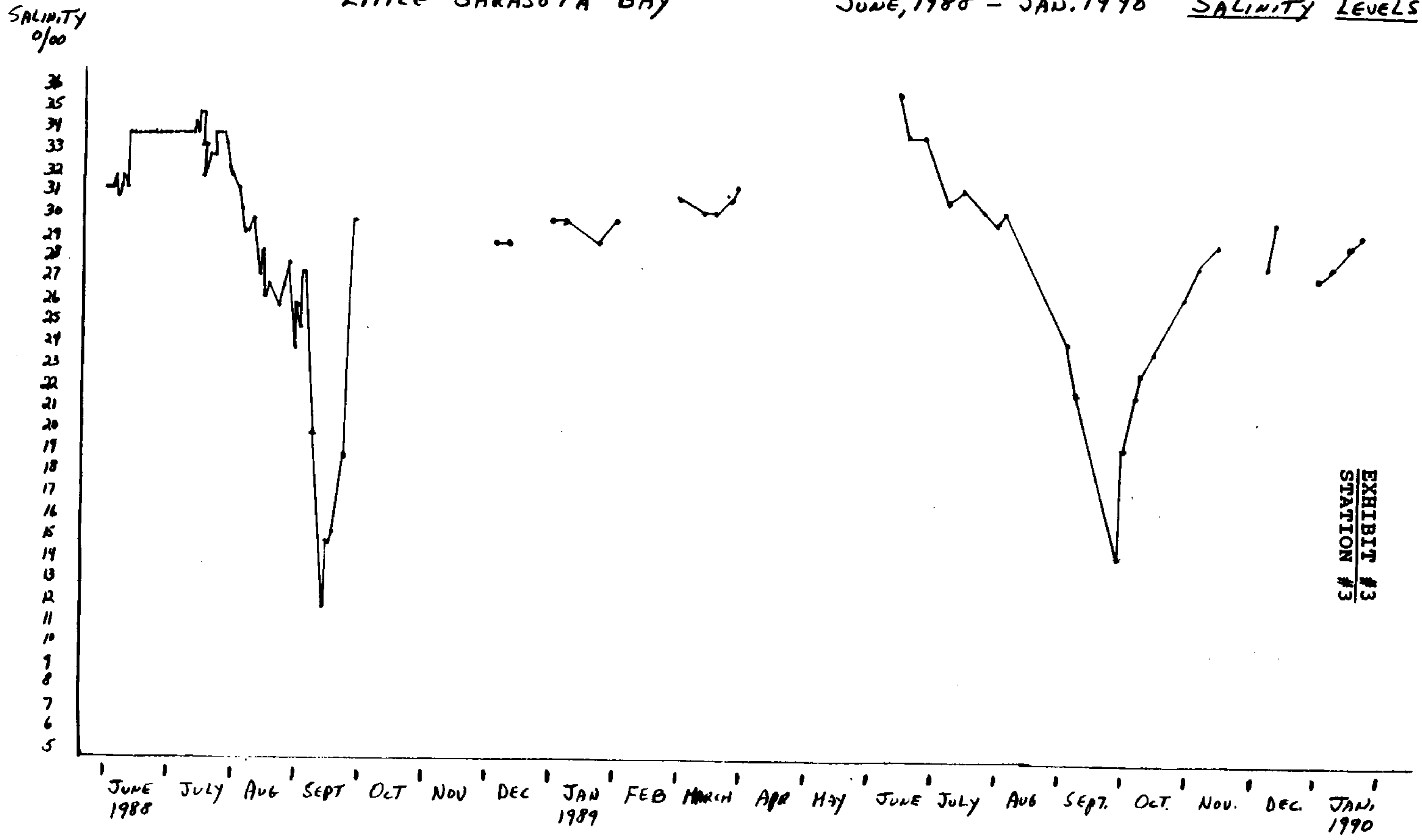
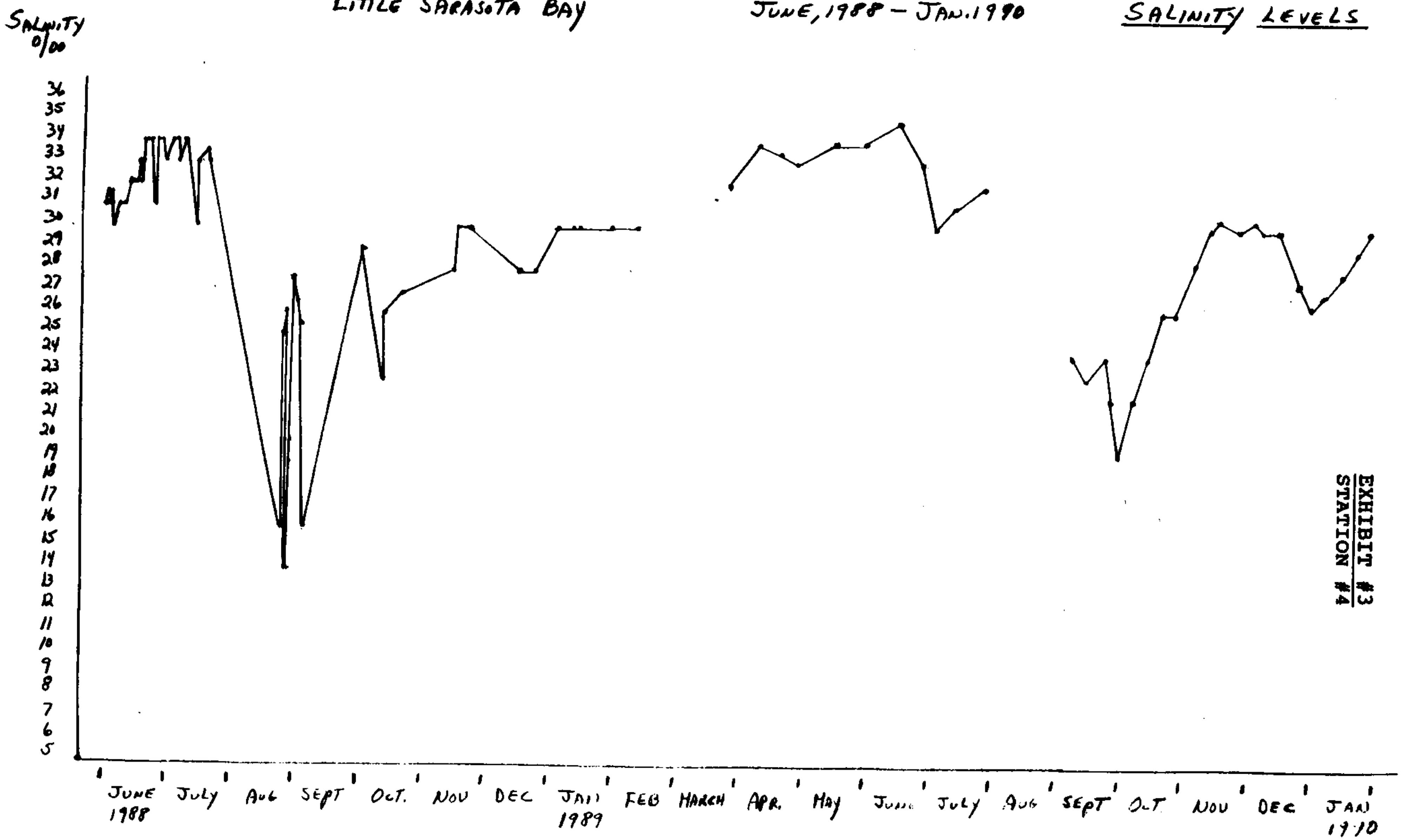


EXHIBIT #3
STATION #3

MIDNIGHT PASS SOCIETY
WATER MONITORING STATION #4 TROPICAL SHORES DOCK MAINLAND
LITTLE SARASOTA BAY
JUNE, 1988 – JAN. 1990

SALINITY LEVELS

EXHIBIT #3
STATION #4



MIDNIGHT PASS SOCIETY
WATER MONITORING STATION #5 8407 MIDNIGHT PASS RD. SIESTA KEY
LITTLE SARASOTA BAY AUG., 1988 – JAN. 1990

SALINITY LEVELS

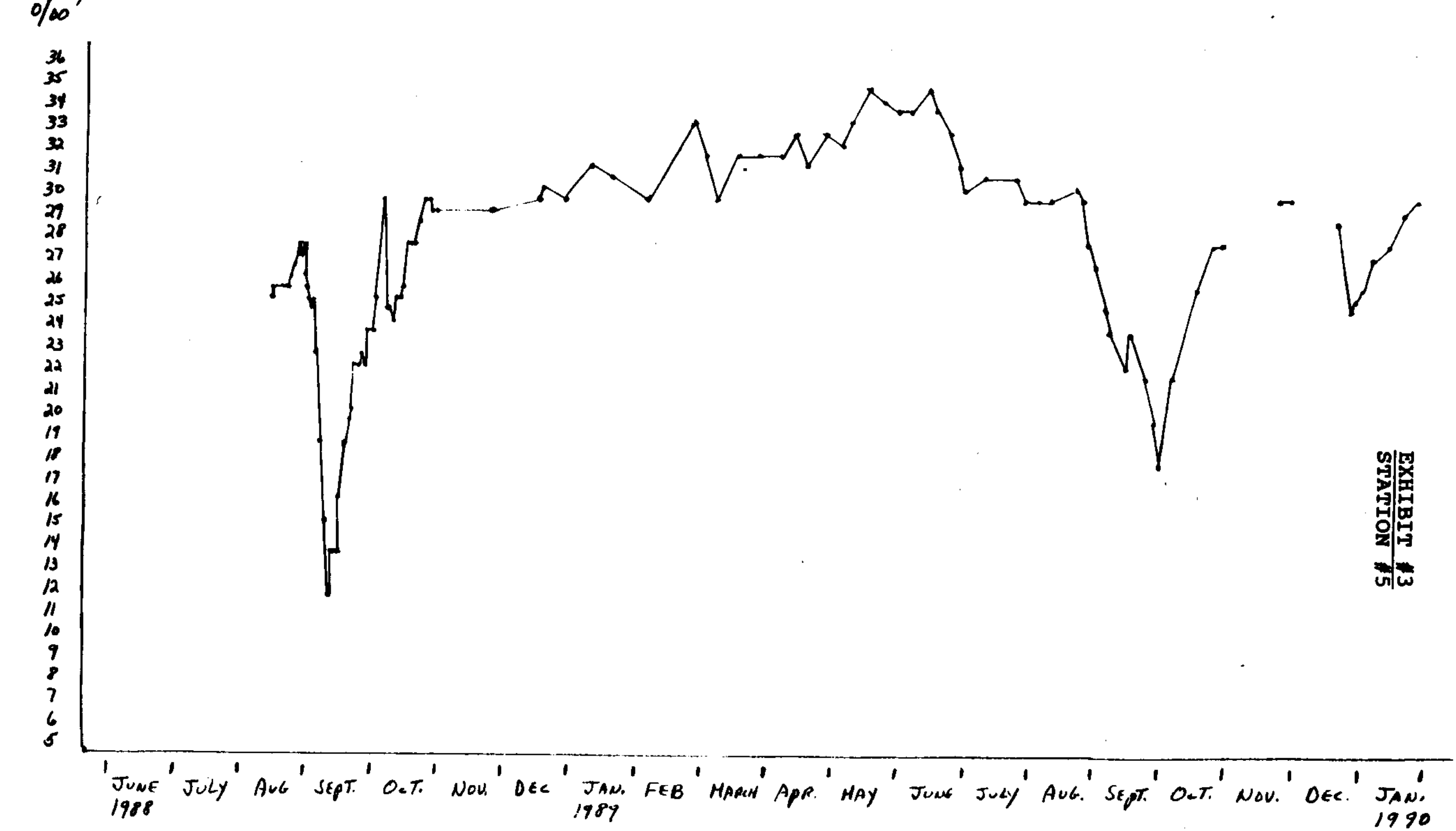
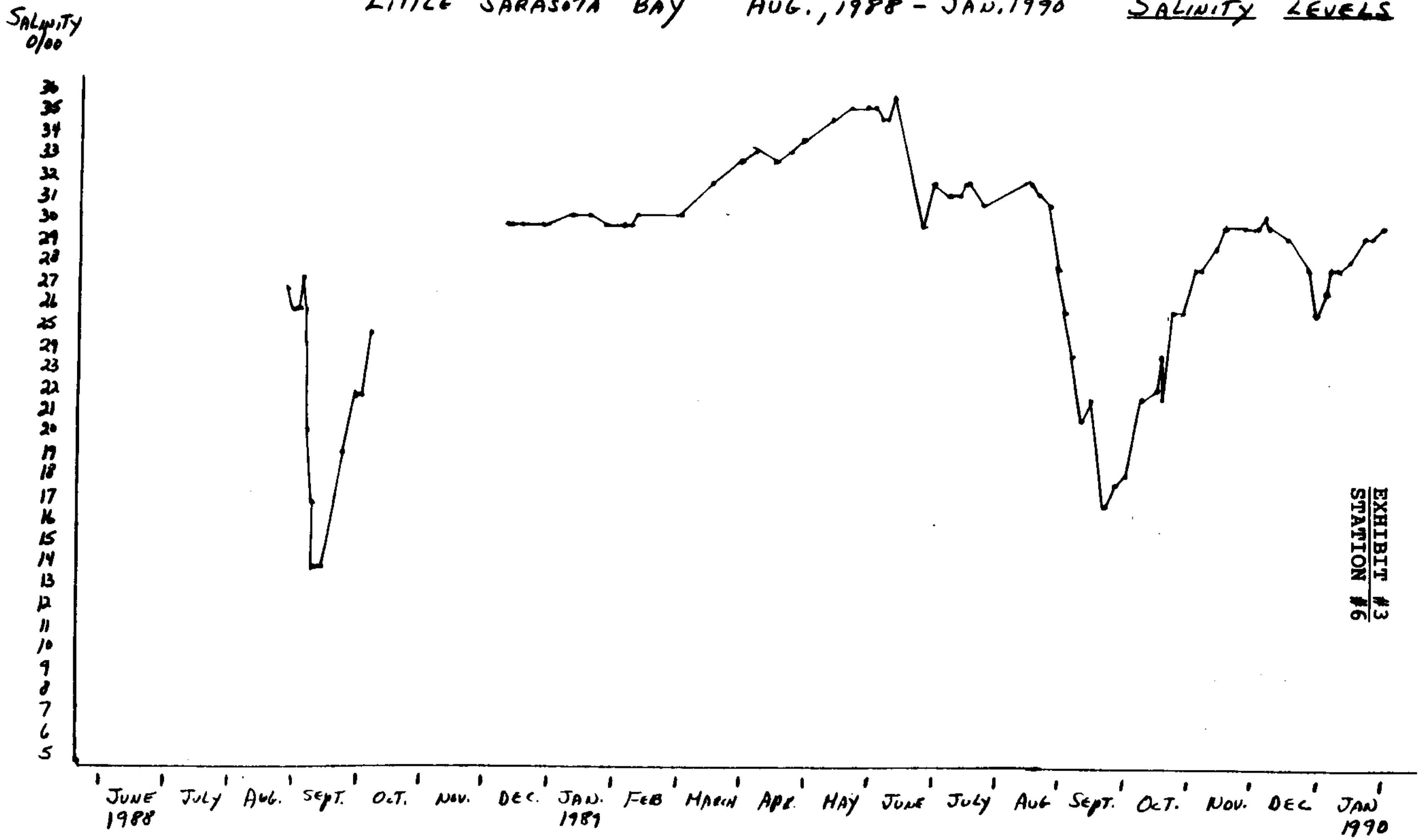


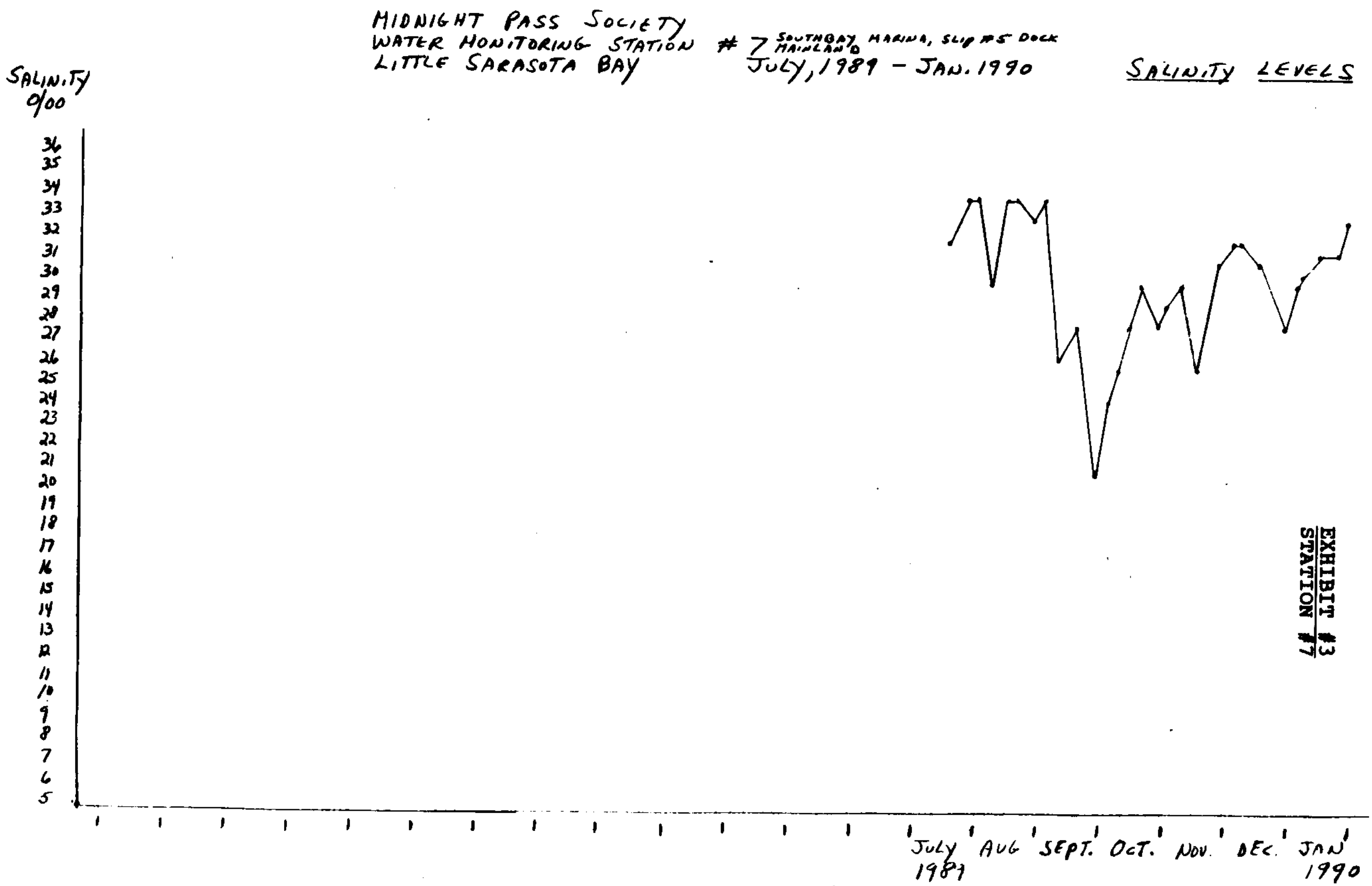
EXHIBIT #3
STATION #5

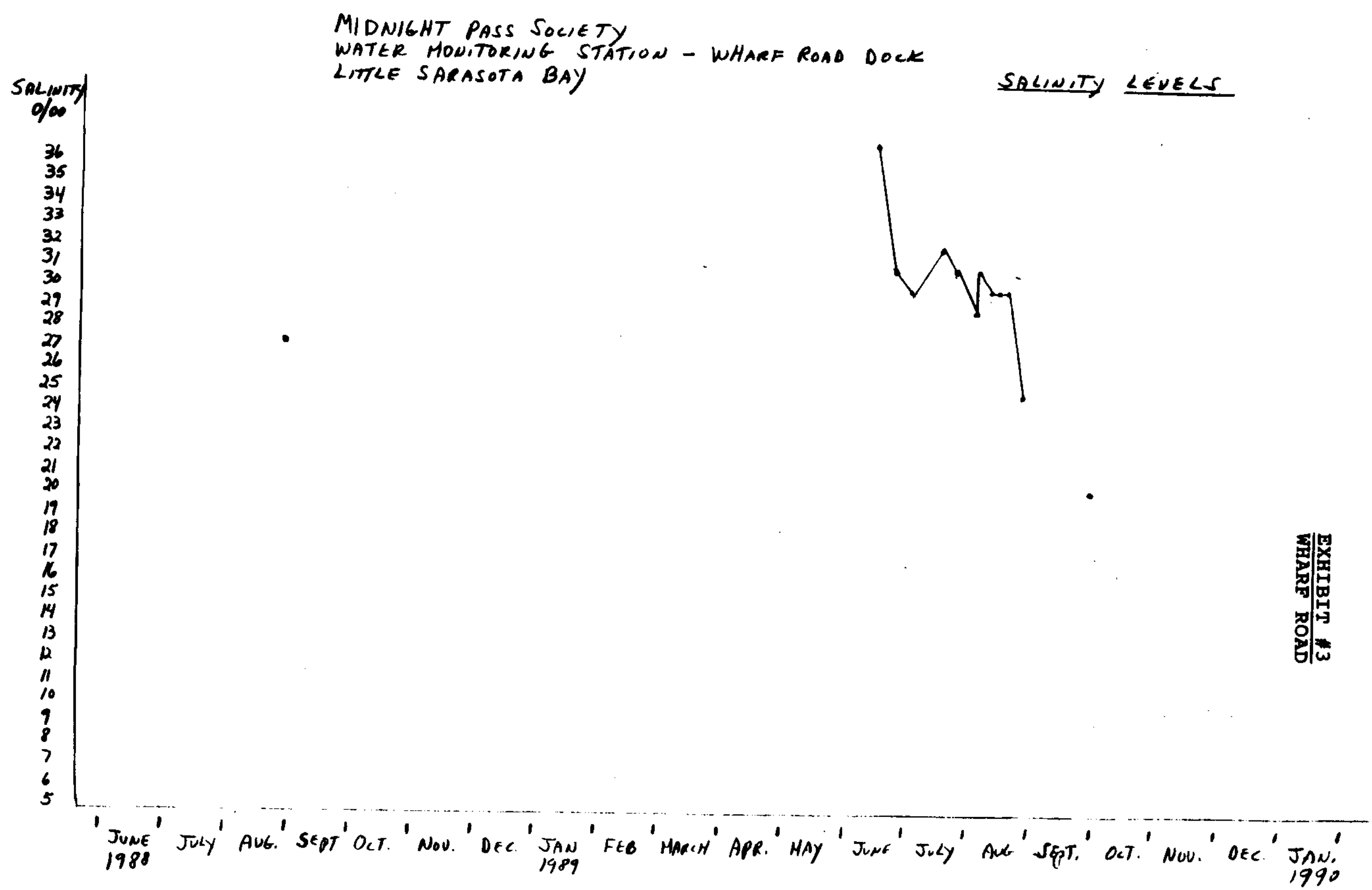
EXHIBIT #3
STATION #6

MIDNIGHT PASS SOCIETY
WATER MONITORING STATION #6 BLIND PASS LAGOON SIESTA KEY
LITTLE SARASOTA BAY AUG., 1988 - JAN. 1990

SALINITY LEVELS




MIDNIGHT PASS SOCIETY
WATER MONITORING STATION #7 SOUTHBAY MARINA, SLIP #5 DOCK MAINLAND
LITTLE SARASOTA BAY JULY, 1989 – JAN. 1990
SALINITY LEVELS
SALINITY 0/00
36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5
JULY 1989 AUG SEPT. OCT. NOV. DEC. JAN 1990
EXHIBIT #3
STATION #7



MIDNIGHT PASS SOCIETY
WATER MONITORING STATION - WHARF ROAD DOCK
LITTLE SARASOTA BAY
SALINITY LEVELS
SALINITY 0/00
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JUNE 1988
JULY
AUG.
SEPT
OCT.
NOV.
DEC.
JAN 1989
FEB
MARCH
APR.
MAY
JUNE
JULY
AUG
SEPT.
OCT.
NOV.
DEC.
JAN. 1990
EXHIBIT #3
WHARF ROAD

EXHIBIT #4
MONTHLY RAINFALL

MIDNIGHT PASS SOCIETY
MONTHLY RAINFALL - LITTLE SARASOTA BAY (SOUTHPOINTE SHORES - MAINLAND) JUNE 1988 - JAN. 1990 (solid line)

SARASOTA HERALD-TRIBUNE JUNE 1988 - JAN. 1990 (dashed line)

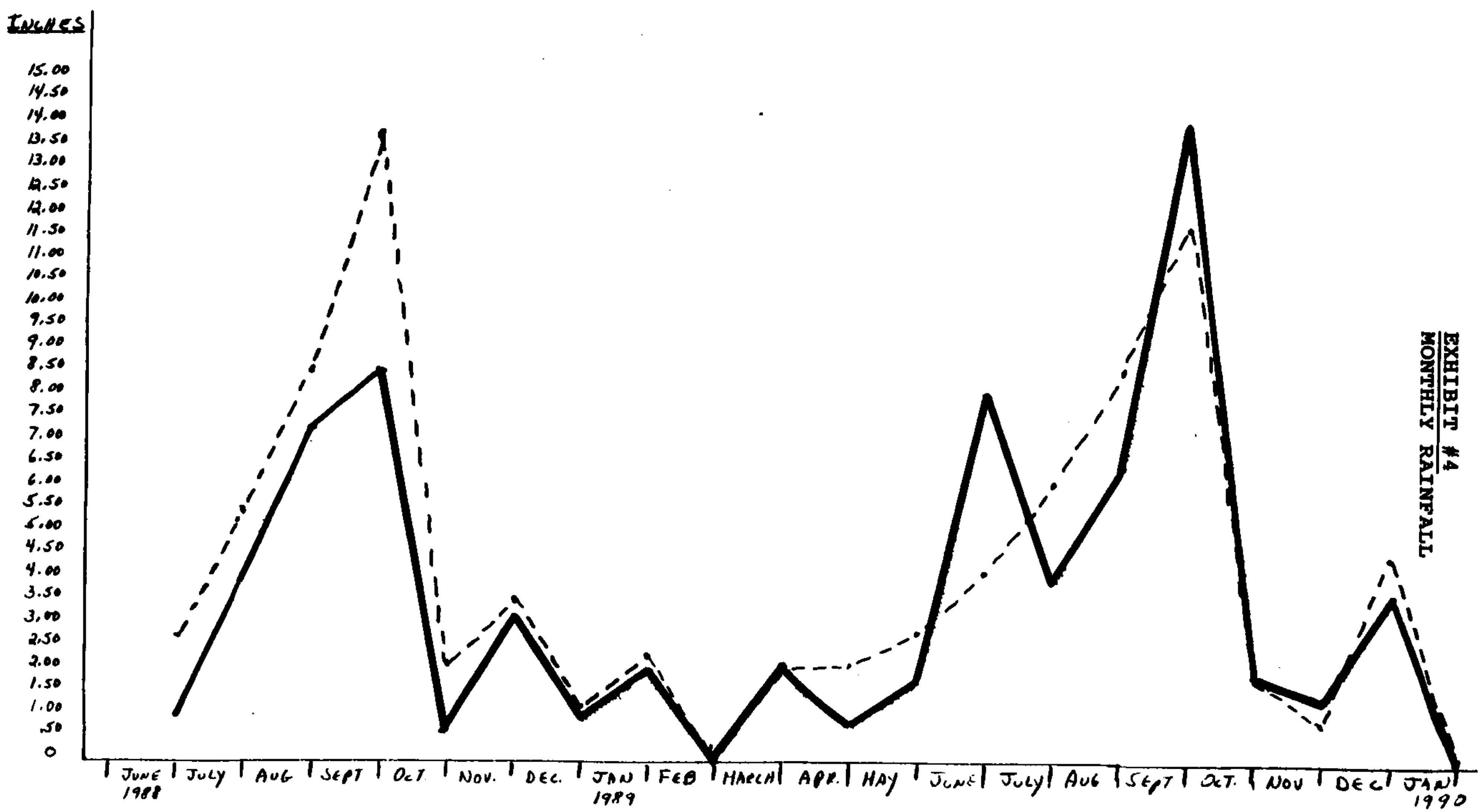


EXHIBIT #5
10 DAY RAINFALLS
1988/90

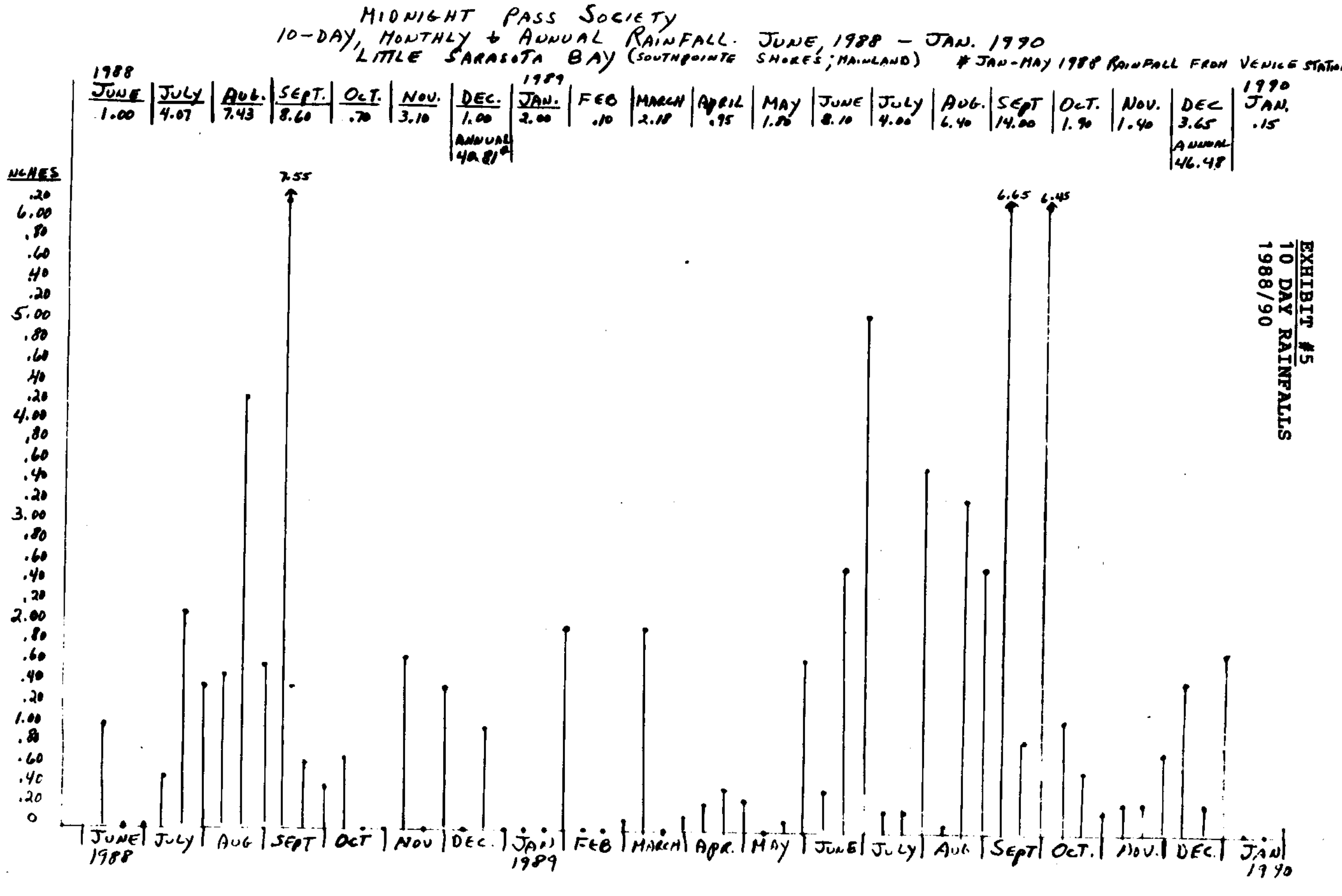
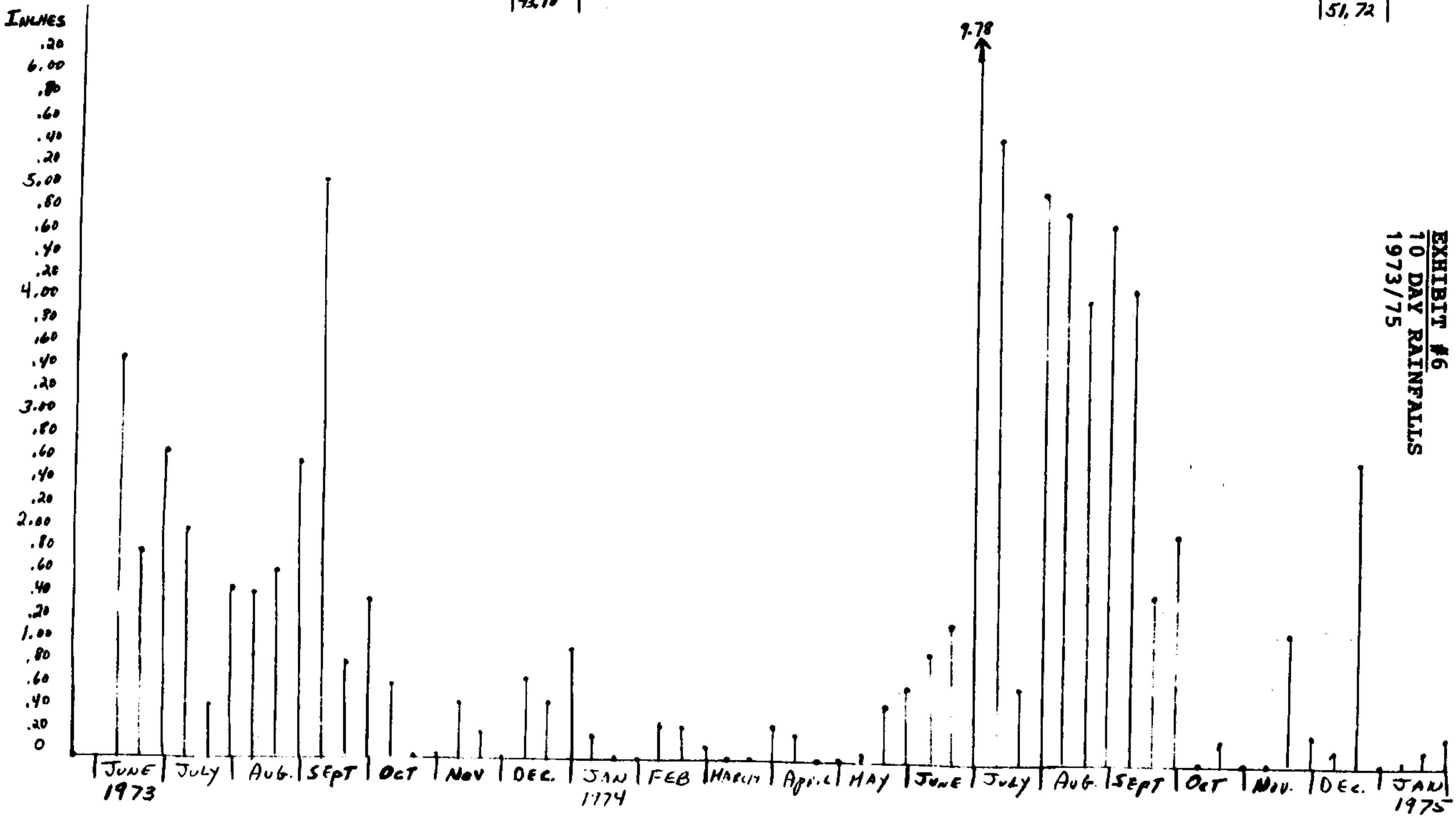


EXHIBIT #6
10 DAY RAINFALLS
1973/75

MIDNIGHT PASS SOCIETY
10-DAY, MONTHLY + ANNUAL RAINFALL JUNE, 1973 - JAN. 1975
VENICE STATION

1973 June	July	Aug	Sept.	Oct.	Nov	Dec.	1974 Jan.	Feb	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov	Dec	1975 Jan
7.04	4.06	5.68	7.38	.73	.74	2.27	.24	.74	.40	.26	1.28	11.93	11.14	13.69	7.62	.20	1.41	2.81	.43
						Annual 43.10												Annual 51.72	



Major Rainfall Events in the Vicinity of

Little Sarasota Bay

1985	July 17-27	11	4.40		1985	35.5
	Sept. 17-20	4	4.05			
1986	Oct. 25-Nov. 1	9	6.26	Hurricane Elena 3.0 inches in one day!	1986	48.2
1987	July 18-21	4	6.28	Major fishkill, Little Sarasota Bay	*1987	57.1
1988	Sept. 5-9	4	8.54	Major phytoplankton bloom of Skeletonema in Big and Little Sarasota Bays.	1988	44.4
1989	June 22-July 2	11	8.16		1989	41.4
	Aug. 18-21	4	3.83			
	Sept. 22-27	6	4.70			

Rainfall data from Venice, Florida weather station records via National Climatic data center
*Rainfall data, Sarasota Herald Tribune.