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Seagrass and Caulerpa monitoring in Hillsborough Bay Seventh Annual Report

City of Tampa Department of Sanitary Sewers

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

SUBMITTED TO

THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

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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 several water quality parameters since the early 1980's. The improvements in water quality was 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 coverage, because seagrass may serve as an indicator of water quality. However, the study is not intended to link the discharge from the Howard F. Curren 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 28.2ha. Coverage for R. maritima has fluctuated between 0.2ha and 2.2ha since 1986. In 1995, R. maritima coverage in Hillsborough Bay was about 1.3ha. 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. In 1995, C. prolifera coverage was less than 0.2ha in Hillsborough Bay.

Seagrass recolonization is occurring in the intertidal and subtidal areas of Hillsborough Bay apparently in response to improved water quality. Sizeable H. wrightii meadows are now established in southeastern Hillsborough Bay and along Interbay peninsula in western Hillsborough Bay.

INTRODUCTION

The City of Tampa, Bay Study Group (BSG), created in 1976, has monitored the effects of pollution abatement in Hillsborough Bay since 1979. During the mid 1980's, 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 submerged aquatic vegetation (SAV) began in April 1986 with a thorough groundtruthing effort which located and described Halodule wrightii, Ruppia maritima and the attached benthic alga, Caulerpa prolifera. Six additional intensive groundtruthing efforts to document H. wrightii were completed in 1989 and 1991-1995, all during the month of October. In addition, study sites were established for H. wrightii, R. maritima and C. prolifera. However, monitoring of R. maritima and C. prolifera at specific study sites has been discontinued. Generally, study sites are monitored three times a year.

The BSG transplanted H. wrightii into Hillsborough Bay in 1987 and 1989. Monitoring of H. wrightii transplants in Hillsborough Bay has been discontinued due to coalition with naturally occurring coverage. Data for transplants were included in the reports submitted through 1994. Transplant coverage is now included as part of the baywide H. wrightii areal coverage estimate.

The purpose of the BSG seagrass program is to monitor changes of SAV, excluding drift macroalgae, in Hillsborough Bay. Seagrass is an important Tampa Bay habitat and may serve as an indicator of water quality. However, 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 seventh annual report submitted to the Florida Department of Environmental Protection (FDEP) to satisfy the requirements set forth in specific condition #14 of FDEP operation permit D029-1845321B.

METHODS

The BSG seagrass program has been modified several times since 1986. The report, "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.

Seagrass coverage in an embayment east of the north end of Apollo Beach (Figure 1), had been included in reports after 1989. It is unclear if this area should be included within the boundary of Hillsborough Bay, however, the BSG decided to omit this area as part of the study. Therefore, Hillsborough Bay seagrass estimates reported after 1989 were revised in the sixth annual report to FDEP submitted on March 1, 1995.

STUDY SITES

Halodule wrightii

The intertidal and shallow subtidal flats of Hillsborough Bay were divided into thirteen areas (Figure 1). Within each area, one patch of H. wrightii, if present, was chosen for study at a depth of 20-30cm below mean low water. An additional patch was added on the deeper portion of the bar if the location was deeper than 80cm below mean low water. 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 each 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 the short shoot basal stalk to tip of the blade) is measured to the nearest centimeter. Subjective evaluations concerning 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. R. maritima patches are selected at random and measurements of blade length, short shoot density, and inflorescence, if present, are taken. Short shoot density is determined with a 10x10cm square.

Caulerpa prolifera

Five C. prolifera transects (Figure 2) in Hillsborough Bay were visited seasonally through the fall of 1994. However, due to the paucity of C. prolifera in Hillsborough Bay, the BSG discontinued detailed investigation of these five transects pending the return of significant C. prolifera coverage. In the interim, data will only be collected where the alga is present. Data from five randomly tossed 1x1m squares will include: percent C. prolifera coverage, frond density and length, percent drift macroalgae cover, the number of the polychaete, Diopatra cupraea, depth, temperature, and salinity. Data describing transect coverage through 1994 may be found in the 1995 report.

AREAL COVERAGE

Areal coverage for H. wrightii, R. maritima, and C. prolifera is estimated with high altitude (ca. 6,000ft.) aerial photographs taken in the fall from a fixed wing aircraft. After a scale is determined for each photograph, a grid composed of 1x1mm squares is placed over the photograph. The number of $1mm^2$ squares covering a SAV signature in the photograph are counted and the areal extent of the SAV is determined by multiplying the number of squares counted times the scale determined for a 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 the high altitude photograph. These areas are visited within four weeks of the overflight and any SAV encountered is documented. The major and minor axes for each H. wrightii patch is measured and the area determined using the formula for an ellipse. Areal coverage of R. maritima and C. prolifera is determined by estimating the percent cover of each species in an area of a known acreage.

RESULTS AND DISCUSSION

Halodule wrightii

Halodule wrightii coverage described in Hillsborough Bay for 1991, 1992, and 1993 has been revised, due to the change of bay area definition, to 2.0ha, 5.2ha and 7.3ha respectively, nearly thirty percent below coverage reported for each year.

H. wrightii coverage in Hillsborough Bay increased about 40 percent from 19.7ha reported in 1994 to about 28ha in 1995 (Figure 3). Area 2, in southeastern Hillsborough Bay (Figure 1), registered the greatest increase in coverage, gaining over 3ha (Figure 4). In addition, coverage in areas 10, 11, and 12 (Figures 5, 6, and 7),in western Hillsborough Bay , expanded considerably with increases of 2.2ha, 1.8ha, and 1.4ha respectively. Areas 3 and 13 had modest increases in coverage (Figures 8 and 9) while areas 1 and 4 (Figures 10 and 11) were essentially unchanged. Areas 5 and 9 lost $450m^2$ and $1700m^2$ of H. wrightii respectively (Figures 12 and 13). No H. wrightii coverage has been observed in areas 6, 7, and 8. H. wrightii coverage in each area during 1986, 1989, and 1991-1995 is presented in Table 1.

Ruppia maritima

R. maritima persists in several areas of Hillsborough Bay, however, the areal extent may vary greatly on an annual basis. In 1995, the intertidal area between Gadsden Point west to the Macdill AFB marina channel contained about $2000m^2$ of R. maritima and scattered coverage was found along eastern Interbay peninsula and in the Kitchen. About 1ha was documented between Pendola Point and the Alafia River, with most of the coverage found around the mouth of

Archie Creek. R. maritima coverage has been sparse in McKay Bay after reaching 0.8ha in 1990. About 1.3ha of R. maritima were found in Hillsborough Bay in 1995.

Table 1. Halodule wrightii coverage (m^2) by area in Hillsborough Bay for the years 1986, 1989, and 1991-1995.

	1986	1989	1991	1992	1993	1994	1995
AREA							
1	690	700	400	500	2000	2630	2500
2	1125	3300	16300	40801	34000	135000	167000
3	0	0	40	350	250	1200	2500
4	0	0	200	475	500	600	500
5	0	0	15	150	600	1200	750
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	85	140	800	1900	7000	10400	8700
10	40	750	1600	6750	22400	32400	54000
11	0	65	200	650	5000	10500	28500
12	20	20	20	250	1300	2800	17000
13	0	0	0	0	30	100	400
TOTAL	1960	4975	19575	51825	73080	196830	281850

Caulerpa prolifera

C. prolifera has been observed in four general areas of Hillsborough Bay: 1) along southeastern Interbay Peninsula; 2) near Ballast Point; 3) between Pendola Point and the Alafia River; and 4) along Davis Island.

C. prolifera in Hillsborough Bay has exhibited both rapid increase and rapid loss in coverage since monitoring began in 1986. For example, in 1986, between April and December, a 40 fold increase in coverage to 200ha was documented in western Hillsborough Bay. A 90 percent reduction in coverage occurred in the fall of 1988 immediately following a "25 year" rainfall event which lowered salinities to 2ppt in some parts of Hillsborough Bay. The decline of C. prolifera in that area is probably a result of extended

exposure to unusually hyposaline conditions. Similarly, in an area south of Pendola Point, the alga expanded from 0.8ha in 1987 to 190ha in 1990. Following this maxima, coverage has steadily declined. However, a causative event cannot be singled out for the decline of the alga in this area.

Three major areas of C. prolifera coverage were reported in 1994: 1) between Gadsden Point and the marina on the south end of Macdill AFB (25ha), 2) Ballast Point (1ha), and 3) south of Pendola Point (3ha). However, in 1995, very sparse coverage was observed in all three areas.

C. prolifera presence followed by its disappearance has been documented in other areas of Hillsborough Bay. Sparse Caulerpa was found along southeastern Davis Island from 1986-1989 and on the western end of Bird Island (Figure 1) from 1993-1994.

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 less than 0.2ha in the fall of 1995.

CONCLUSION

Improving water quality in Hillsborough Bay has allowed recolonization of H. wrightii into many intertidal and subtidal areas of Hillsborough Bay. 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.

Some areas of Hillsborough Bay have R. maritima meadows which may vary in coverage from year to year. However, this species has recently become a less significant portion of the total seagrass coverage in Hillsborough Bay.

C. prolifera has been a major contributor to SAV coverage in the past decade. This alga generally persists in deeper waters than H. wrightii, indicating that the alga may be a pioneer species in areas with relatively low light penetration. C. prolifera can vegetate large areas in a short period of time and, conversely, undergo sudden, large scale, die-offs. For example, loss of C. prolifera meadows in western Hillsborough Bay occurred immediately following exposure to unusually low salinities for an extended period in 1988. In other areas, reductions in areal coverage do not appear to be salinity related and may occur more gradually.

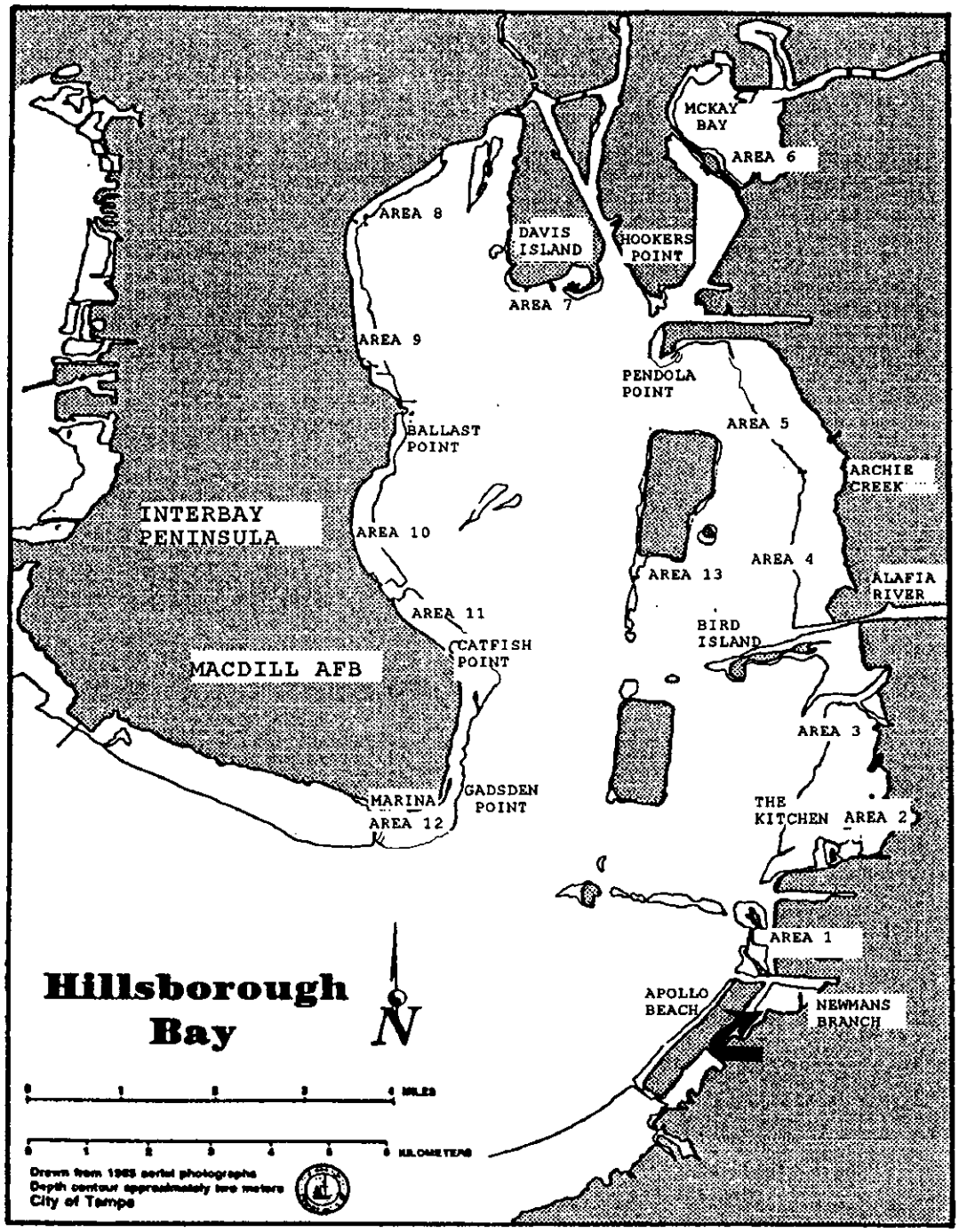

Figure 1. Location of the thirteen Halodule wrightii study areas in Hillsborough Bay. Arrow indicates embayment previously included as part of Hillsborough Bay.

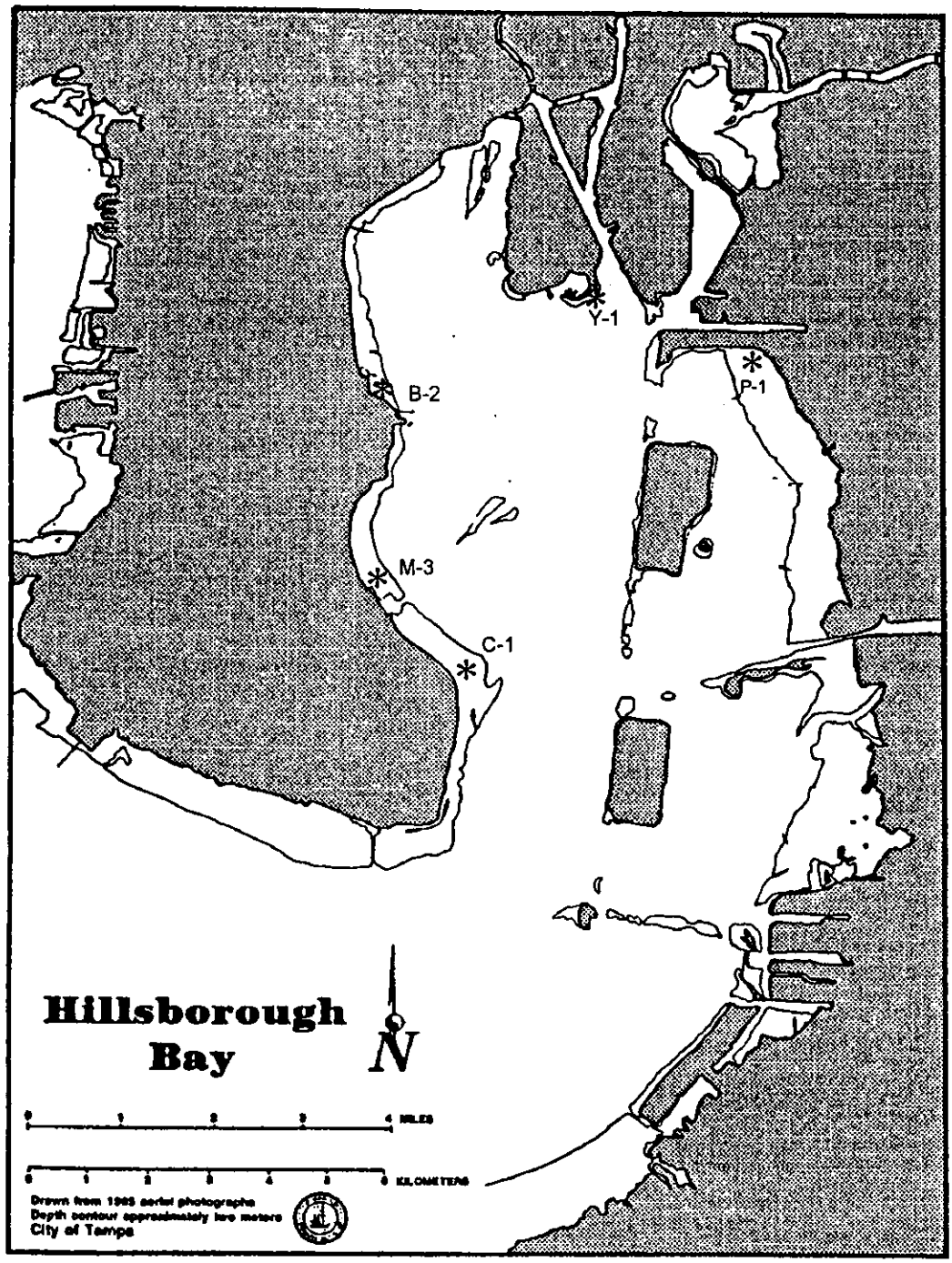

Figure 2. Location of the five Caulerpa prolifera transects (*): B-2, C-1, M-3, P-1, and Y-1.

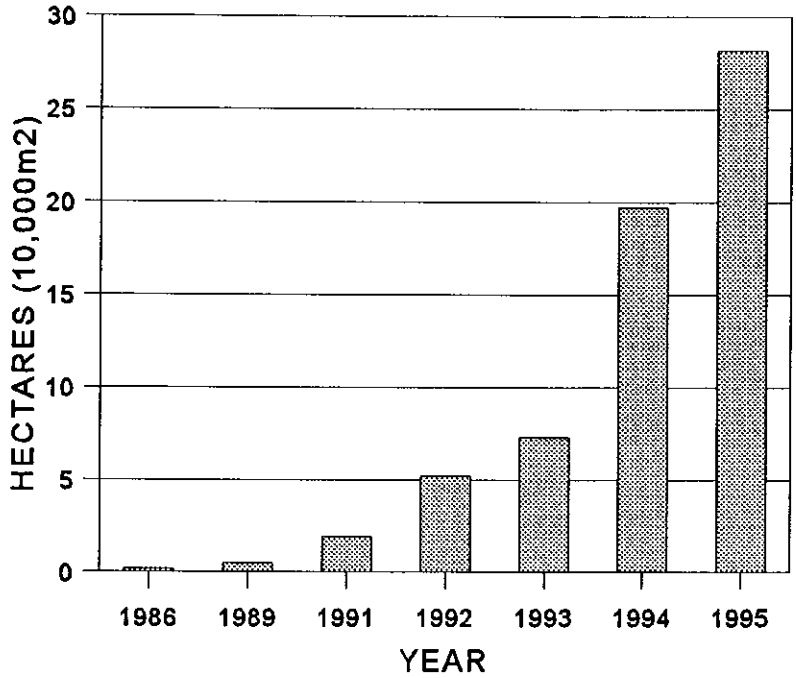

Figure 3. Halodule wrightii coverage in Hillsborough Bay.

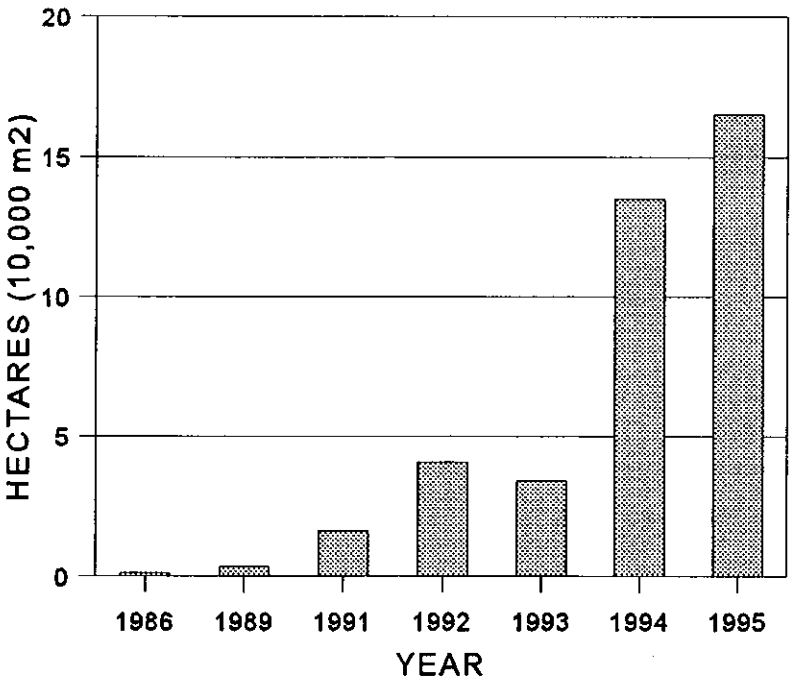

Figure 4. Halodule wrightii coverage in area 2.

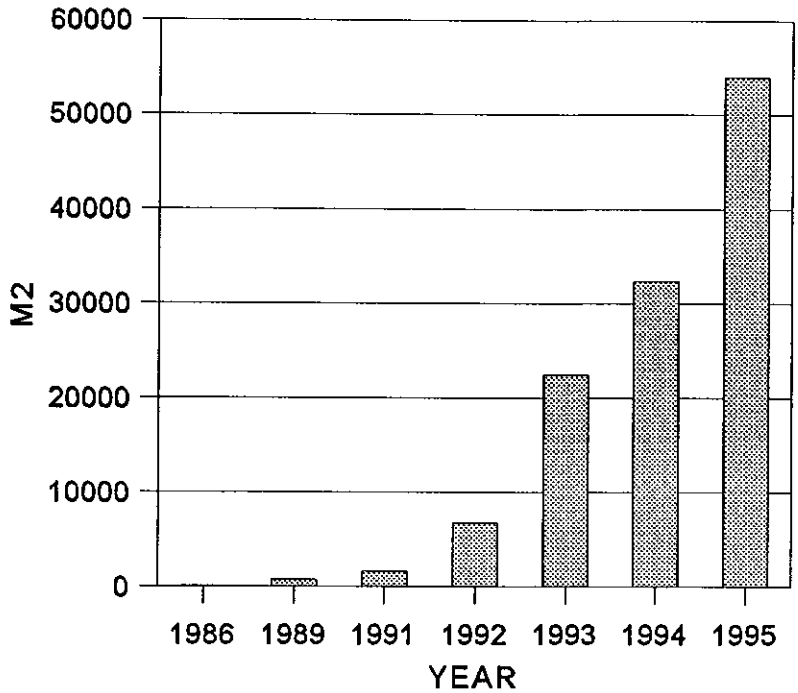

Figure 5. Halodule wrightii coverage in area 10.

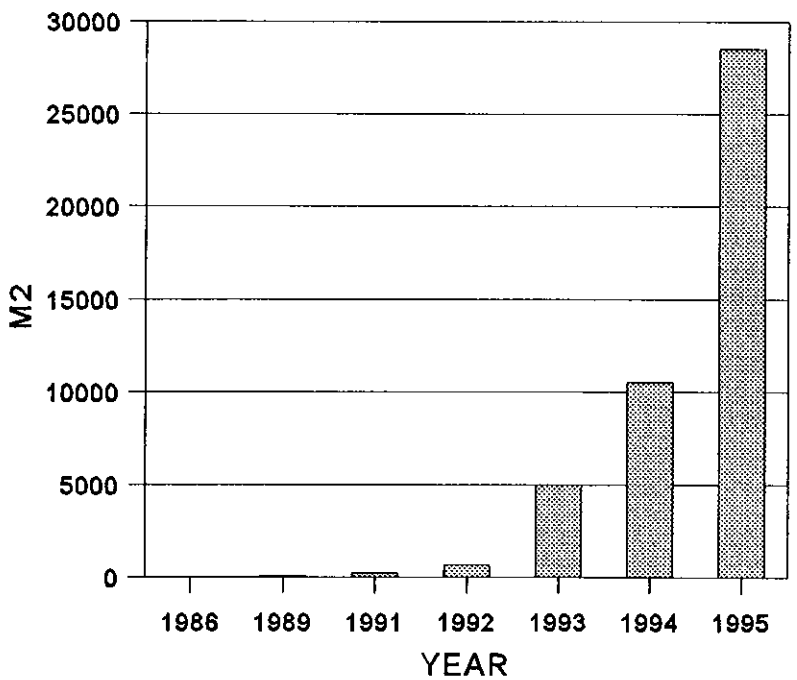

Figure 6. Halodule wrightii coverage in area 11.

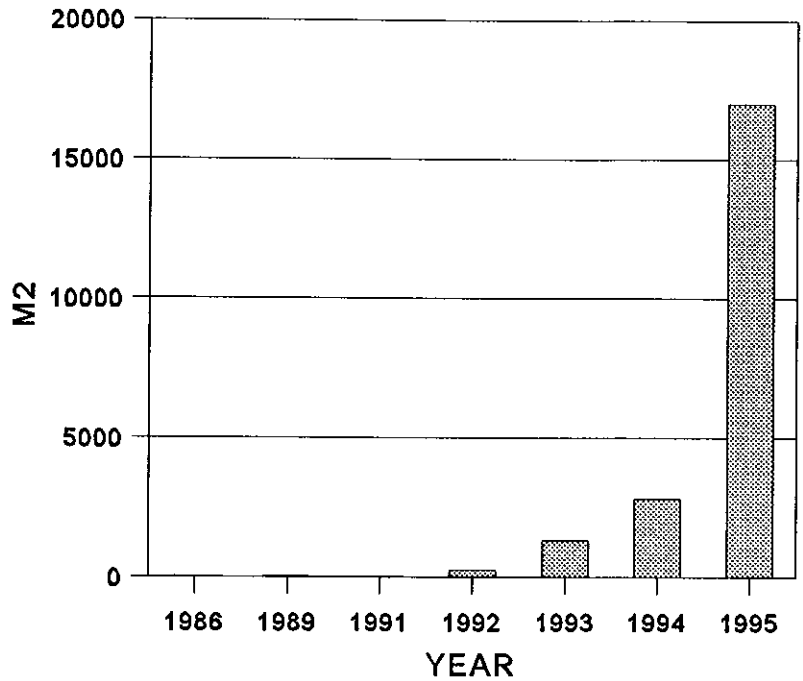

Figure 7. Halodule wrightii coverage in area 12.

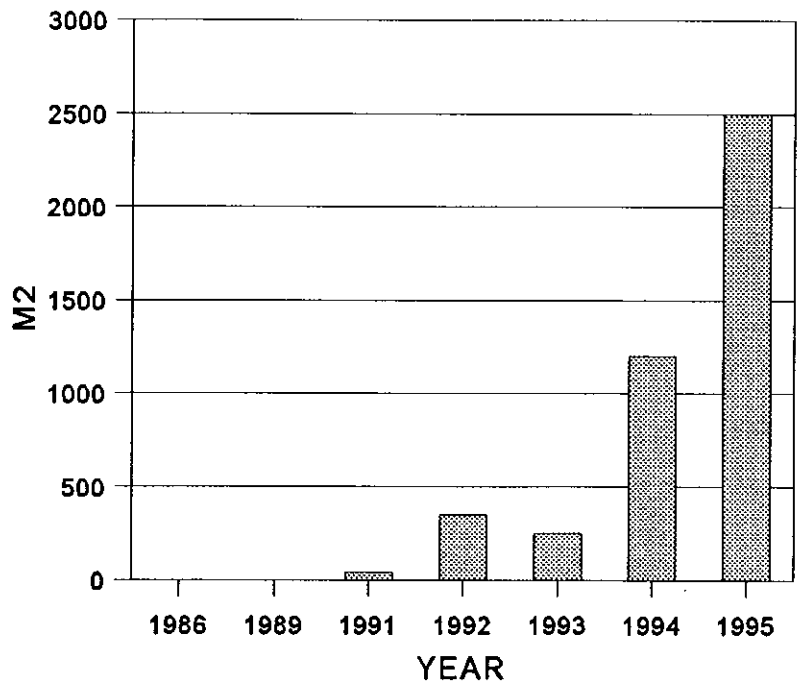

Figure 8. Halodule wrightii coverage in area 3.

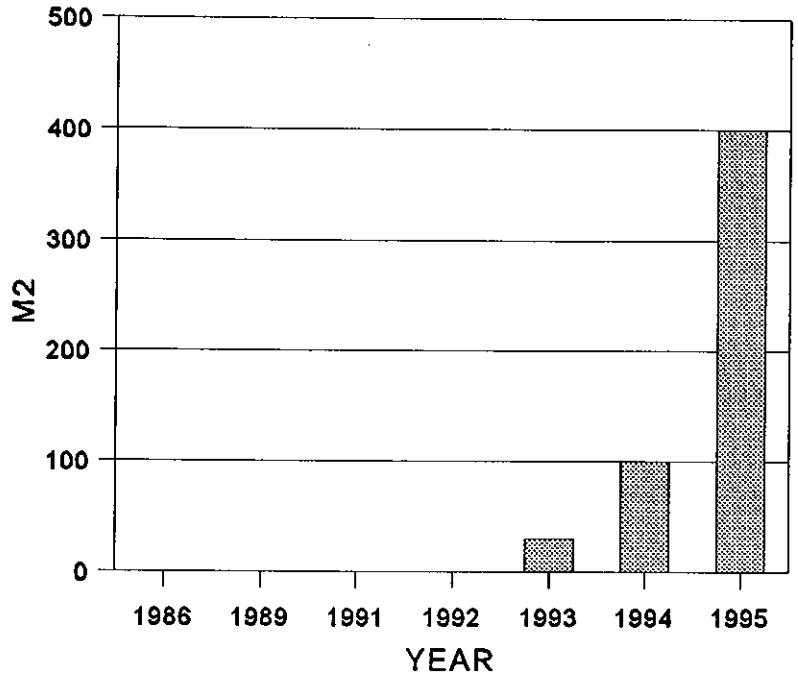

Figure 9. Halodule wrightii coverage in area 13.

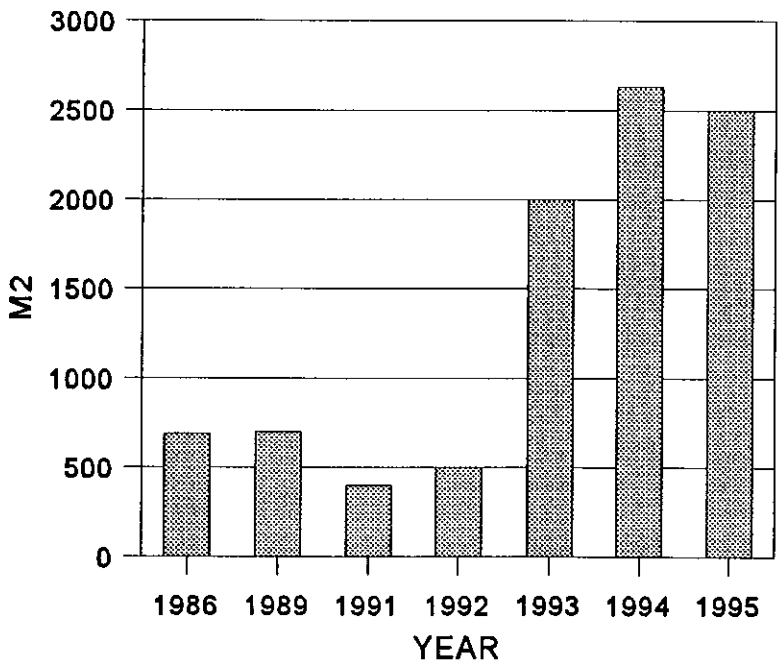

Figure 10. Halodule wrightii coverage in area 1.

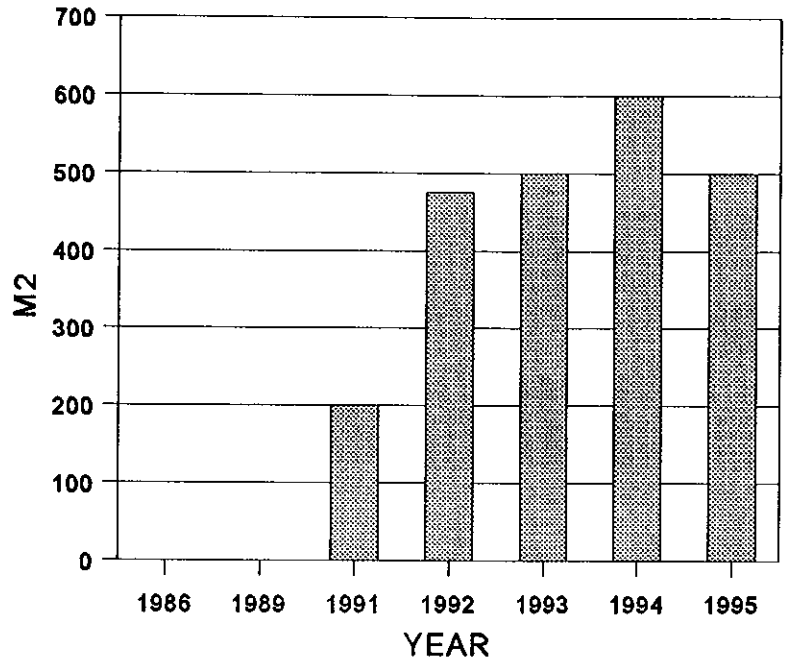

Figure 11. Halodule wrightii coverage in area 4.

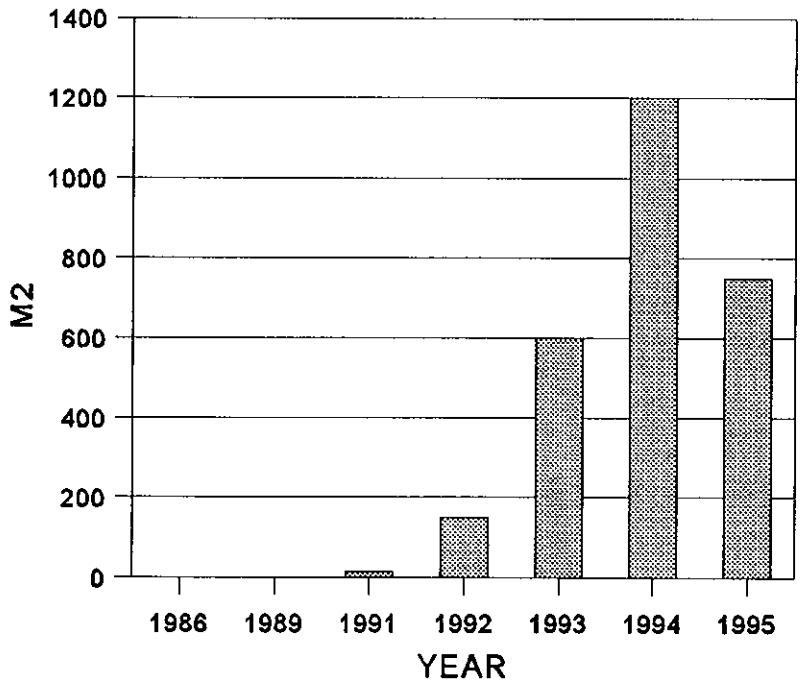

Figure 12. Halodule wrightii coverage in area 5.

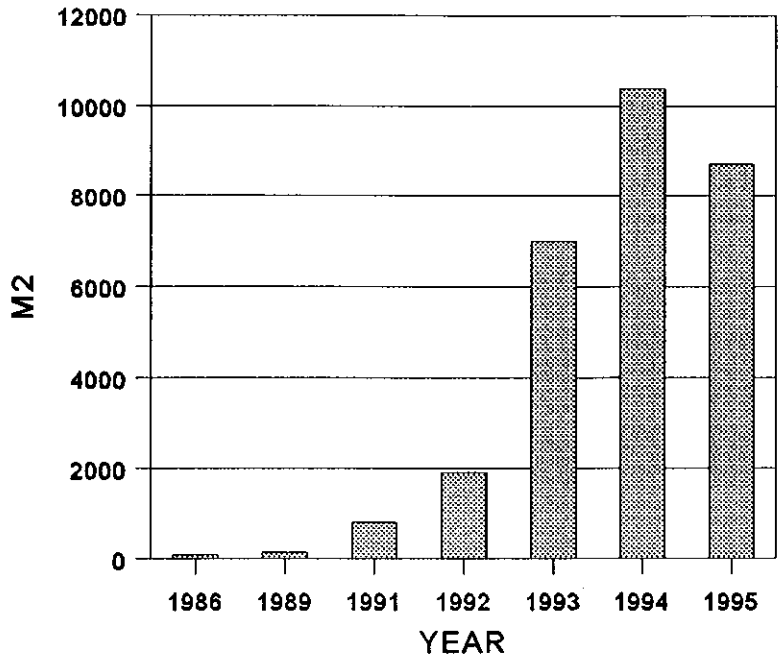

Figure 13. Halodule wrightii coverage in area 9.