3-1-1995

Seagrass and Caulerpa monitoring in Hillsborough Bay Sixth Annual Report

City of Tampa Department of Sanitary Sewers

SEAGRASS AND *CAULERPA* MONITORING IN HILLSBOROUGH BAY
SIXTH ANNUAL REPORT

SUBMITTED TO

THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

TAMPA OFFICE

MARCH 1, 1995

CITY OF TAMPA

DEPARTMENT OF SANITARY SEWERS

BAY STUDY GROUP

EXECUTIVE SUMMARY

The City of Tampa, Bay Study Group has been monitoring water quality in Hillsborough Bay since 1976 and has documented improvements in water quality parameters since the early 1980's. The improvements in water quality were followed by the emergence of shoalgrass, Halodule wrightii, in several areas of Hillsborough Bay.

The Bay Study Group began a monitoring program in 1986 of the seagrasses H. wrightii and Ruppia maritima, and the alga, Caulerpa prolifera. The purpose of the study was to monitor changes in seagrass, since expanding seagrass coverage may be an indicator of improving water quality. However, the study is not intended to link the discharge from the Howard F. Curren Advanced Wastewater Treatment Plant (formerly Hookers Point Advanced Wastewater Treatment Plant) with changes in the seagrass community. H. wrightii baywide areal coverage was about 2,000m^2 in the initial survey in 1986, and has now increased to about 19.7ha. Coverage for R. maritima has fluctuated between 0.2ha and 2.2ha since 1986, and was 1.2ha in 1994. C. prolifera coverage has varied greatly over the study period. After reaching maximum coverage of 220ha in 1986, C. prolifera meadows were reduced nearly an order of magnitude following a "25 year" rainfall event in 1988. C. prolifera coverage was 29ha in 1994.

Seagrass recolonization is occurring in the intertidal and subtidal areas of Hillsborough Bay. Additionally, several intertidal areas that developed scattered H. wrightii patches early in the study are now coalescing into sizable seagrass meadows. Seagrass recolonization in Hillsborough Bay apparently is a result of improving water quality.

INTRODUCTION

The City of Tampa, Bay Study Group (BSG), created in 1976, has monitored the effects of pollution abatement in Hillsborough Bay since 1979. Within the last decade, water quality improvements and evidence of minor seagrass revegetation in Hillsborough Bay prompted the BSG to initiate a seagrass study to compliment other programs assessing the environmental status of Hillsborough Bay.

Documentation of natural seagrass coverage began in April 1986 with a thorough groundtruthing effort which located and described Halodule wrightii, Ruppia maritima and the attached benthic alga, Caulerpa prolifera. Five additional intensive groundtruthing efforts to document H. wrightii were completed during October for the years of 1989, and 1991-1994. In addition, study sites have been established for H. wrightii and C. prolifera. Generally, these sites are monitored three times a year.

The BSG transplanted H. wrightii into Hillsborough Bay in 1987 and 1989. Monitoring of many H. wrightii transplants in Hillsborough Bay was discontinued due to coalition with naturally occurring coverage. Transplants which have not coalesced are still visited seasonally. Data for these transplants, however, will not be contained in this or future reports. Instead, transplant coverage will be included as part of the baywide H. wrightii areal coverage estimate.

The purpose of the BSG seagrass study is to monitor changes of submerged aquatic vegetation (SAV), excluding drift macroalgae, in Hillsborough Bay. Seagrass is an important component of the Tampa Bay ecosystem and expansion of the seagrass community may reflect improvement of water quality. The seagrass program is not intended to link the discharge from the Howard F. Curren Advanced Wastewater Treatment Plant with changes in the seagrass community. This is the sixth annual report to FDEP to partly satisfy the requirements set forth in specific condition #14 of FDEP operation permit D029-1845321B.

METHODS

The seagrass program has been modified several times since 1986. The report by the BSG, "An Ongoing Survey of Halodule wrightii, Ruppia maritima, and the Alga, Caulerpa prolifera in Hillsborough Bay, Florida: Initial Assessment and Design" describes study site locations and experimental design for the naturally occurring seagrass and C. prolifera projects through the 1991 spring survey. It does not, however, contain seagrass transplant information and

project modifications made after the 1991 spring survey. Transplant information and methods used to evaluate SAV during 1991, 1992, and 1993 are discussed in the annual report submitted to DEP in March, 1994. The 1995 report presents modifications made in 1994 to evaluate H. wrightii in Hillsborough Bay. Survey methods for C. prolifera and R. maritima have not changed since 1991 and 1992, respectively.

Seagrass coverage in an embayment east of the north end of Apollo Beach (Figure 1) have been included in reports after 1989. Since it is unclear if this area should be within the boundary of Hillsborough Bay, the BSG has decided to omit this area from the Hillsborough Bay study area. Therefore, Hillsborough Bay seagrass estimates reported after 1989 will be revised in this report.

STUDY SITES

Study sites are visited each year during the spring, summer, and fall. The initial assessment (survey 1) was conducted in fall 1986 and the most recent assessment (survey 25) conducted in fall 1994.

Halodule wrightii

In 1994, the intertidal and shallow subtidal flats of Hillsborough Bay was divided into thirteen areas (Figure 1). Within each area, one patch of H. wrightii, if present, was chosen for study in the shallow zone. An additional patch was added in the deeper portion of the bar if the location met the deep criteria as follows: shallow patches were <30cm below mean low water while deep patches were >80cm deep. Two of the original study sites, B-1 and K-5, have been retained as shallow study sites.

Each study site is evaluated on a seasonal basis. During a visit to a study site, short shoot density, blades per short shoot, and blade length are measured. Short shoot density is determined using a $100cm^2$ square. Blade length (emergence from short shoot basal stalk to tip of blade) is measured to the nearest centimeter. Observations of epiphytes and seagrass health are recorded. Epiphytic cover is rated as clean, light, moderate, or heavy. Seagrass appearance is rated as poor, fair, good, or very good. Salinity, temperature, and depth are recorded.

Ruppia maritima

One Ruppia maritima transect was established in western Hillsborough Bay in 1987 and discontinued in 1992. Currently, data

on R. maritima is collected during seasonal visits to the thirteen subdivisions in Hillsborough Bay. A R. maritima patch in an area is selected at random and measurements of blade length, short shoot density, and inflorescence, if present, are taken. Short shoot density is determined with a 100cm^2 square.

Caulerpa prolifera

Five C. prolifera transects (Figure 2) in Hillsborough Bay are visited seasonally. Transects range from 80m to 300m in length. Transects are divided into 20m quadrats and within each quadrate two one square meter locations are randomly chosen for evaluation. Percent C. prolifera coverage, drift macroalgae, and the number of the polychaete, Diopatra cupraea, is recorded for each square meter. Salinity, temperature, and depth are also recorded.

AREAL COVERAGE

Areal coverage for H. wrightii, R. maritima, and C. prolifera is estimated with high altitude (ca. 6,000ft.) areal photographs taken in the fall from fix winged aircraft. After a scale is determined for each photograph, a grid composed of 1x1mm squares is placed over a photograph. The number of 1mm^2 squares covering a SAV signature in the photograph is counted. The areal extant of the SAV is determined by multiplying the number of squares covering a SAV signature times the scale determined for 1x1mm square. All SAV is groundtruthed within four weeks of the overflight.

Some areas of Hillsborough Bay do not have sufficient SAV coverage to produce a signature on a high altitude photograph. These areas are visited within four weeks of the overflight and any SAV encountered is documented. For each H. wrightii patch, the major and minor axes is measured and the area determined using the formula for an ellipse. Areal coverage of R. maritima and C. prolifera is based on site visual estimates.

RESULTS AND DISCUSSION

Halodule wrightii

Halodule wrightii coverage described in Hillsborough Bay for 1991, 1992, and 1993 has been revised to 2.0ha, 5.2ha and 7.3ha respectively, reflecting the previously discussed change of the study area definition. This is nearly thirty percent below coverage originally reported for each year.

H. wrightii coverage in Hillsborough Bay has nearly tripled from 7.4ha reported in 1993 to 19.7ha in 1994 (Figure 3). Area 2, in southeastern Hillsborough Bay (Figure 1), registered the greatest increase in coverage, gaining nearly 10ha (Figure 4). Coverage in areas 9, 10, and 11, in western Hillsborough Bay (Figures 5,6,7), also expanded considerably with increases of 3400m^2, 1ha, and 5500m^2 respectively. Areas 1, 3, 4, 5, 12, and 13 had modest increases in coverage (Figures 8, 9, 10, 11, 12, 13) while no H. wrightii coverage has been observed in areas 6, 7, and 8. H. wrightii coverage in each area during 1986, 1989, and 1991-1994 is presented in Table 1.

Table 1. Halodule wrightii coverage (m^2) by area in Hillsborough Bay for the years 1986, 1989, and 1991-1994.

	1986	1989	1991	1992	1993	1994
AREA						
1	690	700	400	500	2000	2630
2	1125	3300	16300	40800	34000	135000
3	0	0	40	350	250	1200
4	0	0	200	475	500	600
5	0	0	15	150	600	1200
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	85	140	800	1900	7000	10400
10	40	750	1600	6750	22400	32400
11	0	65	200	650	5000	10500
12	20	20	20	250	1300	2800
13	0	0	0	0	30	100
TOTAL	1960	4975	19575	51825	73080	196830

Ruppia maritima

R. maritima persists in several areas of Hillsborough Bay, however, the areal extant may vary greatly on an annual basis. In 1994, the intertidal area between Gadsden Point west to the Macdill AFB marina channel contained about 3000m^2 of R. maritima and scattered coverage was found along eastern Interbay Peninsula and in the Kitchen. About 6000m^2 was documented between Pendola Point and the Alafia River. R. maritima coverage has been sparse in McKay Bay after reaching 0.8ha in 1990. In total, about 1.2ha of R. maritima was found in Hillsborough Bay in 1994, nearly thirty percent less than coverage reported for 1993.

Caulerpa prolifera

Since monitoring began in 1986, C. prolifera has been shown to vegetate large areas of subtidal flats in a short time period and also to quickly diminish from vast areas due to sudden die-offs. Growth has been observed in four general areas of Hillsborough Bay: 1) along the southeastern Interbay Peninsula, 2) near Ballast Point, 3) along Davis Island, and 4) between Pendola Point and the Alafia River.

Subtidal areas up to three meters in depth along the southeastern Interbay Peninsula represent a region where C. prolifera has exhibited both rapid increase and rapid loss in coverage. Two C. prolifera transects, M-2 and C-1, are monitored in this area. Estimates from aerial photography documented a 40 fold increase in coverage to 200ha between April and December in 1986. A 90 percent reduction in coverage occurred in the fall of 1988 (survey 6) immediately following a "25 year" rainfall event which lowered salinities to 2ppt in some parts of Hillsborough Bay. C. prolifera transect M-3 was reduced to trace amounts (Figure 14) following the rain event. No C. prolifera was observed at study site M-3 during surveys 8-25, however, patchy coverage has been developing north and south of the transect since 1992. Transect C-1 was established after the rain event under the premise the alga would recolonize the intertidal and shallow subtidal shelf. However, only sparse coverage has been documented since 1989 (Figure 15).

Transect B-2, near Ballast Point, also suffered marked coverage reductions after the "25 year" rainfall event (Figure 16). There was sparse C. prolifera coverage in the transect in surveys 11-13 and 21-22 while no coverage observed during surveys 14-20 and 23-25. In 1994, a C. prolifera meadow located immediately north of the transect was estimated at 1ha, about half the coverage found in this area in 1993.

C. prolifera was found adjacent to the ship channel along subtidal flats of Davis Island in October 1986. Results from the transect Y-1 indicate low percent coverage through survey 5, and trace amounts in surveys 6-10 (Figure 17). Scattered C. prolifera coverage was observed in the deeper portion (1-2m) of the study site during survey 11. However, trace amounts were recorded in surveys 12 and 13. No coverage was observed during surveys 14-25. The initial decline to only trace amounts following survey 5 occurred prior to the "25 year" rainfall event.

In the northeastern region of Hillsborough Bay, between Pendola Point and Archie Creek, C. prolifera meadows have undergone rapid expansion and decline since October 1987. The C. prolifera meadows expanded from about 8,000m^2 in 1987 to maximum coverage of 190ha in 1990. Coverage declined to about 10ha in 1991 and then increased to about 28ha by the fall of 1993. However, in 1994, only 3ha of the algae was noted with the majority of the coverage located to the northeast of transect P-1. In this area, C. prolifera did not experience a large scale die-off following the 1988 "25 year" rainfall event. Salinity reductions near Pendola Point after the rainfall event may not have been as large compared to salinity reductions observed along the western side of Hillsborough Bay. It may be that long term exposure to moderate salinity reductions, perhaps in the 10-15ppt range for several weeks or more, is also detrimental to the alga in the same manner as severe hyposaline conditions of shorter duration. The Pendola Point transect P-1 reflects the growth pattern of C. prolifera in this region. The percent cover in transect P-1 (Figure 18) has varied between 0 and 100 percent through survey 25.

Additional C. prolifera coverage was found in the subtidal area from Gadsden Point west to the Macdill AFB marina channel and on the western end of Bird Island (Figure 1). C. prolifera meadows in the Gadsden Point area were estimated to cover 25ha in 1994. In 1993, a band of C. prolifera about five meters wide was found at the western end of Bird Island. However, coverage was greatly reduced to a small area near the southwestern portion of the island in 1994.

In summary, C. prolifera has rapidly colonized large intertidal and subtidal areas of Hillsborough Bay since 1986. Furthermore, this alga appears to be sensitive to low salinity for extended periods. Overall coverage was estimated at 29ha in the fall of 1994.

CONCLUSION

Improving water quality has allowed recolonization of H. wrightii into many intertidal and subtidal areas of Hillsborough Bay, including areas approaching two meters in depth. A majority of the H. wrightii renewal has occurred in the Kitchen, although

development and coalition of H. wrightii patches have created sizable meadows in western and northwestern sections of the bay.

Areal photography has shown that many areas of Hillsborough Bay have established R. maritima meadows which may vary in coverage from year to year. The information gained from the single Hillsborough Bay study site did not represent baywide trends.

C. prolifera generally persists in deeper waters than H. wrightii, indicating that the alga may be a pioneer of areas with relatively low light penetration. C. prolifera rapidly colonized large intertidal and subtidal areas of Hillsborough Bay in 1986, however, it is not known what stimulated the sudden increase in growth. In 1988, a large scale die off occurred immediately following a "25 year" rain event. The loss of C. prolifera in 1988 may be a result of exposure to low salinity for long periods.

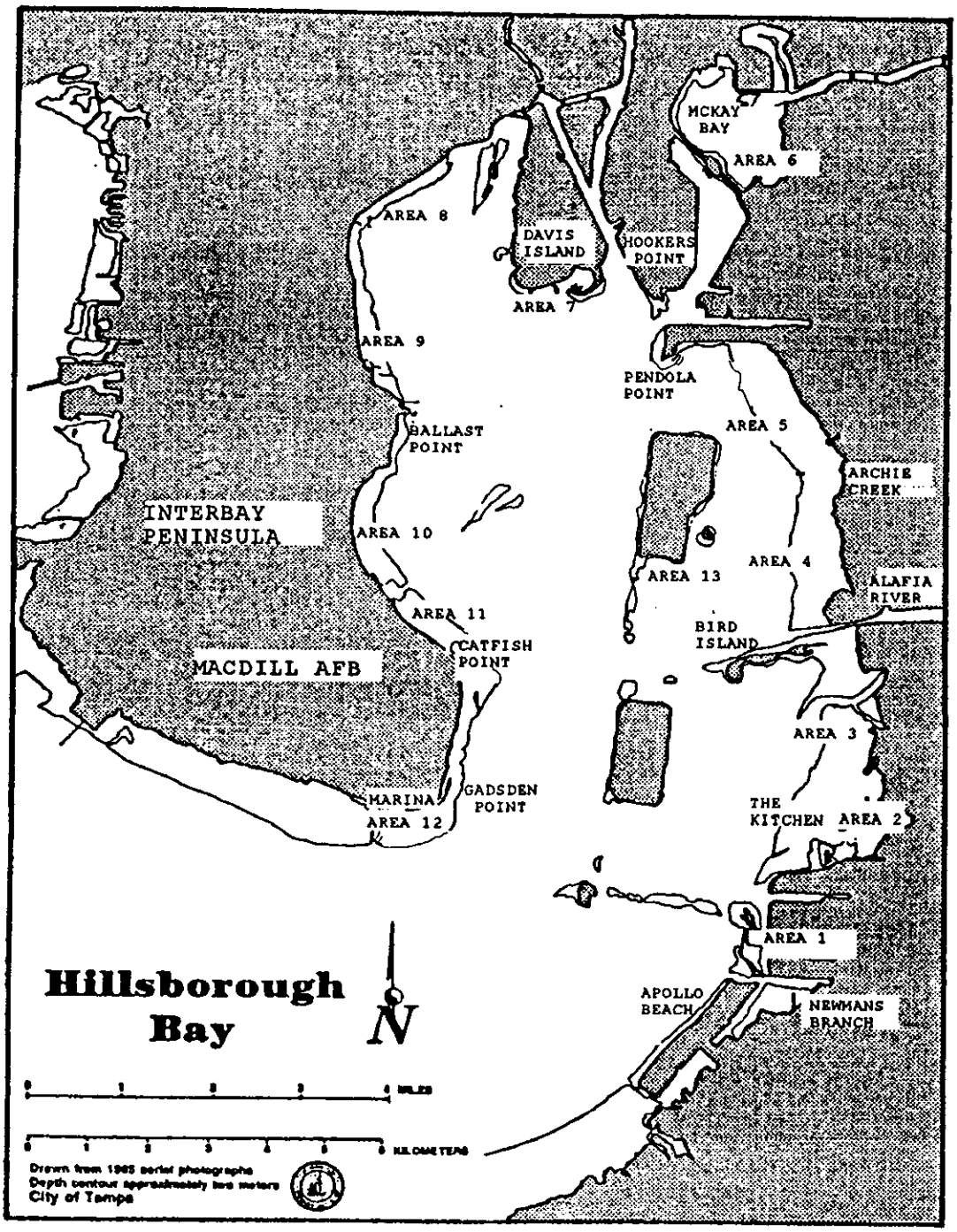

Figure 1. Location of the thirteen Halodule wrightii study areas in Hillsborough Bay. Arrow indicates embayment previously included as part of Hillsborough Bay.

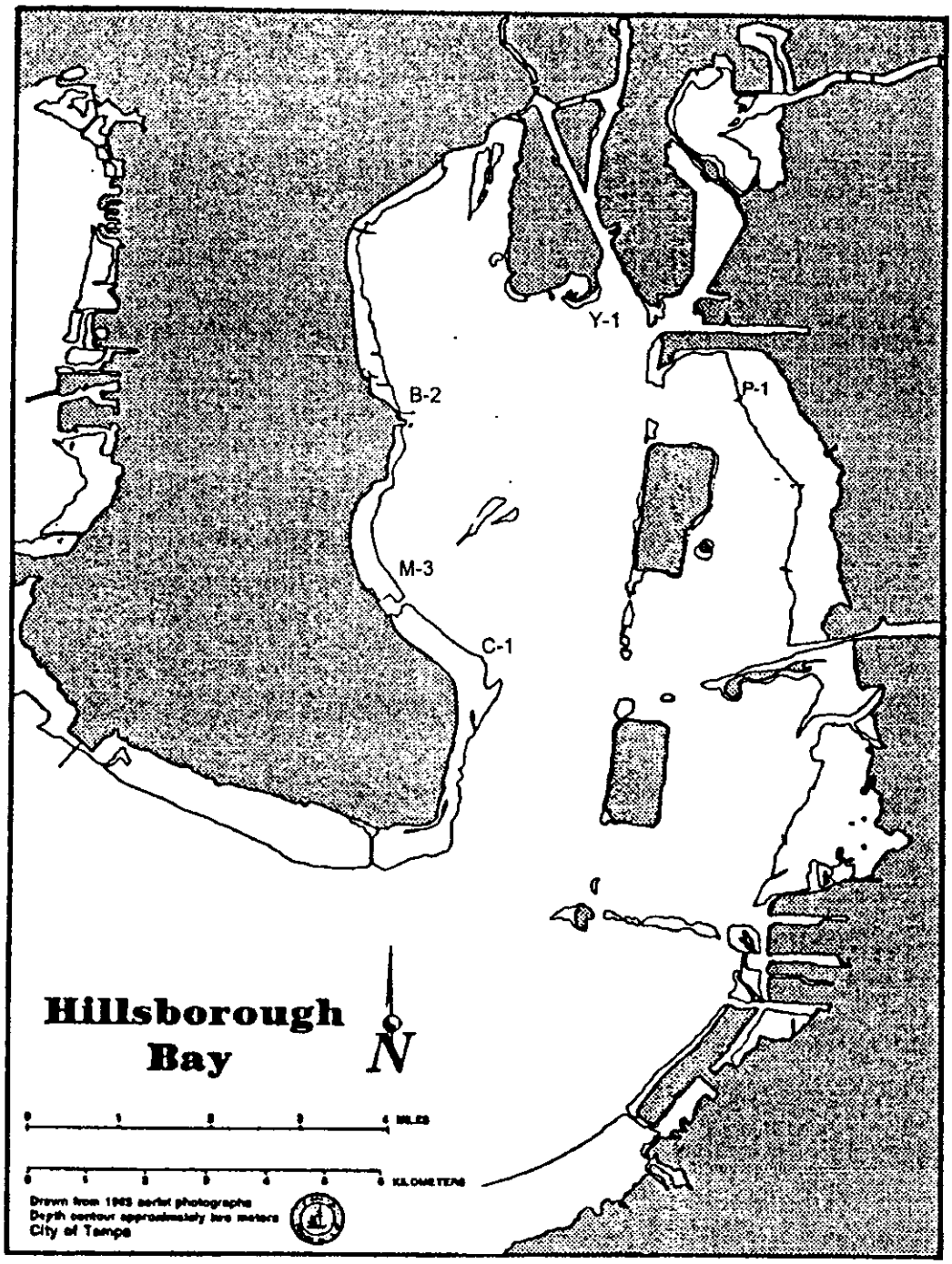

Figure 2. Location of the five Caulerpa prolifera transects ( ): B-2, C-1, M-3, P-1, and Y-1.

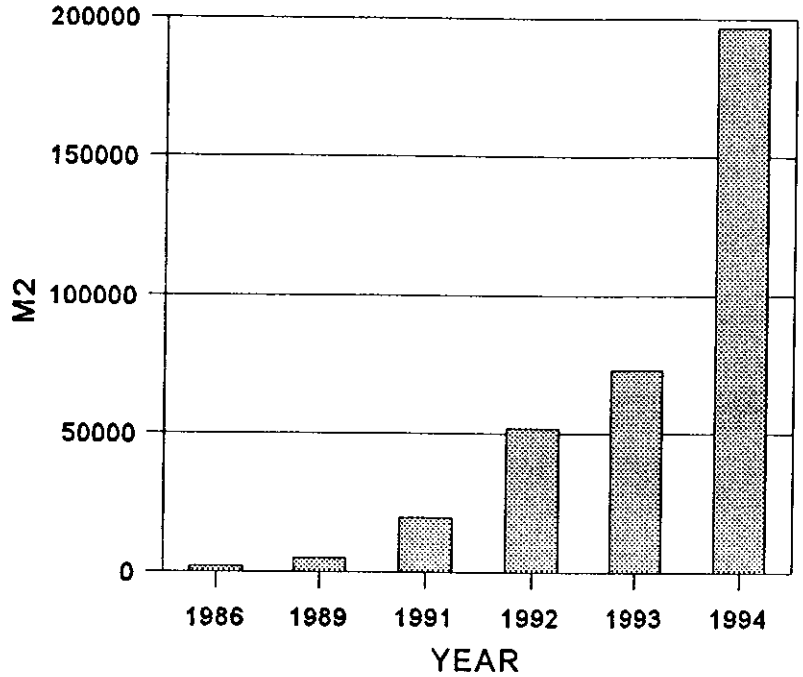

Figure 3. Halodule wrightii coverage in Hillsborough Bay.

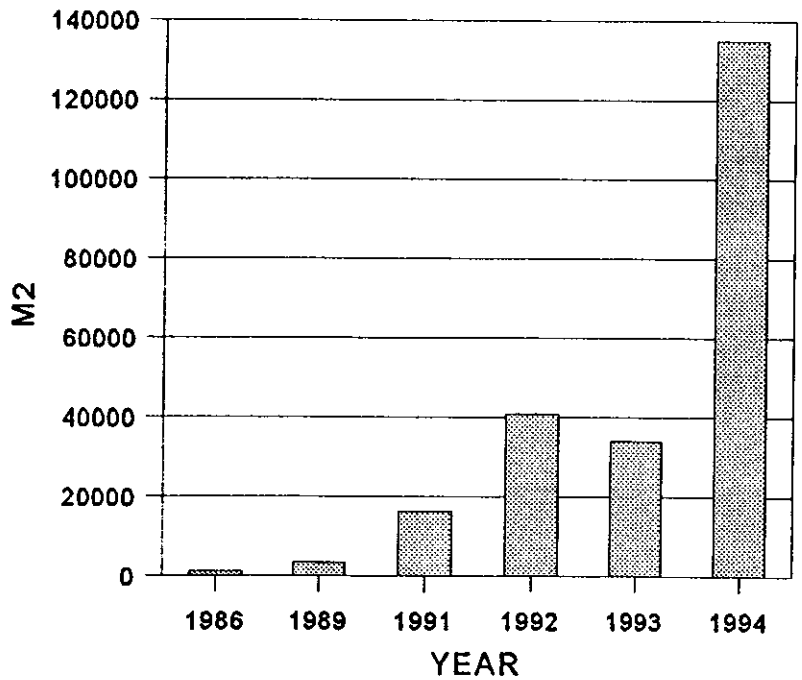

Figure 4. Halodule wrightii coverage in area 2.

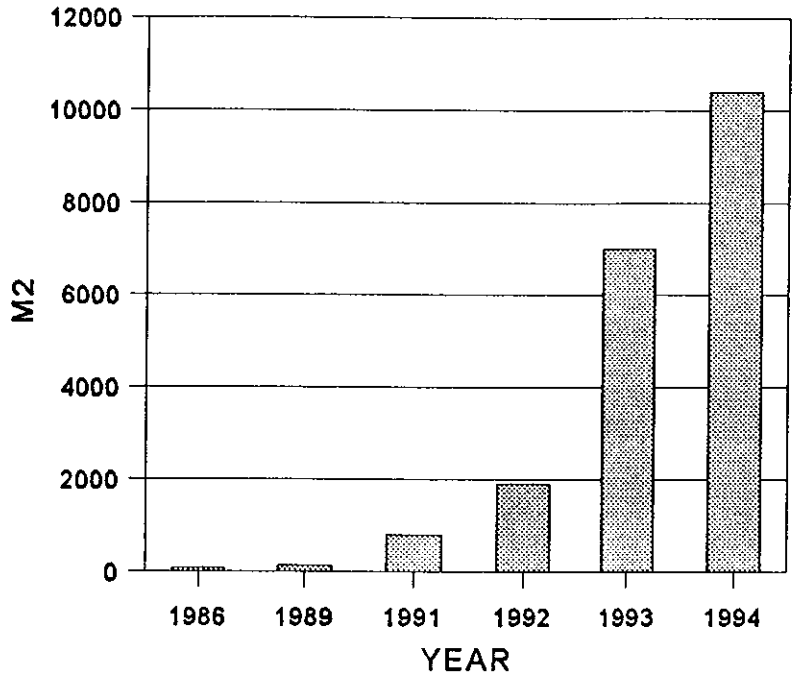

Figure 5. Halodule wrightii coverage in area 9.

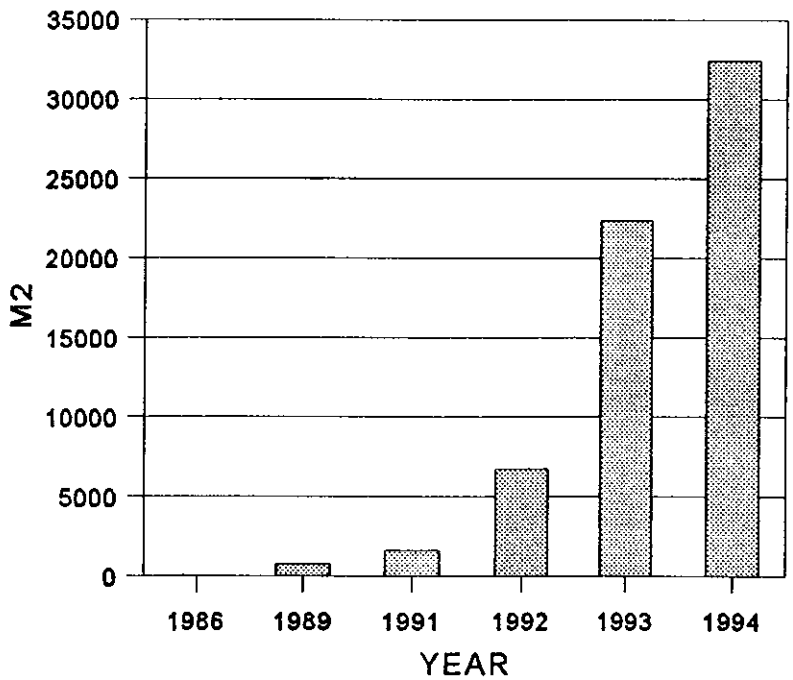

Figure 6. Halodule wrightii coverage in area 10.

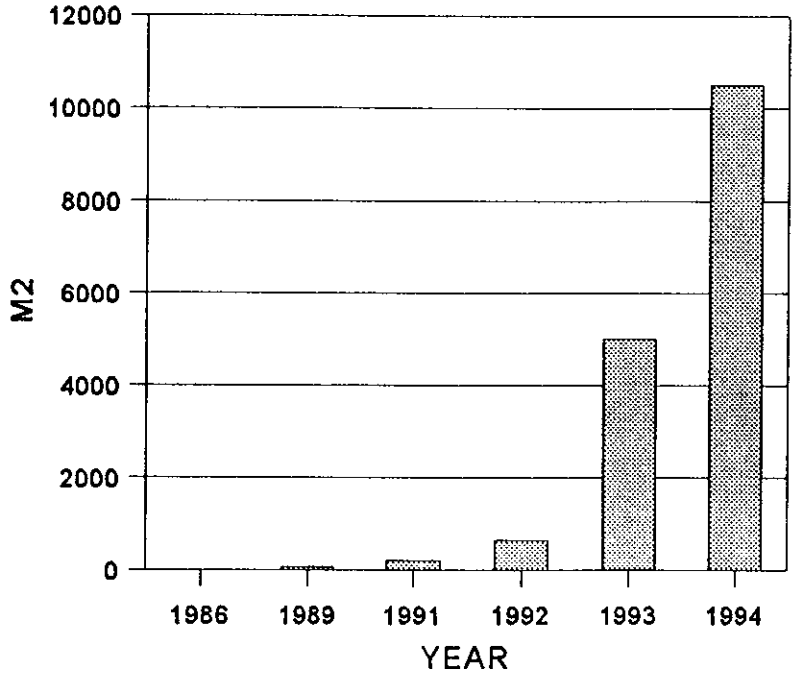

Figure 7. Halodule wrightii coverage in area 11.

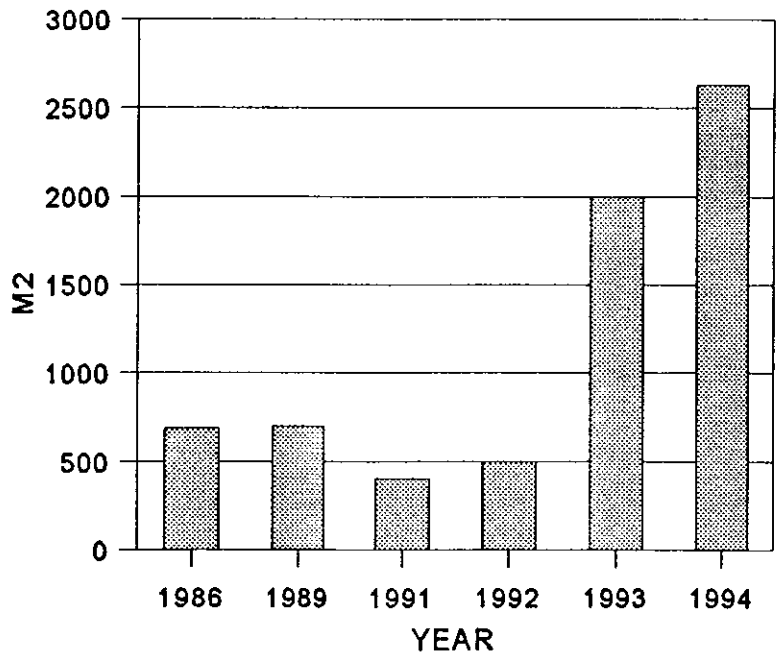

Figure 8. Halodule wrightii coverage in area 1.

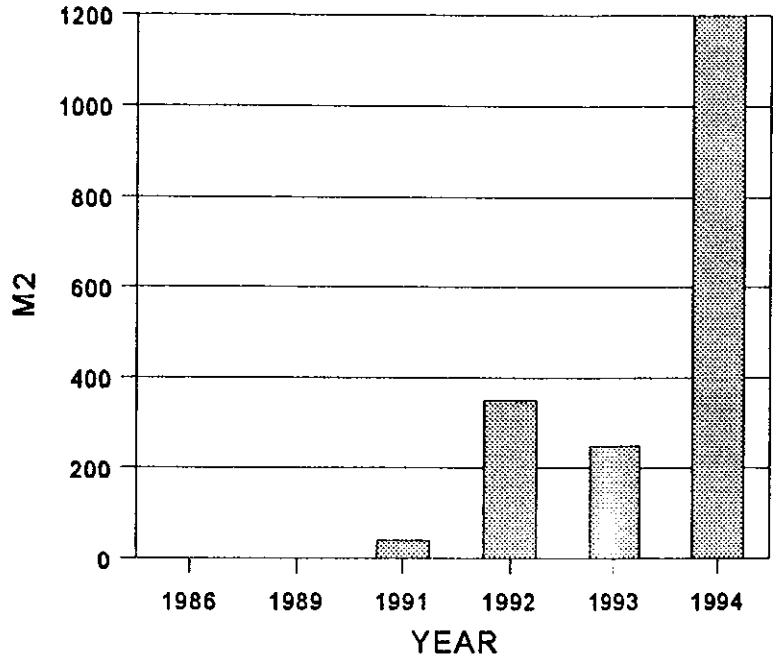

Figure 9. Halodule wrightii coverage in area 3.

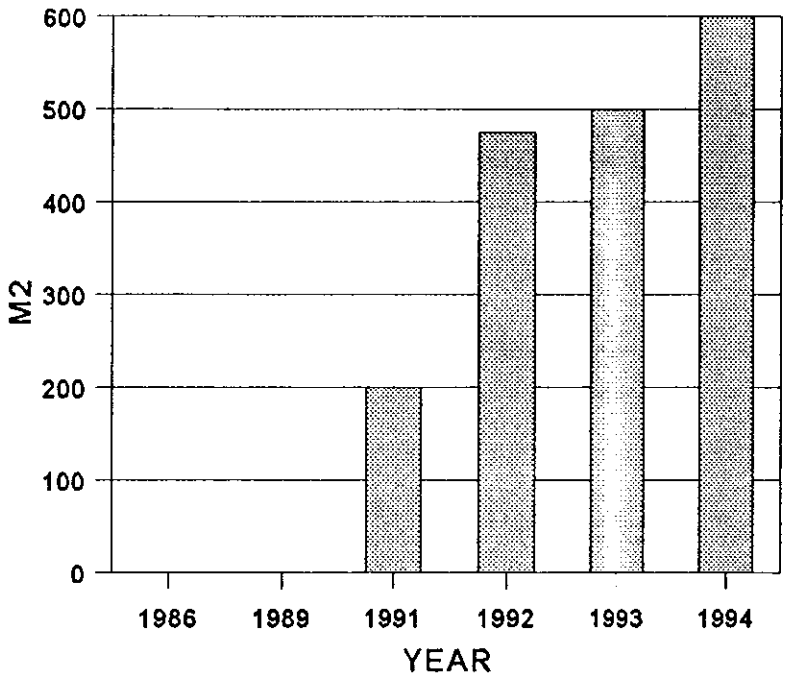

Figure 10. Halodule wrightii coverage in area 4.

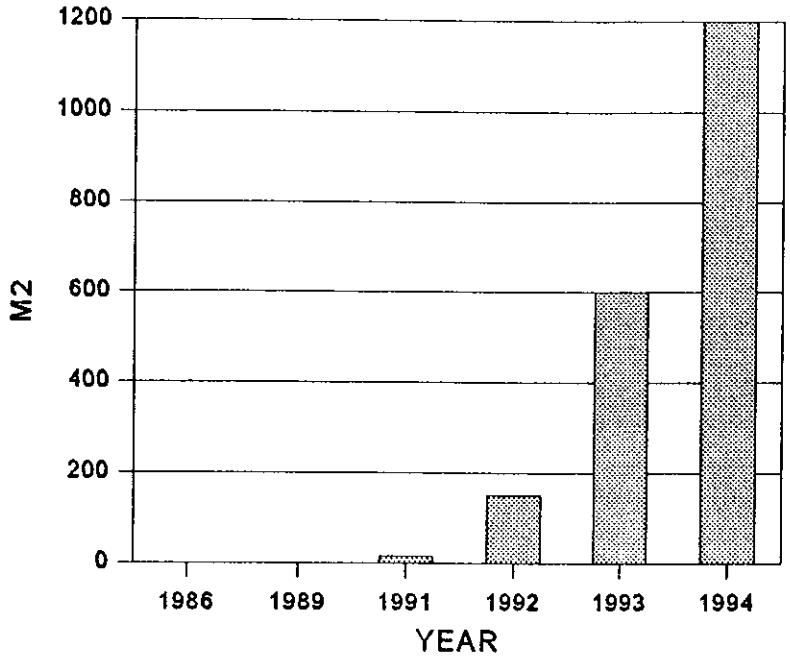

Figure 11. Halodule wrightii coverage in area 5.

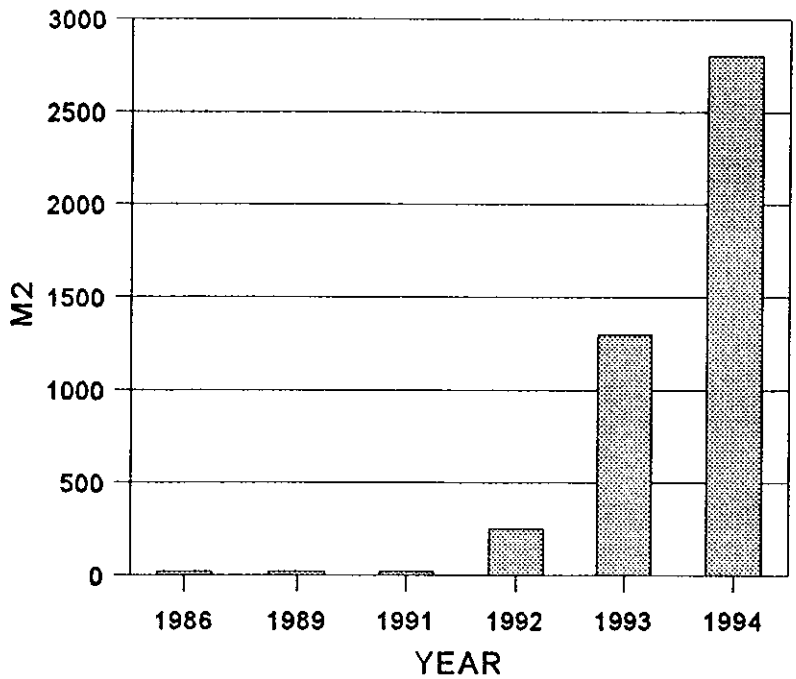

Figure 12. Halodule wrightii coverage in area 12.

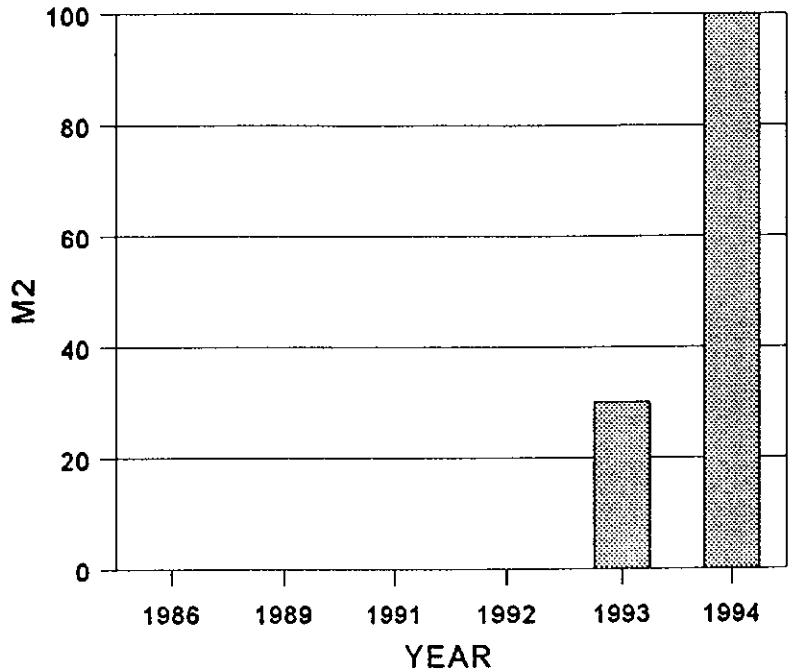

Figure 13. Halodule wrightii coverage in area 13.

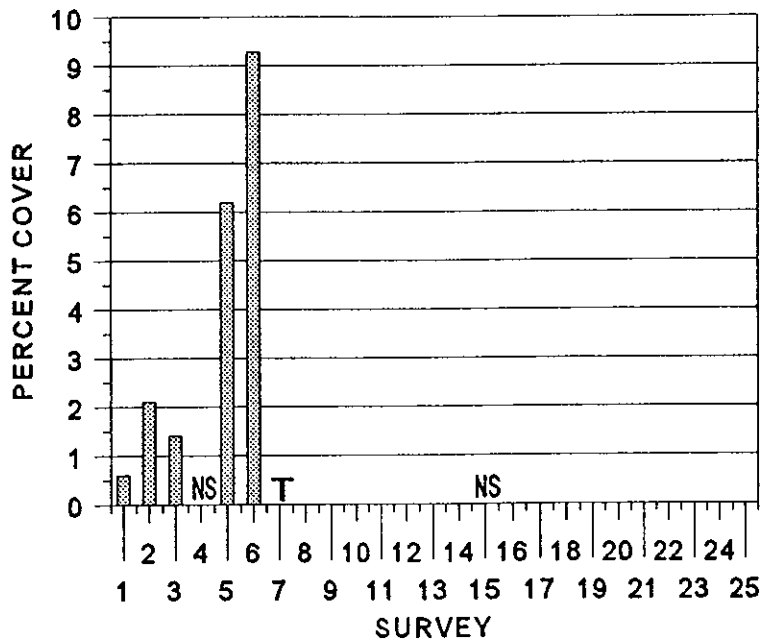

Figure 14. Percent coverage by Caulerpa prolifera at study site M-3. NS=No Sample T=Trace

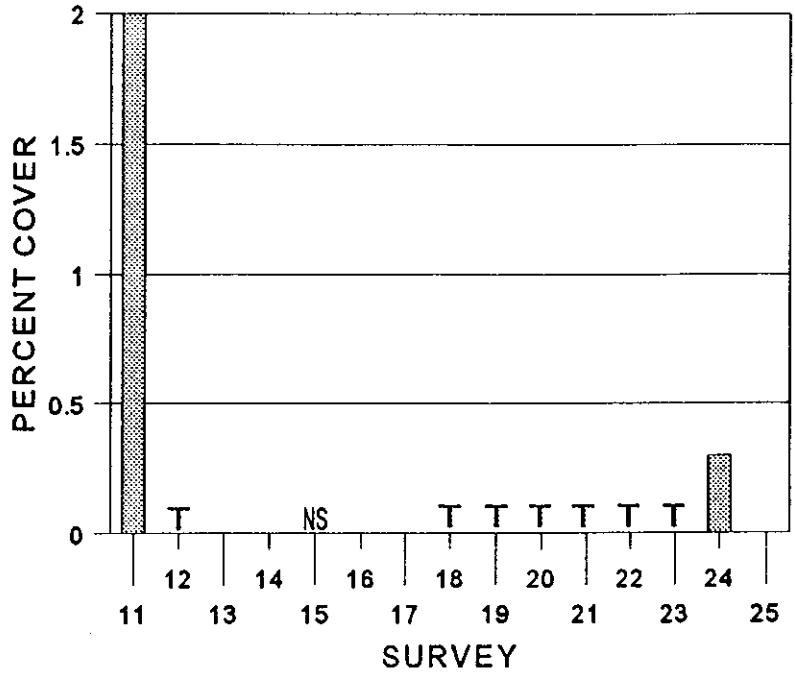

Figure 15. Percent coverage by Caulerpa prolifera at study site C-1.
NS=No Sample T=Trace

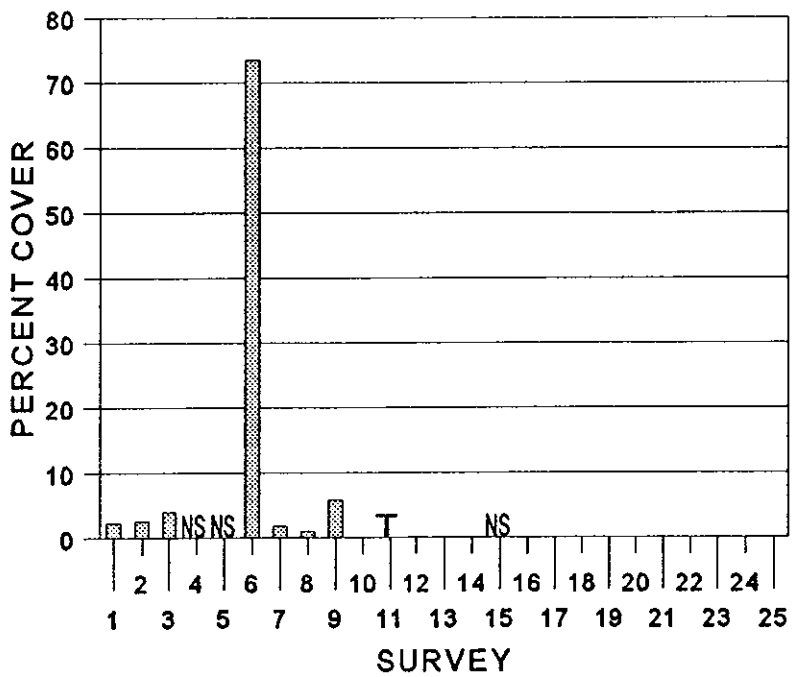

Figure 16. Percent coverage by Caulerpa prolifera at study site B-2.
NS=No Sample T=Trace

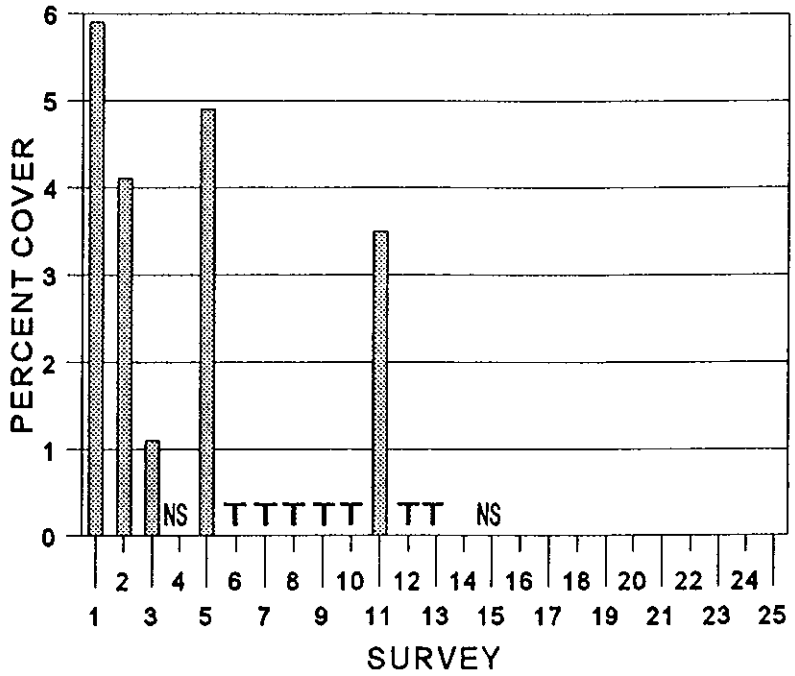

Figure 17. Percent coverage by Caulerpa prolifera at study site Y-1. NS=No Sample T=Trace

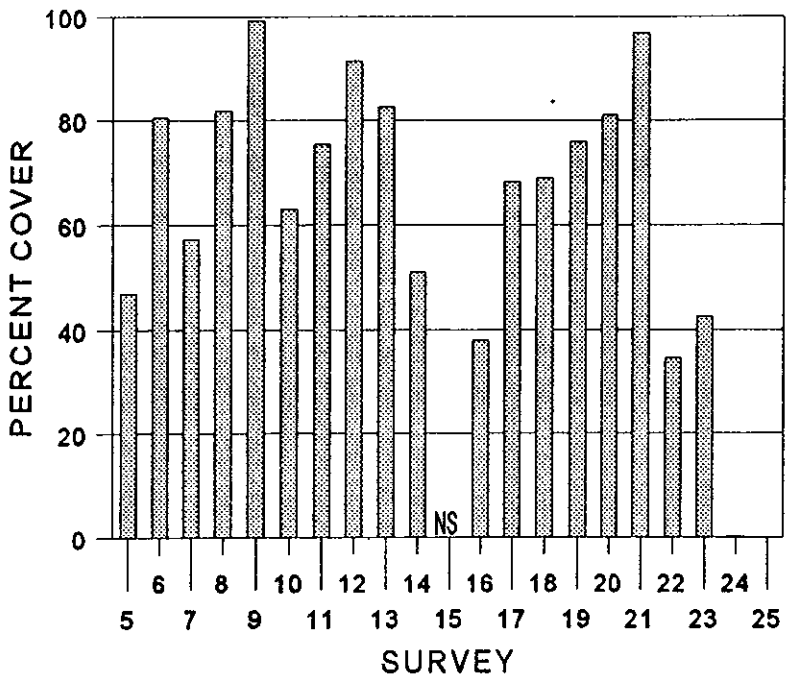

Figure 18. Percent coverage by Caulerpa prolifera at study site P-1. NS=No Sample