Tampa Bay Interagency Seagrass Monitoring Program
A Synopsis of Seagrass Trends from 1997-2006

Prepared for the Tampa Bay Estuary Program
100 8th Avenue SE
St. Petersburg, FL

By

Walter Avery and Roger Johansson
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Executive Summary

For nearly a decade, the Tampa Bay Interagency Seagrass Monitoring Program has conducted an annual Tampa Bay seagrass assessment utilizing fixed transects. Five species of seagrass have been found: *Halophila engelmanni*, *Halodule wrightii*, *Ruppia maritima*, *Syringodium filiforme*, and *Thalassia testudinum*. In addition, the attached alga, *Caulerpa prolifera* was found to be a significant component of Tampa Bay's submerged aquatic vegetation (SAV).

Seagrass coverage in Hillsborough Bay (HB), Middle Tampa Bay (MTB), and Old Tampa Bay (OTB) has been dominated by *H. wrightii*. This species appears to have increased in percent frequency of occurrence (PFOC) in OTB but has remained relatively stable in HB and MTB. Seagrass coverage transitions to predominately *T. testudinum* in Lower Tampa Bay (LTB). Following a period of *T. testudinum* loss in LTB from 1998-2002, the PFOC for this species has remained stable. In Boca Ciega Bay (BCB), *H. wrightii* and *T. testudinum* are co-dominant species. *T. testudinum* PFOC has remained relatively stable, however, *H. wrightii* increased from 2000-2005 before declining somewhat in 2006. Overall, Tampa Bay seagrass PFOC has not changed significantly since 1998.

C. prolifera has been an important SAV component in southwestern HB, MTB and OTB. Within each of these upper Tampa Bay subsections there have been episodes of rapid colonization followed by loss of coverage. The PFOC for this alga has been variable.

In 2007, the Tampa Bay Estuary Program divided Tampa Bay into thirty management areas, of which twenty-eight contained fixed seagrass transects. Using the data generated from transects, trends for each SAV species were determined within each management area. Table 1 highlights management areas (Figure 1; page 16) in which seagrass PFOC is: 1) less than 25 percent, 2) 25 to 50 percent 3) 51 to 75 percent and, 3) greater than 75 percent. OTB PFOC was the greatest along the eastern shoreline and the least in the north/northwestern bay areas. Hillsborough Bay has had the lowest PFOC among the Tampa Bay segments. Generally, the PFOC in MTB management areas increases from up-bay to down-bay. LTB PFOC has been variable, especially in the southeastern and Manatee River management areas. BCB PFOC was generally greater than fifty percent in all management areas.

Segment	MA	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Average
OTB	19	ND										
OTB	20	ND	ND	ND	ND							
OTB	21	ND	ND	ND	ND							
OTB	22	ND	ND	ND	ND							
OTB	23	ND										
OTB	24	ND	ND									
OTB	25	ND										
OTB	26	ND	ND	ND	ND							
OTB	28	ND										
HB	1											
HB	2											
HB	3											
HB	4											
HB	5											
MTB	6	ND										
MTB	7	ND										
MTB	17	ND										
MTB	18	ND										
MTB	27	ND										
LTB	8	ND										
LTB	9	ND										
LTB	10	ND										
LTB	11	ND						ND	*			
BCB	12	ND										
BCB	13	ND										
BCB	14	ND										
BCB	15	ND									ND	
BCB	16	ND										

Table 1. Study period trends of percent frequency of occurrence for each management area (MA) from 1997-2006. Red blocks = seagrass in ‹25% of meter square placements; orange blocks = seagrass in 25-50% of meter square placements; yellow blocks = seagrass in 51-75% of meter square placements; green blocks = seagrass in ›75% of meter square placements. ND = No data for that year. (*) transect moved in 2004. Boca Ciega Bay (BCB), Hillsborough Bay (HB), Lower Tampa Bay (LTB), Middle Tampa Bay (MTB), Old Tampa Bay (OTB).

Table of Contents

Introduction

In 1996, the Tampa Bay National Estuary Program (now Tampa Bay Estuary Program or TBEP) adopted a resource based management strategy to protect and restore Tampa Bay (Tampa Bay National Estuary Program 1996). Seagrass status and trends were chosen as “biological barometers” to gauge improvements in water quality as point and non-point source nitrogen loading targets were adopted.

Initially, seagrass coverage change was determined through examination of biennial photography of Tampa Bay seagrass meadows. However, it became apparent that further data were needed to detect spatial and temporal changes within specific seagrass zones and species composition over depth gradients. Subsequently, the City of Tampa, Bay Study Group (BSG) initiated a fixed transect seagrass monitoring program in Hillsborough Bay which embraced several levels of monitoring recommended by the TBEP Technical Advisory Committee (Squires et al., 1993). This transect program provided a template for the TBEP to expand transect monitoring into other Tampa Bay subsections in 1998. Currently, 62 transects (Figure 1) are monitored by the Tampa Bay Interagency Seagrass Monitoring Program or TBISP (Avery and Johansson, 2001). Seven local agencies participate in the annual monitoring effort.

In 2006, the Environmental Protection Commission of Hillsborough County drafted a seagrass management plan for Hillsborough County (Environmental Protection Commission of Hillsborough County, 2006). During 2007, the TBEP expanded this concept to include thirty management areas within Tampa Bay (Figure 1). Seagrass transect data are currently collected within twenty-eight of the management areas.

This paper presents trends in percent frequency of occurrence (PFOC) of submerged aquatic vegetation (SAV). PFOC is defined as the number of times a seagrass or attached alga species is found within a specific data set of meter square placements divided by the total number of meter square placements within that data set. The data sets comprised of all meter square placements grouped either by management area (MA), bay subsection (Figure 2), or Tampa Bay as a whole. Ancillary data of SAV species annual PFOC, abundance, short shoot density (SSDm^{-2}), canopy height (cm), and seagrass trend analysis are presented in Appendix A. Finally, annual seagrass species abundance over a general depth gradient is presented for each transect in Appendix B.

Transect Monitoring Methods

At most sites, the fixed transects start at the shoreline and traverse the study area on a line most often perpendicular to the shoreline. Most transects end at a water depth greater than the depth needed to attain the seagrass coverage target for the shallow water estuarine shelf (Janicki, 1996) for that particular bay subsection. Transect depth maximums range from approximate depths of -1.0m to -3.5m Local Mean Tide Level (LMTL). Transect lengths range from 40m to 2700m. PVC poles mark the starting point, each 100m mark (where applicable), and the terminus of each transect (Figure 3). Both differentially corrected and uncorrected GPS positions have been used to record the location of the 100m poles.

SAV composition and abundance, if present, were determined within a 1x1m PVC frame placed by a diver on the bottom. In Old Tampa Bay, Hillsborough Bay, and Middle Tampa Bay, information was collected at a minimum of 25m intervals and at a minimum of 50m intervals in Boca Ciega Bay and Lower Tampa Bay (Figure 3). The abundance of each SAV species observed within the frame was estimated using the Braun Blanquet coverage class rating system (Braun Blanquet, 1965). In addition, short shoot density and canopy height were determined within subsets (generally 100cm^2 to 625cm^2) of selected 1x1m PVC frame placements. These placement sites were selected by TBISP field personnel assigned to the transect using one or more applicable criteria:

1. In meadows less than 100m in width: at a minimum, placements were selected in mid bed and edge bed; the edge bed is defined as the last seagrass short shoot on the transect.
2. In meadows greater than 100m in width: at a minimum, placements were selected at 100m intervals and edge bed; here, the edge bed is defined as the most seaward seagrass short shoot on a transect.
3. Deepest site that a species is found; this may be in addition to 1 and 2.
4. Sites of new species development along a transect; this may be in addition to 1 and 2.

SAV assessments along eleven Hillsborough Bay fixed seagrass transects and two Middle Tampa Bay fixed seagrass transects began in 1997. Forty-eight fixed seagrass transects were initiated in 1998 to provide seagrass information from the remainder of Tampa Bay. However, since 1998, several transects have been added while others were deleted. In addition, issues have arisen to preclude data collection at several sites for one to two years. Avery and Johansson (2003) present current transect sites including a detailed discussion of the transect selection process and related issues.

Sediment elevation contours of several permanent seagrass transects located in Hillsborough Bay, Middle Tampa Bay, and Old Tampa Bay have been determined from near-shore to approximately 2m(LMTL) depth using high resolution kinematic GPS (KGPS). See Johansson (2002) for a detailed description of this technique.

Data Analysis Methods

The purpose of this paper is to describe overall seagrass trends within each of the 28 MAs. Accordingly, in management areas that have more than one transect, the transect information has been grouped into a single data set. This approach may mask specific local trends that could be evident in examination of individual transects (see Appendix B). Further, inconsistencies in data collection along some transects due to large fluctuations in 1x1m PVC frame placements on the shallow estuarine shelf may generate misleading trends. This may have happened due to inaccurate methodology assumptions by the assigned TBISP team. Finally, addition and subtraction of transects between 2000 and 2001 tend to bias MA trends in some cases. These biases are discussed when the trends are substantially altered due to data inconsistency.

Nonlinear regression analysis of trends were performed for PFOC, abundance, short shoot density, and canopy height for each of the 28 MAs using Systat®v.12 and plotted with Systat SigmaPlot® v.10. Data were grouped by:

- Each MA SAV species averaged for all years
- Each MA SAV species by year
- Each MA seagrass by year
- Each bay segment SAV species averaged for all years
- Each bay segment SAV species by year
- Each bay segment seagrass by year
- Tampa Bay SAV species averaged for all years
- Tampa Bay SAV species by year
- Tampa Bay seagrass by year

The statistical results of the PFOC trends are presented in Table 2.

Results

The PFOC for SAV absence and presence, averaged over the monitoring period, and annual seagrass PFOC are presented for the following groups: 1) by MA for each Tampa Bay subsection, 2) Tampa Bay subsections: Old Tampa Bay, Hillsborough Bay, Middle Tampa Bay, Lower Tampa Bay and Boca Ciega Bay, and 3) Tampa Bay. Further, seagrass depth ranges are discussed for Old Tampa Bay, Hillsborough Bay, and Middle Tampa Bay.

Data concerning SAV PFOC by year and SAV abundance, short shoot density, and canopy height for each MA, bay subsection, and Tampa Bay are found in Appendix A.

Seagrass Management Areas: *Trends in Submerged Aquatic Vegetation*

<u>Old Tampa Bay</u>

Data from MA19 was generated from transects S1T9 and S1T14. SAV in MA19 (Figure 4) has consisted of the seagrass *H. wrightii*, *S. filiforme*, *T. testudinum*, and the alga *Caulerpa prolifera*. *H. wrightii* has been the dominant seagrass in this area, although *S. filiforme* and *T. testudinum* were major constituents (Figure 5). In addition, *C. prolifera* has been a major SAV constituent. Since the addition of S1T14 in 2001, the PFOC has been stable (Figure 6).

Data from MA20 was generated from transect S1T16 (Figure 4). MA20 SAV has consisted of the seagrass *H. wrightii*, *Ruppia maritima*, *S. filiforme*, *T. testudinum*, and *C. prolifera*. *H. wrightii* has been the dominant seagrass in this area, although *C.*

prolifera, *R. maritima, S. filiforme* and *T. testudinum* were major constituents (Figure 5). Seagrass PFOC increased slightly between 2001 and 2003 but has since leveled (Figure 6).

Data from MA21 was generated from transect S1T17 (Figure 4). MA21 SAV has consisted of *H. wrightii*, *R. maritima*, *S. filiforme*, and *C. prolifera*. In this area of sparse seagrass coverage, *H. wrightii* has been the dominant species (Figure 5). *R. maritima* and *S. filiforme* were minor seagrass constituents as was the alga *C. prolifera*. Seagrass PFOC was fairly stable between 2001-2004 but increased in 2005 (Figure 6).

Data from MA22 was generated from transect S1T13 (Figure 4). MA22 SAV has consisted of *H. wrightii*, *R. maritima*, and *S. filiforme*. *H. wrightii* has been the dominant seagrass in this area (Figure 5). In addition, *R. maritima* and *S. filiforme* were minor seagrass constituents. Seagrass PFOC decreased between 2001-2003 but has since increased (Figure 6).

Data from MA23 was generated from transects S1T1 and S1T3 (Figure 4). MA23 SAV has consisted of *H. wrightii*, *Halophila engelmanni*, *S. filiforme*, *T. testudinum*, and *C. prolifera*. *H. wrightii* has been the dominant seagrass in this area though *H. engelmanni* and *C. prolifera* have occasionally been major contributors (Figure 5). Seagrass PFOC increased between 1999-2001, however, PFOC decreased in 2002 and has since been stable (Figure 6).

Data from MA24 was generated from transect S1T4 (Figure 4). MA24 SAV has consisted of *H. wrightii*, *Halophila engelmanni,* and *T. testudinum. H. wrightii* has been the primary seagrass species along this generally barren flat (Figure 7). Although seagrass PFOC indicates an upward trend (Figure 8), coverage has remained sparse.

Data from MA25 was generated from transects S1T5 and S1T6 (Figure 4). MA25 SAV has consisted of *C. prolifera*, *R. maritima*, *H. wrightii*, *S. filiforme*, and *T. testudinum*. *H. wrightii* and *T. testudinum* have been the codominant species in this area (Figure 7). Further, *R. maritima* and *S. filiforme* were important constituents. *C. prolifera* was rarely documented. Seagrass PFOC in this area has remained consistently high (Figure 8).

Data from MA26 was generated from transect S1T15 (Figure 4). MA26 SAV has consisted of *H. wrightii*, *S. filiforme*, *T. testudinum* and *C. prolifera*. *H. wrightii* has been the dominant species in this area, although *S. filiforme* and *T. testudinum* were major constituents (Figure 7). Seagrass PFOC increased slightly following 2003 (Figure 8).

Data from MA28 was generated from transect S1T8 (Figure 4). MA28 SAV has consisted of *H. wrightii*, *S. filiforme*, *T. testudinum* and *C. prolifera*. *S. filiforme* has been the dominant SAV species, though *T. testudinum* and *C. prolifera* were major constituents (Figure 7). Seagrass PFOC decreased following 1999 but then increased from 2003-2006 (Figure 8).

Hillsborough Bay

Data from MA1 was generated from transect S2T6 (Figure 9). MA1 SAV has consisted of *R. maritima* (Figure 10). Seagrass PFOC has been very low (Figure 11).

Data from MA2 was generated from transects S2T8 and S2T9 (Figure 9). MA2 SAV has consisted of *H. wrightii* (Figure 10). The seagrass PFOC by this species has been stable (Figure 11), however, the majority of the flats have lacked seagrass coverage.

Data from MA3 was generated from transects S2T4 and S2T5 (Figure 9). MA3 SAV has consisted of *H. wrightii* and *R. maritima*. *H. wrightii* has been the dominant SAV constituent (Figure 10). Seagrass PFOC has been consistently low (Figure 11) as the majority of the flats have lacked seagrass coverage.

Data from MA4 was generated from transects S2T10, S2T111 and S2T112 (Figure 9). MA4 SAV has consisted of *H. wrightii*, *R. maritima*, and *C. prolifera*. *H. wrightii* has been the dominant SAV constituent (Figure 10). *R. maritima* and *C. prolifera* were noted infrequently. Seagrass PFOC reached a maximum during 1999-2000 and then declined through 2005 (Figure 11).

Data from MA5 was generated from transects S2T2 and S2T3 (Figure 9). MA5 SAV has consisted of *H. wrightii* and *R. maritima*. *H. wrightii* has been the dominant SAV constituent (Figure 10). This Hillsborough Bay MA has generally had the highest seagrass PFOC (Figure 11). Further, the recent increase in seagrass FOC can be attributed to increased *H. wrightii* coverage on the transect located near Bullfrog Creek (Avery and Johansson, 2006).

Middle Tampa Bay

Data from MA6 was generated from transects S3T9 and S3T13 (Figure 12). MA6 SAV has consisted of *H. wrightii, R. maritima, T. testudinum, and C. prolifera*. *H. wrightii* has been the major SAV constituent (Figure 13). *R. maritima* and *T. testudinum* have been minor constituents. In spite of interannual fluctuations, seagrass coverage documented in this MA during 2006 was similar to that found early in the study (Figure 14).

Data from MA7 was generated from transects S3T3, S3T4, S3T5, and S3T6 (Figure 12). MA7 SAV has consisted of *H. wrightii*, *S. filiforme* and *T. testudinum*. *H. wrightii* has been the dominant species, though *S. filiforme* and *T. testudinum* have been major constituents (Figure 13). Seagrass PFOC in this area has declined slightly (Figure 14).

Data from MA17 was generated from transects S3T6 and S3T7 (Figure 12). MA17 SAV has consisted of *H. wrightii, R. maritima*, *S. filiforme, T. testudinum,* and *C. prolifera*. *S. filiforme* has been the dominant species, though *C. prolifera*, *H. wrightii*, and *T. testudinum* have been major constituents (Figure 13). *R. maritima* was not frequently present. Seagrass PFOC in this MA has been stable (Figure 14).

Data from M18 was generated from transects S3T1 and S3T11 (Figure 12). MA18 SAV has consisted of *H. wrightii, S. filiforme, T. testudinum*, and *C. prolifera*. *S. filiforme* has been the dominant species, though *H. wrightii*, and *T. testudinum* have been major constituents (Figure 13). *C. prolifera* has been a minor SAV component in this area. Overall, seagrass PFOC in this area has not appreciably changed during the course of the study (Figure 14).

Data from MA27 was generated from transects S2T12, S3T2, S3T10, and S3T12 (Figures 9 and 12). MA27 SAV has consisted of *H. wrightii, R. maritima*, *S. filiforme, T. testudinum*, and *C. prolifera*. *H. wrightii* has been the dominant SAV species in this area followed by *C. prolifera* (Figure 13). *S. filiforme* and *T. testudinum* have been minor constituents. Seagrass PFOC has been generally stable in this MA (Figure 14).

<u>Lower Tampa Bay</u>

Data from MA8 was generated from transects S4T1, S4T2, S4T3, S4T4, S4T5, S4T6, S4T13, S4T14, and S4T15 (Figure 15). MA8 SAV has consisted of *H. wrightii*, *S. filiforme, and T. testudinum. T. testudinum* has been the dominant seagrass, though *H. wrightii*, and *S. filiforme* have been major constituents (Figure 16). Seagrass PFOC declined from 1998-2003 and then increased through 2006 (Figure 17).

Data from MA9 was generated from transects S4T7, S4T8, and S4T9 (Figure 15). MA9 SAV has consisted of *H. engelmanni*, *H. wrightii, R. maritima*, *S. filiforme*, and *T. testudinum*. *H. wrightii* has been the dominant species, though *T. testudinum* has been a major constituent (Figure 16). This area has had the greatest fluctuation of seagrass PFOC in Lower Tampa Bay (Figure 17).

Data from MA10 was generated from transects S4T10, and S4T11 (Figure 15). MA10 SAV has consisted of *H. wrightii*, *S. filiforme,* and *T. testudinum*. *T. testudinum* has been the dominant species, though *H. wrightii* has also been prevalent (Figure 16). *S. filiforme* was a minor constituent in this MA. Seagrass PFOC in this area has been the least variable of the Lower Tampa Bay MAs (Figure 17).

Data from MA11 was generated from transect S4T12 (Figure 15). MA11 SAV has consisted of *H. wrightii*, *S. filiforme*, and *T. testudinum*, and *C. prolifera*. *T. testudinum* has been the dominant species, although *S. filiforme* and *H. wrightii* have been major constituents (Figure 16). *C. prolifera* has been a minor constituent. The seagrass PFOC is not presented due to inconsistent placement of the 1x1 meter PVC frames during several sampling occasions.

<u>Boca Ciega Bay</u>

Data from MA12 was generated from transects S5T7, S5T9, S5T10 and S5T11 (Figure 18). MA12 SAV has consisted of *H. wrightii*, *S. filiforme*, and *T. testudinum*. *T. testudinum* has been the major SAV constituent (Figure 19). *H. wrightii* has also been commonly present with *S. filiforme* generally a minor component in this area. Seagrass PFOC has been consistently above 75 percent (Figure 20).

Data from MA13 was generated from transects S5T5 and S5T6 (Figure 18). MA13 SAV has consisted of *H. wrightii* and *T. testudinum*. *H. wrightii* has been the dominant species (Figure 19). Overall, seagrass PFOC was positive during the sampling period (Figure 20).

Data from MA14 was generated from transects S5T2, S5T3, and S5T4 (Figure 18). MA14 SAV has consisted of *H. wrightii* and *T. testudinum*. *H. wrightii* has been the dominant species (Figure 19). Seagrass PFOC has increased from ca 70 percent in 1998 to ca 95 percent in 2005 and was followed by a slight reduction during 2006 (Figure 20).

Data from MA15 was generated from transect S5T1 (Figure 18). MA15 SAV has consisted of *H. wrightii* (Figure 19). The PFOC decreased early in the study but has since increased (Figure 20) due to *H. wrightii* expansion (Appendix A; BCB-1).

Data from MA16 was generated from transect S5T8 (Figure 18). MA16 SAV has consisted of *H. wrightii*, *S. filiforme*, *T. testudinum* and *C. prolifera*. *S. filiforme* and *T. testudinum* have codominated this area, although *H. wrightii* has been a major constituent (Figure 19). *C. prolifera* has been seen infrequently. The seagrass PFOC has been consistently above 75 percent (Figure 20).

Tampa Bay Subsections: *Trends in Submerged Aquatic Vegetation*

<u>Old Tampa Bay</u>

Five seagrass species, *H. wrightii*, *H. engelmanni*, *R. maritima*, *S. filiforme*, and *T. testudinum*, and the alga, *C. prolifera*, have been documented within Old Tampa Bay (Figure 21). *H. wrightii* has been the most common species, found in over 40 percent of 1x1 meter PVC frame placements (Figure 21). The seagrass PFOC in this bay subsection has increased from near 60 percent in 1998 to ca 75 percent in 2006 (Figure 22).

<u>Hillsborough Bay</u>

Hillsborough Bay SAV has consisted of *H. wrightii*, *R. maritima*, and *C. prolifera*. *H. wrightii* has been the most common species with *R. maritima* and *C. prolifera* seen intermittently (Figure 21). However, only 10 to 20 percent of the 1x1 meter PVC frame placements contained any seagrass coverage (Figure 22).

<u>Middle Tampa Bay</u>

Middle Tampa Bay SAV has consisted of *H. wrightii*, *R. maritima*, *S. filiforme*, *T. testudinum*, and *C. prolifera*. *H. wrightii* has been the dominant seagrass in Middle Tampa Bay, found at nearly twice the frequency of *S. filiforme* and *T. testudinum* (Figure 21). Seagrass PFOC has increased slightly since 1998 (Figure 22).

Lower Tampa Bay

Lower Tampa Bay SAV has consisted of *H. engelmanni*, *H. wrightii*, *R. maritima*, *S. filiforme*, *T. testudinum*, and *C. prolifera*. *T. testudinum* has been the most common species in this subsection's seagrass meadows (Figure 21). *H. wrightii* was also frequently seen. Seagrass PFOC in this Tampa Bay subsection was reduced by ca 20 percent between 1998 and 2000 (Figure 22), but has since remained somewhat stable.

Boca Ciega Bay

Boca Ciega Bay SAV has consisted of *H. wrightii*, *S. filiforme*, *T. testudinum*, and *C. prolifera*. *H. wrightii* and *T. testudinum* codominate the seagrass coverage in this bay subsection (Figure 21). Seagrass PFOC has increased slightly since 1998 (Figure 22).

Tampa Bay: *Trends in Submerged Aquatic Vegetation*

Tampa Bay SAV has consisted of the seagrasses *H. engelmanni*, *H. wrightii*, *R. maritima*, *S. filiforme*, *T. testudinum*, and the attached alga, *C. prolifera*. *H. wrightii* has been the dominant SAV component in Tampa Bay (Figure 23), found at nearly twice the frequency of *T. testudinum*. The PFOC of each seagrass species are presented in Table 3 along with the 1980 results of Lewis et al. (1985). Overall, seagrass PFOC was stable near 50 percent from 1998-2006 (Figure 24).

Seagrass Depth Ranges

Old Tampa Bay

Depth contours have been developed in MA20, MA21, MA25, and MA26. Within this data set, *H. wrightii* and *S. filiforme* had a similar depth range of 0m to -1.9mLMTL and -0.1 to -1.9mLMTL, respectively (Figure 25). *R. maritima* was restricted to a shallower depth range of -0.1 to -0.8mLMTL. *T. testudinum* was found between -0.4 to -1.6mLMTL.

Hillsborough Bay

Depth contours have been developed for all Hillsborough seagrass transects (Figure 9). *H. wrightii* occurred at a depth range of 0 to -1.4mLMTL (Figure 26). *R. maritima* occupied a narrower depth range of 0 to -0.5mLMTL.

Middle Tampa Bay

Depth contours have been developed for one transect in MA6 and all transects in MA18 and MA27. Within this data set, *H. wrightii* occurred at -0.1 to -2.0mLMTL (Figure 27) which is similar to that found in Old Tampa Bay. *R. maritima* was found at a shallower depth range of 0.2 to -0.5mLMTL. *S. filiforme* was found at -0.2 to -1.9mLMTL, while *T. testudinum* had a slightly narrower range of -0.3 to -1.8mLMTL.

Discussion

SAV trends within each Tampa Bay subsection and Tampa Bay as a whole are examined below. Further, ancillary data which drive major changes within MA seagrass are presented. Also, the depth limits for seagrass species are compared within the upper Tampa Bay subsections. Finally, longshore sandbar features found in Old Tampa Bay and Middle Tampa are discussed.

Seagrass Trends in Tampa Bay Subsections

Old Tampa Bay

Seagrass PFOC in Old Tampa Bay has shown the greatest increase of any Tampa Bay subsection (Figure 22), primarily due to increased *H. wrightii* and *S. filiforme* coverage (Appendix A; OTB1). In 2006, the seagrass PFOC was near 75 percent, following only BCB in this category. However, a large shallow subtidal flat in MA21 has been the least vegetated MA in this bay subsection. *H. wrightii* has been the most common species in this area though coverage has been erratic (Appendix A; OTB1). A suite of intensive studies conducted during 2003-2006 found that the combined water quality constituents of chlorophyll-*a*, color, and turbidity may reach levels to preclude sustained seagrass recolonization in this area (Greening, 2004; Cross, 2007).

C. prolifera has been a common SAV component in MA19 and MA28 (Appendix A: OTB1). However, this alga was absent within these two areas in 2006. Conversely, dense *C. prolifera* coverage developed during 2006 in western MA23.

Hillsborough Bay

H. wrightii has dominated the seagrass PFOC in Hillsborough Bay (Appendix A; HB1). *R. maritima* has been common in MA1 and MA3. In spite of the varying *H. wrightii* coverage noted between 1997 and 2006, seagrass PFOC has remained between 10-20 percent (Figure 22). Over 80 percent of the shallow subtidal flats were barren of seagrass coverage through 2006.

During the 1980s and 1990s, there were several episodes of *C. prolifera* rapidly vegetating several large areas followed by loss of coverage (City of Tampa 2003). A similar “boom and bust” episode occurred in MA4 and eastern MA27 (Figure 1) along southeastern Interbay Peninsula (Figure 2) during 2002-2006.

Middle Tampa Bay

Middle Tampa Bay seagrass PFOC has remained near 40 percent over the period of study (Figure 22). However, a degree of variability was seen among *H. wrightii* and *S. filiforme*. For example, in the western section of Middle Tampa Bay, increased *S. filiforme* PFOC in MA18 offset decreases in *H. wrightii* PFOC (Appendix A; MTB1). Similarly, increased *H. wrightii* coverage in the northern area of MA6 offset the loss of most *H. wrightii* at the mouth of the Little Manatee River (Avery and Johansson, 2006). *T. testudinum* PFOC was relatively stable for all the MAs.

C. prolifera has been a variable SAV component in Middle Tampa Bay. Prior to the October 2006 SAV assessment period, *C. prolifera* was a prominent feature along southeastern Interbay Peninsula (MA27). However, between June and August 2006, the coverage of this alga was greatly reduced. During the same time period, *C. prolifera* disappeared in MA17 (Dr. Susan Bell, personal communication). It is interesting to note that during the period of *C. prolifera* loss in MA27, a large number of a green sacoglossans (nudibranch) tentatively identified as *Elysia sp.* were noted in the SAV of this area. Although it has been postulated that *Elysia sp.* may act as a biological control of *Caulerpa sp*. (Thibaut et al., 2001), the cause for this coverage loss is not clear.

Lower Tampa Bay

The reduction of Lower Tampa Bay seagrass PFOC from ca 90 percent in 1998 to ca 50 percent during 2002 (Figure 22) was primarily due to offshore *T. testudinum* loss in MA8, MA9, and MA11 (Appendix A; LTB1). *S. filiforme* has been seen in ca 15 percent of 1x1 meter PVC frame placements and was predominately found in Terra Ceia Bay with intermittent coverage located near the mouth of the Manatee River. Seagrass coverage upstream in the Manatee River has been variable, consisting of mixed *H. engelmanni*, *H. wrightii*, and *R. maritima* coverage.

Boca Ciega Bay

Seagrass composition transitions from a *H. wrightii* dominated community at the north end of Boca Ciega Bay to a *T. testudinum* dominated community at the south end (Avery and Johansson, 2006). Boca Ciega Bay seagrass PFOC has increased during the study period (Figure 22). *H. wrightii* has been most stable in MA12 (Appendix A; BCB1). *T. testudinum* PFOC has been stable in each MA where present except MA16. Within this MA, a large reduction in *T. testudinum* occurred between 1998 and 2001 as species composition transitioned to a *S. filiforme* dominated meadow.

Tampa Bay Seagrass Trends

The dominant Tampa Bay seagrass, *H wrightii*, was found in nearly forty percent of meter square placements (Figure 23). In contrast, *T. testudinum*, which is the most common species in the lower areas of Tampa Bay, was found in nearly twenty percent of placements. *S. filiforme* was found at nearly half that of *T. testudinum*. *H. wrightii* PFOC was stable (Appendix A; TB1). *T. testudinum* PFOC declined slightly between 1998 and 2002, but since, has changed little. The *S. filiforme* PFOC has been consistent at nearly twenty percent. Also, *C. prolifera* has been a major SAV constituent and has been predominately found in upper Tampa Bay.

No SAV was seen in nearly half of the meter square placements during 1998-2006 (Figure 24) indicating that a large portion of Tampa Bay's shallow shelf is available for seagrass recolonization. Much of this available area is located in Hillsborough Bay and in several areas of Middle Tampa Bay and Old Tampa Bay. Seagrass recolonization in these areas would substantially increase the total Tampa Bay seagrass coverage.

Lewis et al. (1985) found *H. wrightii* and *T. testudinum* to be codominant species during 1980. However, results from this study found *H. wrightii* at twice the frequency of *T. testudinum* (Table 2). This may indicate that most of the recent increases in Tampa Bay seagrass coverage (Greening and Janicki, 2006) are due to in *H. wrightii* expansion, especially in the upper portions of the bay.

Seagrass Depth Ranges

Middle Tampa Bay *H. wrightii* had the greatest depth range (0 to -2.0mLMTL, Figure 27) within the MAs assessed for bathymetry. A similar, but slightly narrower range was found in Old Tampa Bay for this species (Figure 25) with yet a more limited range found in Hillsborough Bay (Figure 26). Although there were interannual differences, *S. filiforme* in Old Tampa Bay (Figure 25) and Middle Tampa Bay (Figure 27) were found at similar depths (0 to -1.9mLMTL and -0.1 to -1.9mLMTL, respectively). *T. testudinum* was found at a wider depth range in Middle Tampa Bay (-0.4 to -1.8mLMTL, Figure 27) than in Old Tampa Bay (-0.4 to -1.6mLMTL, Figure 25). *R. maritima* was found at a much narrower depth range in all three of the upper Tampa Bay subsections (Figures 25, 26, and 27) rarely exceeding -0.5mLMTL.

Seagrass Species Zonation and Longshore Bars

Several MAs in Old Tampa Bay and Middle Tampa Bay have longshore sandbars features described by Lewis et. al. (1985). It is hypothesized that these features protect existing seagrass from wave or current energy (Lewis, 2002).

Stable seagrass meadows consisting of *H. wrightii*, *S. filiforme* and *T. testudinum* have persisted in Old Tampa Bay MA19, MA20, MA25, and MA26. These meadows follow the seagrass zonation described by Lewis et. al. (1985) with inshore *H. wrightii* coverage predominating and then transitioning to *T. testudinum*/*S. filiforme* coverage seaward. Longshore sandbars were present near the seaward edge of seagrass coverage in MA19, MA20, MA25, and MA27.

Longshore sandbars, similar to those seen in Old Tampa Bay, have been present in western Middle Tampa Bay (MA17 and MA18). Examinations of the TBISP transect data show that *S. filiforme* has been a common SAV component along the seaward face of these features (Avery and Johansson, 2006). However the zonation of seagrass species has not consistently followed the *H. wrightii*/*T. testudinum*/*S. filiforme* spatial pattern commonly seen in Old Tampa Bay. For example, along the southern transect in MA18, seagrass composition inshore of the longshore bar has been predominately *S. filiforme*. In contrast, inshore seagrass composition along the northern transect within this MA has consisted of a mix of patchy *H. wrightii*, *S. filiforme*, and *T. testudinum*.

Longshore sandbar features, as those described above, were apparently present historically in eastern Middle Tampa Bay (Lewis, 2002). Further, historical photographs suggest that similar structures may have been present south of Interbay Peninsula. Lewis (2002) hypothesized that these features were degraded following losses of the seaward seagrass coverage due to increased eutrophication during the 1950s and 1960s. In 2006, *S. filiforme* was planted south of the Interbay Peninsula along a depth gradient from -0.6 to -0.9mLMTL to investigate the ability of the planted seagrass to stabilize and/or accrete sediments to promote the potential development of a longshore bar feature. This project is ongoing through July 2008.

Summary

<u>Old Tampa Bay</u>

H. engelmanni, *H. wrightii*, *Ruppia maritima*, *S. filiforme*, *T. testudinum*, and *C. prolifera* have comprised the OTB SAV. Well developed seagrass meadows with *H. wrightii* generally dominant inshore and transitioning to predominantly *S. filiforme*/*T. testudinum* meadows offshore are found in eastern OTB MA25, and MA26 (Figure 1). These two MAs generally have had seagrass PFOC of greater than 80 percent (Table 1; Figure 8). Six MAs had seagrass PFOC from 50-75 percent. MA21 and MA24 had the lowest seagrass PFOC in OTB, averaging 25-50 percent and less than 25 percent, respectively (Table 1). About 60 percent of meter square placements between 1998 and 2006 contained seagrass.

<u>Hillsborough Bay</u>

H. wrightii has been the predominant seagrass in Hillsborough Bay. Of the five MAs in this bay subsection, only MA5 and MA6 averaged more than 25 percent seagrass coverage (Table 1; Figure 11). Overall, only 19 percent of meter square placements between 1997 and 2006 contained seagrass.

<u>Middle Tampa Bay</u>

H. wrightii, *Ruppia maritima*, *S. filiforme*, *T. testudinum*, and *C. prolifera* have been MTB SAV constituents. Generally, *H. wrightii* was the primary seagrass component in MA6 and MA27 and had average seagrass PFOC of 25-50 percent (Table 1). Seagrass PFOC in MA17 and MA18, primarily comprised of *S. filiforme*, averaged 25-50 percent and 51-75 percent, respectively. MA7 seagrass PFOC, with the greatest *T. testudinum* PFOC of any MTB MAs, averaged 51-75 percent. Less than 50 percent of meter placements assessed between 1998 and 2006 contained seagrass.

Lower Tampa Bay

H. engelmanni, *H. wrightii*, *Ruppia maritima*, *S. filiforme*, *T. testudinum*, and *C. prolifera* have been LTB SAV constituents. *T. testudinum* has been the dominant seagrass species except in the Manatee River (MA9) where *H. wrightii* has dominated. In MA8 and MA10, loss of offshore *T. testudinum* led to a PFOC decline between 1998 and 2002 (Figure 17). In contrast, *H. wrightii* loss in MA9 led the decline during the same period. However, since the initial decline, seagrass PFOC has been stable. MA10 has had the greatest PFOC, averaging 76-100 percent, while MA8 and MA9 averaged between 50-75 percent. LTB ranks second among the bay subsections with overall PFOC of 63 percent from 1998-2006.

Boca Ciega Bay

H. wrightii, *S. filiforme*, *T. testudinum*, and *C. prolifera* have been LTB SAV constituents. The northern end of this Tampa Bay subsection has been *H. wrightii* dominant, however, seagrass composition transitions to *T. testudinum* dominated meadows in the southern portions. The seagrass PFOC has been most variable in the *H. wrightii* dominated MAs and most stable in the *S. filiforme*/*T. testudinum* meadows (Table 1). BCB had the highest PFOC of the Tampa Bay subsections, nearly 80 percent.

Tampa Bay

Tampa Bay seagrass has been dominated by *H. wrightii* (Figure 23) which has been the primary species found in OTB, HB, and MTB. *T. testudinum*, the primary constituent of LTB and BCB meadows, has been found at ca one half the frequency reported for *H. wrightii*. Overall, ca 50 percent of Tampa Bay's shelf shallower than 2m was devoid of seagrass coverage between 1998 and 2006.

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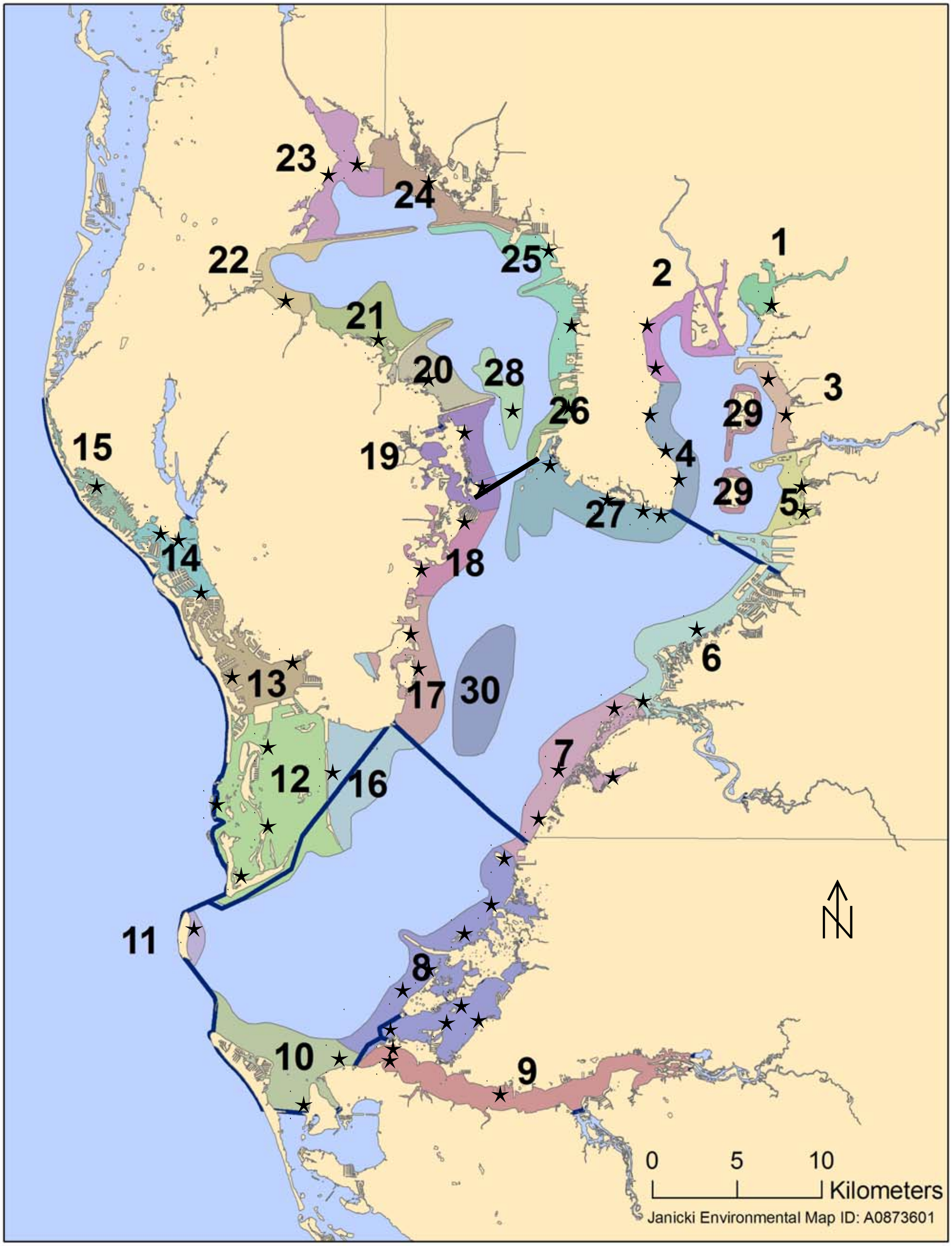


Figure 1. Location of the 30 Management Areas and 62 fixed seagrass transects (★) in Tampa Bay. Map courtesy of Janicki Environmental, Inc.

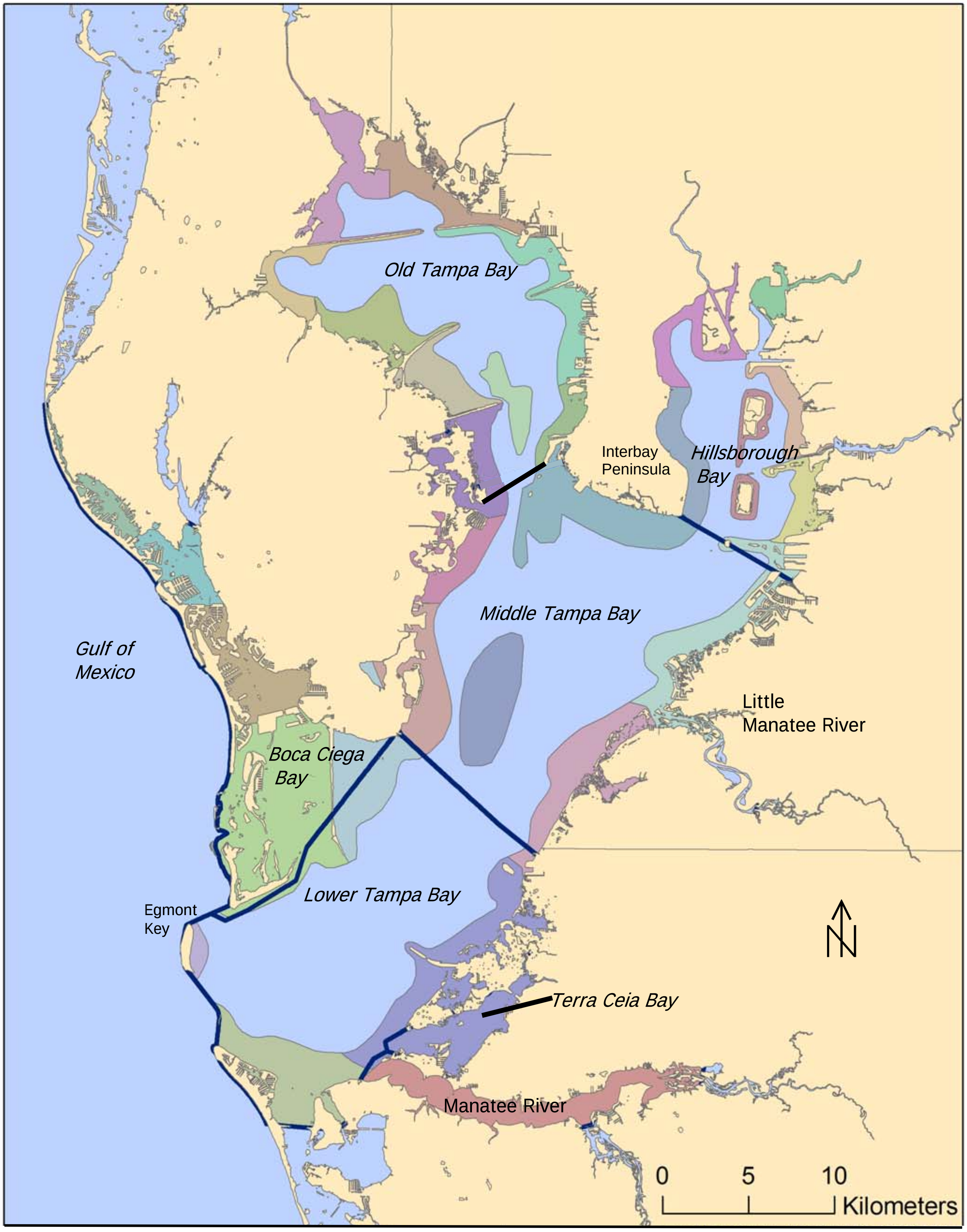
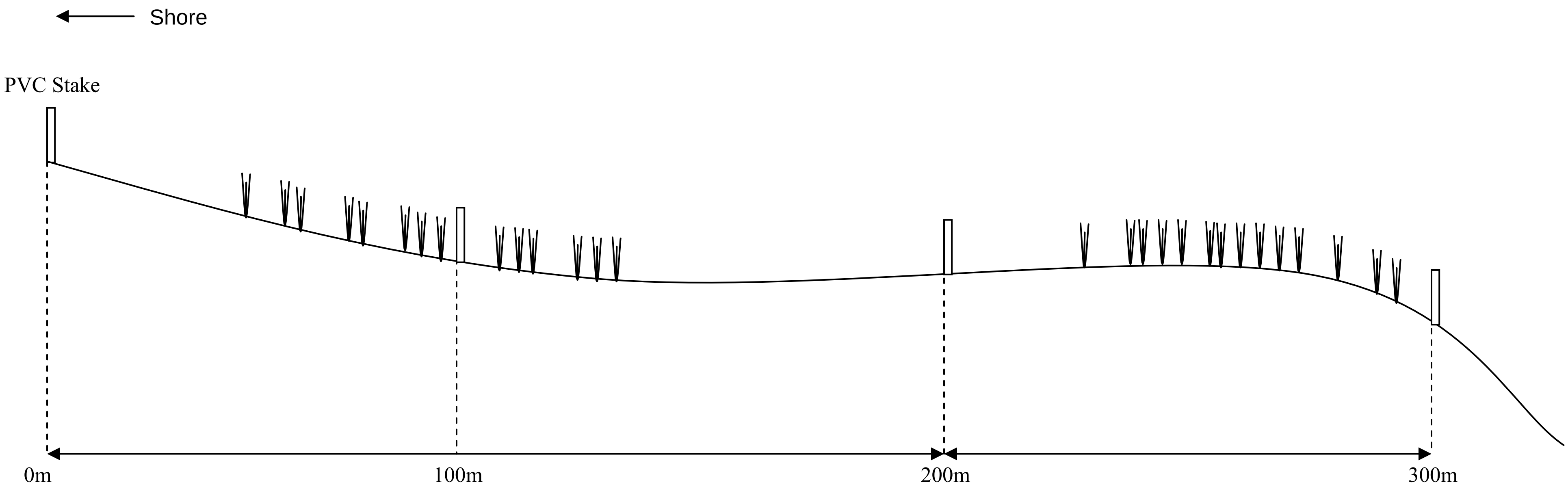


Figure 2. Tampa Bay. Map courtesy of Janicki Environmental, Inc.



For SAV assessments, a 1x1m PVC frame is placed at 25m intervals in Old Tampa Bay, Hillsborough Bay, and Middle Tampa Bay. Placements increase to 50m intervals in Lower Tampa Bay and Boca Ciega Bay. A PVC stake marks each 100m interval.

1x1m PVC frame placements increase to 10m intervals over the seaward 100m quadrant containing seagrass (all Tampa Bay subsections).

Figure 3. Schematic indicating minimum placement intervals of a 1x1m PVC frame for the Tampa Bay Interagency Seagrass Monitoring Program's SAV assessment along a typical fixed transect.

Table 2. Nonlinear regression analyses of percent frequency of occurrence (PFOC) seagrass coverage trends for management areas (* and ** represents $P \geq 0.05$ and $P \geq 0.01$, respectively).

Bay Segment	Management Area	R^2	P	N
OTB	19	0.24	0.6683	6
OTB	20	0.44	0.4154	6
OTB	21	0.76	0.1159	6
OTB	22	0.11	0.8443	6
OTB	23	0.07	0.7970	9
OTB	24	0.45	0.2255	8
OTB	25	0.55	0.0934	9
OTB	26	0.76	0.1162	6
OTB	28	0.63	0.0515	9
HB	1	0.63	0.0311*	10
HB	2	0.76	0.0065**	10
HB	3	0.23	0.3925	10
HB	4	0.41	0.1612	10
HB	5	0.85	0.0014**	10
MTB	17	0.42	0.1913	9
MTB	18	0.31	0.3250	9
MTB	27	0.43	0.1364	10
MTB	6	0.27	0.3307	10
MTB	7	0.48	0.1428	9
LTB	8	0.79	0.0088**	9
LTB	9	0.88	0.0016**	9
LTB	10	0.42	0.1974	9
BCB	12	0.32	0.3077	9
BCB	13	0.08	0.7669	9
BCB	14	0.50	0.1231	9
BCB	15	0.24	0.5001	9
BCB	16	0.03	0.9060	9

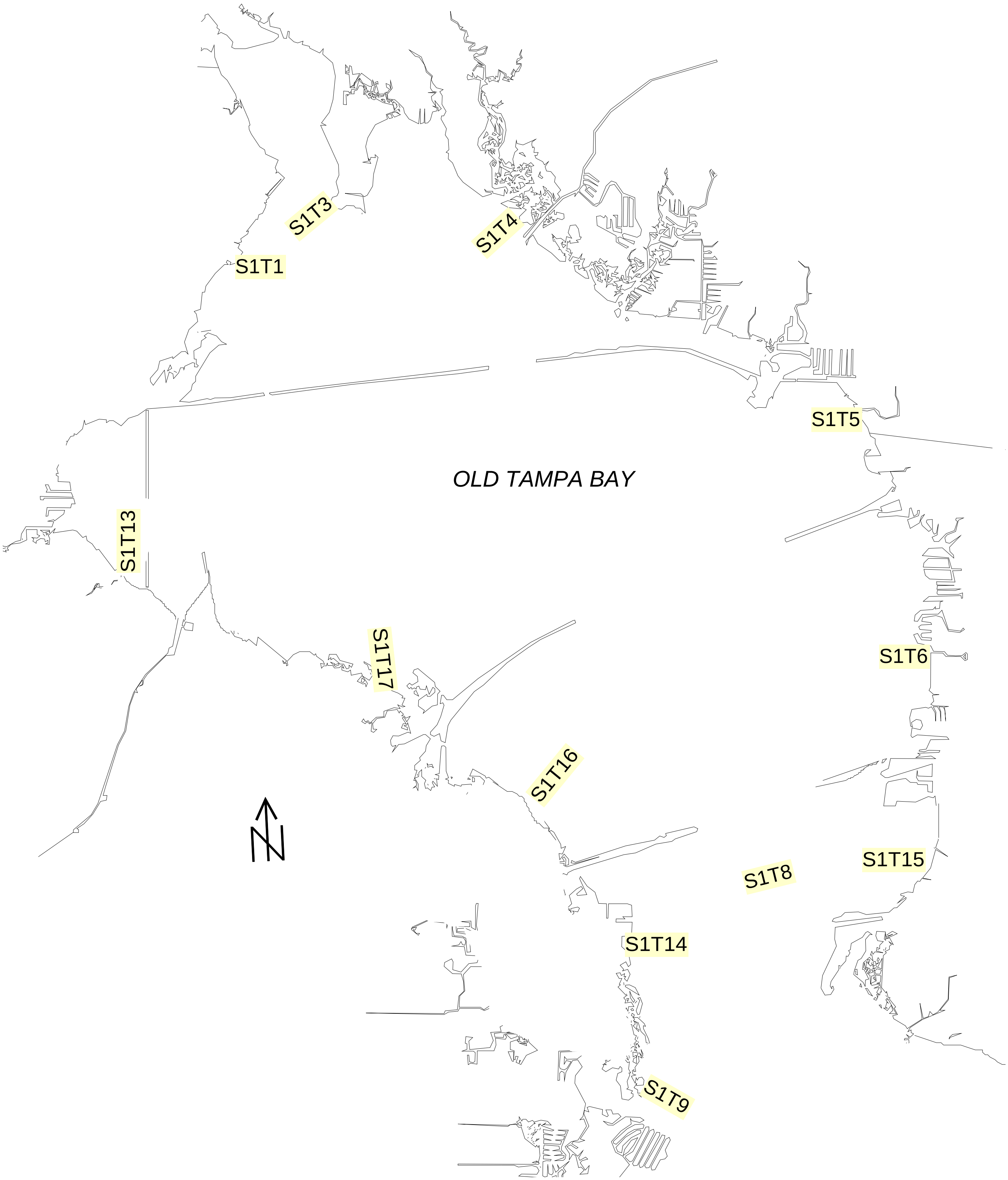


Figure 4. Location of the twelve Old Tampa Bay transects.

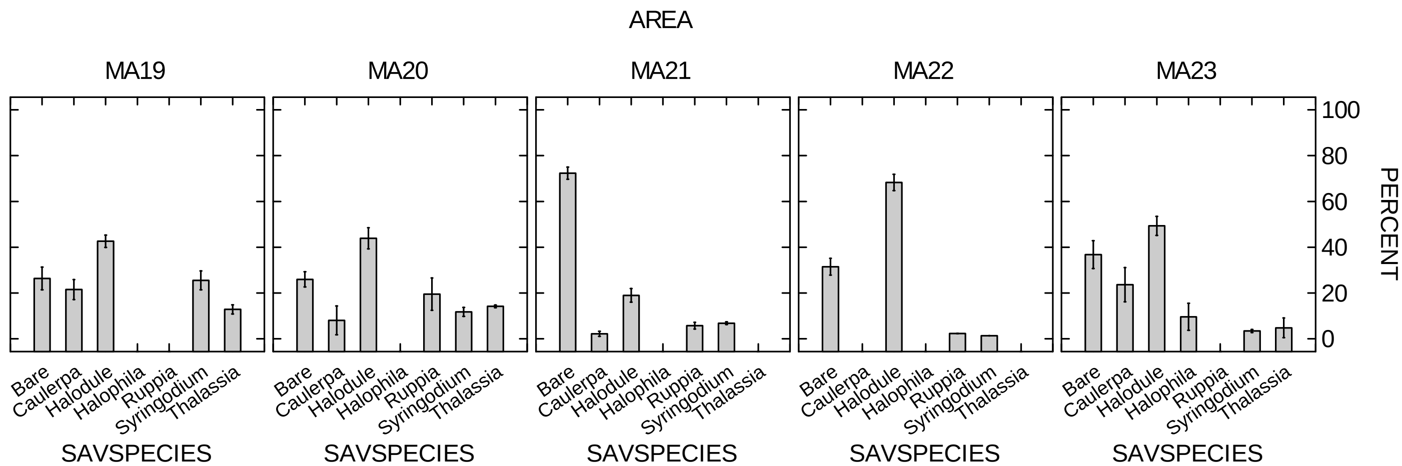


Figure 5. Average percent frequency of occurrence of seagrass coverage, *Caulerpa prolifera* coverage, and bare areas within western Old Tampa Bay management areas. Error bars equal 1SE.

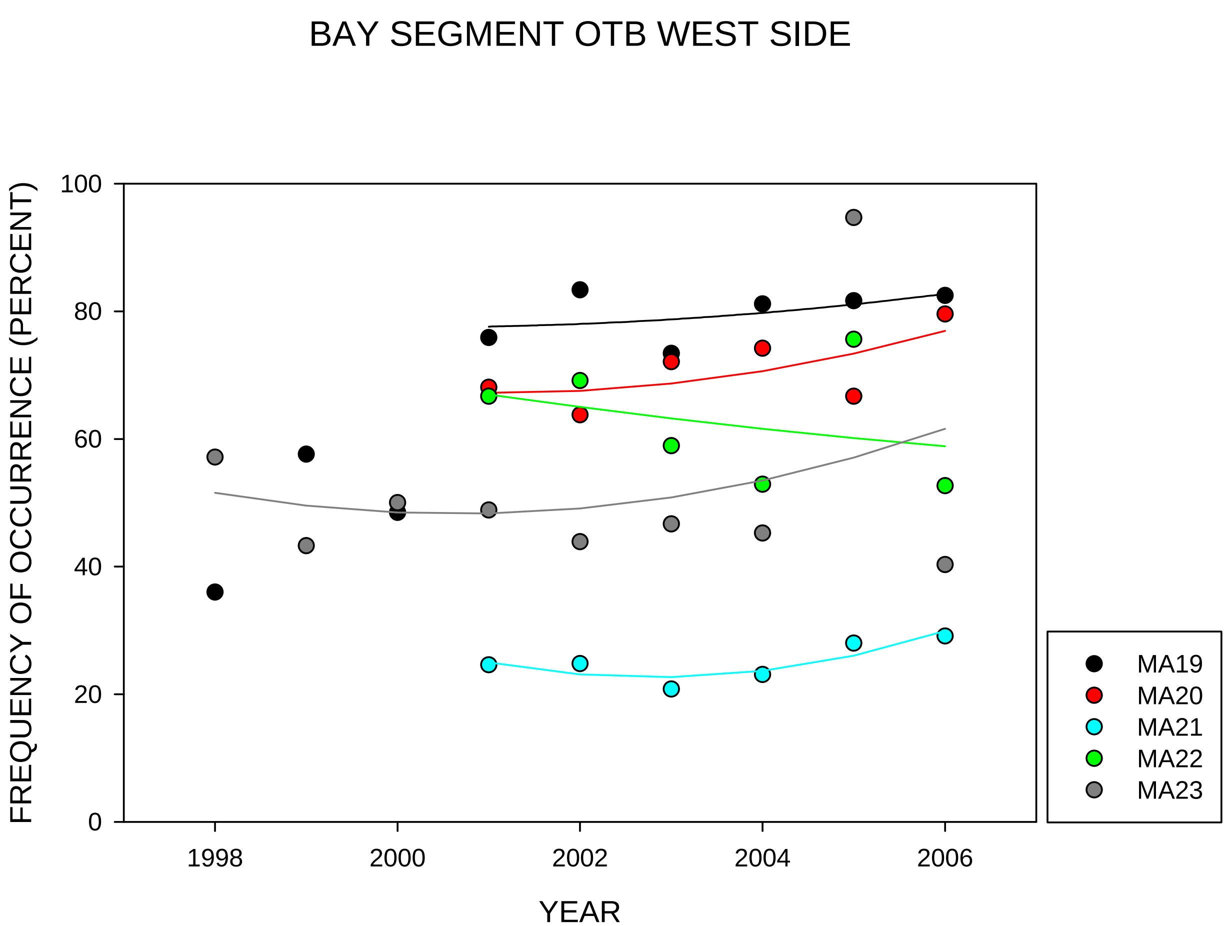


Figure 6. Percent frequency of occurrence of seagrass coverage within western Old Tampa Bay management areas from 1998-2006.

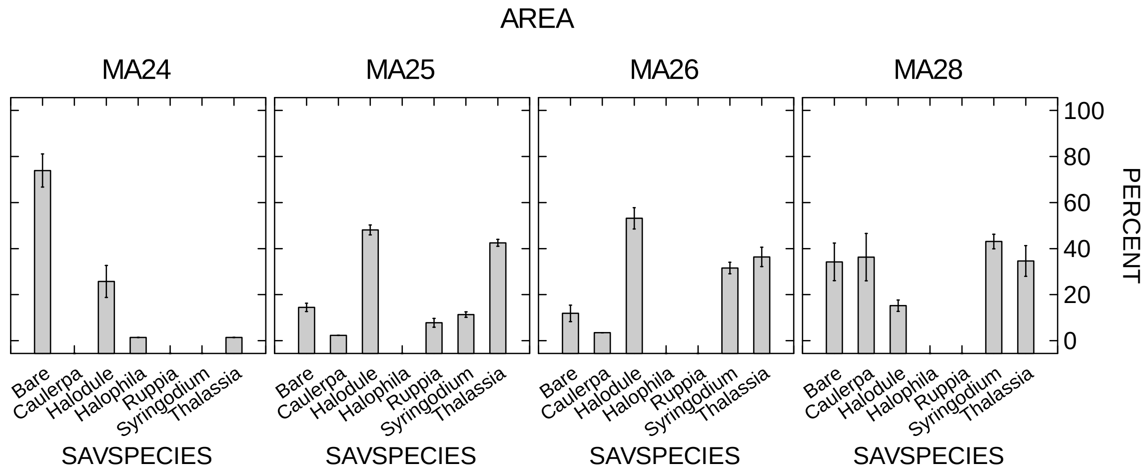


Figure 7. Average percent frequency of occurrence of seagrass coverage, *Caulerpa prolifera* coverage, and bare areas, within eastern Old Tampa Bay management areas. Error bars equal 1SE.

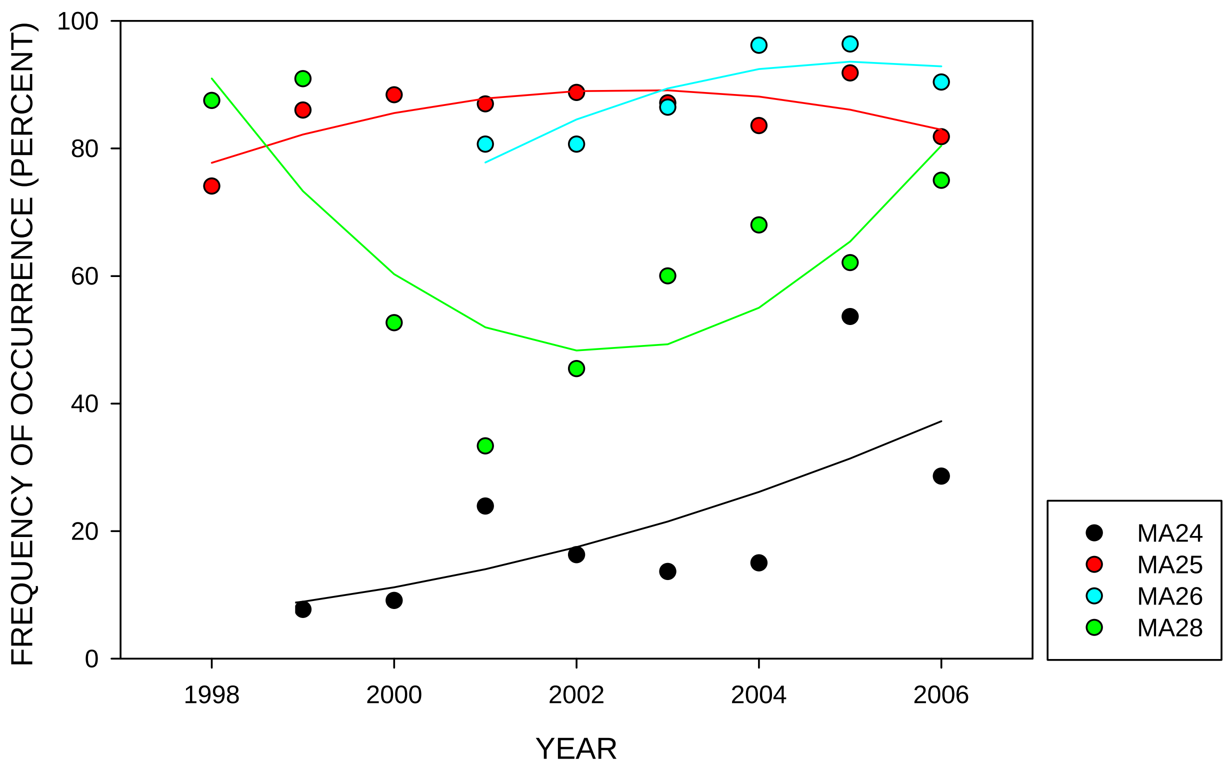


Figure 8. Percent frequency of occurrence of seagrass coverage within eastern Old Tampa Bay management areas from 1998-2006.

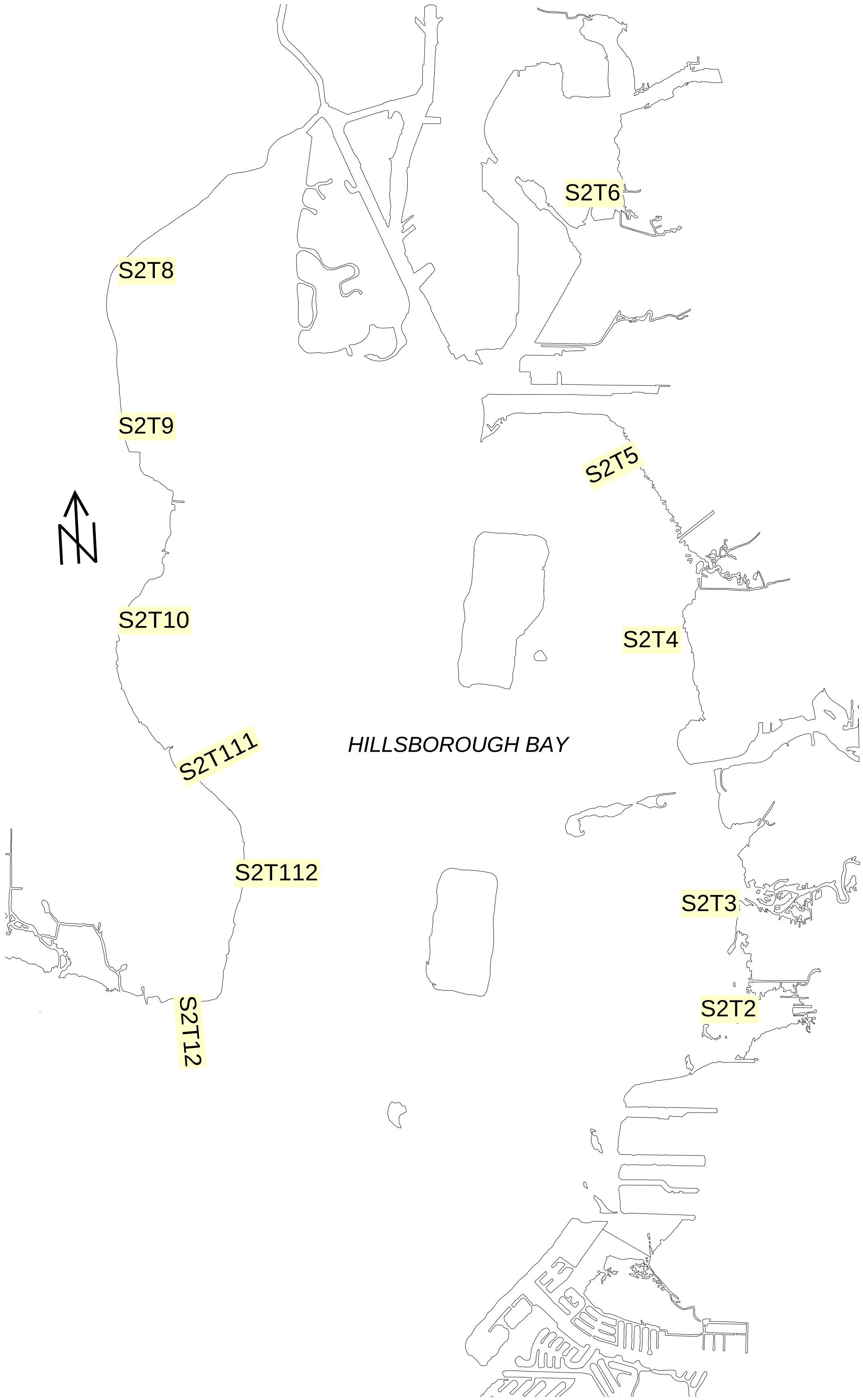


Figure 9. Location of the eleven Hillsborough Bay transects.

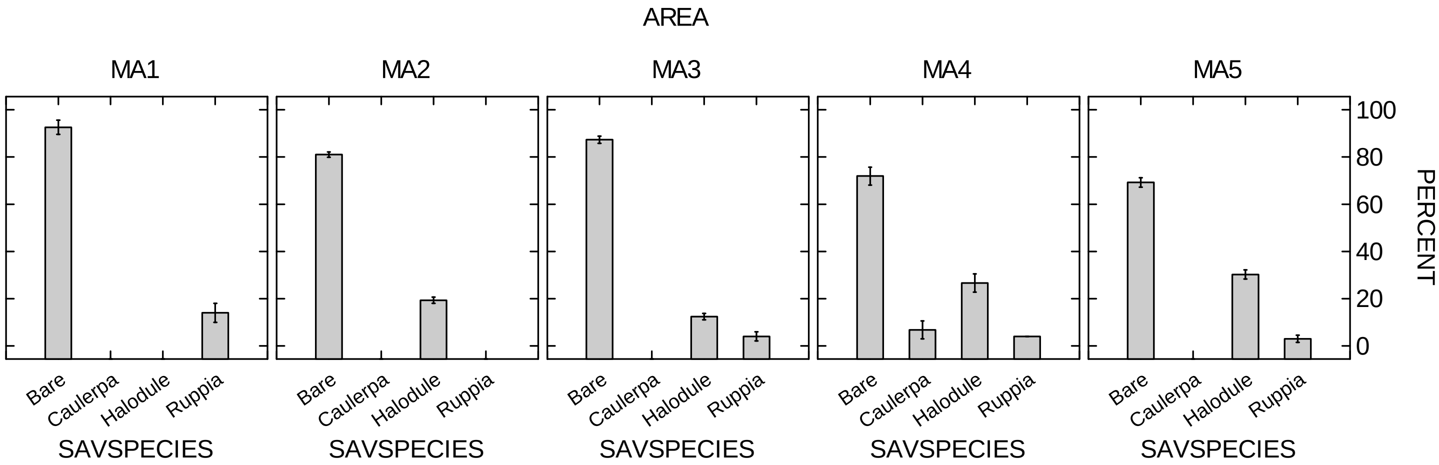


Figure 10. Average percent frequency of occurrence of seagrass coverage, *Caulerpa prolifera* coverage, and bare areas within Hillsborough Bay. Error bars equal 1SE.

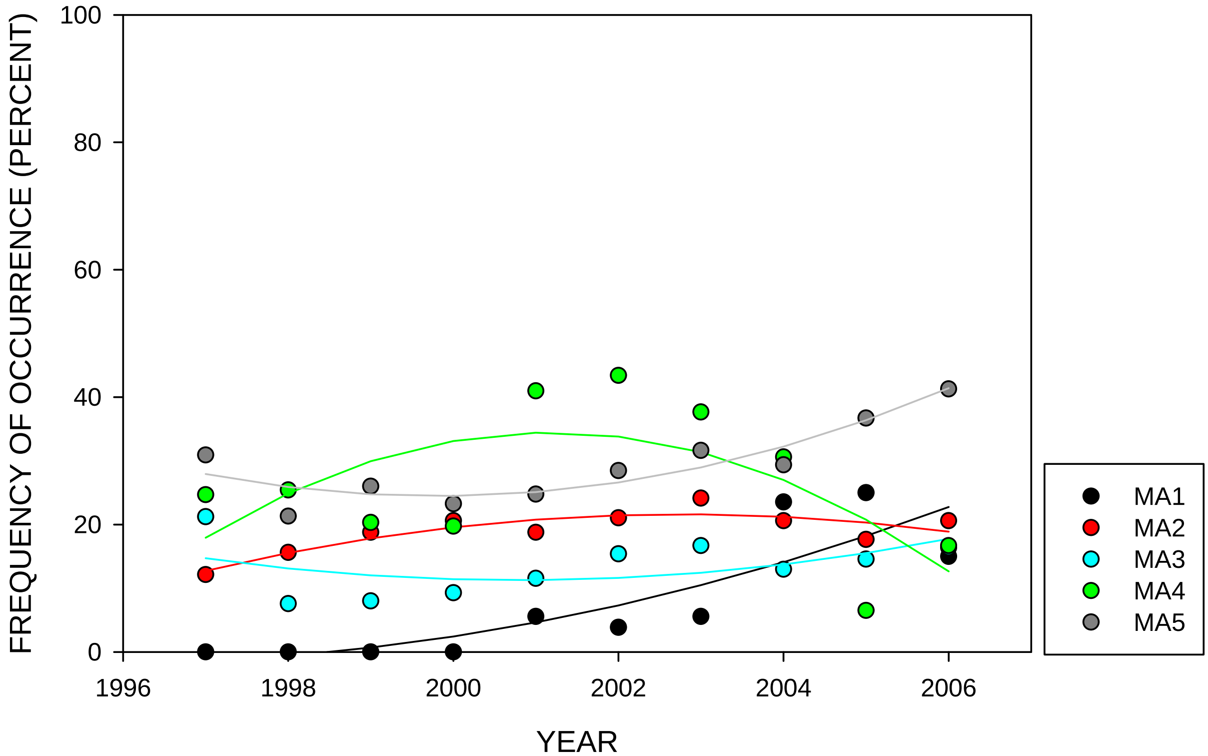


Figure 11. Percent frequency of occurrence of seagrass coverage within Hillsborough Bay management areas from 1997-2006.

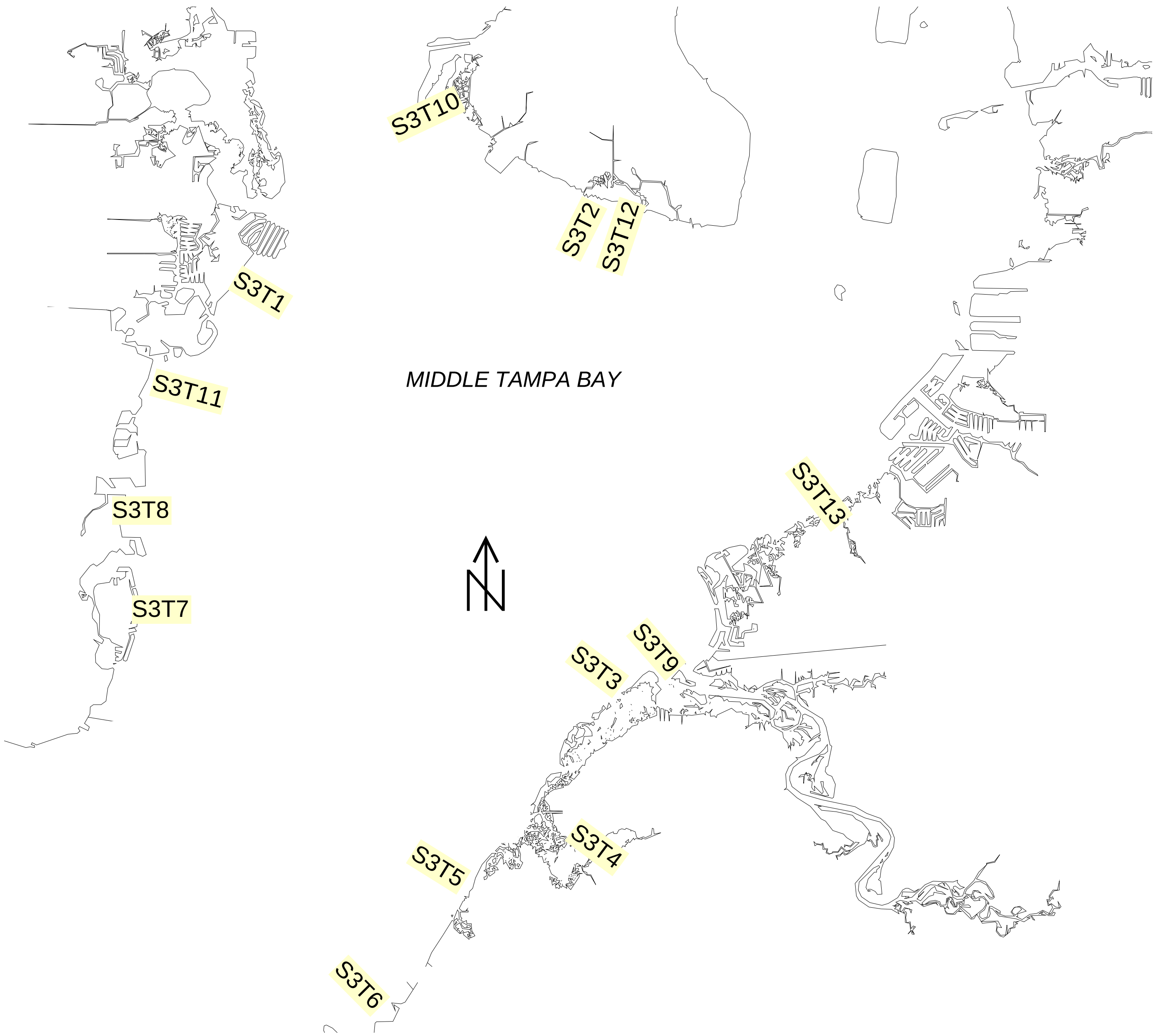


Figure 12. Location of the twelve Middle Tampa Bay transects.

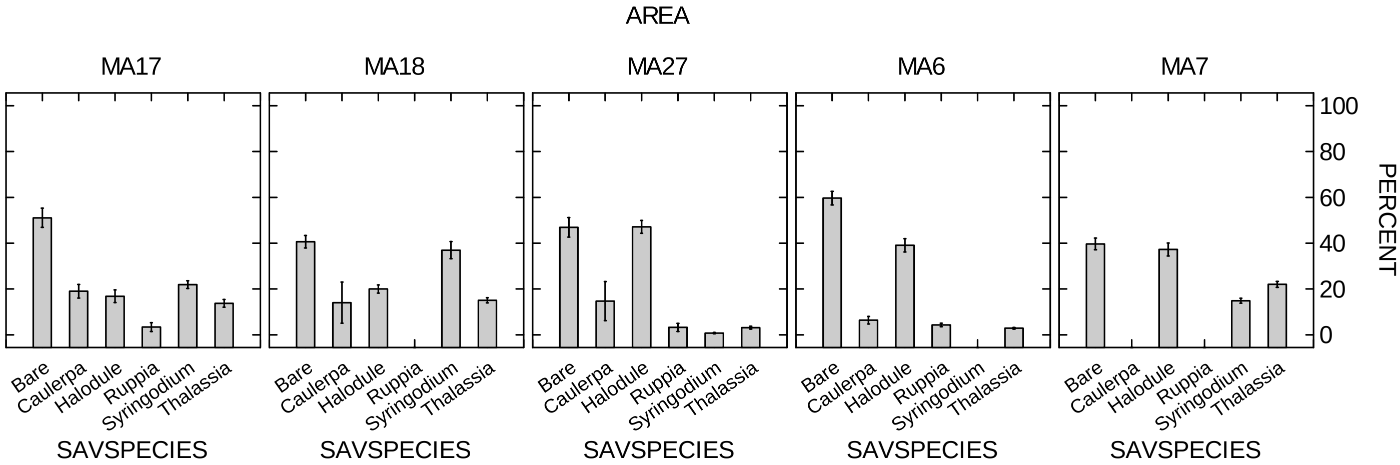


Figure 13. Average percent frequency of occurrence of seagrass coverage, *Caulerpa prolifera* coverage, and bare areas within Middle Tampa Bay. Error bars equal 1SE.

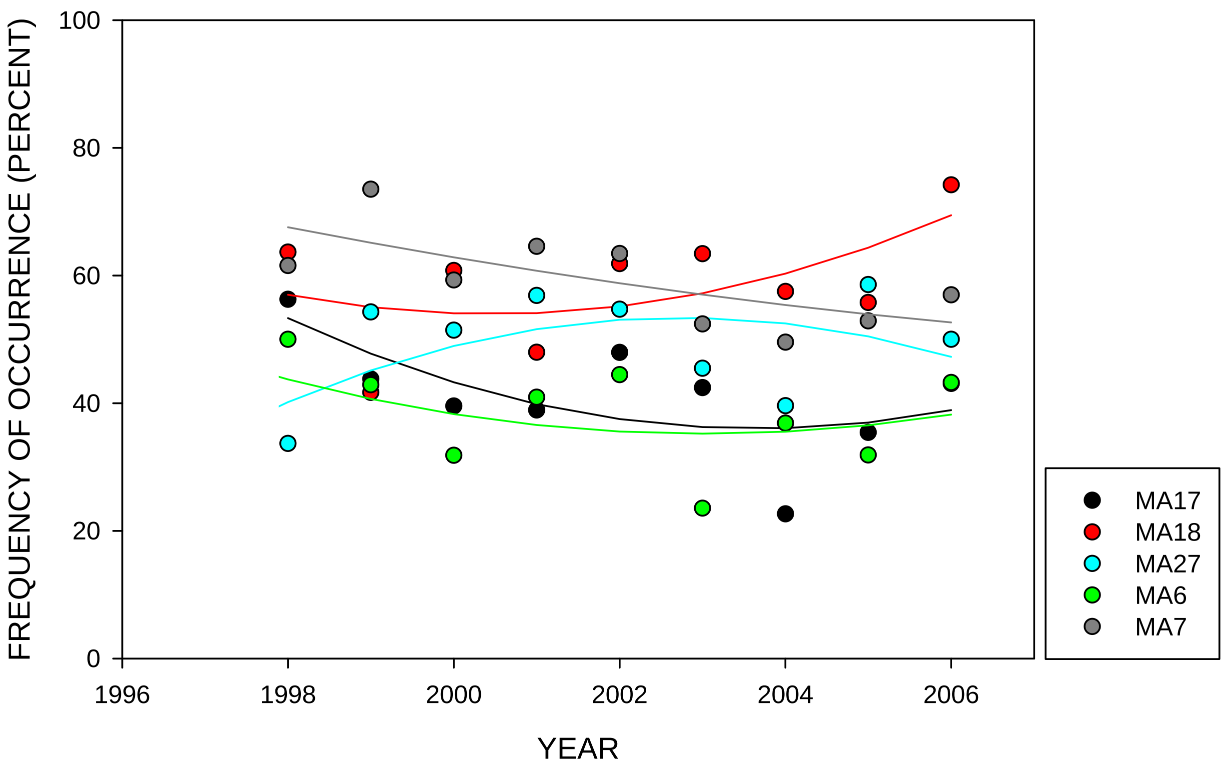


Figure 14. Percent frequency of occurrence of seagrass coverage within Middle Tampa Bay management areas from 1997-2006.

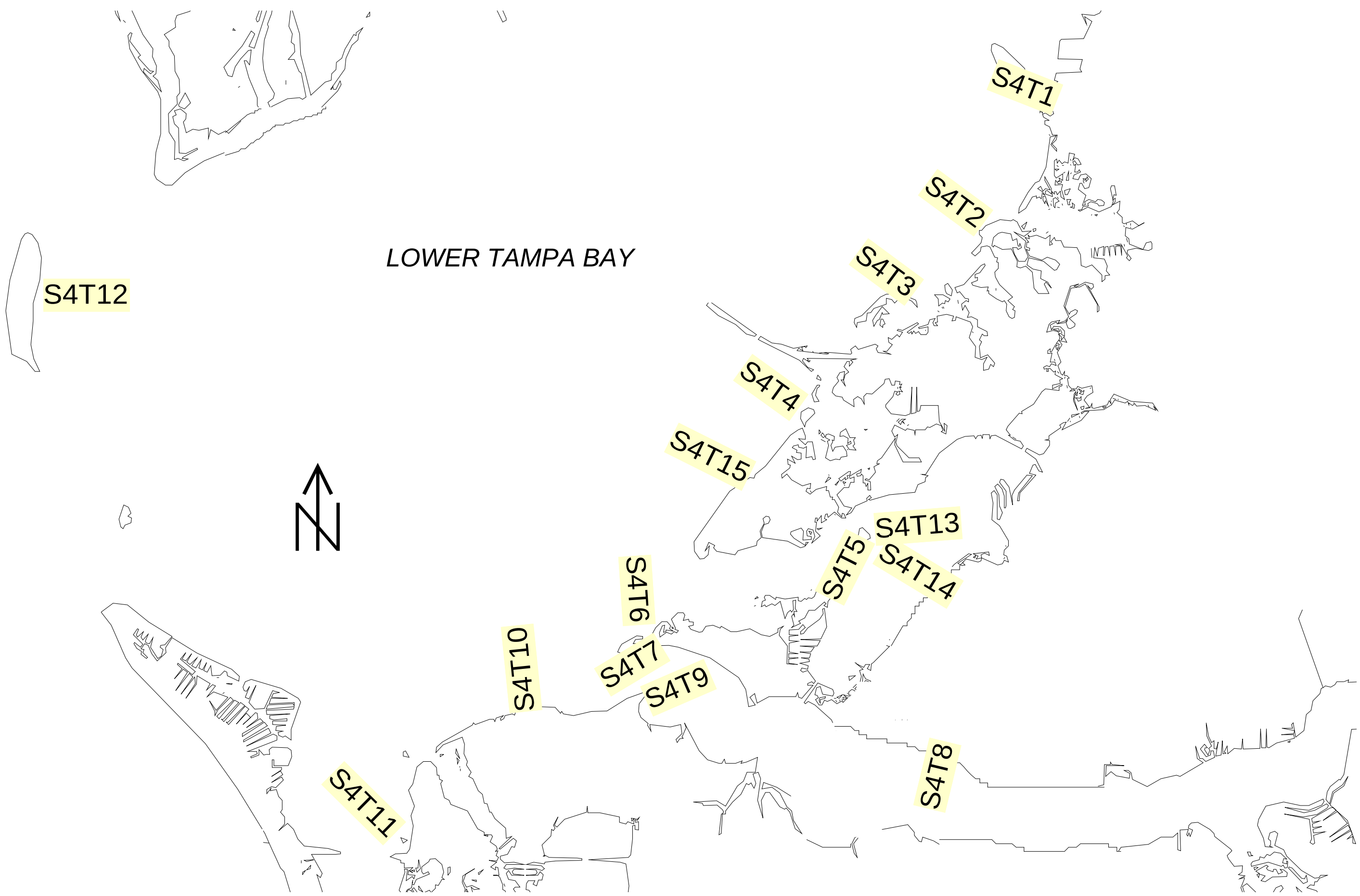


Figure 15. Location of the fifteen Lower Tampa Bay transects.

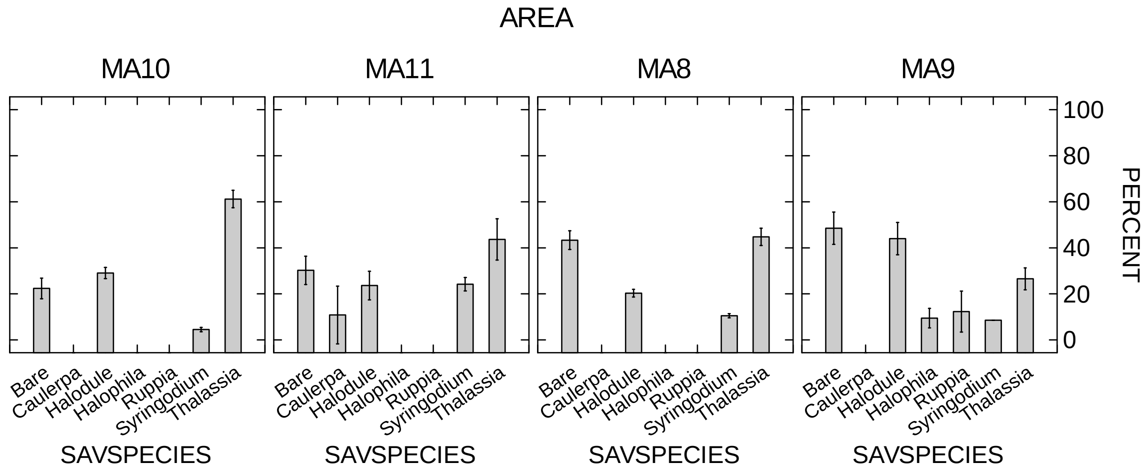


Figure 16. Average percent frequency of occurrence of seagrass coverage, *Caulerpa prolifera* coverage, and bare areas within Lower Tampa Bay. Error bars equal 1SE.

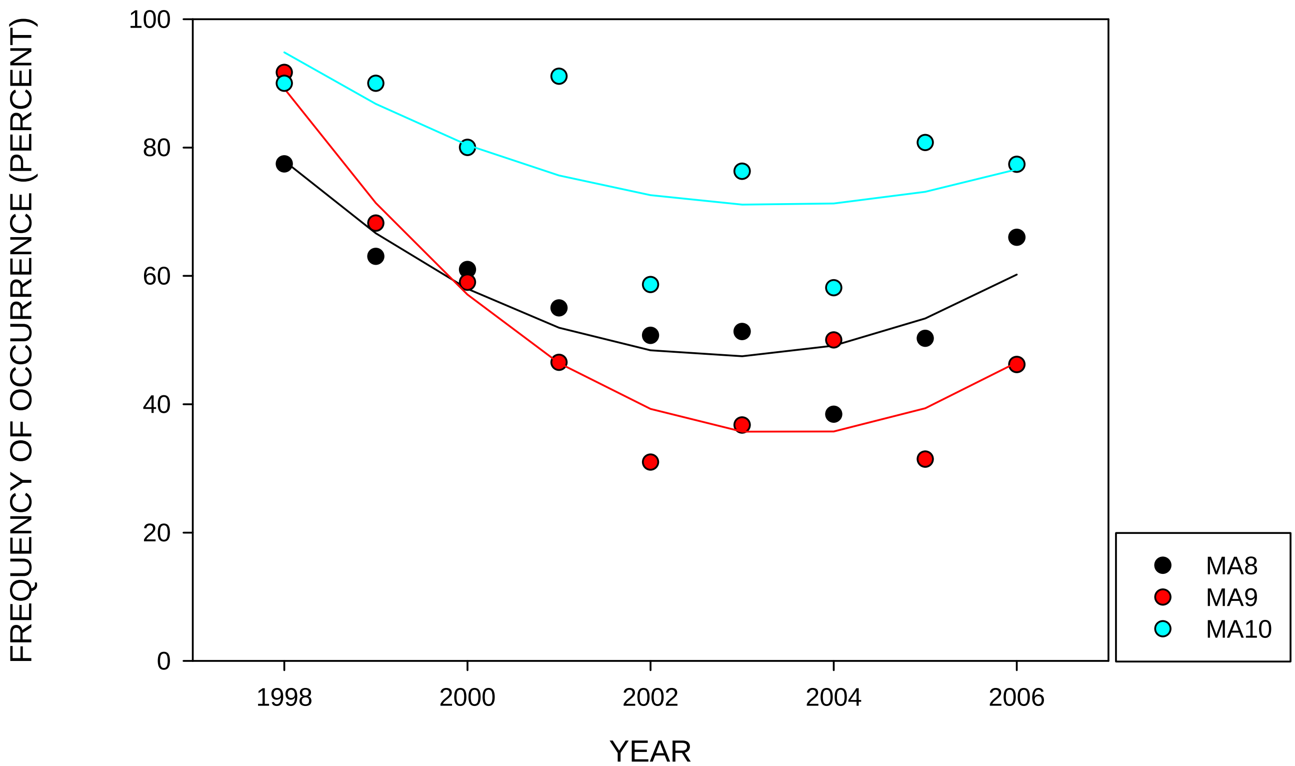


Figure 17. Percent frequency of occurrence of seagrass coverage within Lower Tampa Bay management areas from 1998-2006. Egmont Key transect (S4T12, MA 11) moved to new site in 2004, therefore, data not included.

Figure 18. Location of the eleven Boca Ciega Bay transects.

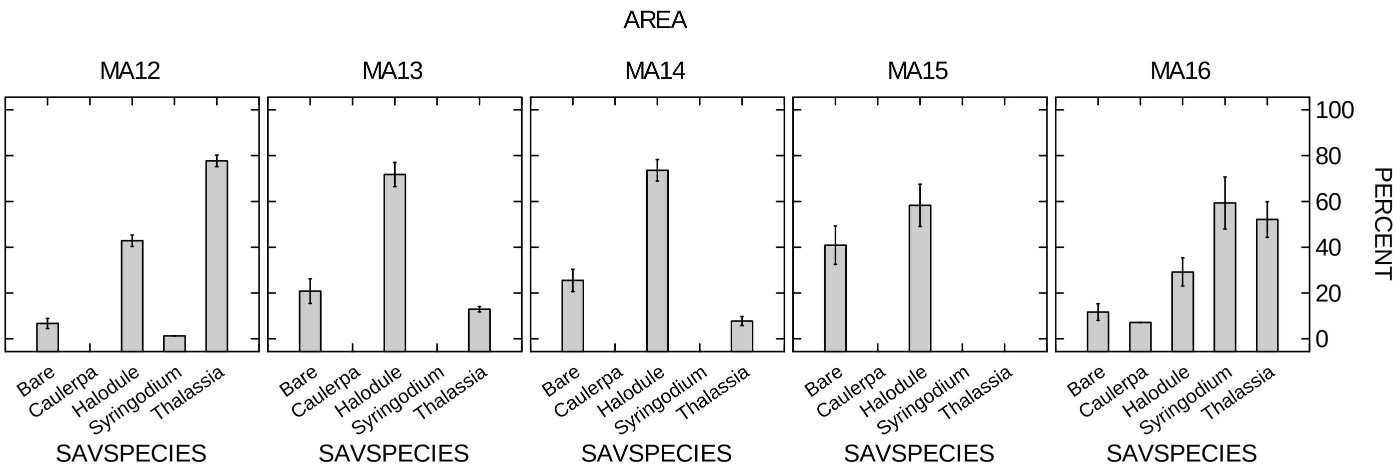


Figure 19. Average percent frequency of occurrence of seagrass coverage, *Caulerpa prolifera* coverage, and bare areas within Boca Ciega Bay. Error bars equal 1SE.

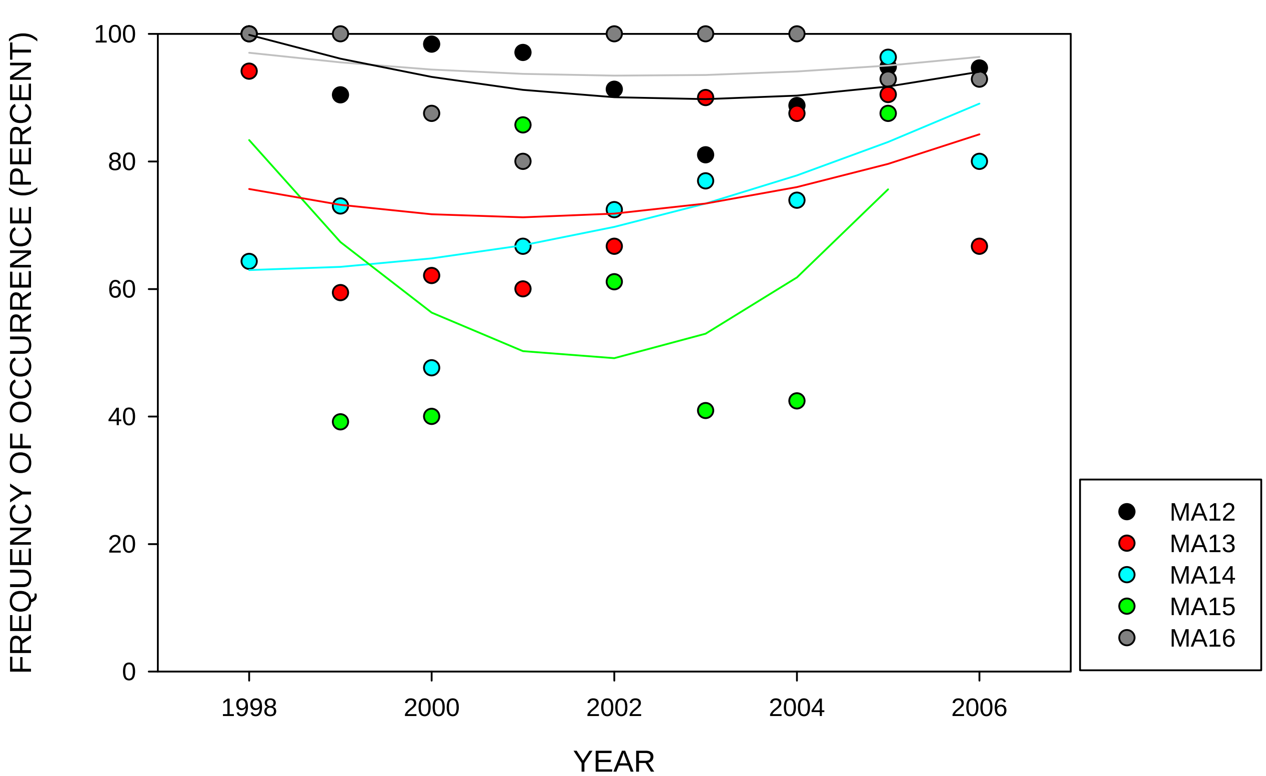


Figure 20. Percent frequency of occurrence of seagrass coverage within Boca Ciega Bay management areas from 1998-2006.

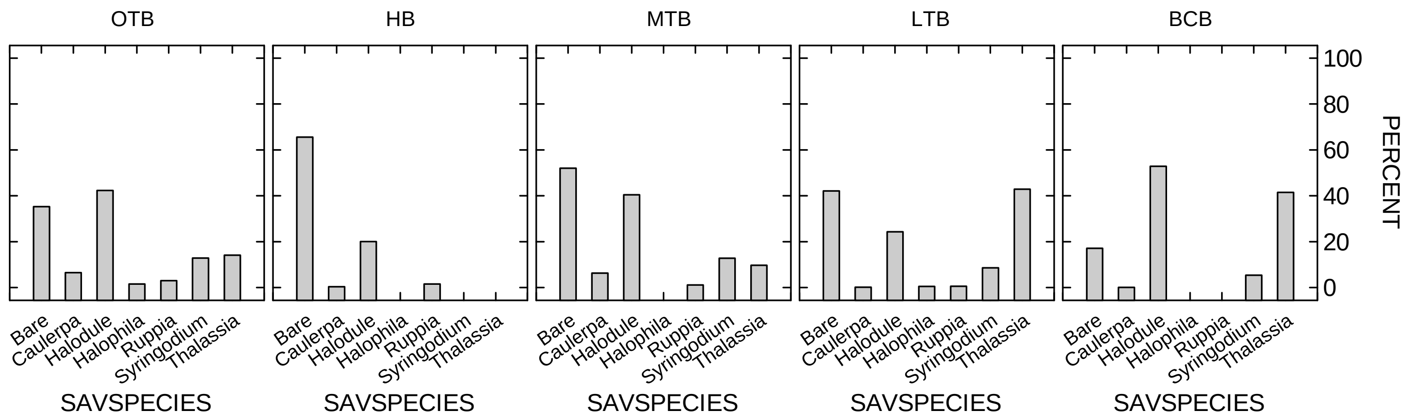


Figure 21. Average percent frequency of occurrence of seagrass coverage, *Caulerpa prolifera* coverage, and bare areas within Tampa Bay subsections: Old Tampa Bay (OTB), Hillsborough Bay (HB), Middle Tampa Bay (MTB), Lower Tampa Bay (LTB), and Boca Ciega Bay (BCB).

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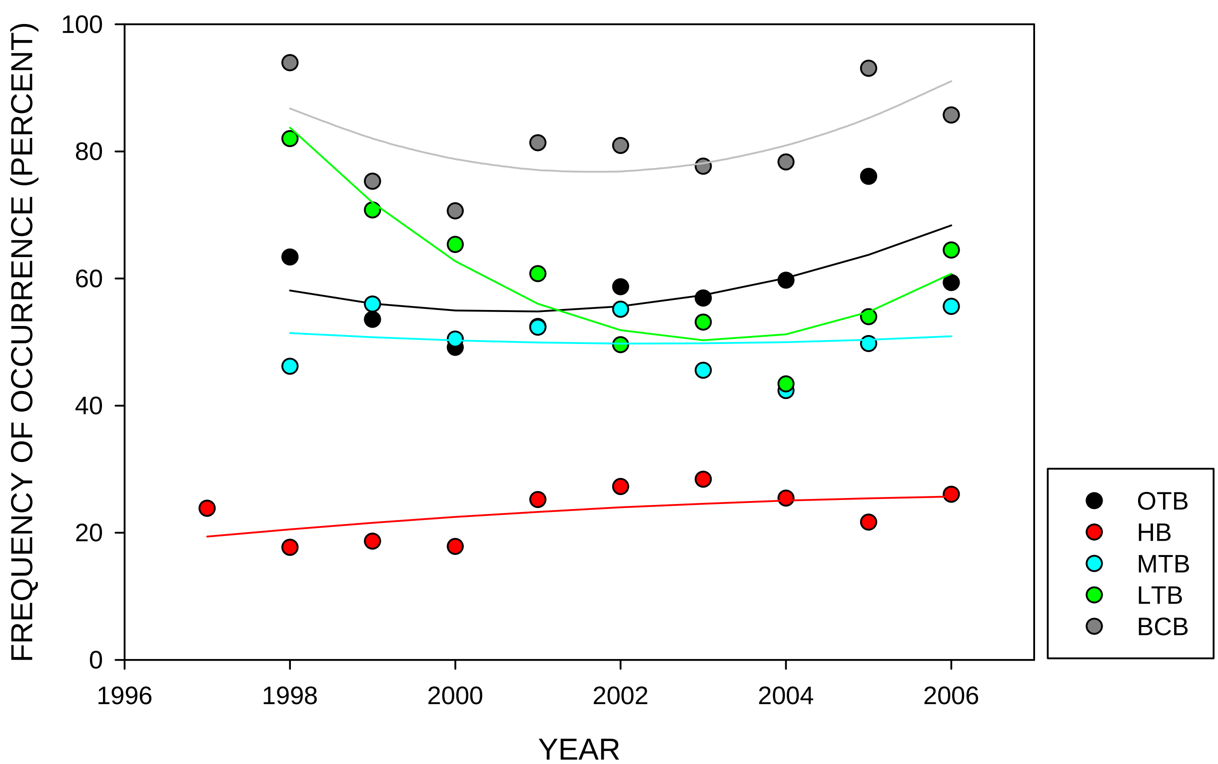


Figure 22. Percent frequency of occurrence of seagrass coverage within Tampa Bay subsections from 1997-2006.

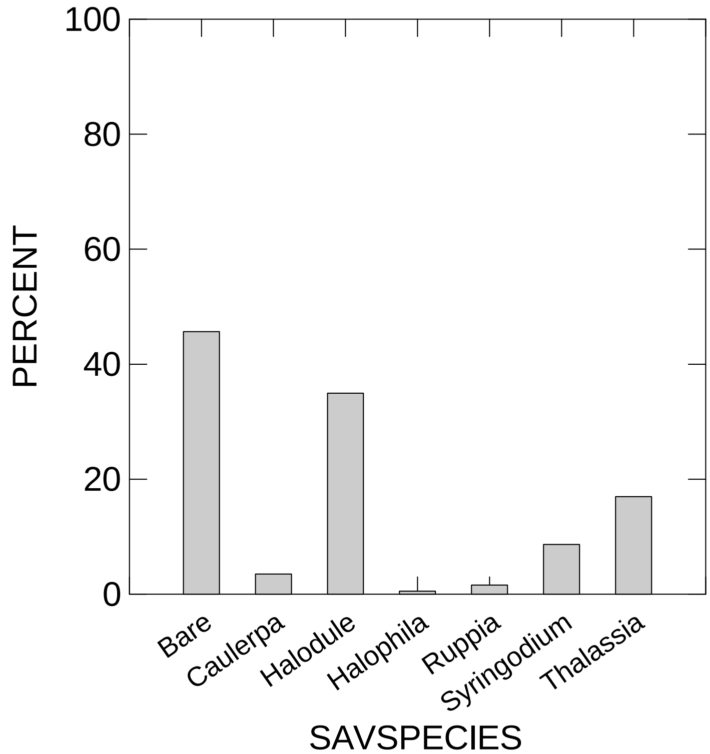


Figure 23. Average percent frequency of occurrence of seagrass coverage, *Caulerpa prolifera* coverage, and bare areas in Tampa Bay.

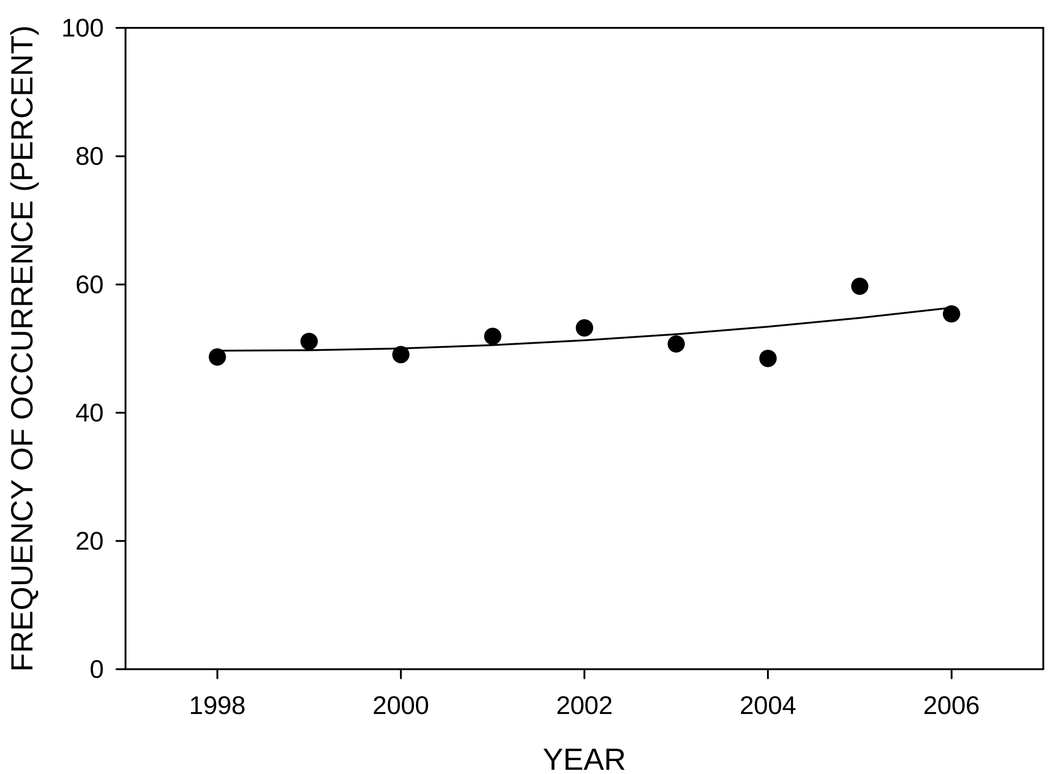


Figure 24. Percent frequency of occurrence of seagrass coverage in Tampa Bay from 1998-2006.

Table 3. Percent of N that a SAV species was found in Tampa Bay from Lewis and Phillips (1980) and this study from 1998-2006. N = number of placements containing SAV. Data from 1997 contains Hillsborough Bay transects and three upper Middle Tampa Bay transects and, therefore, are not included.

SAV Species	1980	1998	1999	2000	2001	2002	2003	2004	2005	2006
N	226	481	631	784	1026	1165	1267	1204	1760	1393
Thalassia testudinum	42.5	31.8	30.3	32.5	28.3	22.3	29.5	24.1	20.3	25.8
Halodule wrightii	40.7	55.3	58.3	51.1	56.7	57.8	48.5	52.5	48.2	51.6
Syringodium filiforme	19.0	6.7	7.8	12.2	9.7	13.7	14.8	15.2	13	17.1
Ruppia maritima	15.5	3.3	0.2	1.4	0.5	1.0	3.2	3.7	3.8	2.0
Halophila engelmanni	0	0	0.8	0.5	0.2	0.2	0	0.4	3.2	0.3
Caulerpa prolifera	NR	2.9	2.7	2.2	3.2	5.0	4.0	7.1	11.5	3.2

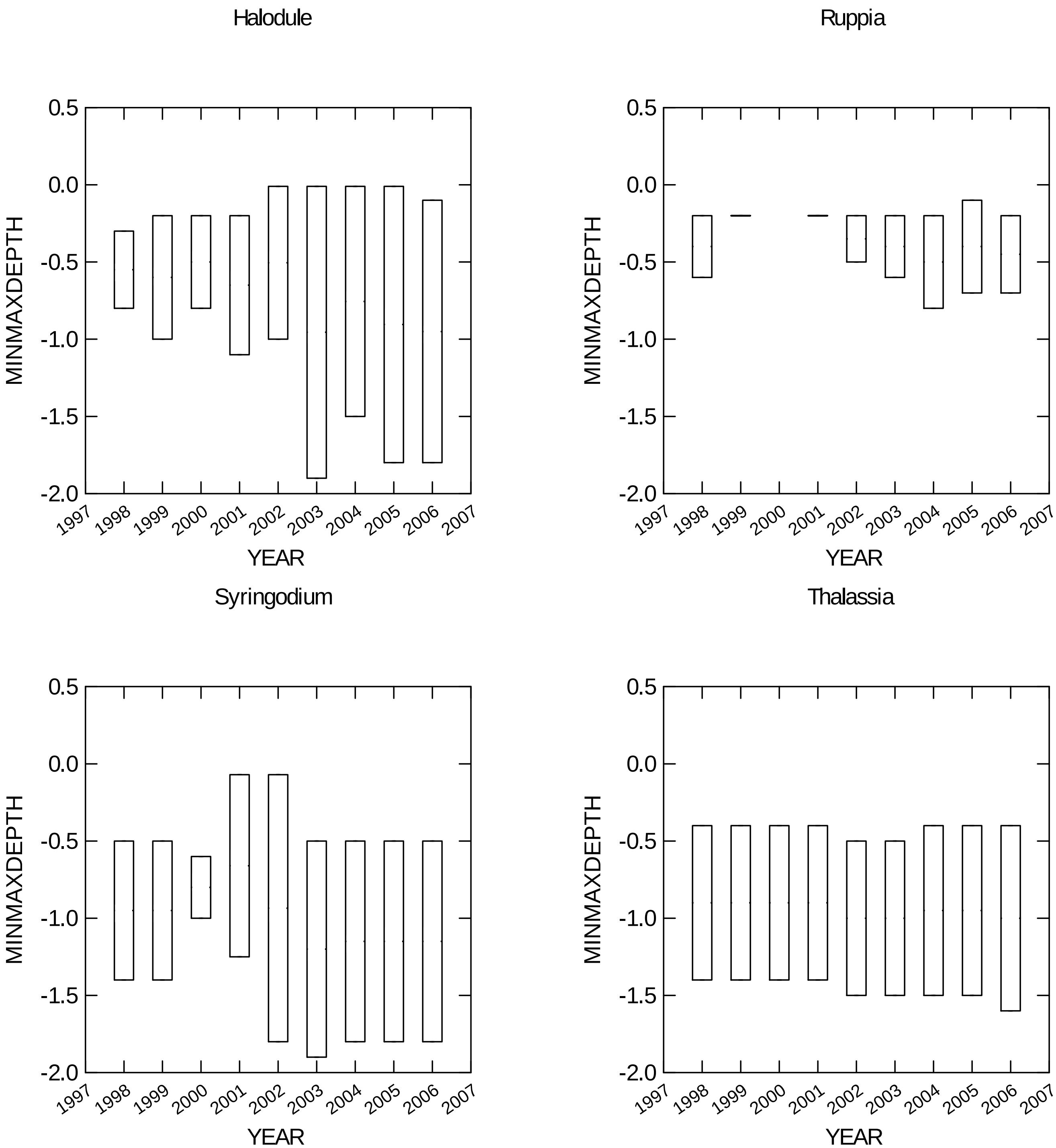


Figure 25. Depth ranges (meters, local mean tide level) of *H. wrightii, R. maritima*, *S. filiforme*, and *T. testudinum* from contours developed for Old Tampa Bay management areas: MA20, MA21, MA25, and MA26.

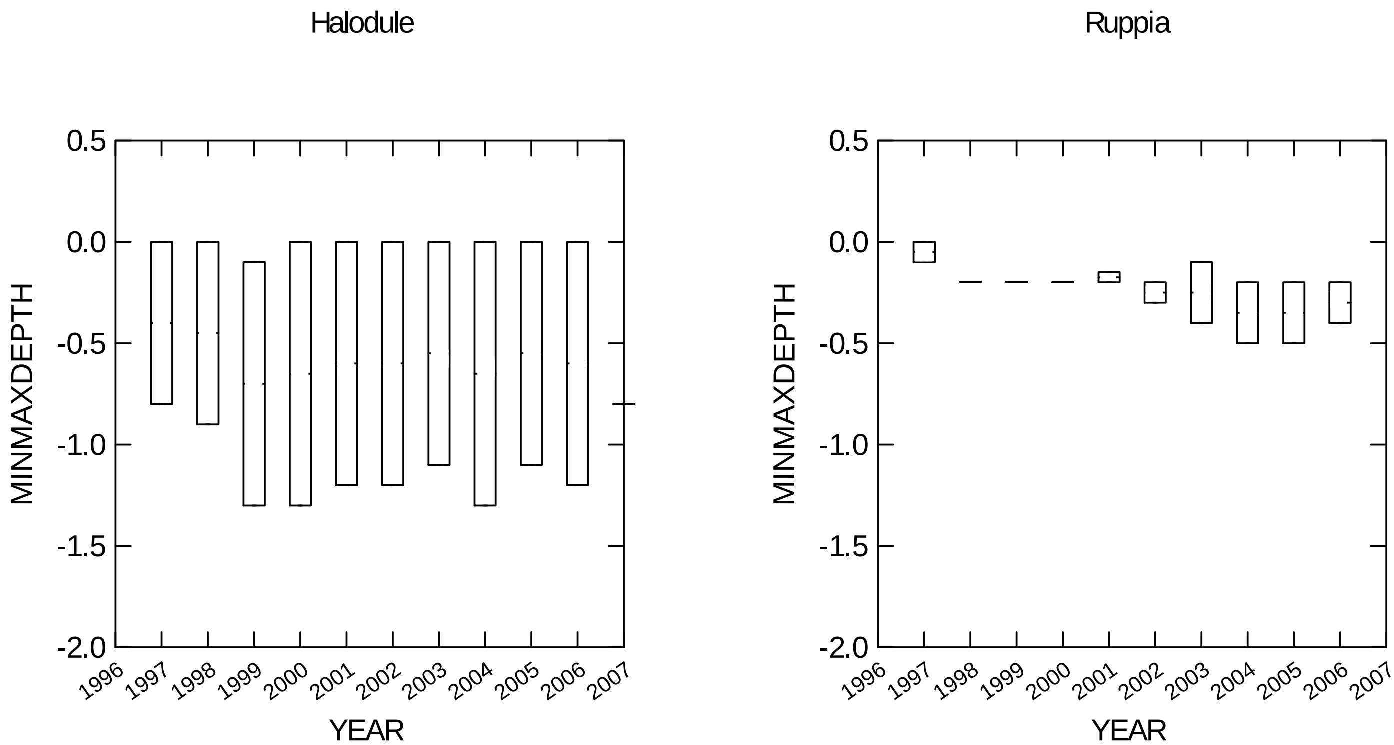


Figure 26. Depth ranges (meters, local mean tide level) of *H. wrightii* and *R. maritima* from contours developed for Hillsborough Bay management areas: MA1, MA2, MA3, MA4, and MA5.

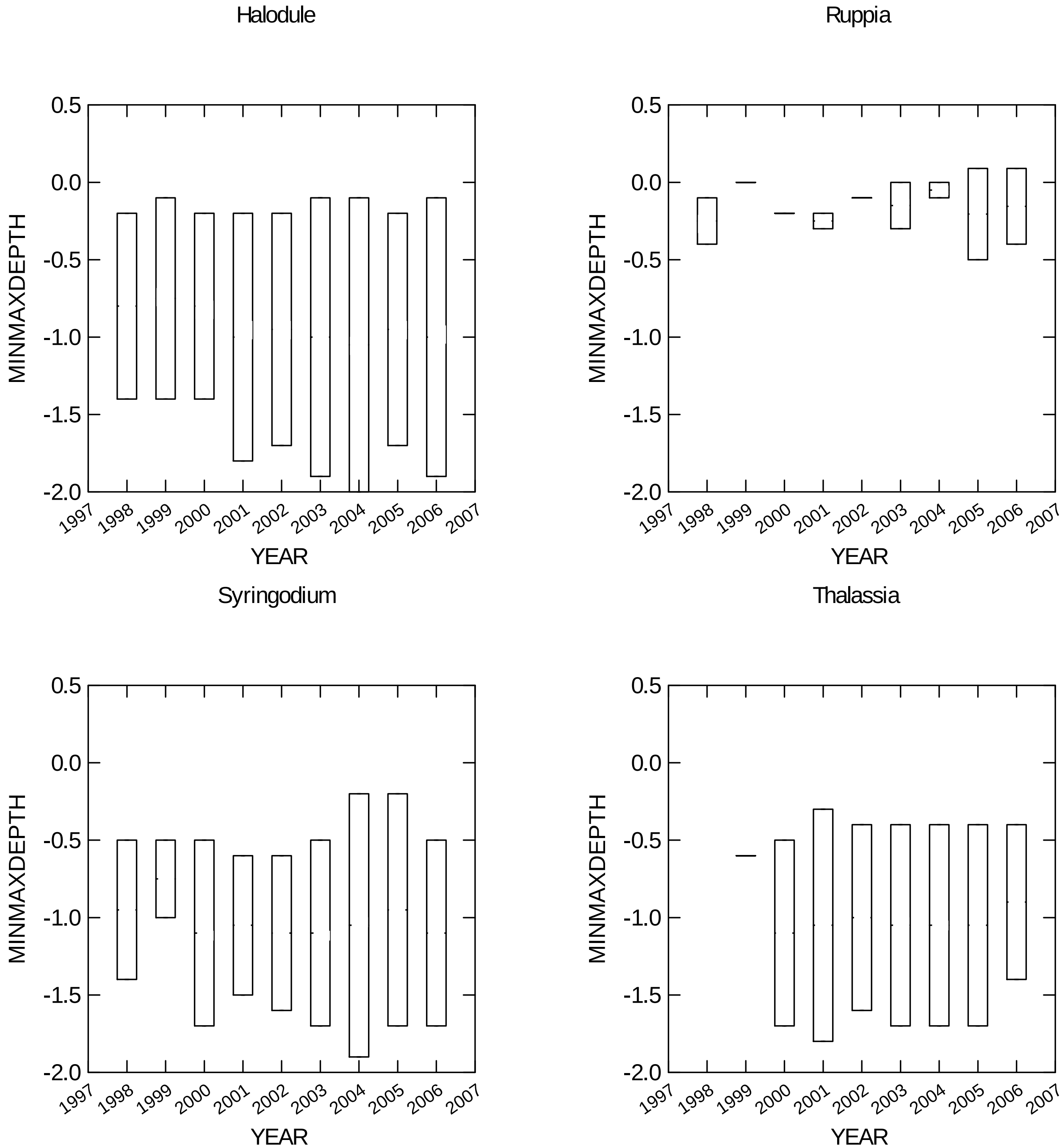
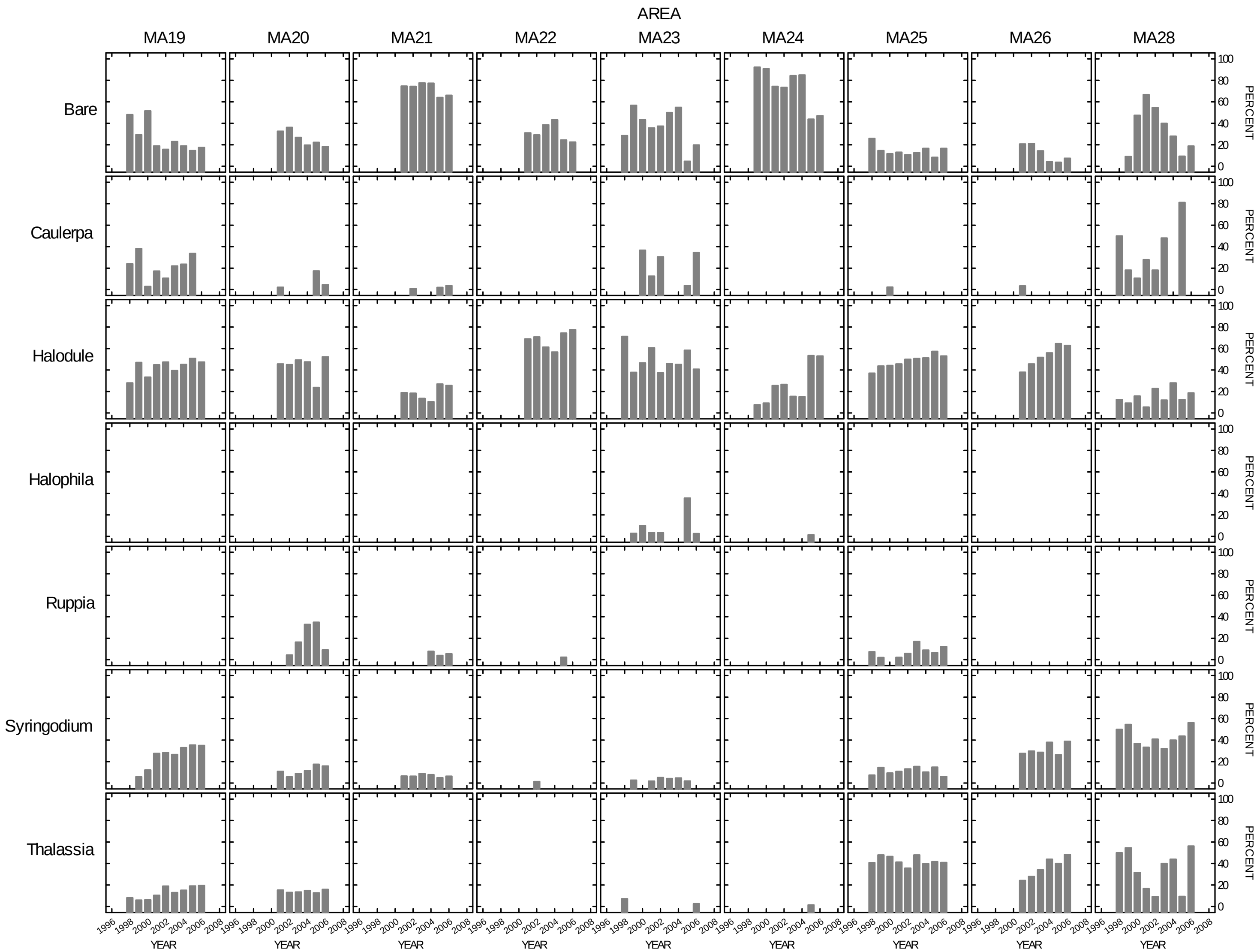
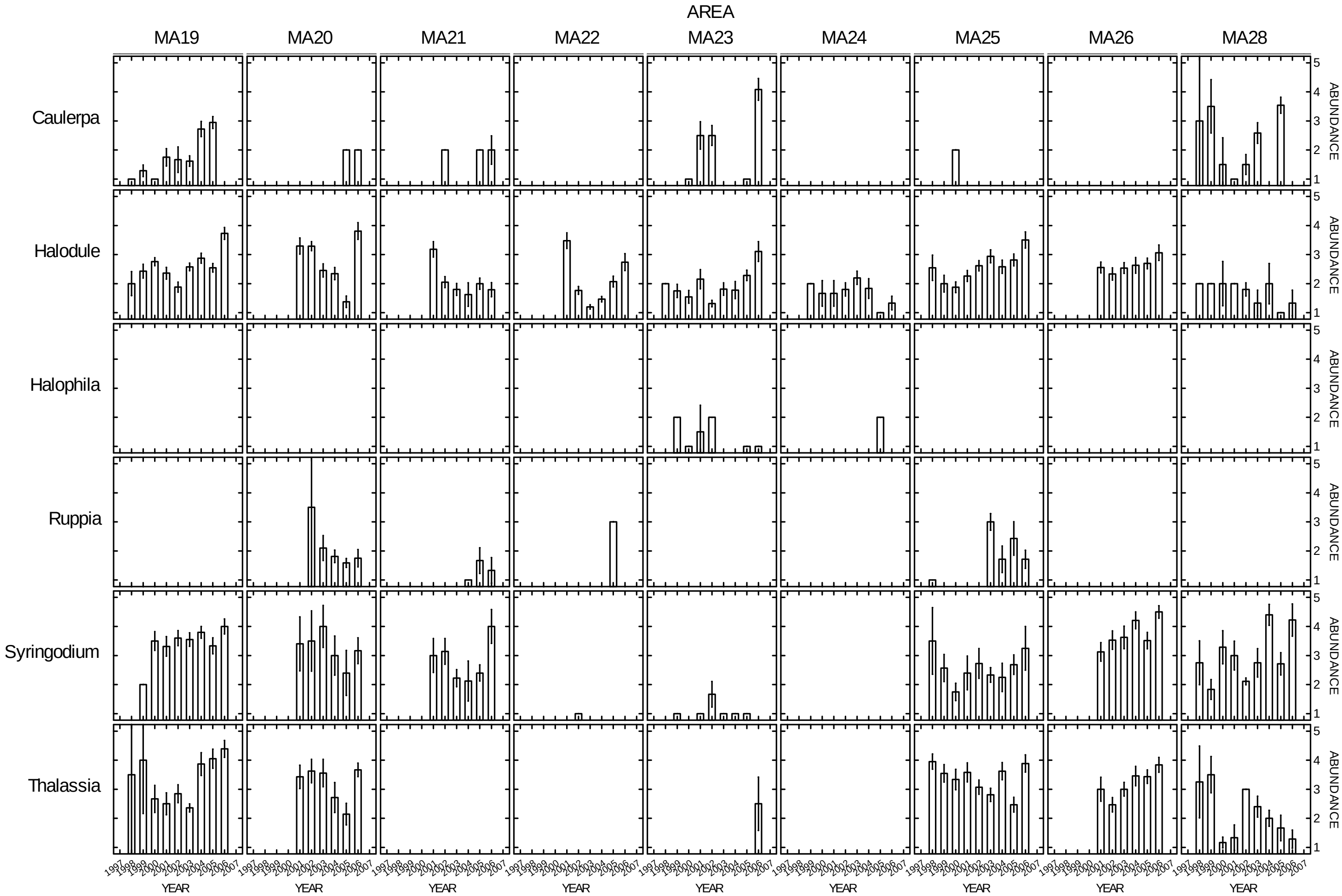


Figure 27. Depth ranges (meters, local mean tide level) of *H. wrightii*, *R. maritima*, *S. filiforme*, and *T. testudinum* from contours developed for Middle Tampa Bay management areas: MA6, MA18, and MA27.

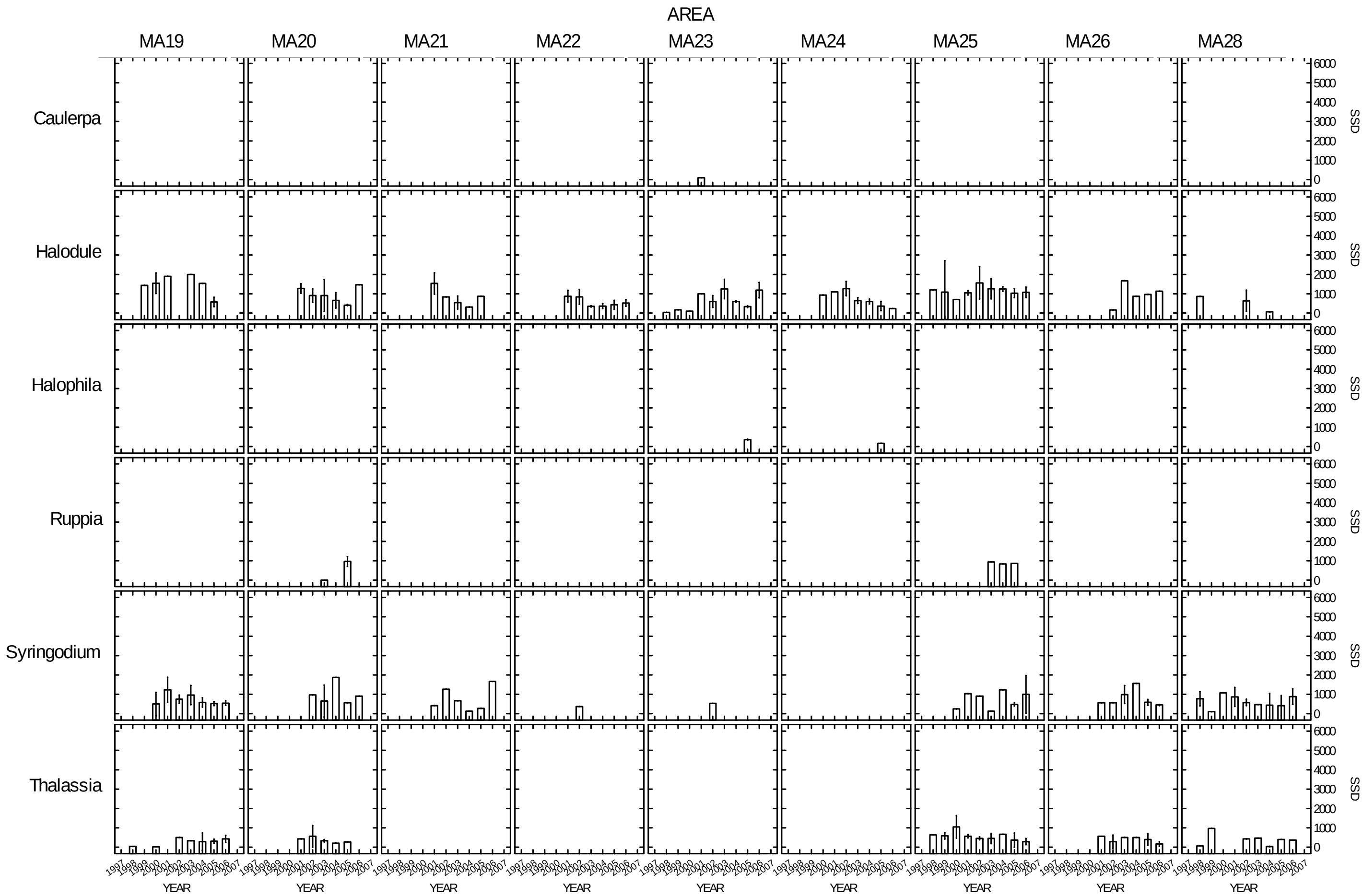
Appendix A



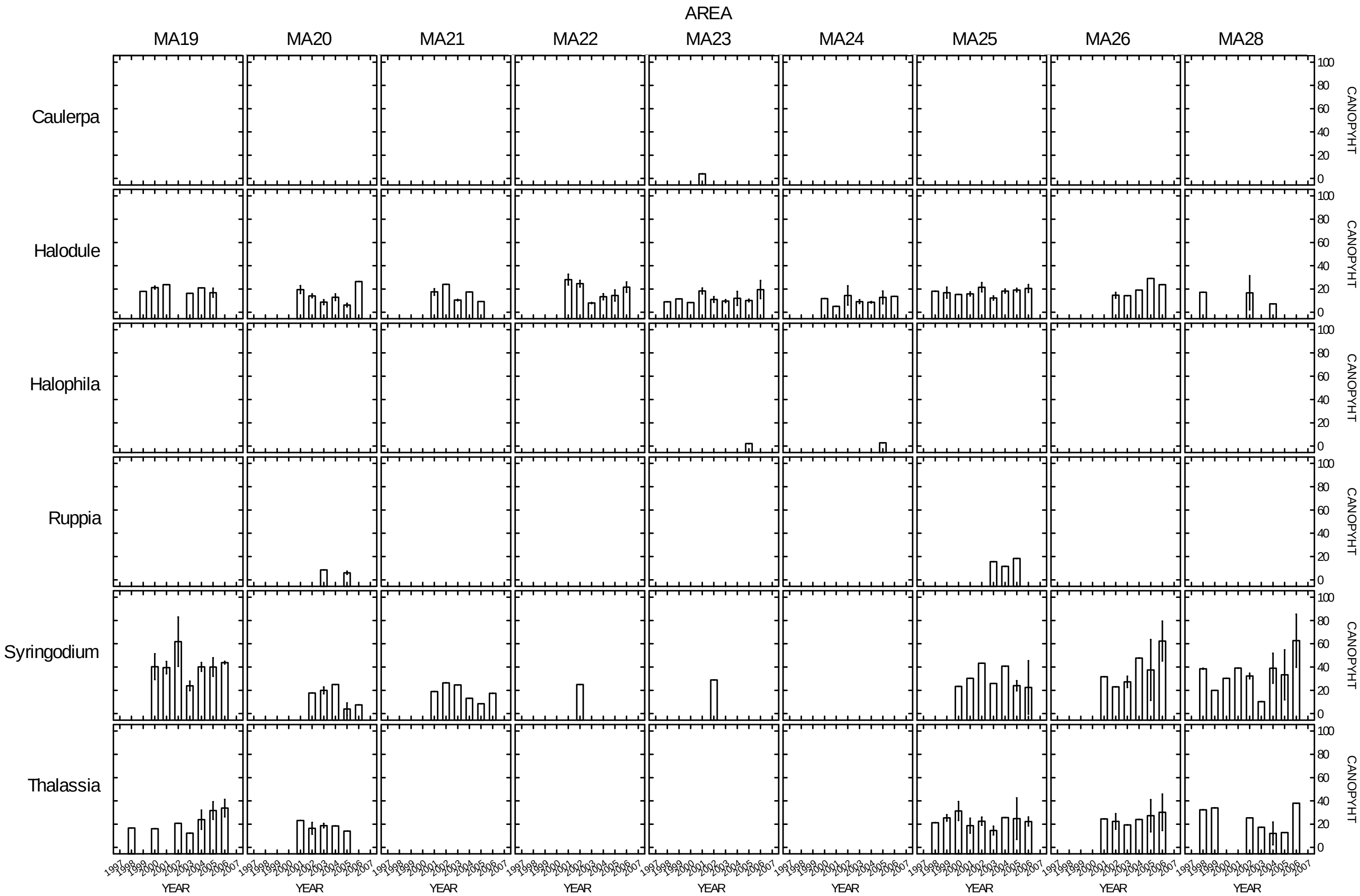
OTB1. Percent frequency of occurrence of seagrass coverage, *Caulerpa prolifera* coverage, and bare areas SAV coverage within Old Tampa Bay Management Areas from 1998-2006.



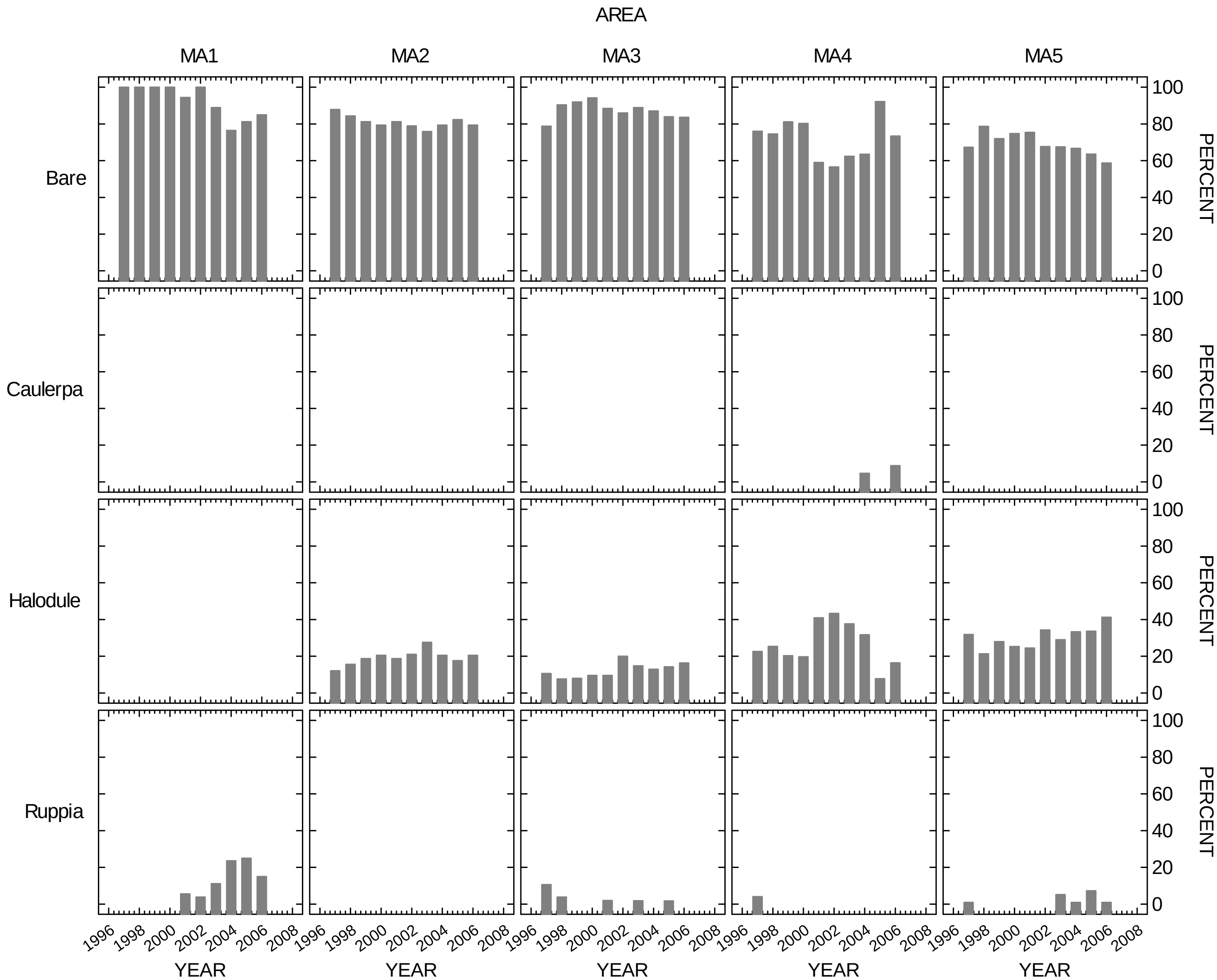
OTB2. Abundance (Braun Blanquet class coverage) of SAV coverage within Old Tampa Bay Management Areas from 1998-2006. Error bars equal 1SE.



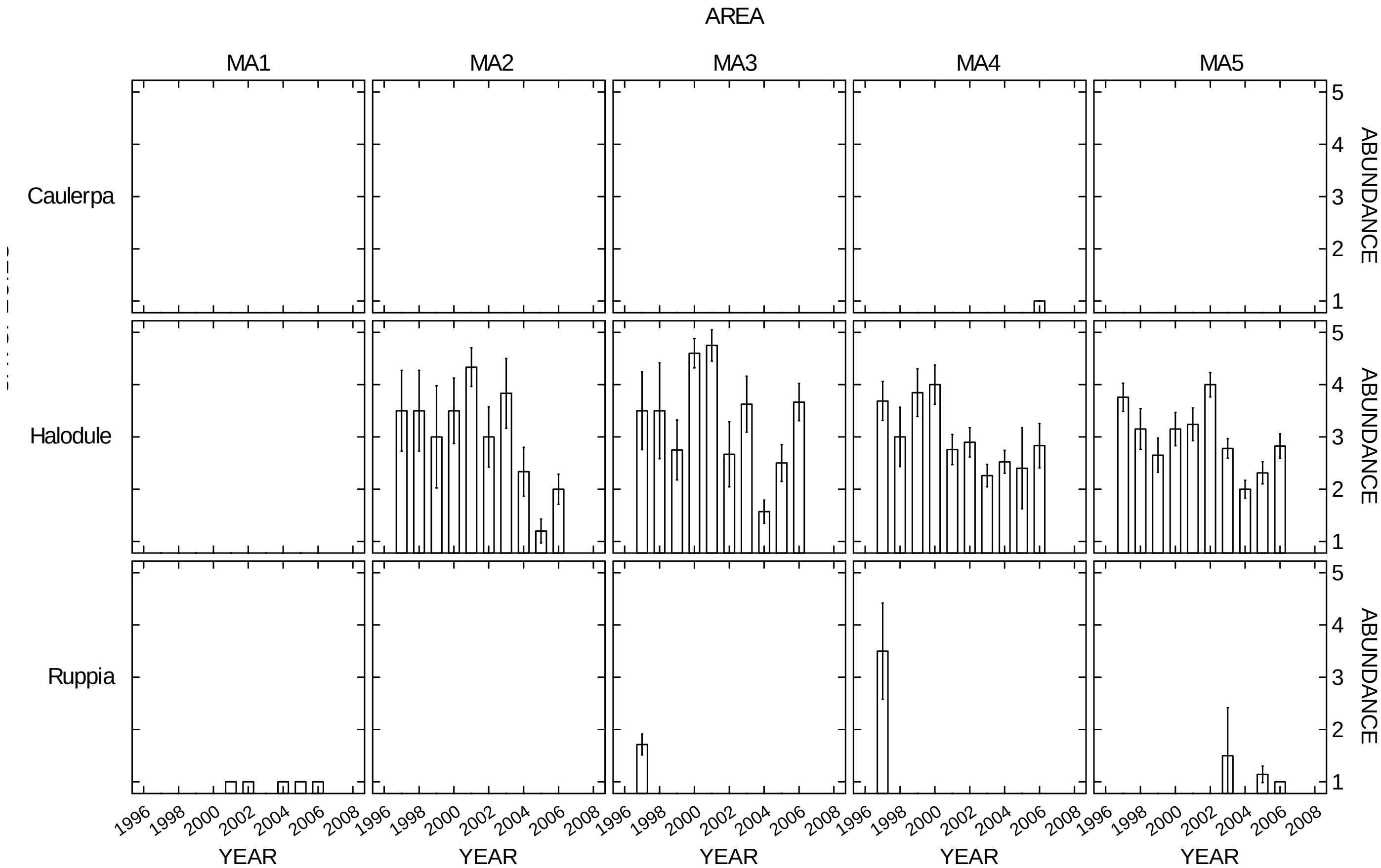
OTB3. Short shoot density ($SSDm^{-2}$) of SAV species within the Old Tampa Bay Management Areas from 1998-2006. Error bars equal 1SE.



OTB4. Canopy height (cm) of SAV species within the Old Tampa Bay Management Areas from 1998-2006. Error bars equal 1SE.

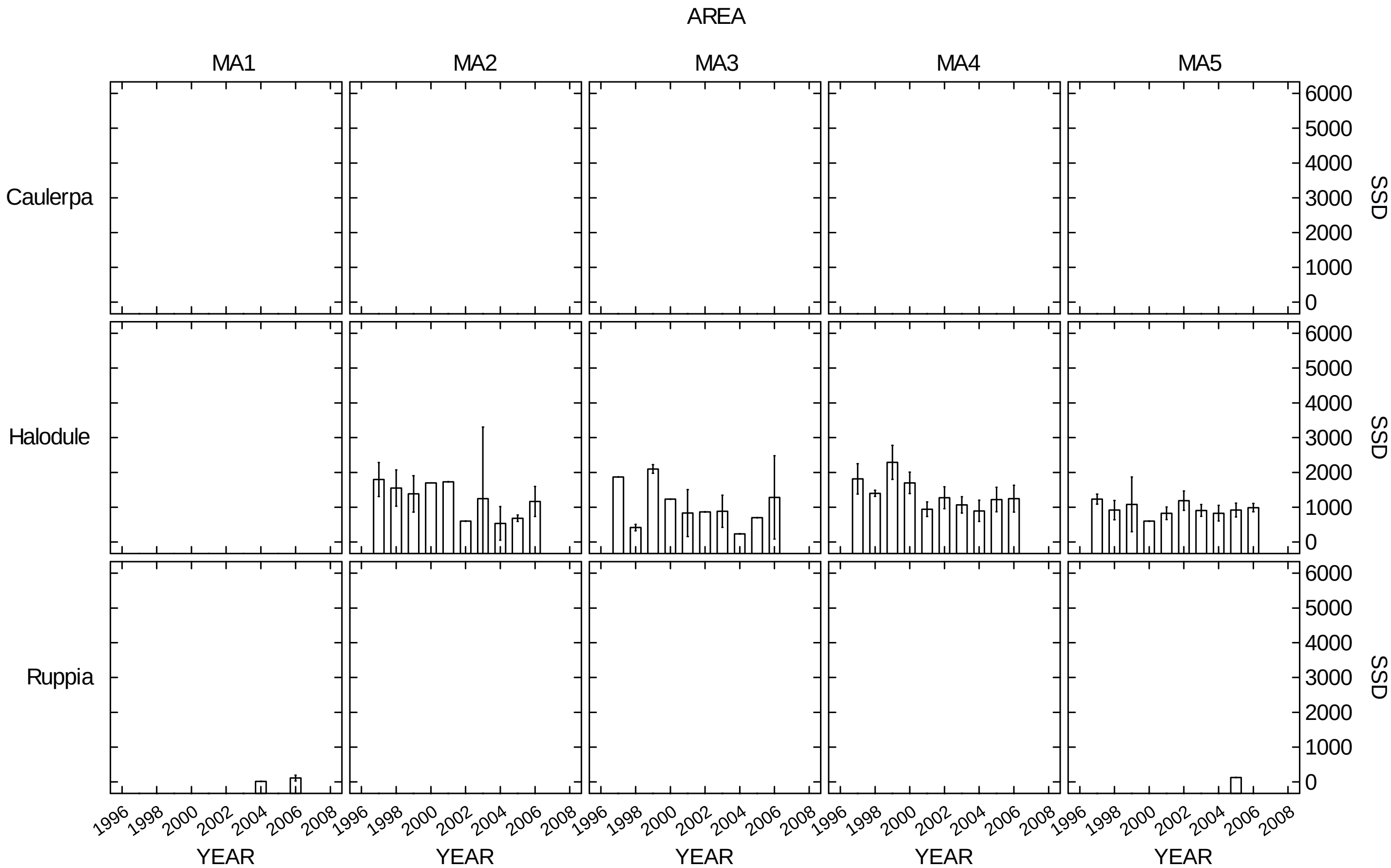


HB1. Percent frequency of occurrence of seagrass coverage, *Caulerpa prolifera* coverage, and bare areas within Hillsborough Bay Management Areas from 1997-2006.

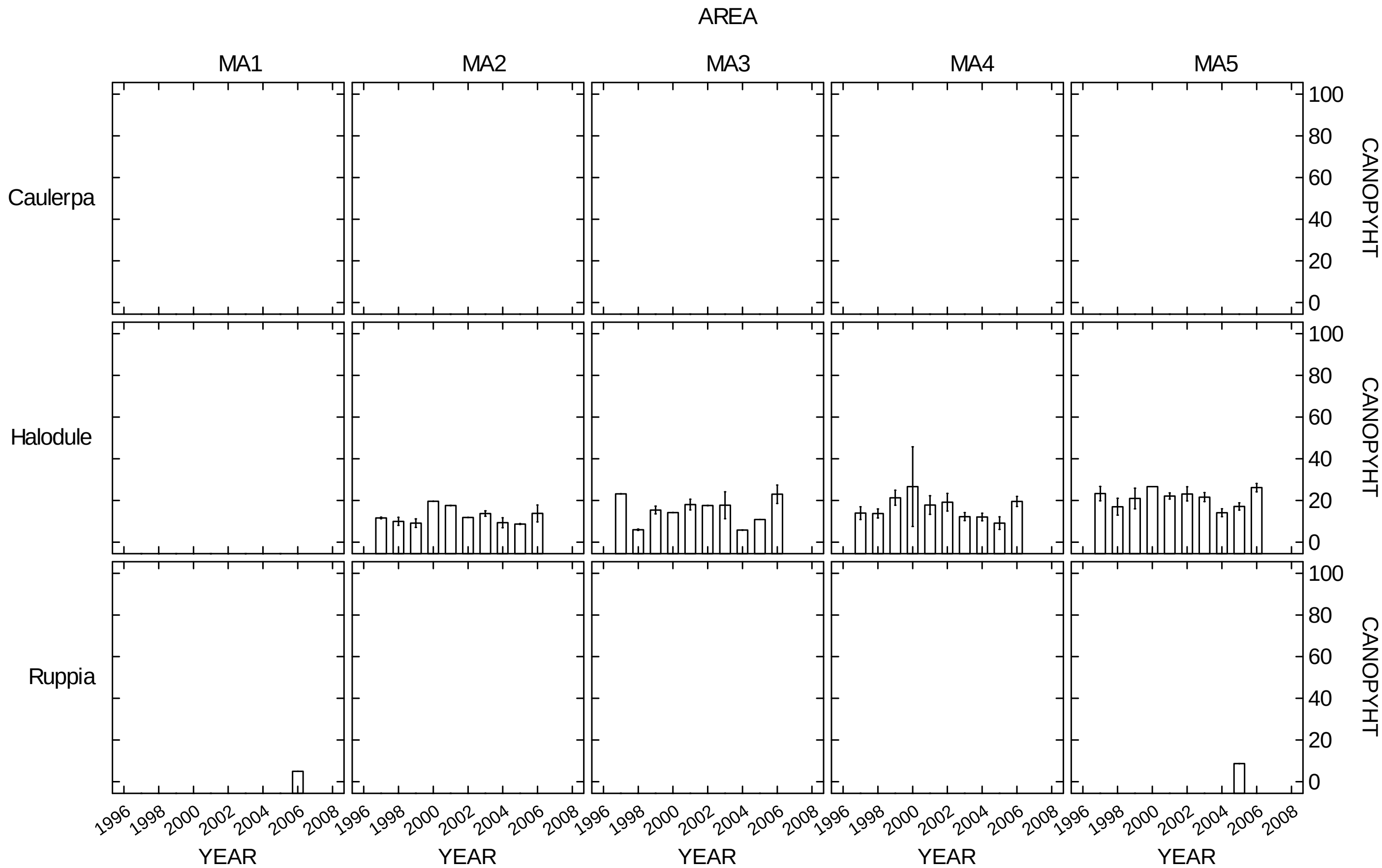


HB2. Abundance (Braun Blanquet class coverage) of SAV coverage within Hillsborough Bay Management Areas from 1997-2006. Error bars equal 1SE.

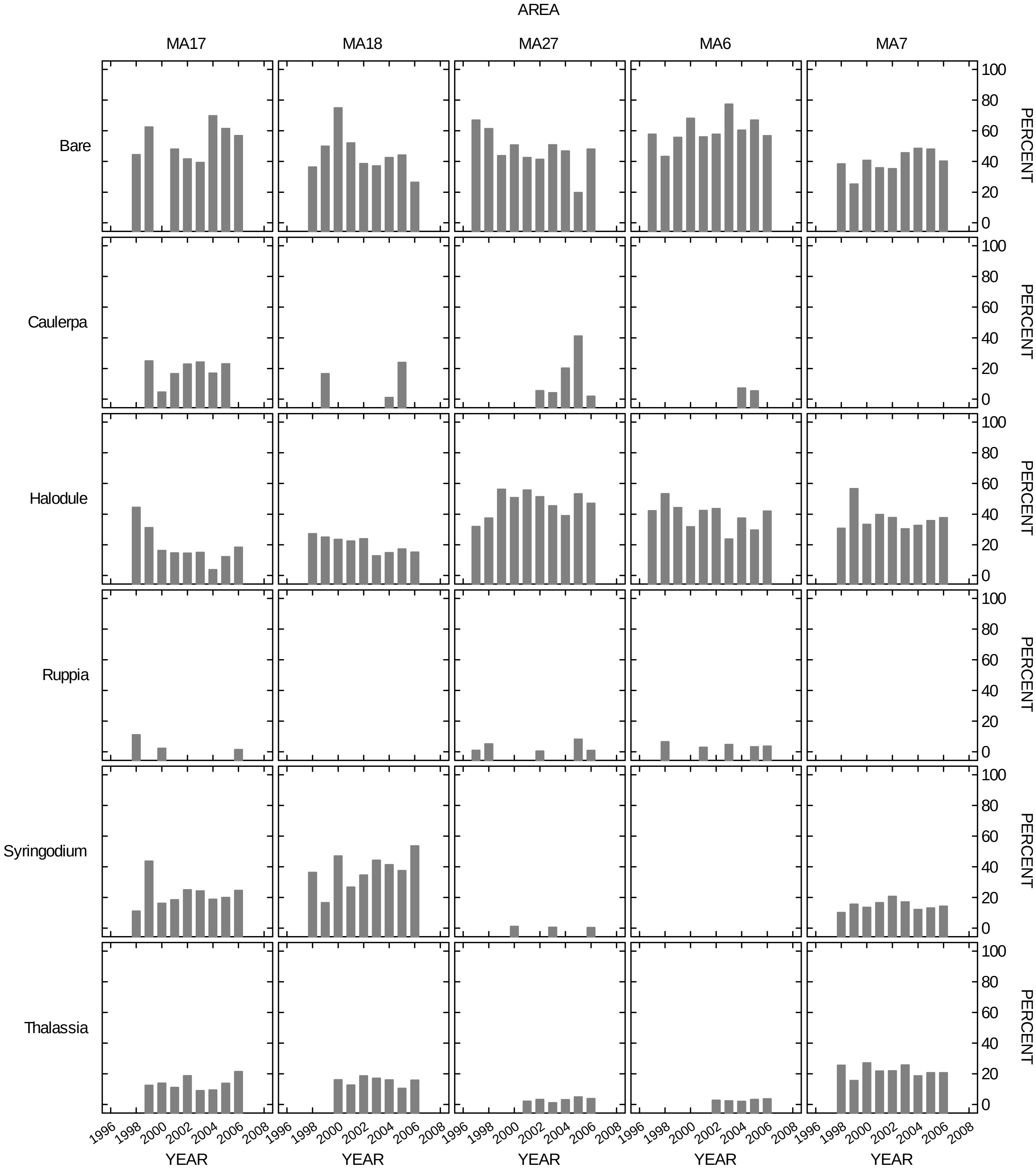
.



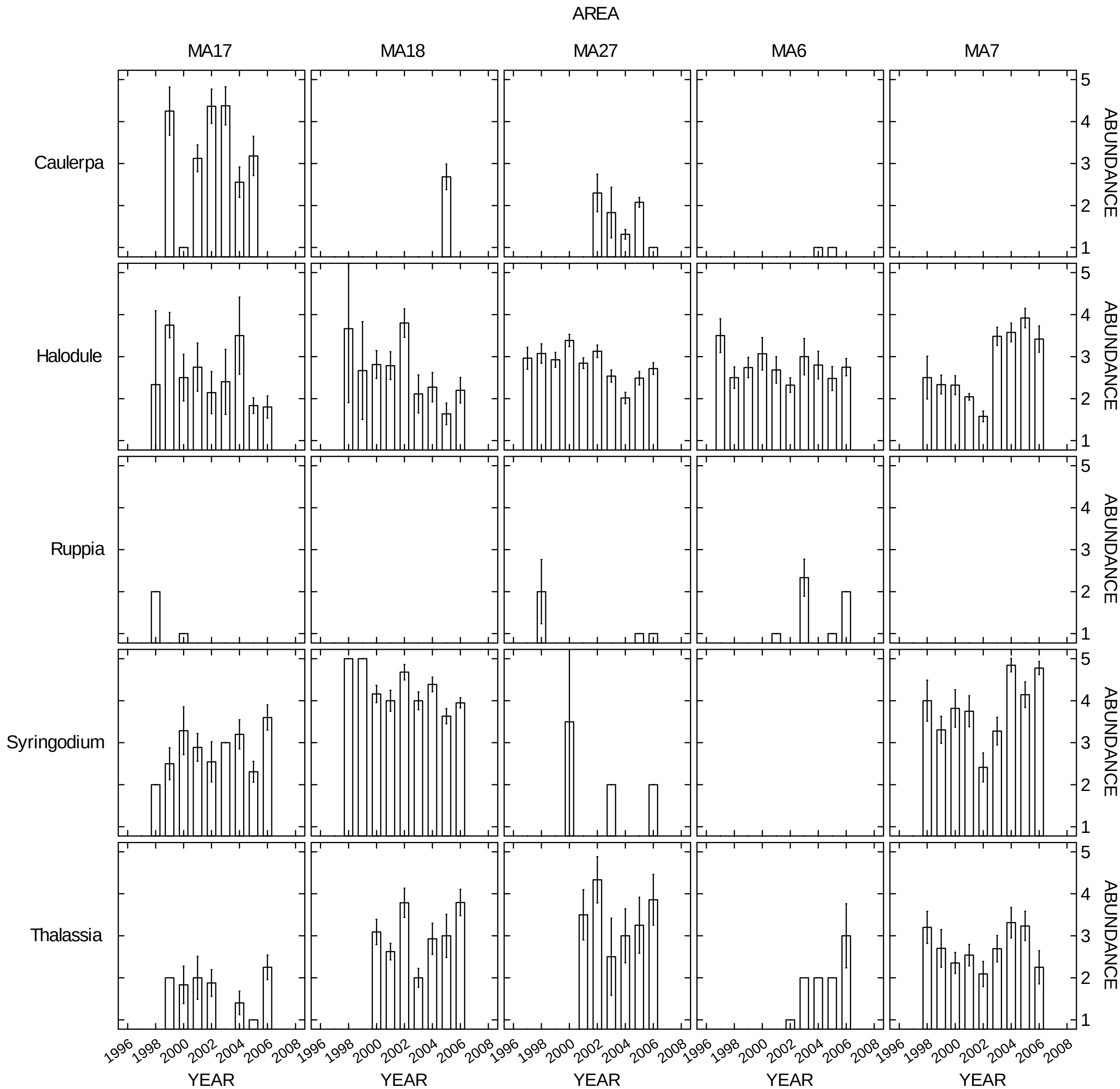
HB3. Short shoot density (SSDm^{-2}) of SAV species within the Hillsborough Bay Management Areas from 1997-2006. Error bars equal 1SE.



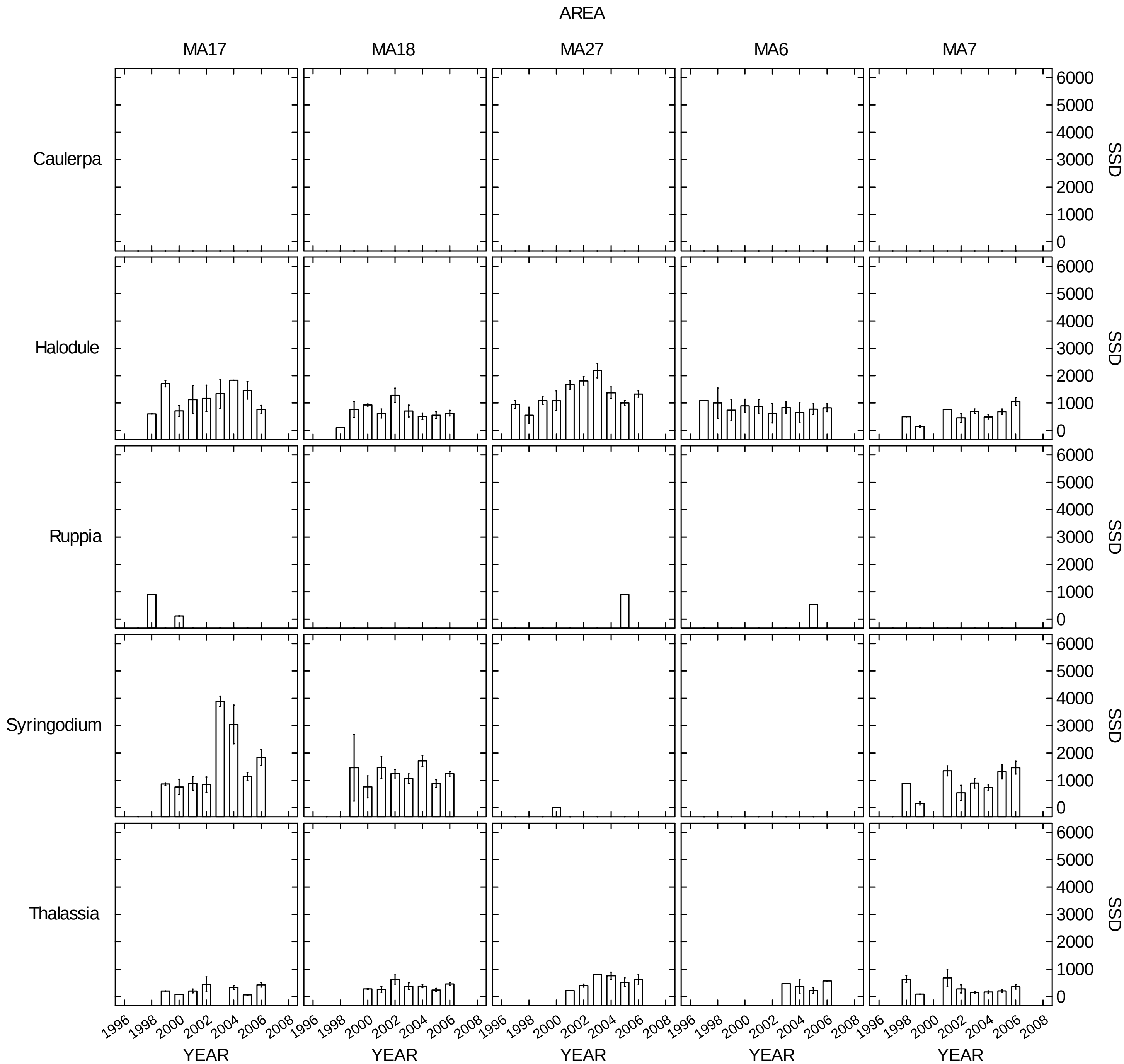
HB4. Canopy height (cm) of SAV species within the Hillsborough Bay Management Areas from 1997-2006. Error bars equal 1SE.



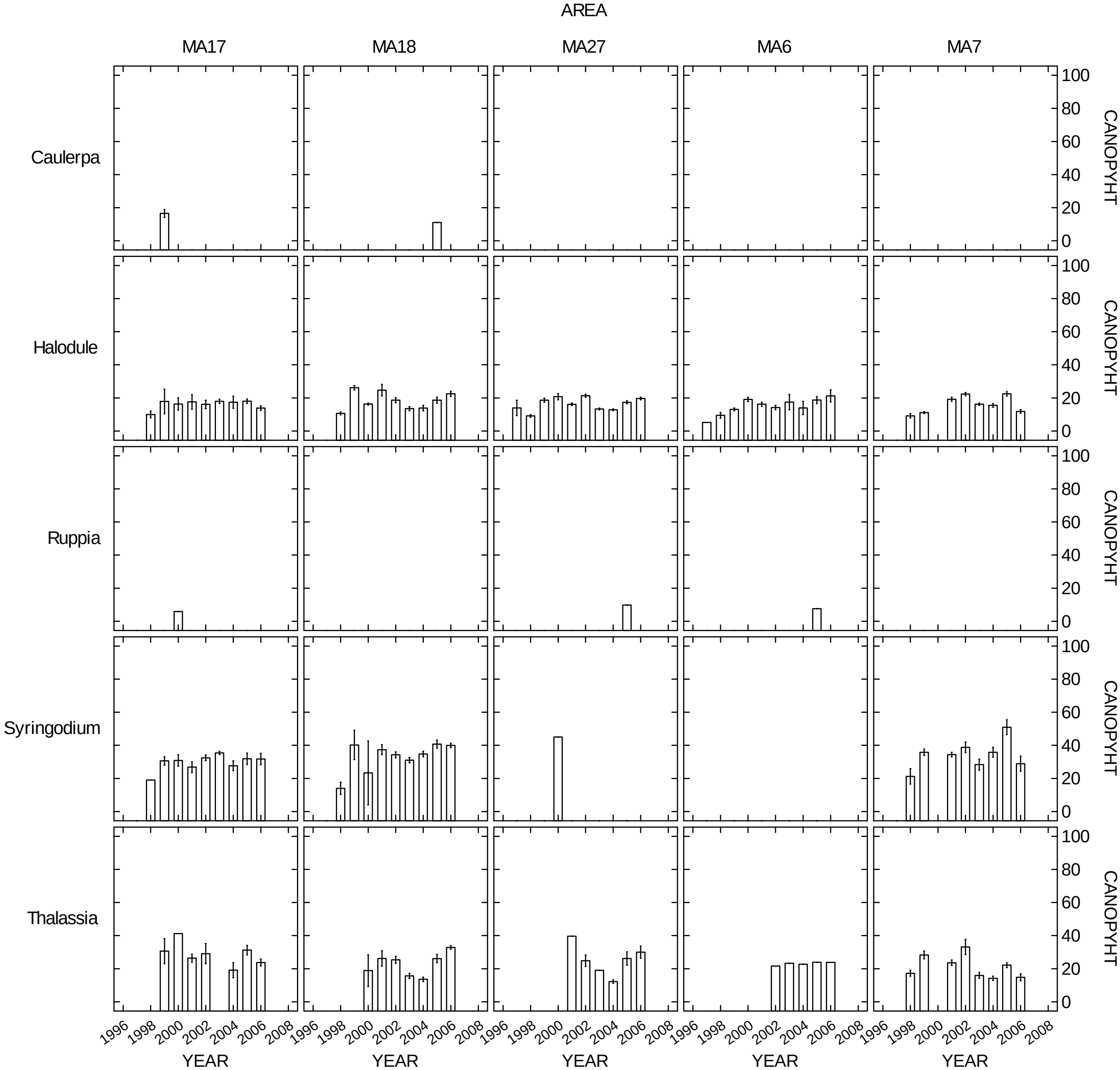
MTB1. Percent frequency of occurrence of seagrass coverage, *Caulerpa prolifera* coverage, and bare areas within Middle Tampa Bay Management Areas from 1998-2006.



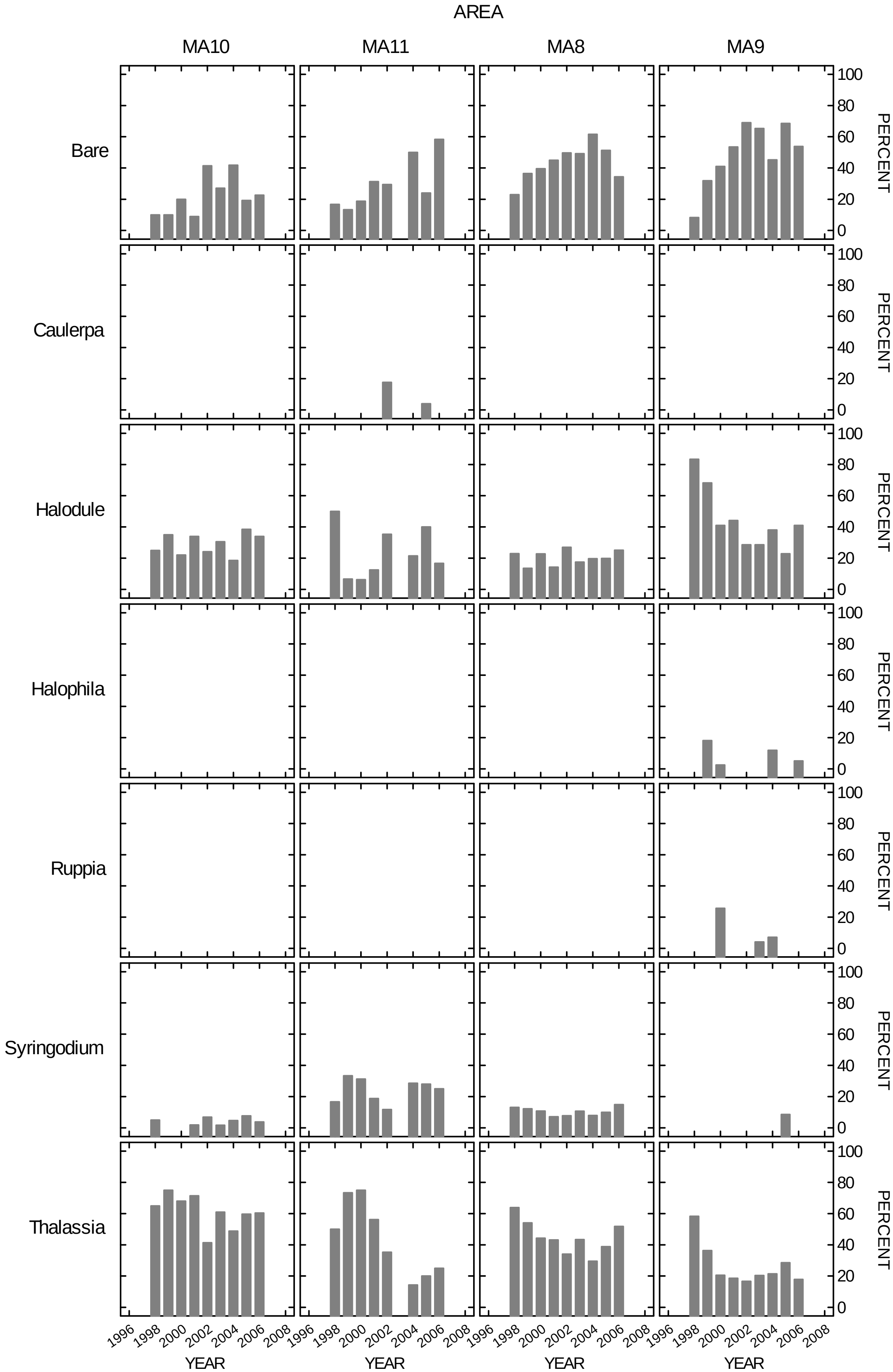
MTB2. Abundance (Braun Blanquet class coverage) of SAV coverage within Middle Tampa Bay Management Areas from 1998-2006. Error bars equal 1SE.



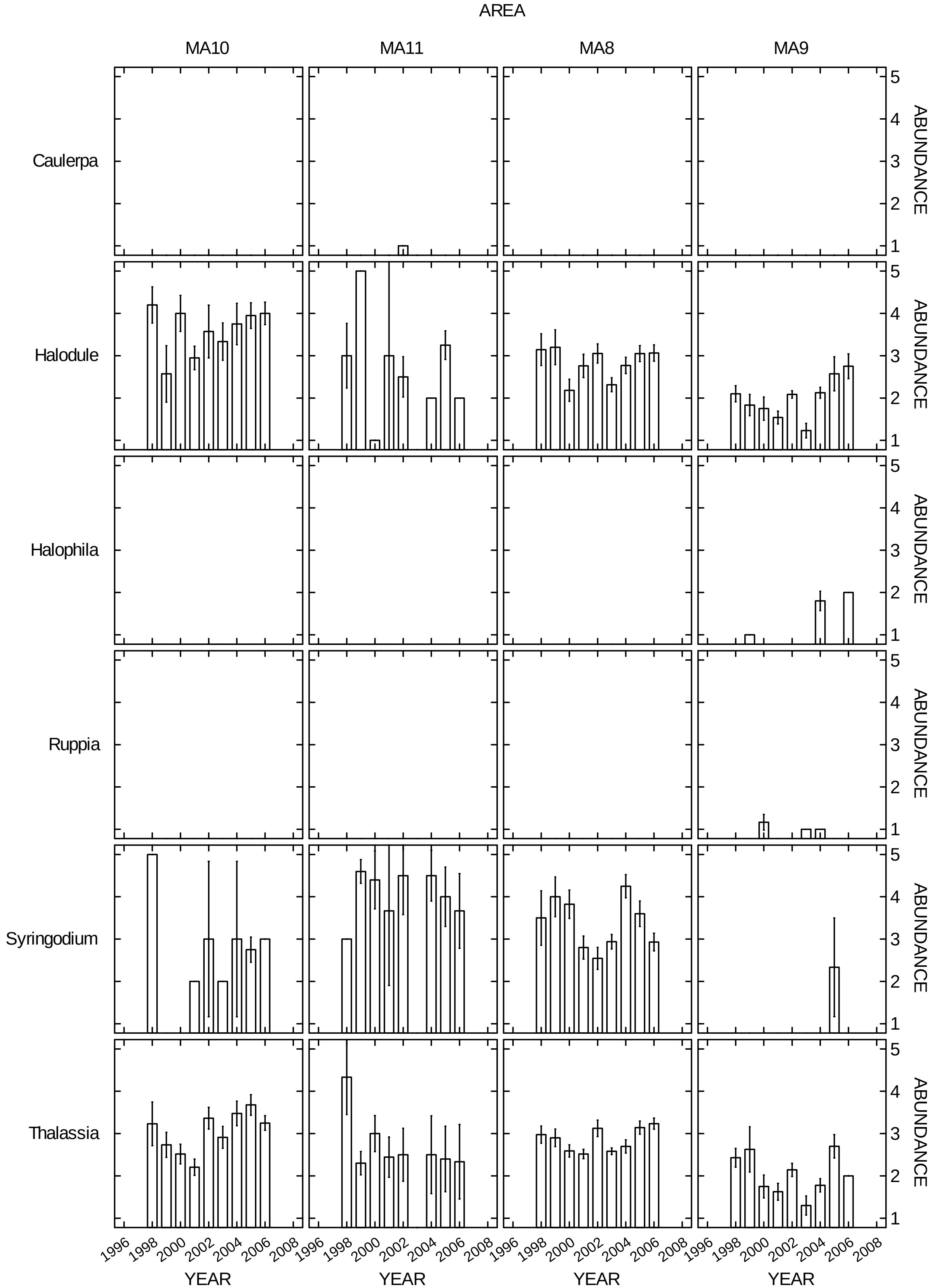
MTB3. Short shoot density ($SSDm^{-2}$) of SAV species within the Middle Tampa Bay Management Areas from 1998-2006. Error bars equal 1SE.



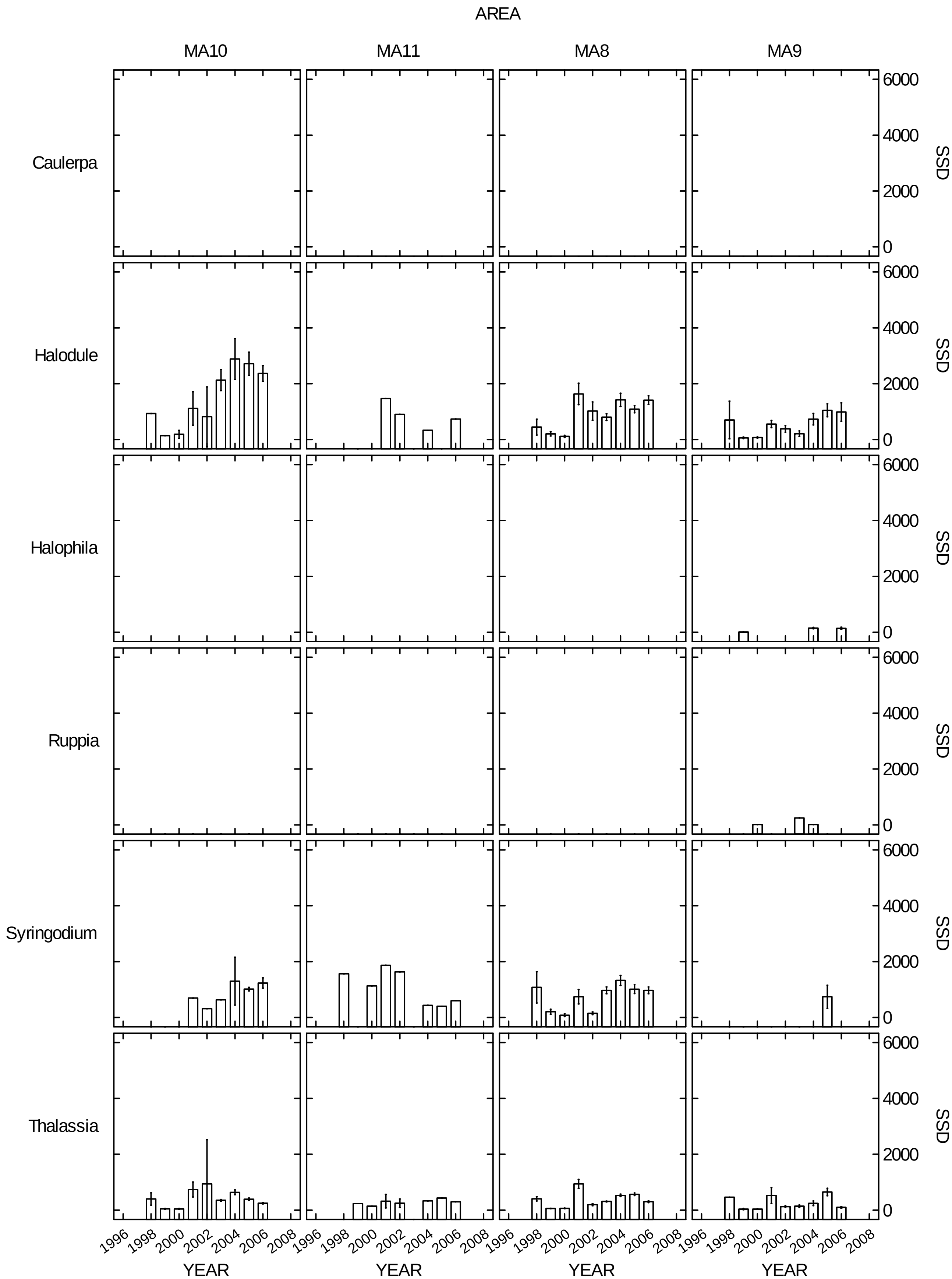
MTB4. Canopy height (cm) of SAV species within the Middle Tampa Bay Management Areas from 1998-2006. Error bars equal 1SE.



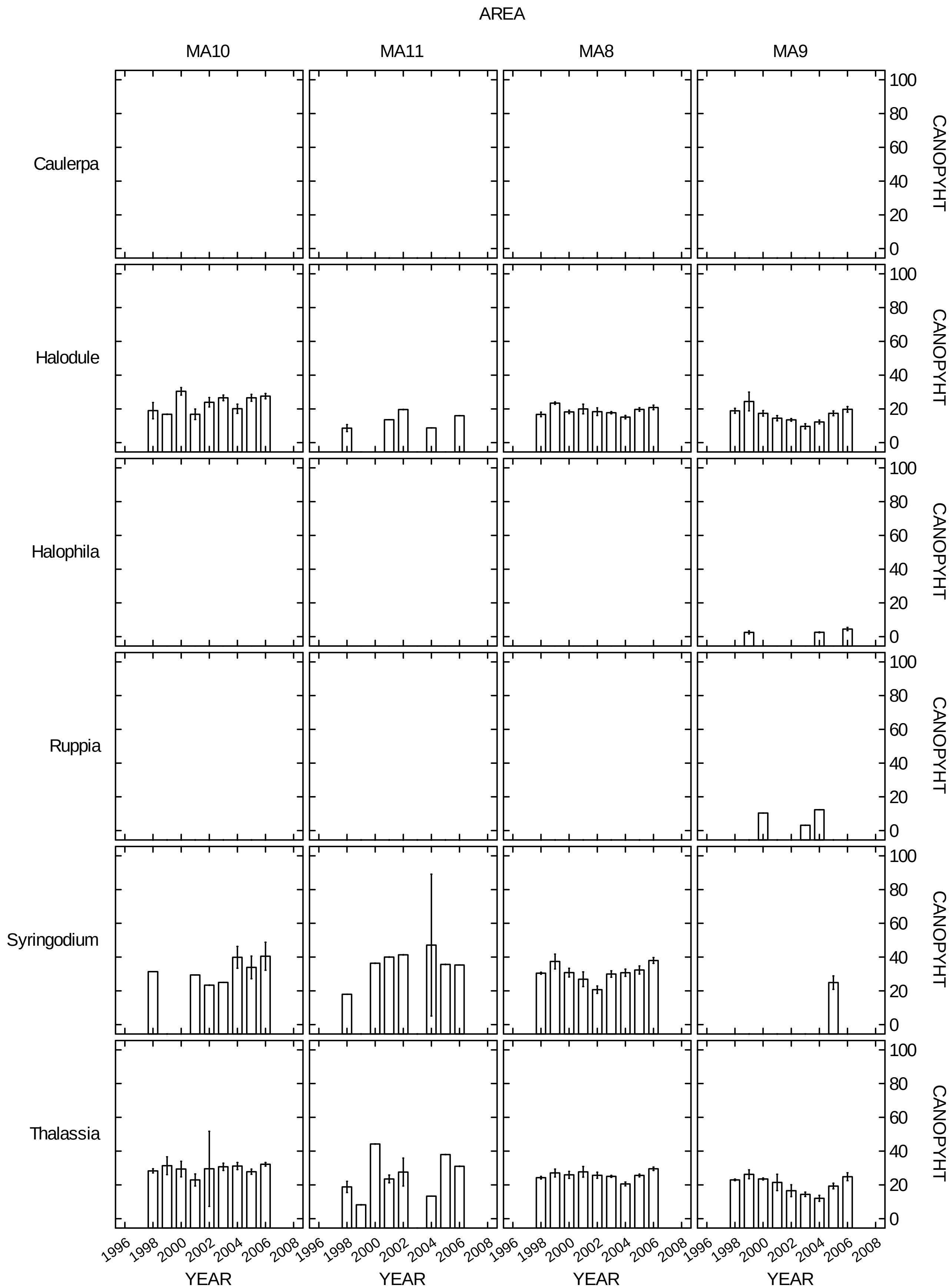
LTB1. Percent frequency of occurrence of seagrass coverage, *Caulerpa prolifera* coverage, and bare areas within Lower Tampa Bay Management Areas from 1998-2006.



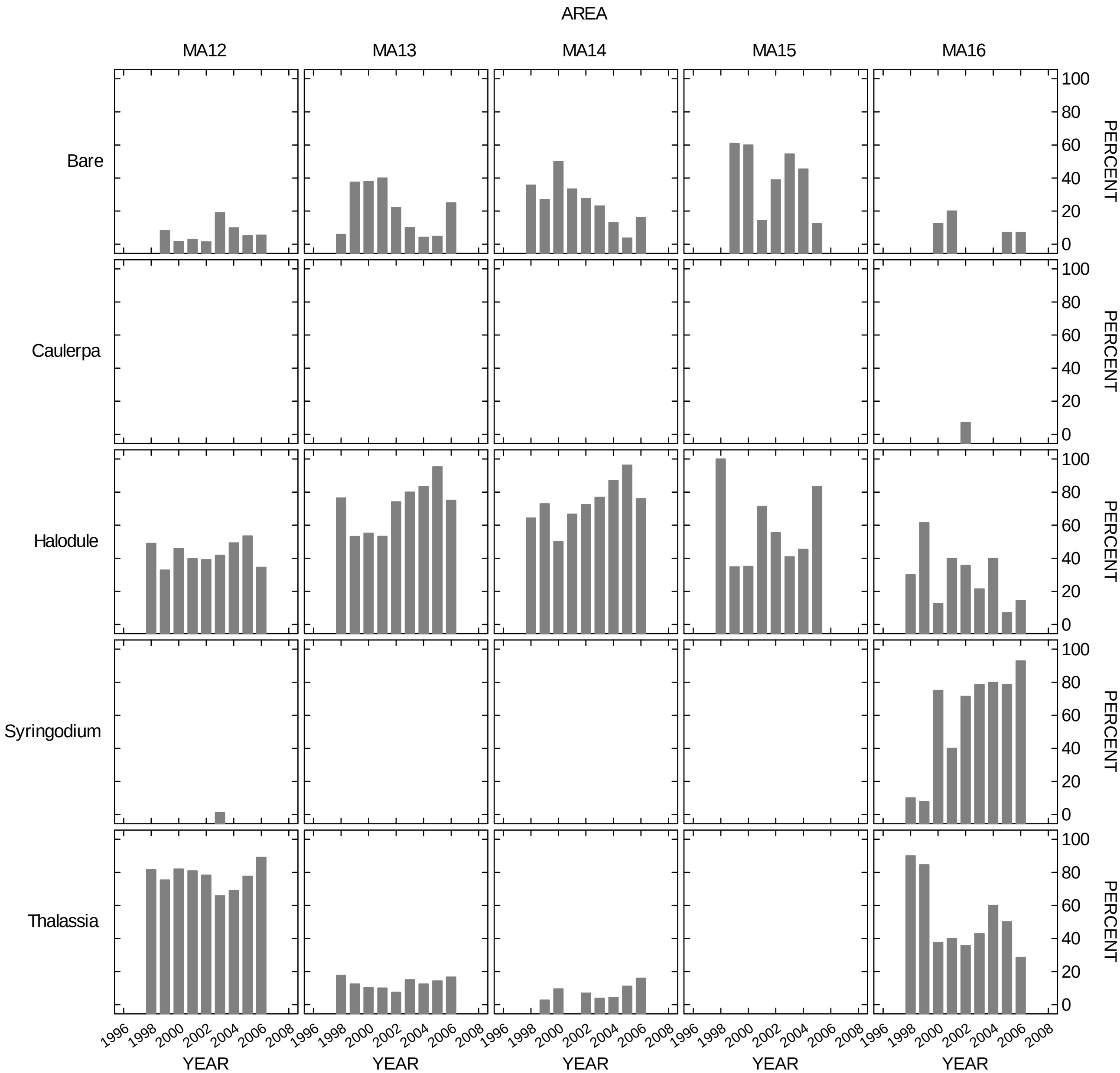
LTB2. The abundance (Braun Blanquet class coverage) of SAV coverage within Lower Tampa Bay Management Areas from 1998-2006. Error bars equal 1SE.



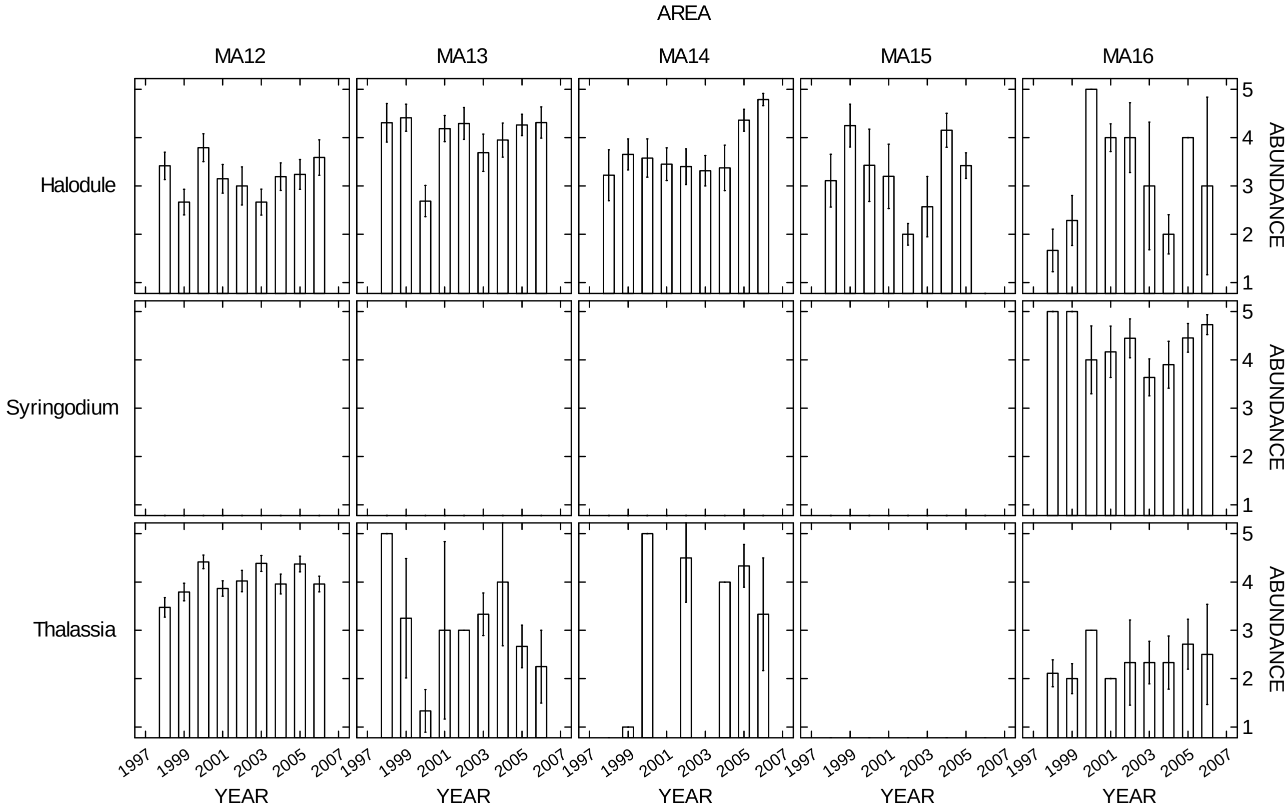
LTB3. Short shoot density ($SSDm^{-2}$) of SAV species within the Lower Tampa Bay Management Areas from 1998-2006. Error bars equal 1SE.



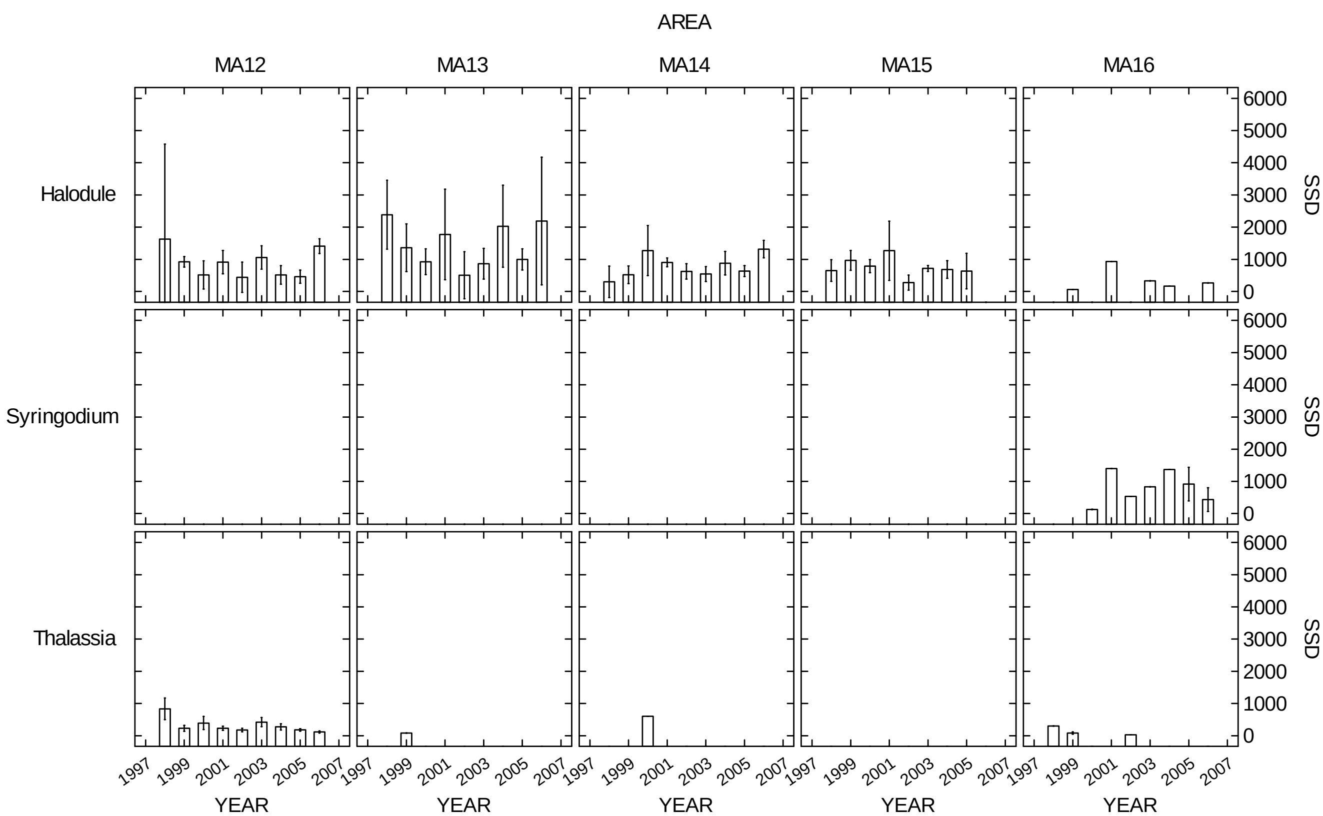
LTB4. Canopy height (cm) of SAV species within the Lower Tampa Bay Management Areas from 1998-2006. Error bars equal 1SE.



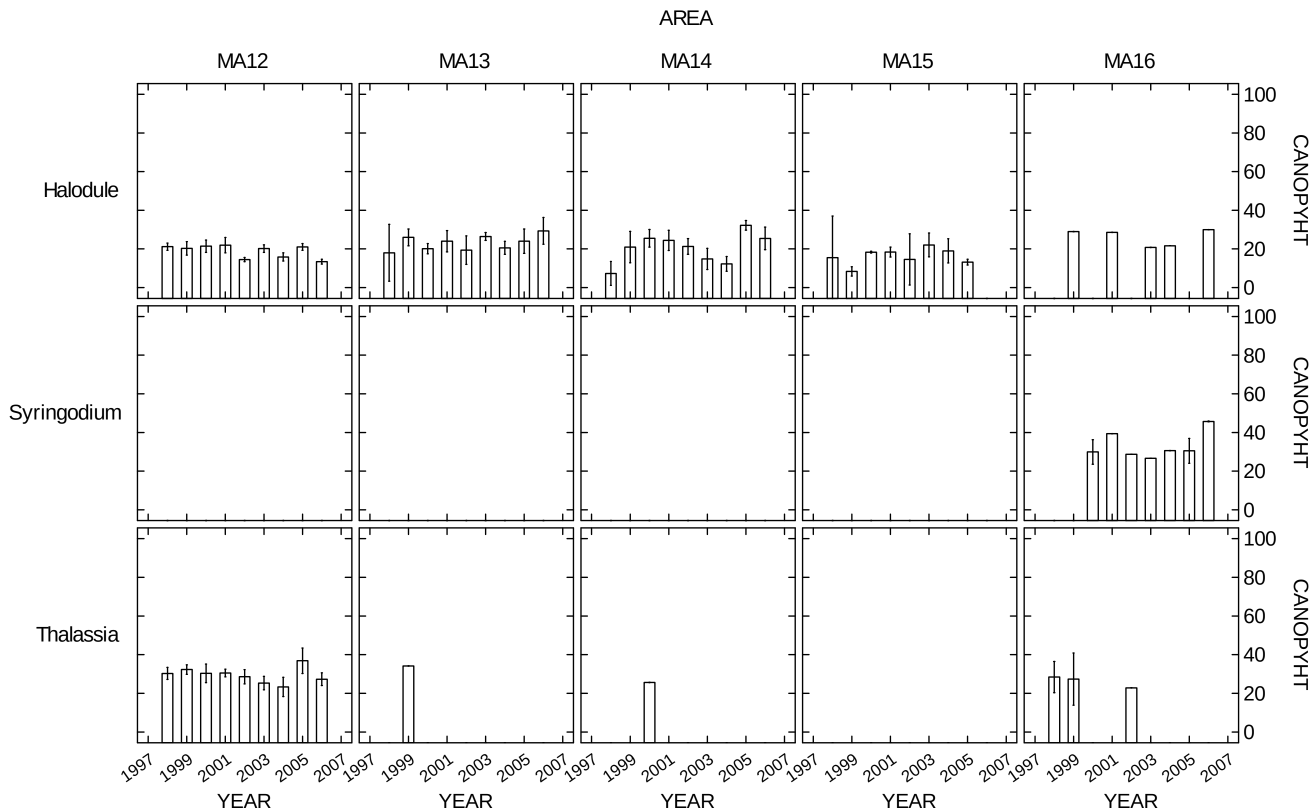
BCB1. Percent frequency of occurrence of seagrass coverage, *Caulerpa prolifera* coverage, and bare areas within Boca Ciega Bay Management Areas from 1998-2006.



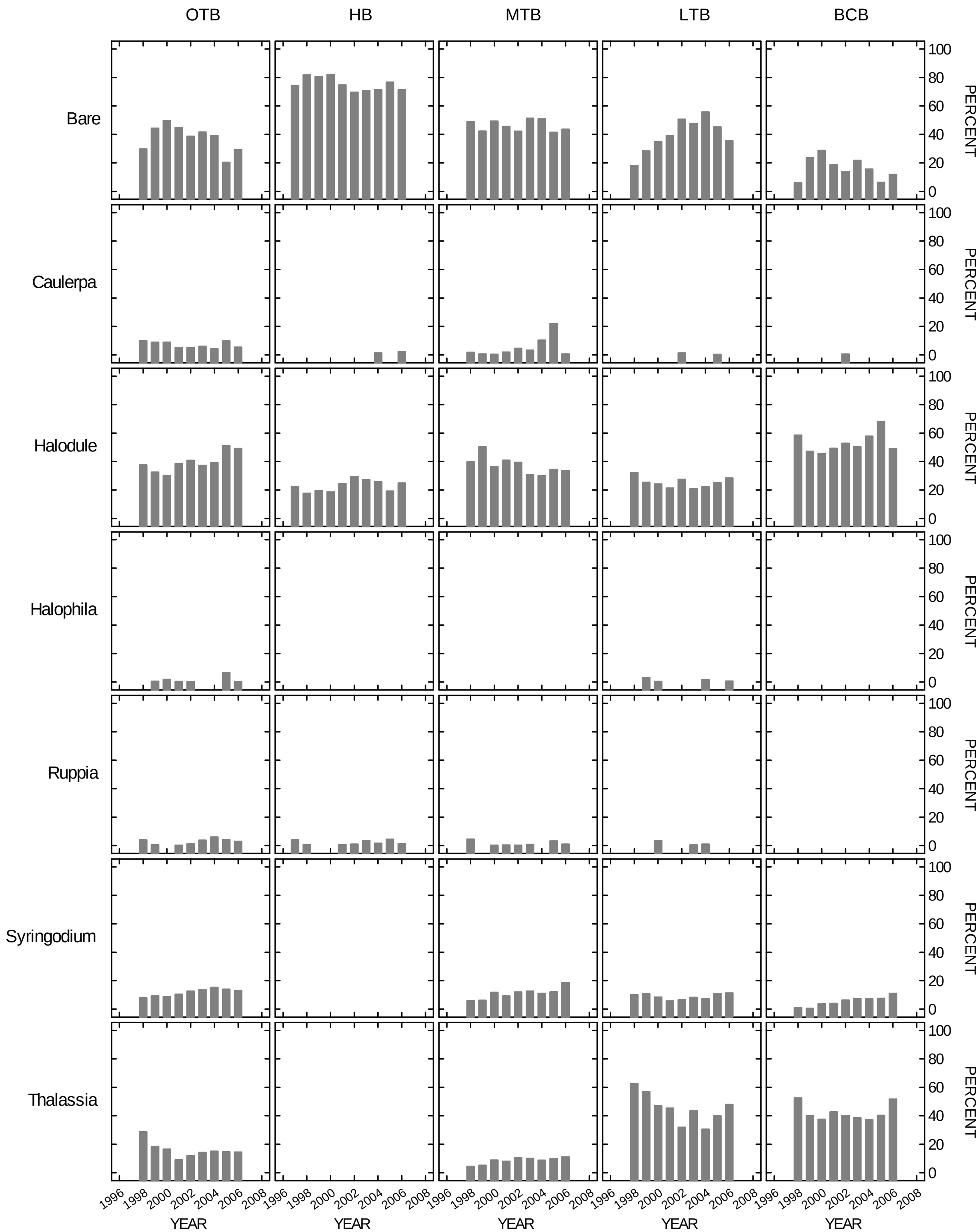
BCB2. The abundance (Braun Blanquet class coverage) of SAV coverage within Boca Ciega Bay Management Areas from 1998-2006. Error bars equal 1SE.



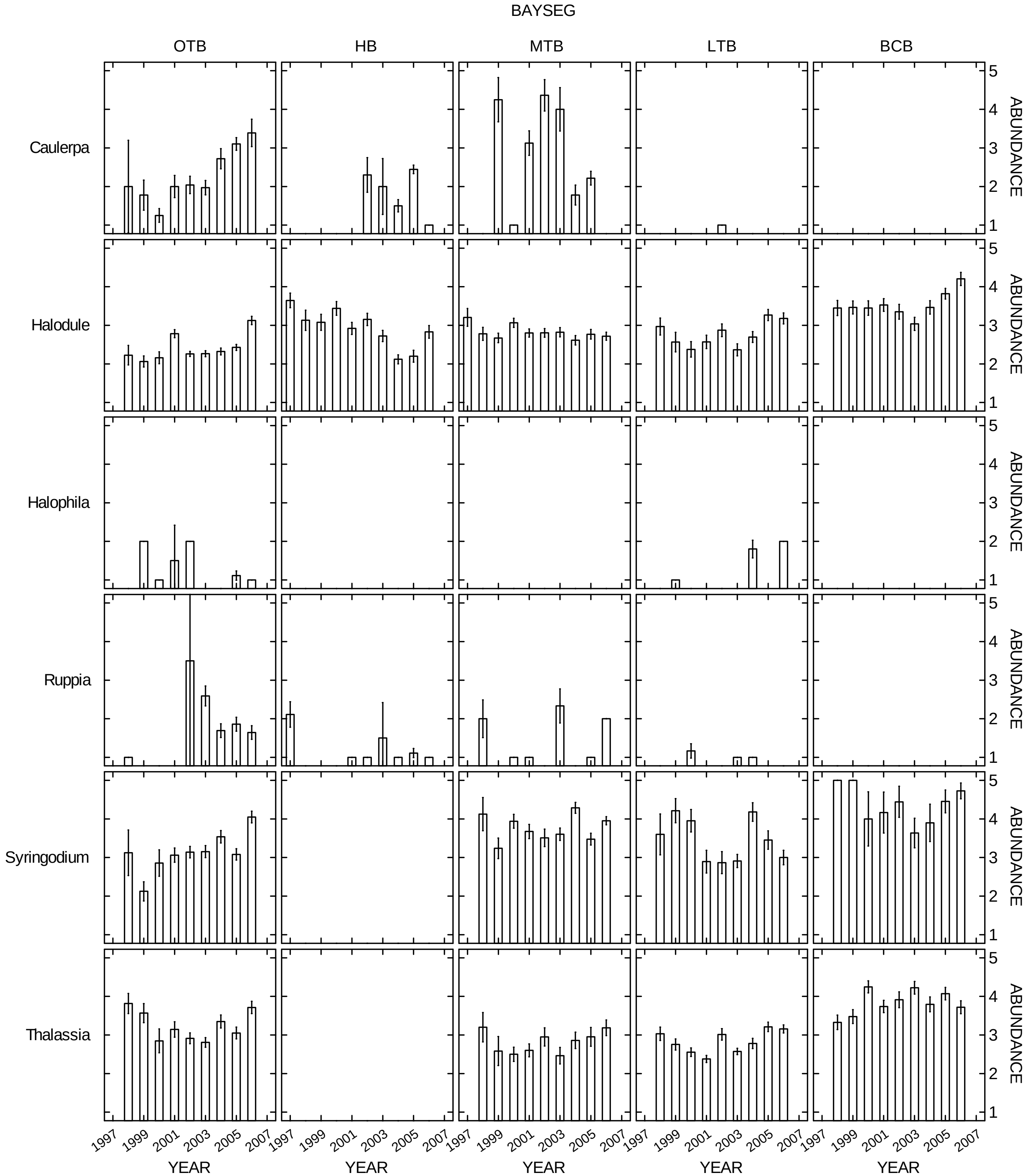
BCB3. Short shoot density ($SSDm^{-2}$) of SAV species within the Boca Ciega Bay Management Areas from 1998-2006. Error bars equal 1SE.



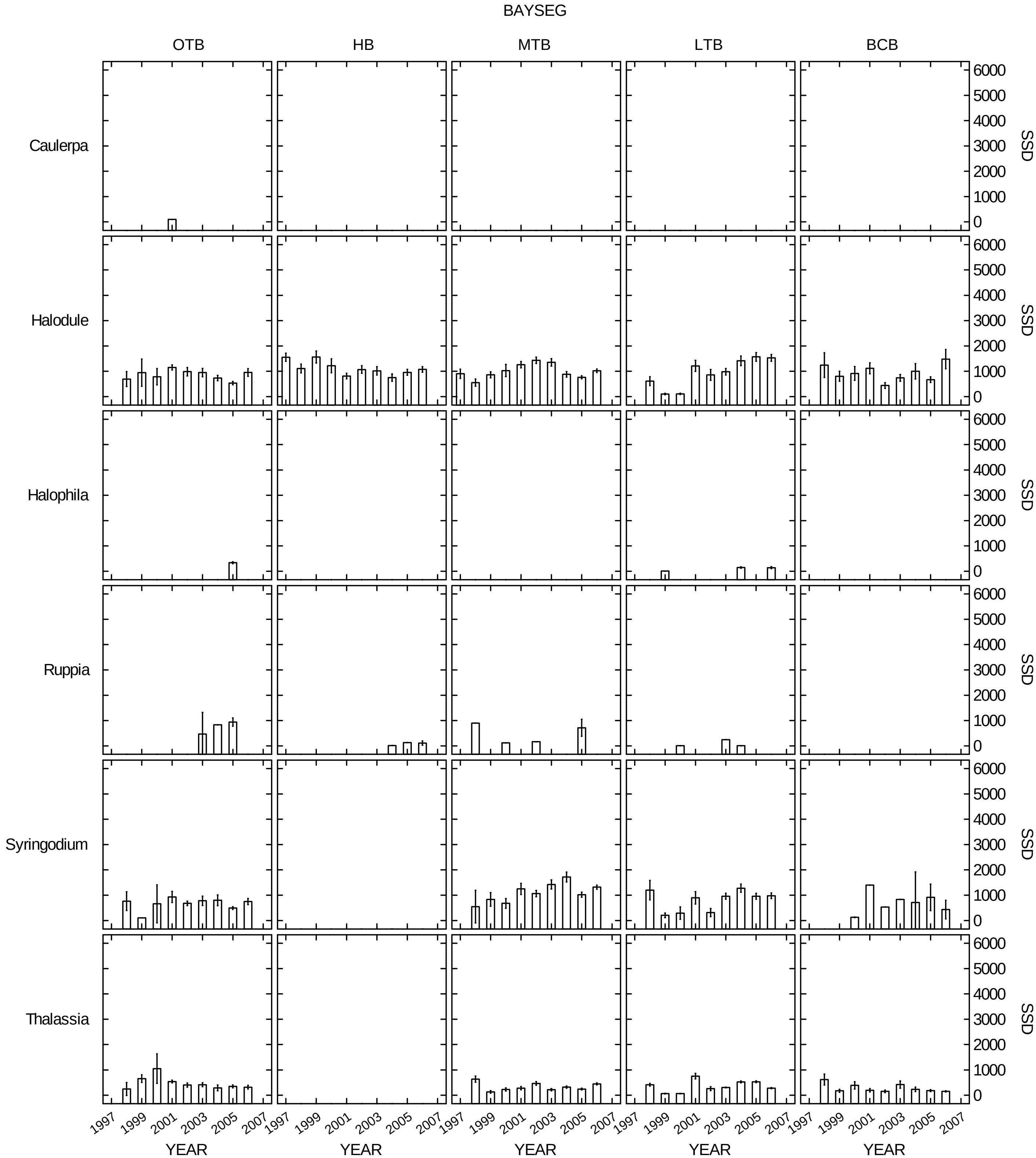
BCB4. Canopy height (cm) of SAV species within the Boca Ciega Bay Management Areas from 1998-2006. Error bars equal 1SE.



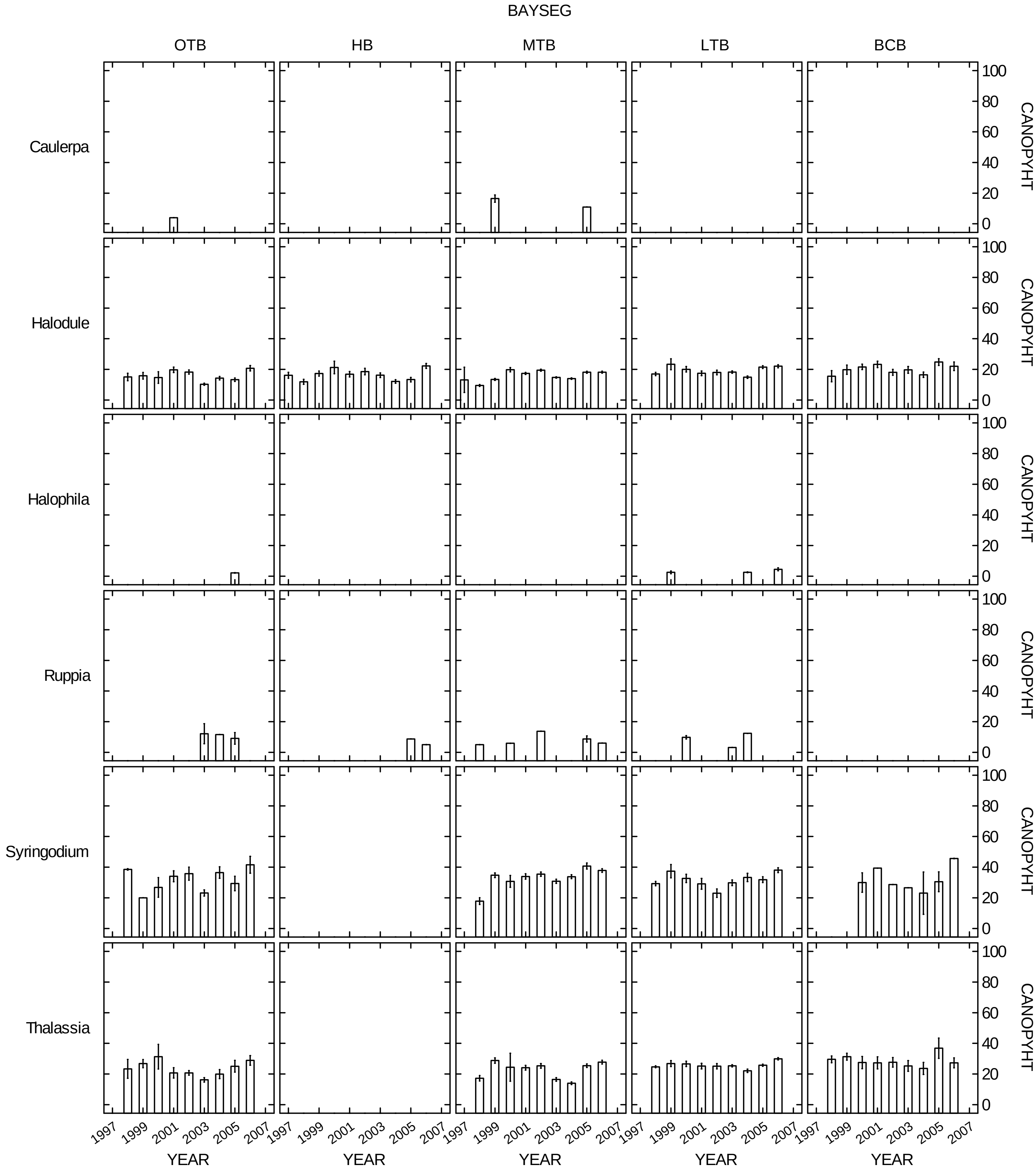
TBS1. Percent frequency of occurrence of seagrass coverage, *Caulerpa prolifera* coverage, and bare areas within the major Tampa Bay subsections from 1997-2006.



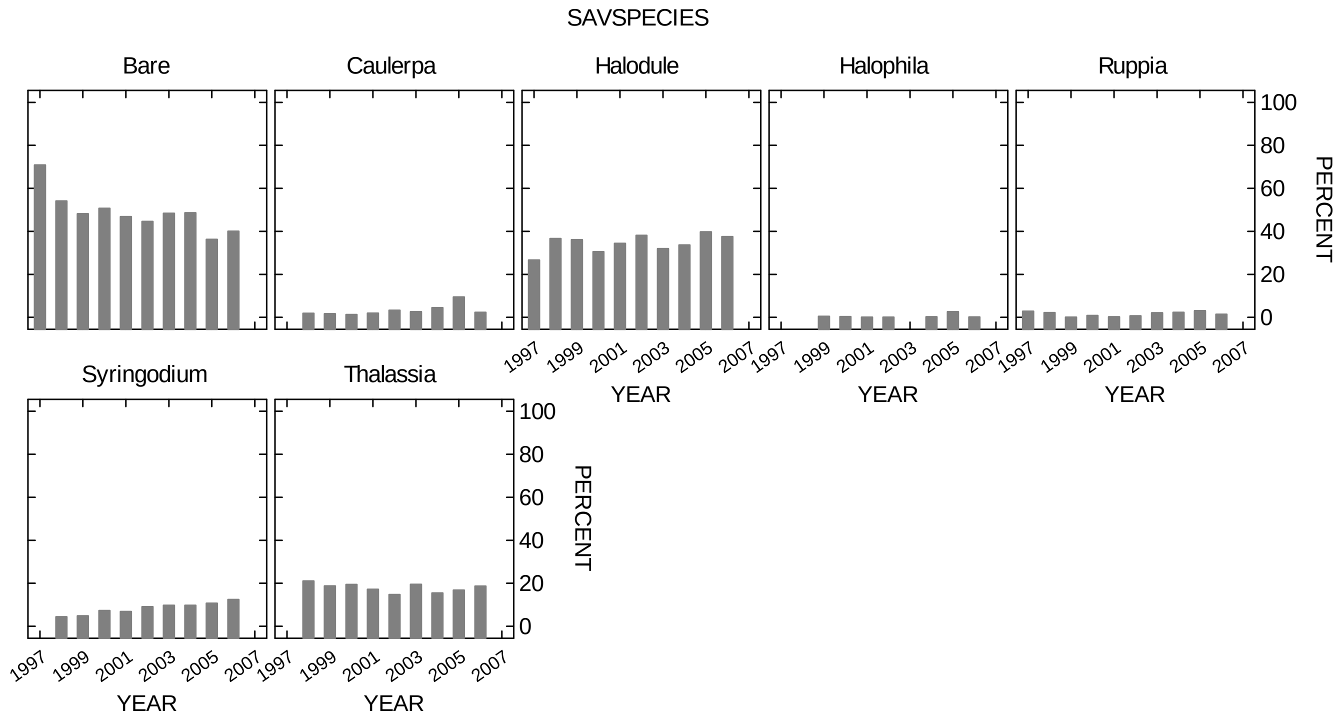
TBS2. Abundance of SAV species within the major Tampa Bay subsections from 1997-2006. Error bars equal 1SE.



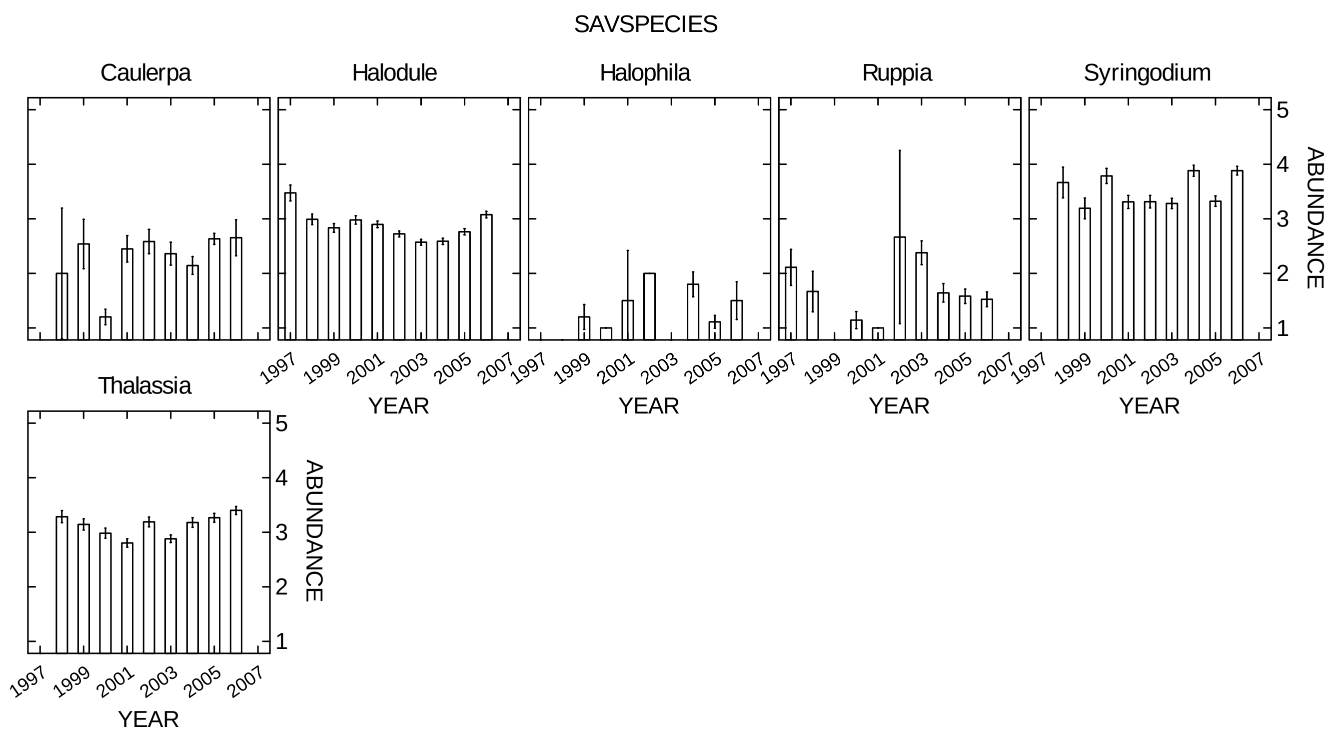
TBS3. Short shoot density (SSDm^{-2}) for SAV species within the major Tampa Bay subsections from 1997-2006. Error bars equal 1SE.



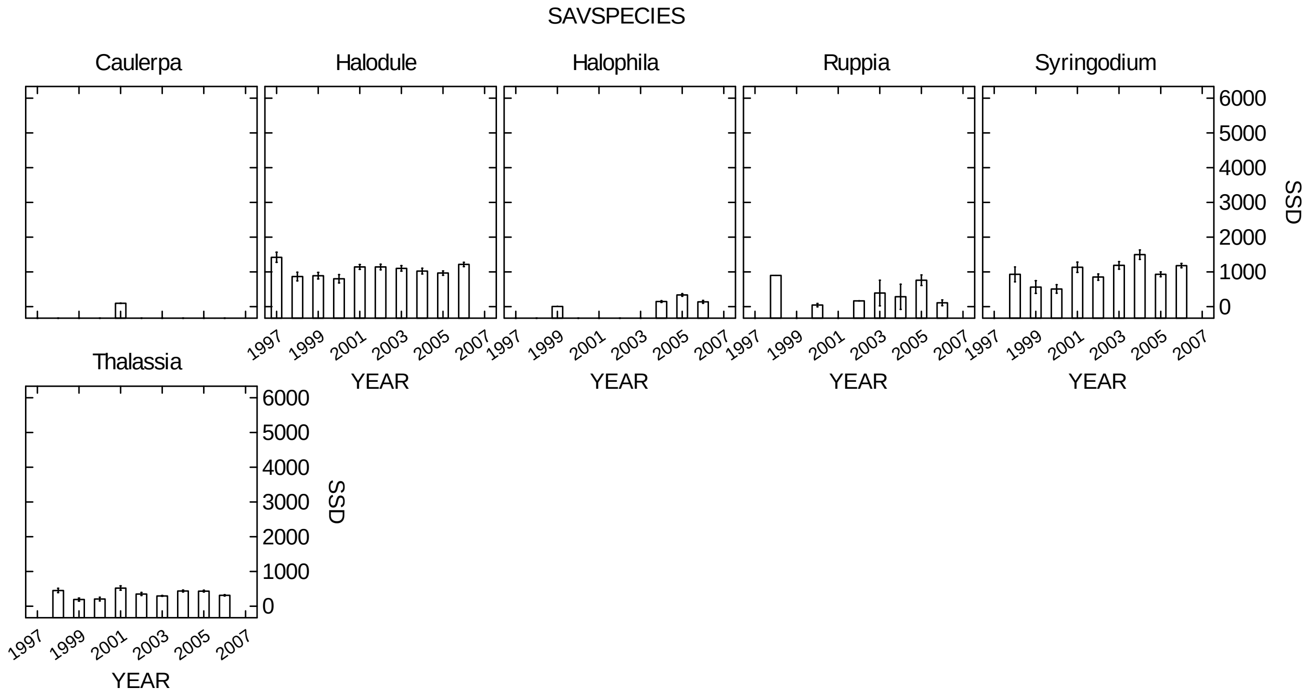
TBS4. Canopy height (cm) for SAV species within the major Tampa Bay subsections from 1997-2006. Error bars equal 1SE.



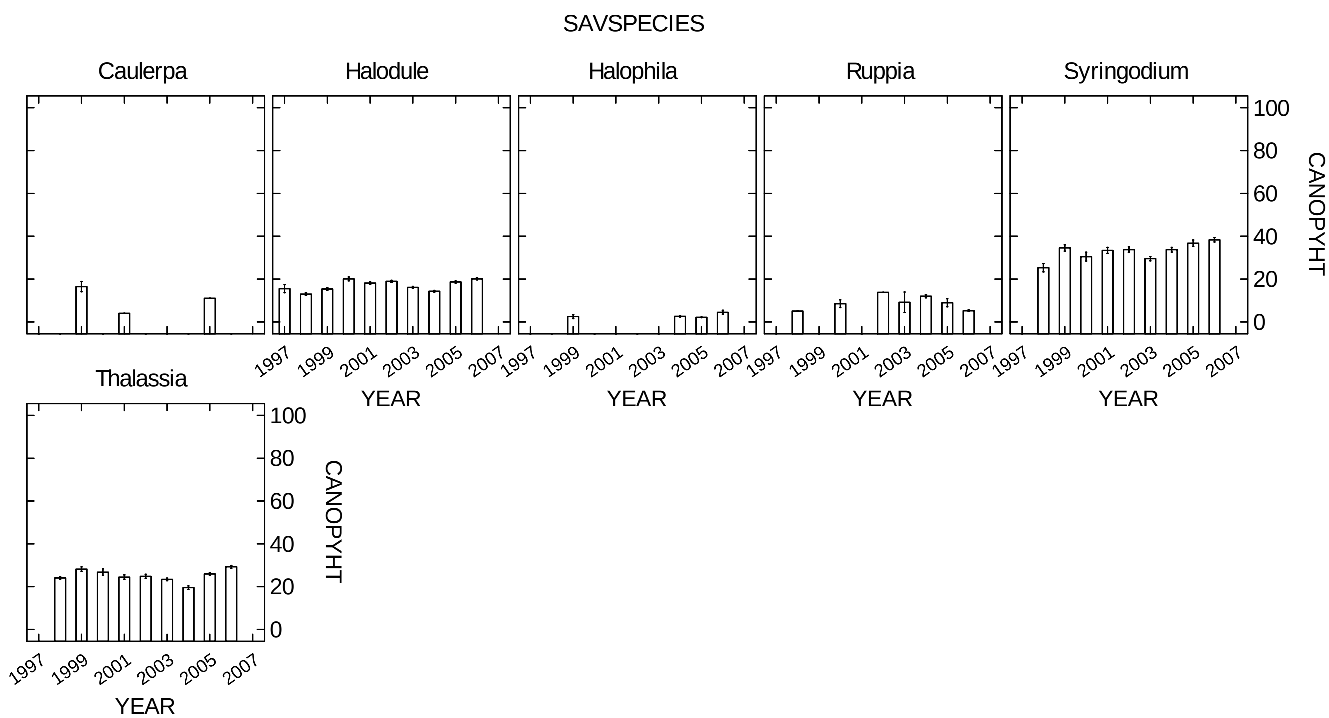
TB1. Percent frequency of occurrence of seagrass coverage, *Caulerpa prolifera* coverage, and bare areas within Tampa Bay from 1997-2006.



TB2. The abundance (Braun Blanquet class coverage) of SAV coverage within Tampa Bay from 1997-2006. Error bars equal 1SE.



TB3. Short shoot density (SSDm^{-2}) of SAV coverage within Tampa Bay from 1997-2006. Error bars equal 1SE.

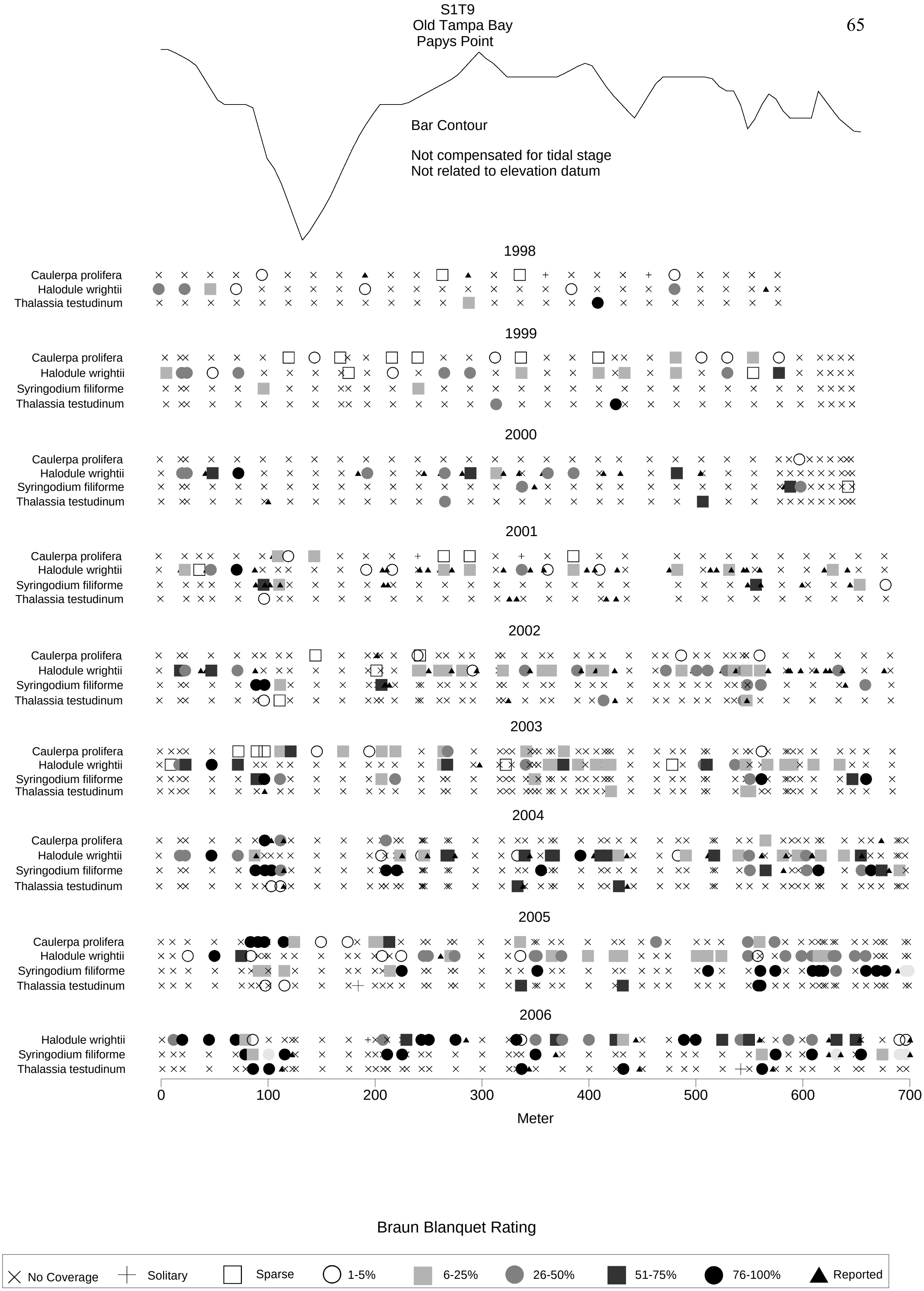


TB4. Canopy height (cm) of SAV coverage within Tampa Bay from 1997-2006. Error bars equal 1SE.

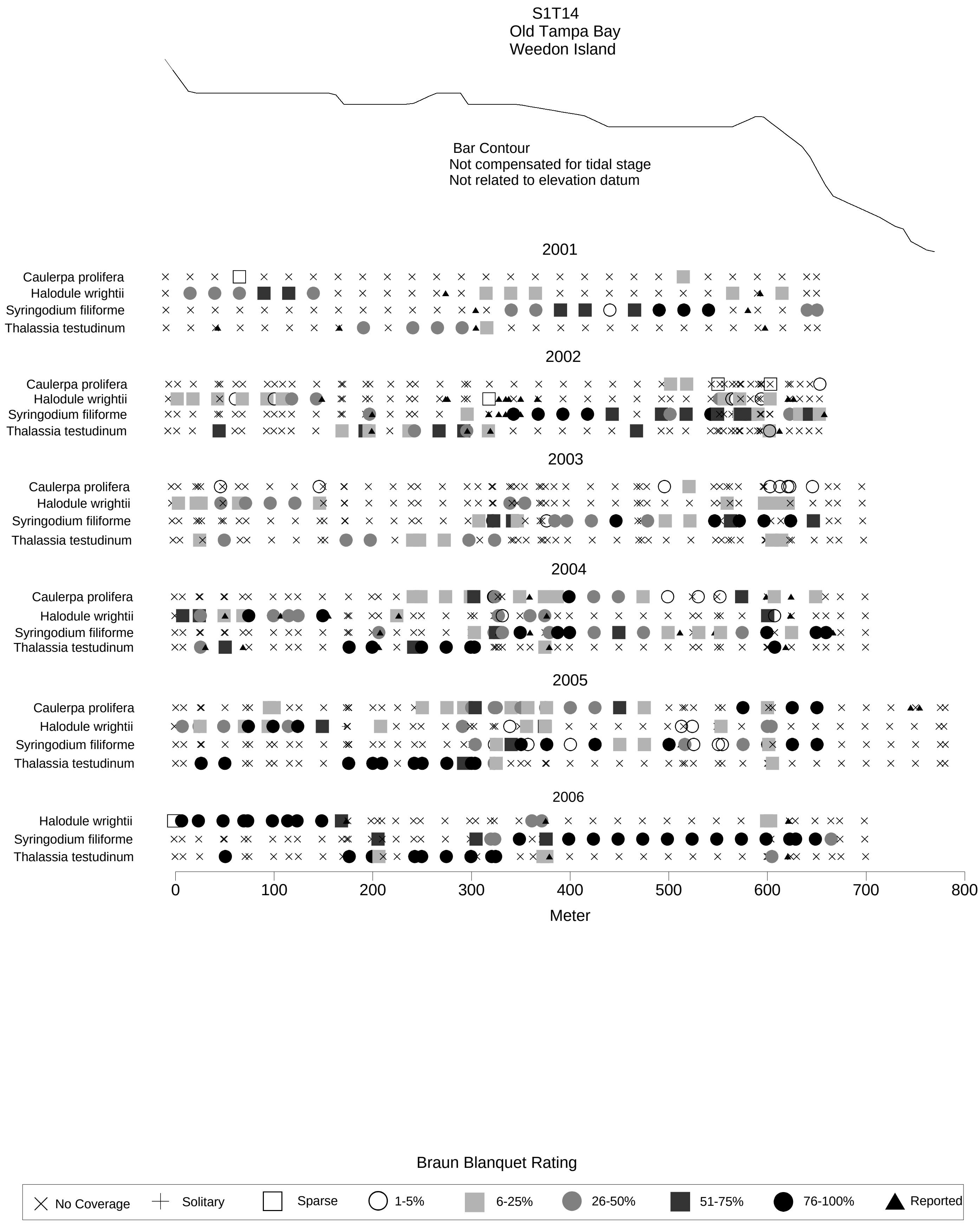
Appendix B

Old Tampa Bay

MA19 Transects

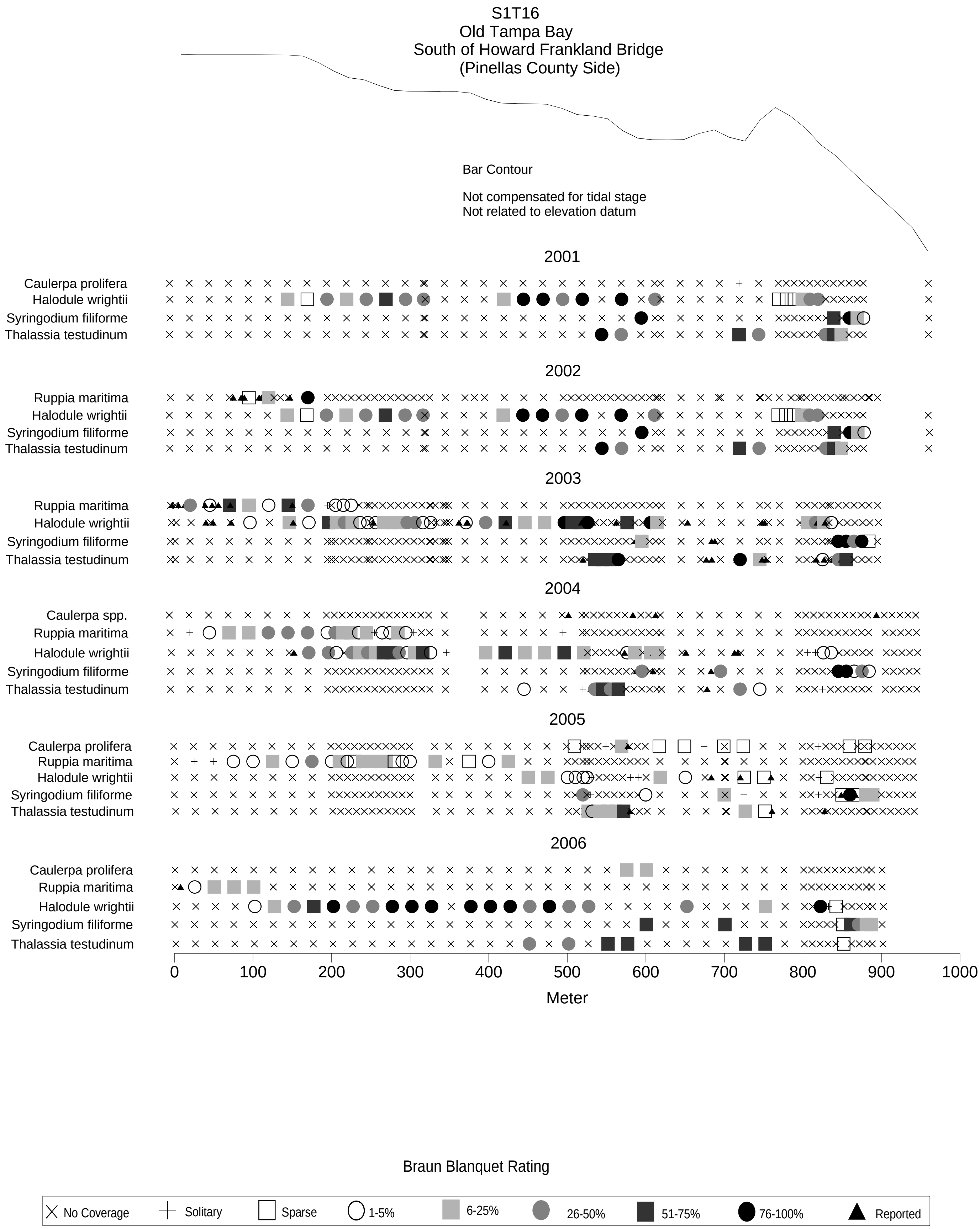


S1T9
Old Tampa Bay
Papys Point
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
Caulerpa prolifera
Halodule wrightii
Thalassia testudinum
1999
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2000
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2001
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2002
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2003
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2004
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2005
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0
100
200
300
400
500
600
700
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported


S1T14
Old Tampa Bay
Weedon Island
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
2001
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2002
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2003
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2004
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2005
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0
100
200
300
400
500
600
700
800
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

Old Tampa Bay

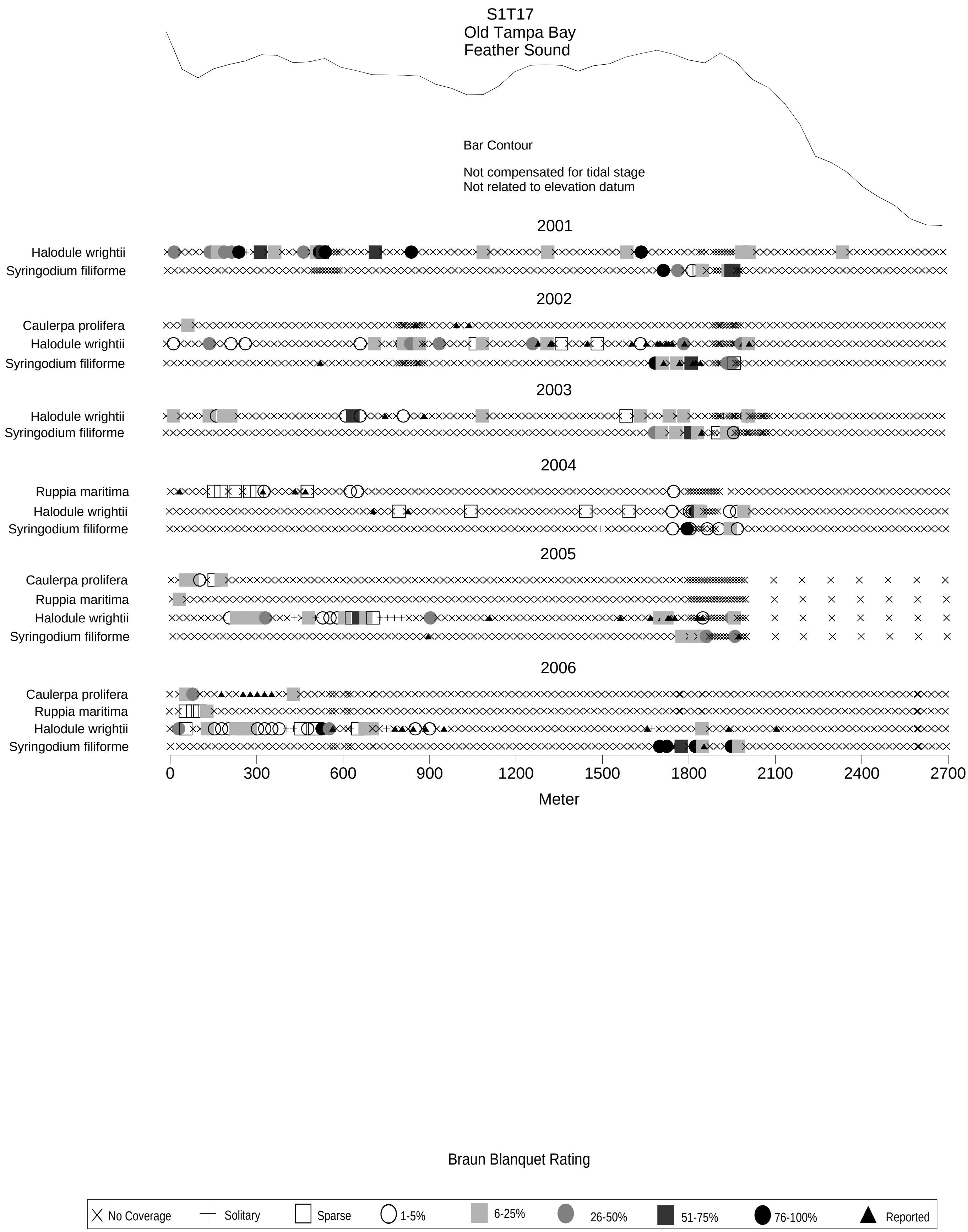
MA20 Transects



S1T16
Old Tampa Bay
South of Howard Frankland Bridge
(Pinellas County Side)
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
2001
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2002
Ruppia maritima
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2003
Ruppia maritima
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2004
Caulerpa spp.
Ruppia maritima
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2005
Caulerpa prolifera
Ruppia maritima
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2006
Caulerpa prolifera
Ruppia maritima
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0
100
200
300
400
500
600
700
800
900
1000
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

Old Tampa Bay

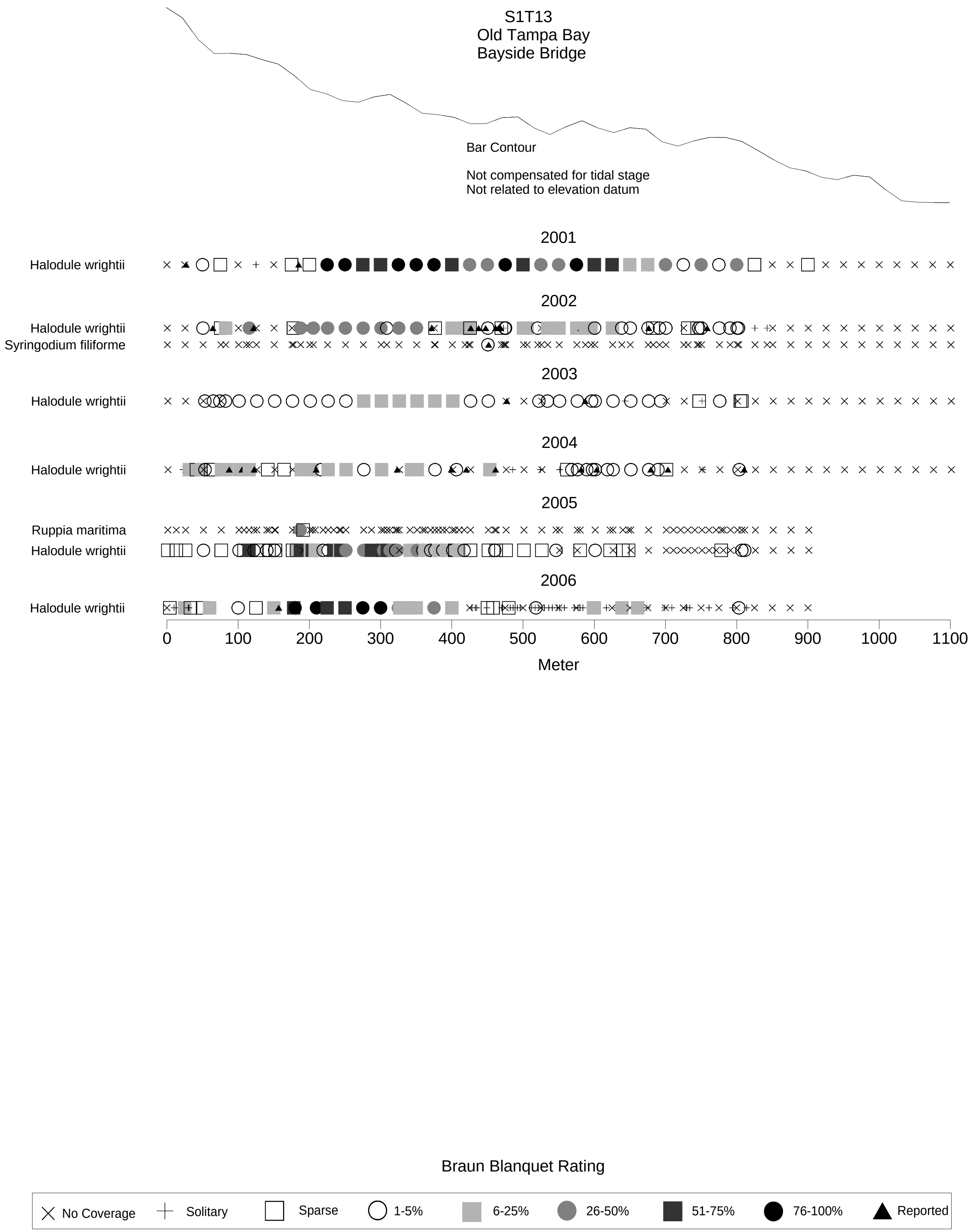
MA21 Transects



S1T17
Old Tampa Bay
Feather Sound
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
2001
Halodule wrightii
Syringodium filiforme
2002
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
2003
Halodule wrightii
Syringodium filiforme
2004
Ruppia maritima
Halodule wrightii
Syringodium filiforme
2005
Caulerpa prolifera
Ruppia maritima
Halodule wrightii
Syringodium filiforme
2006
Caulerpa prolifera
Ruppia maritima
Halodule wrightii
Syringodium filiforme
0
300
600
900
1200
1500
1800
2100
2400
2700
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

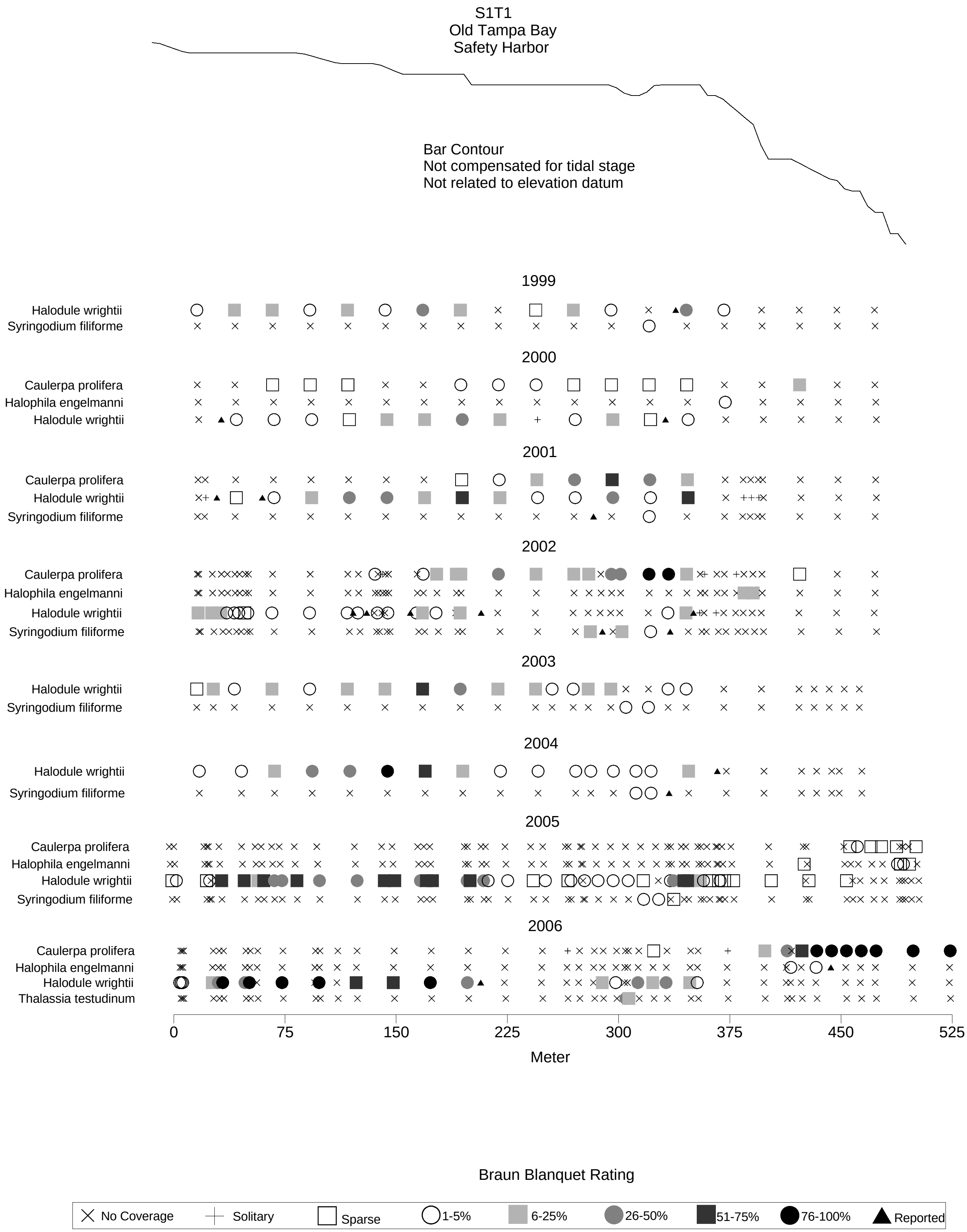
Old Tampa Bay

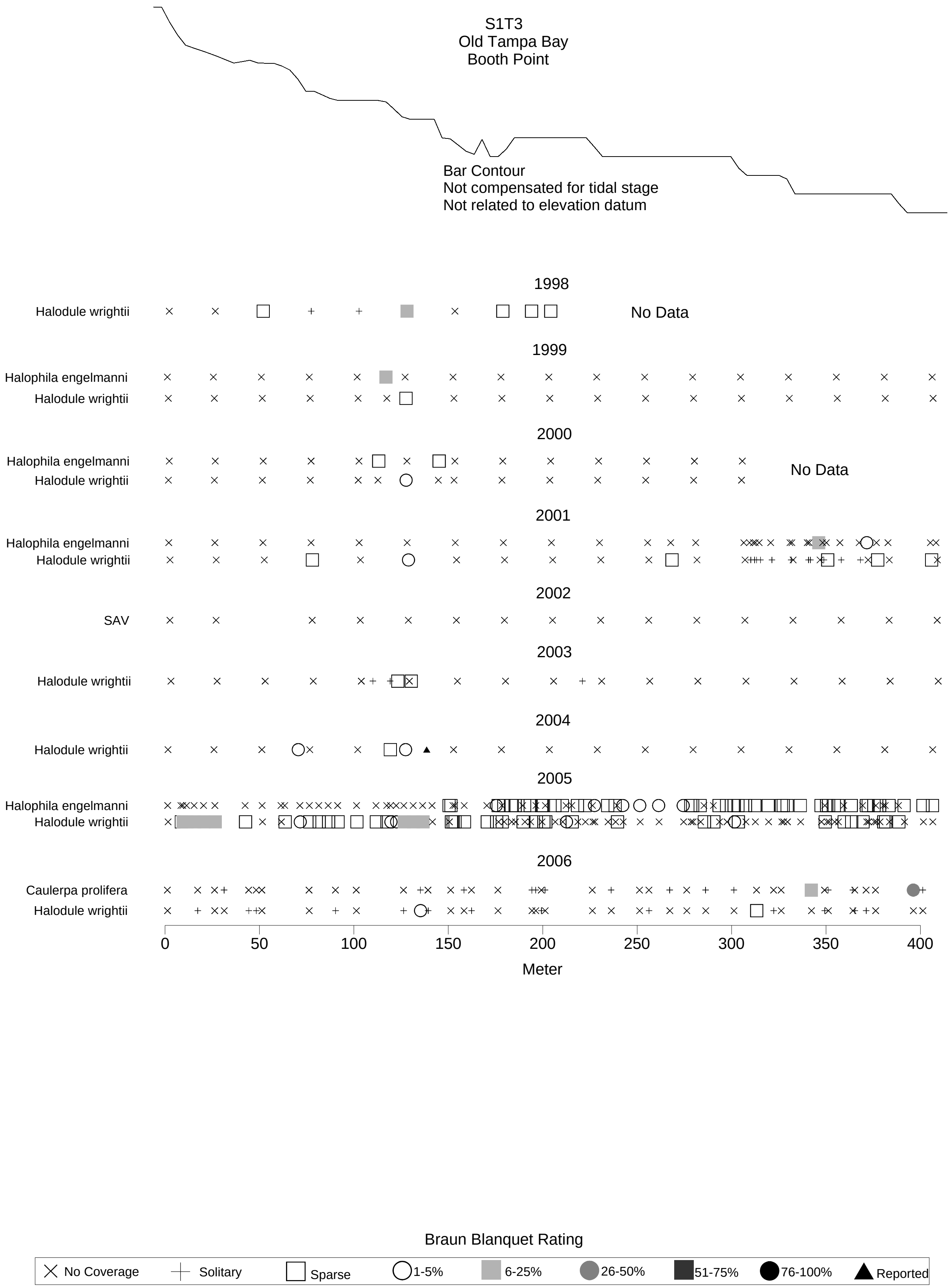
MA22 Transects


S1T13
Old Tampa Bay
Bayside Bridge
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
2001
Halodule wrightii
2002
Halodule wrightii
Syringodium filiforme
2003
Halodule wrightii
2004
Halodule wrightii
2005
Ruppia maritima
Halodule wrightii
2006
Halodule wrightii
0
100
200
300
400
500
600
700
800
900
1000
1100
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

Old Tampa Bay

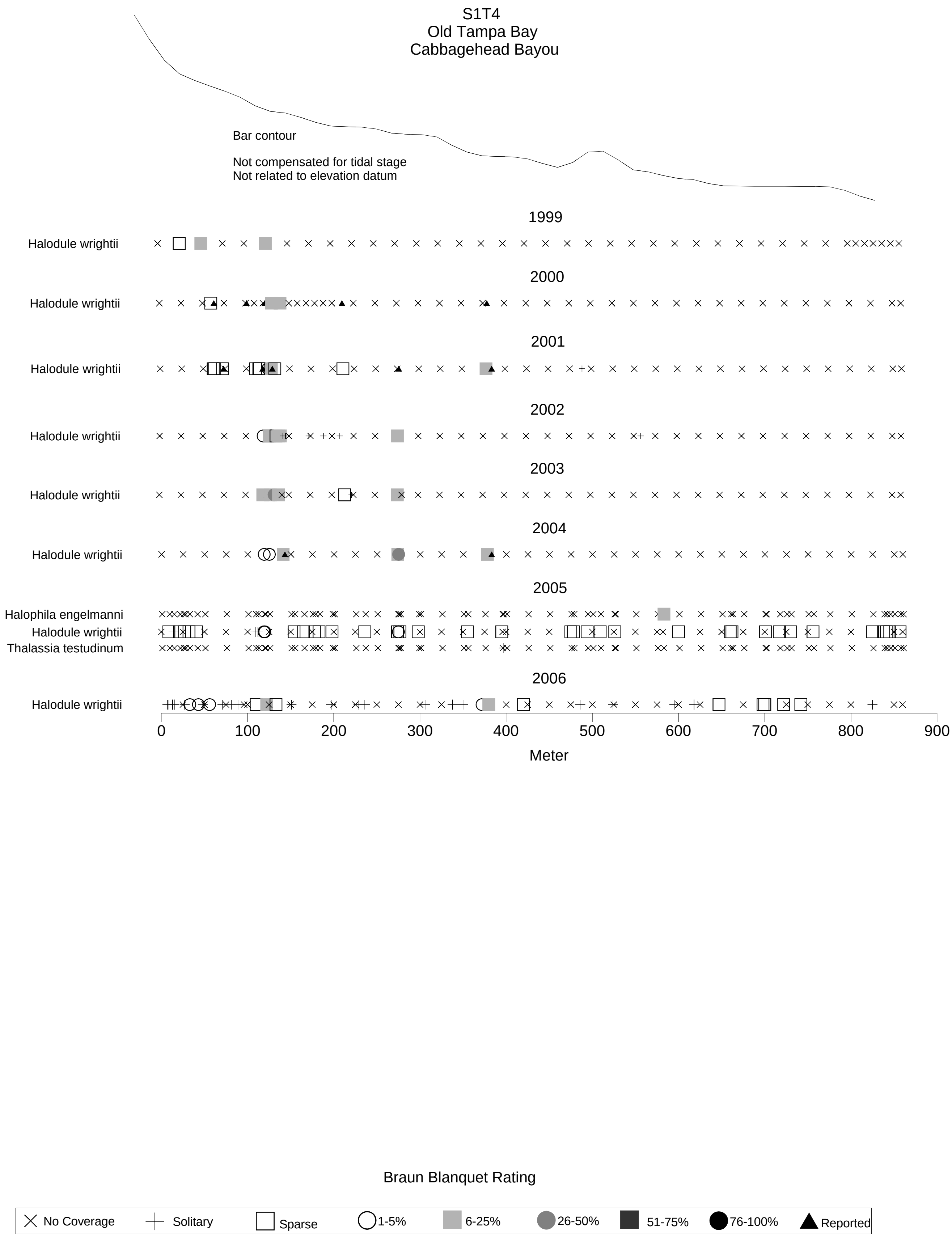
MA23 Transects


S1T1
Old Tampa Bay
Safety Harbor
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1999
Halodule wrightii
Syringodium filiforme
2000
Caulerpa prolifera
Halophila engelmanni
Halodule wrightii
2001
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
2002
Caulerpa prolifera
Halophila engelmanni
Halodule wrightii
Syringodium filiforme
2003
Halodule wrightii
Syringodium filiforme
2004
Halodule wrightii
Syringodium filiforme
2005
Caulerpa prolifera
Halophila engelmanni
Halodule wrightii
Syringodium filiforme
2006
Caulerpa prolifera
Halophila engelmanni
Halodule wrightii
Thalassia testudinum
0
75
150
225
300
375
450
525
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported


S1T3
Old Tampa Bay
Booth Point
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
Halodule wrightii
No Data
1999
Halophila engelmanni
Halodule wrightii
2000
Halophila engelmanni
Halodule wrightii
No Data
2001
Halophila engelmanni
Halodule wrightii
2002
SAV
2003
Halodule wrightii
2004
Halodule wrightii
2005
Halophila engelmanni
Halodule wrightii
2006
Caulerpa prolifera
Halodule wrightii
0
50
100
150
200
250
300
350
400
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

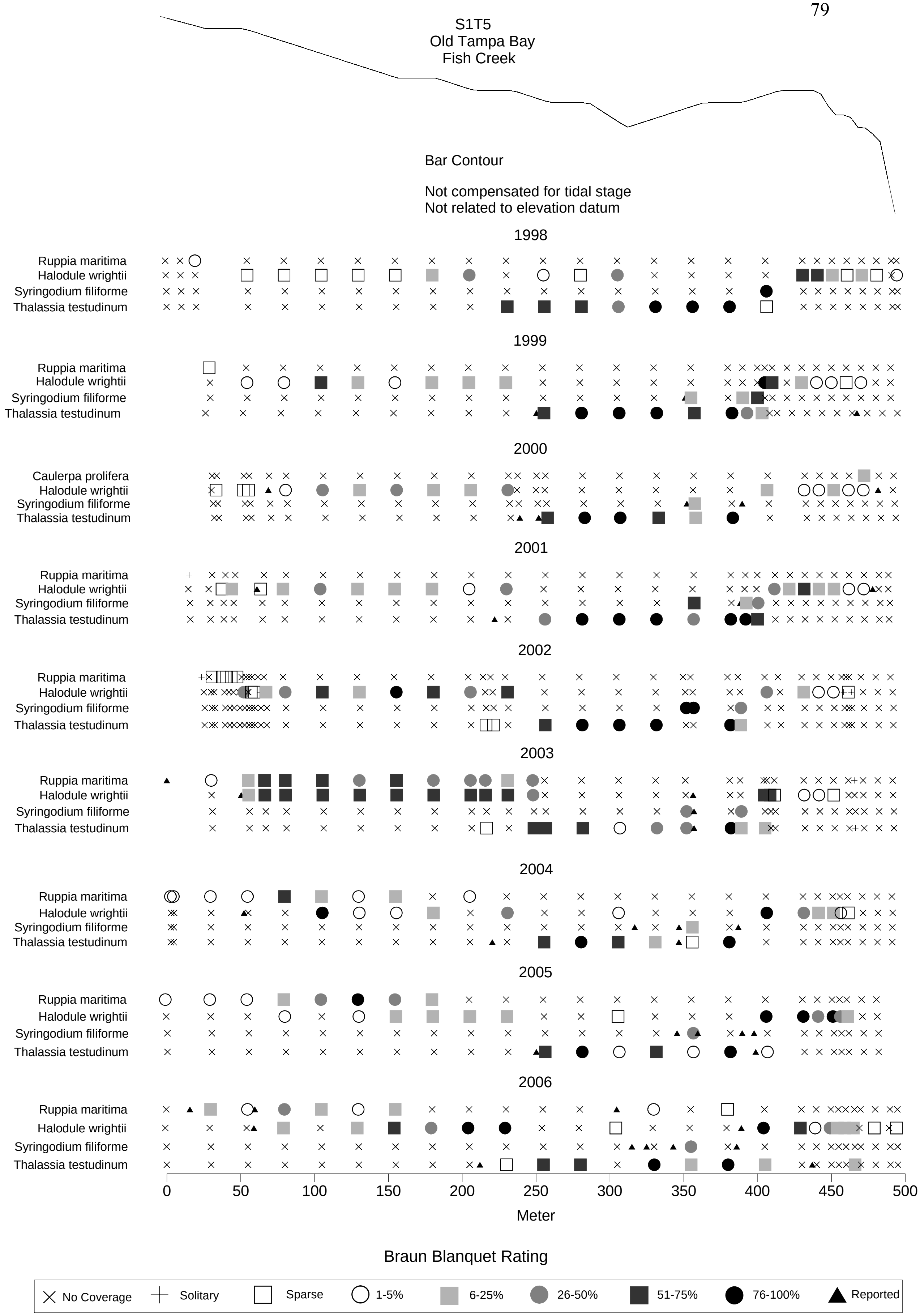
Old Tampa Bay

MA24 Transects


S1T4
Old Tampa Bay
Cabbagehead Bayou
Bar contour
Not compensated for tidal stage
Not related to elevation datum
1999
Halodule wrightii
2000
Halodule wrightii
2001
Halodule wrightii
2002
Halodule wrightii
2003
Halodule wrightii
2004
Halodule wrightii
2005
Halophila engelmanni
Halodule wrightii
Thalassia testudinum
2006
Halodule wrightii
0
100
200
300
400
500
600
700
800
900
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

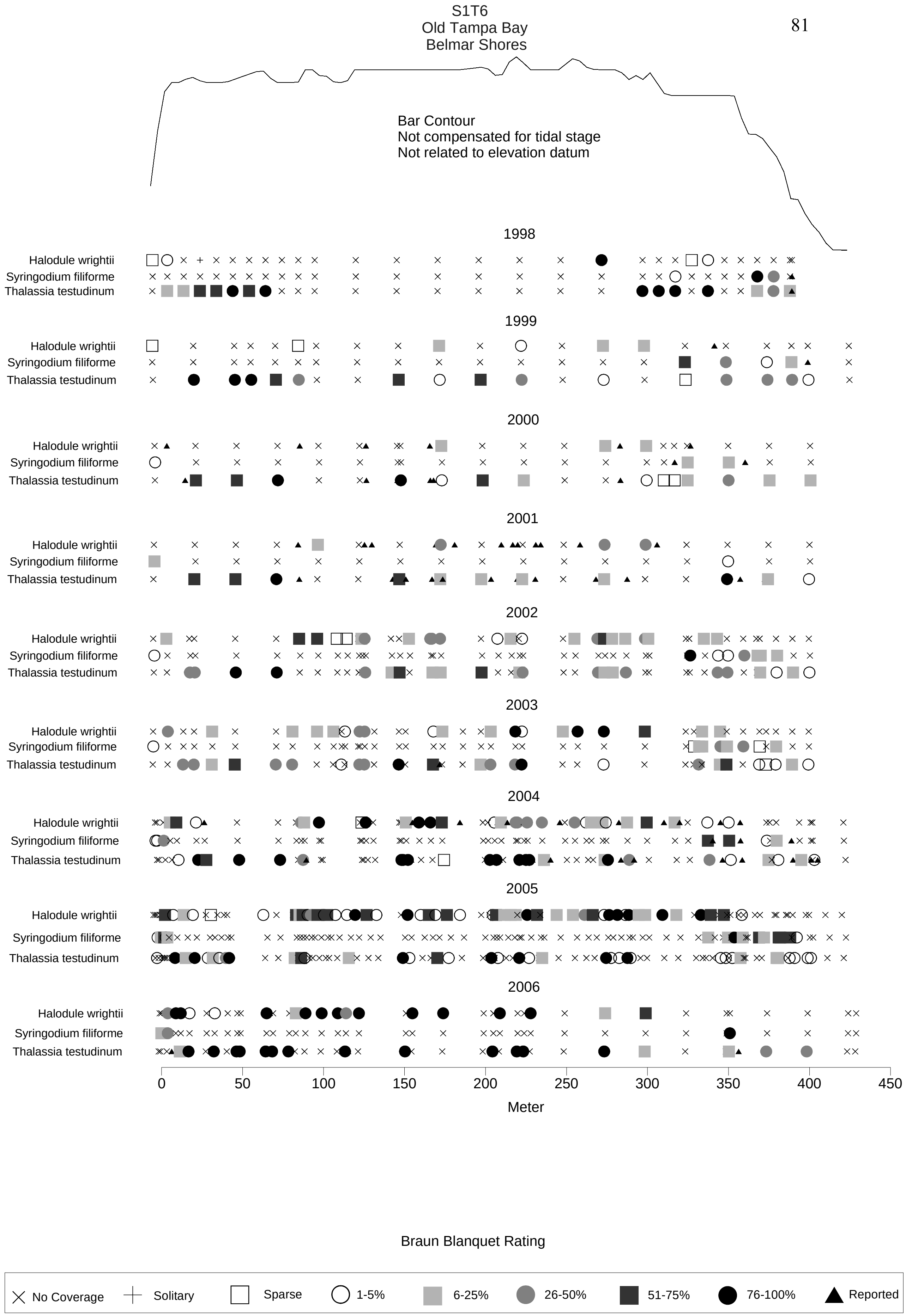
Old Tampa Bay

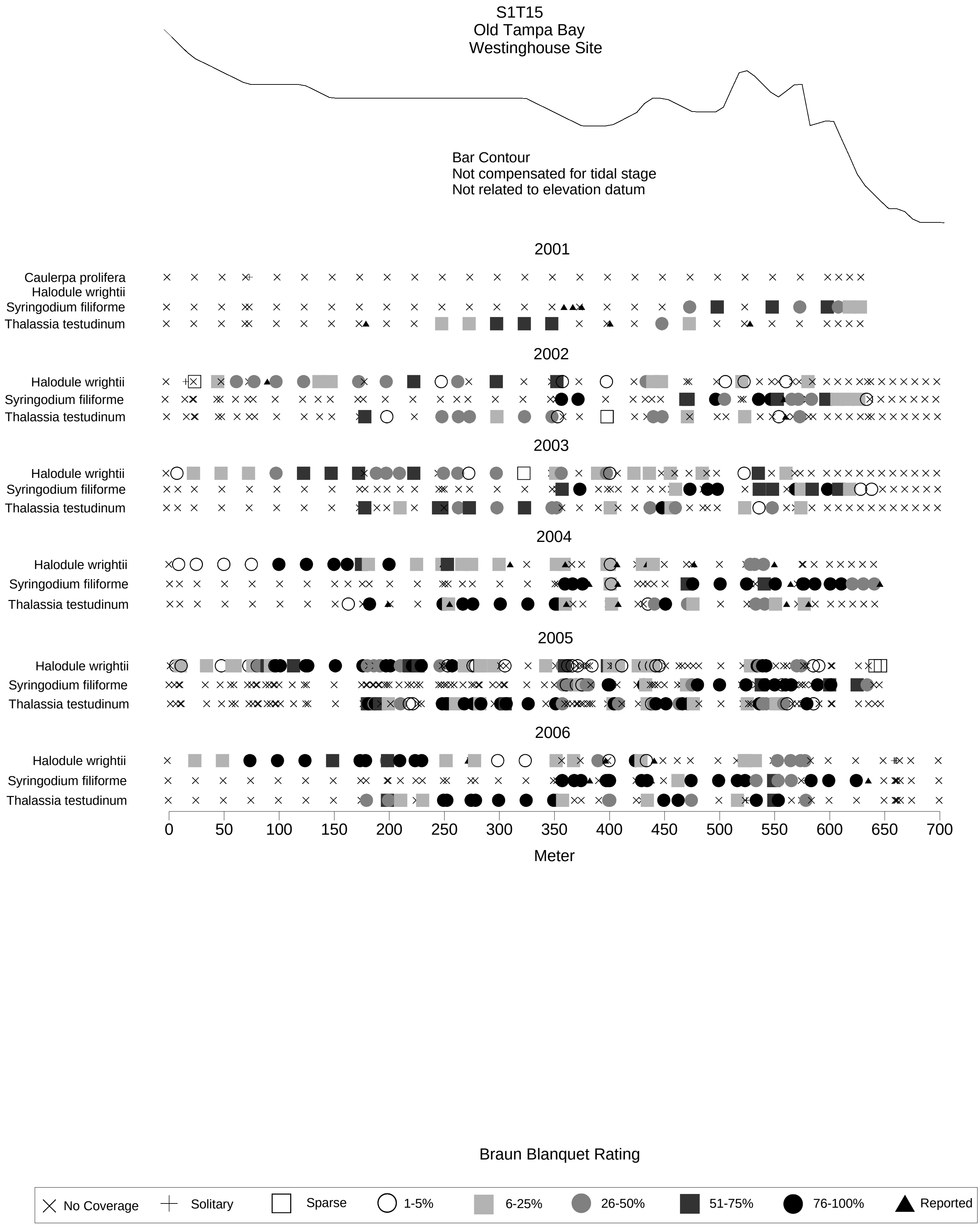
MA25 Transects


S1T5
Old Tampa Bay
Fish Creek
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
1999
2000
2001
2002
2003
2004
2005
2006
Ruppia maritima
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
Caulerpa prolifera
0
50
100
150
200
250
300
350
400
450
500
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

Old Tampa Bay

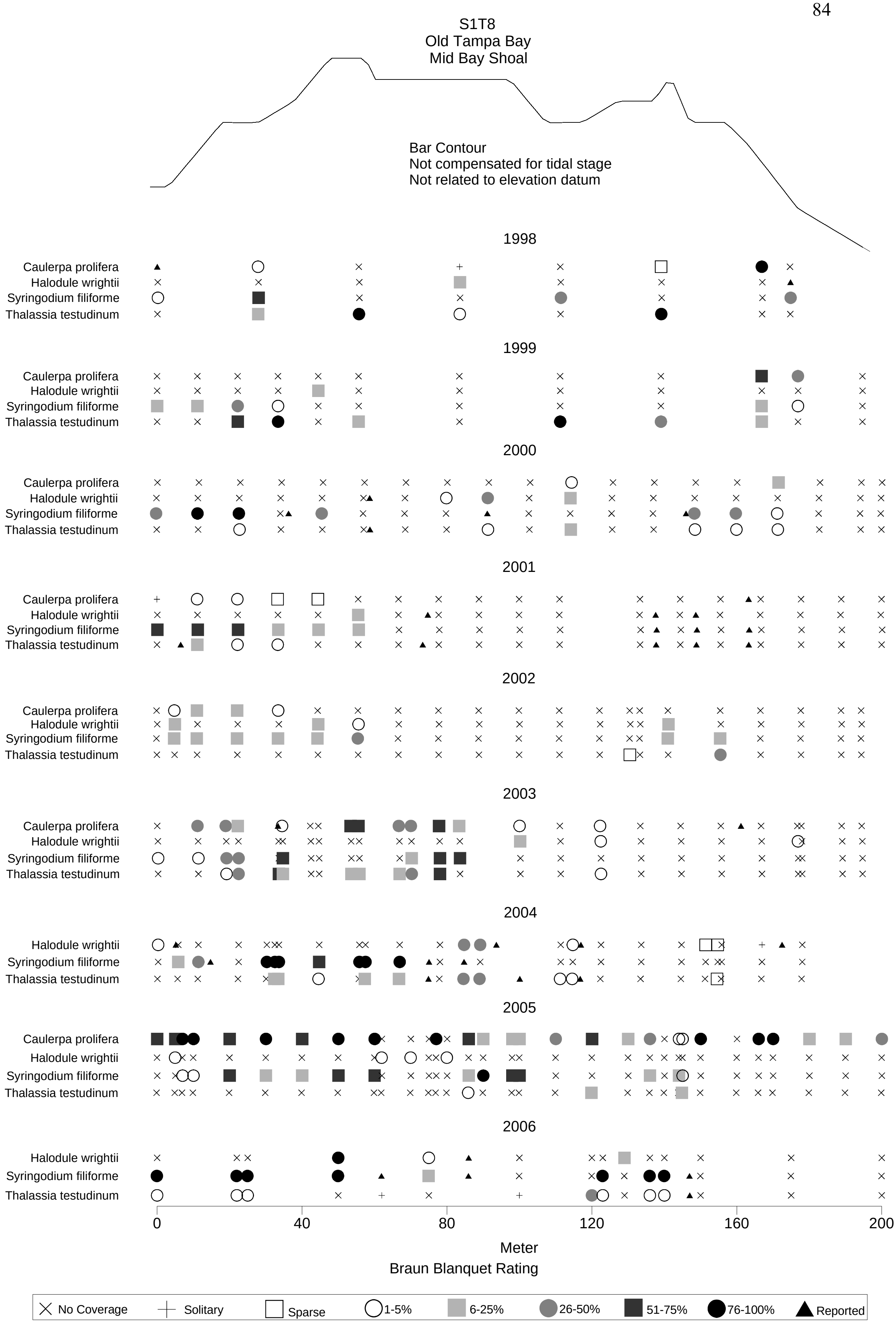
MA26 Transects


S1T6
Old Tampa Bay
Belmar Shores
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
1999
2000
2001
2002
2003
2004
2005
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0
50
100
150
200
250
300
350
400
450
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported


S1T15
Old Tampa Bay
Westinghouse Site
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
2001
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2002
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2003
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2004
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2005
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

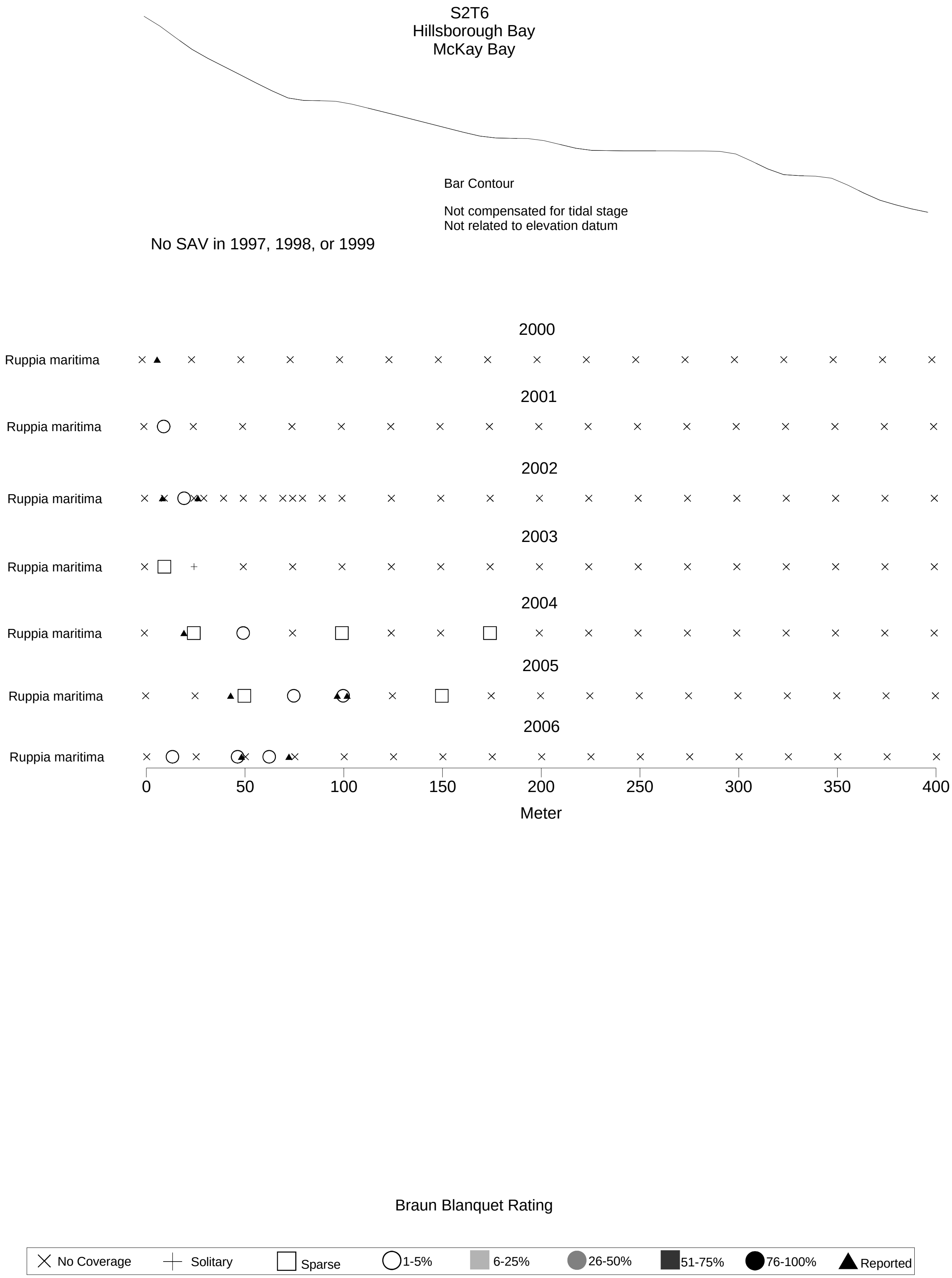
Old Tampa Bay

MA28 Transects


S1T8
Old Tampa Bay
Mid Bay Shoal
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
1999
2000
2001
2002
2003
2004
2005
2006
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0
40
80
120
160
200
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

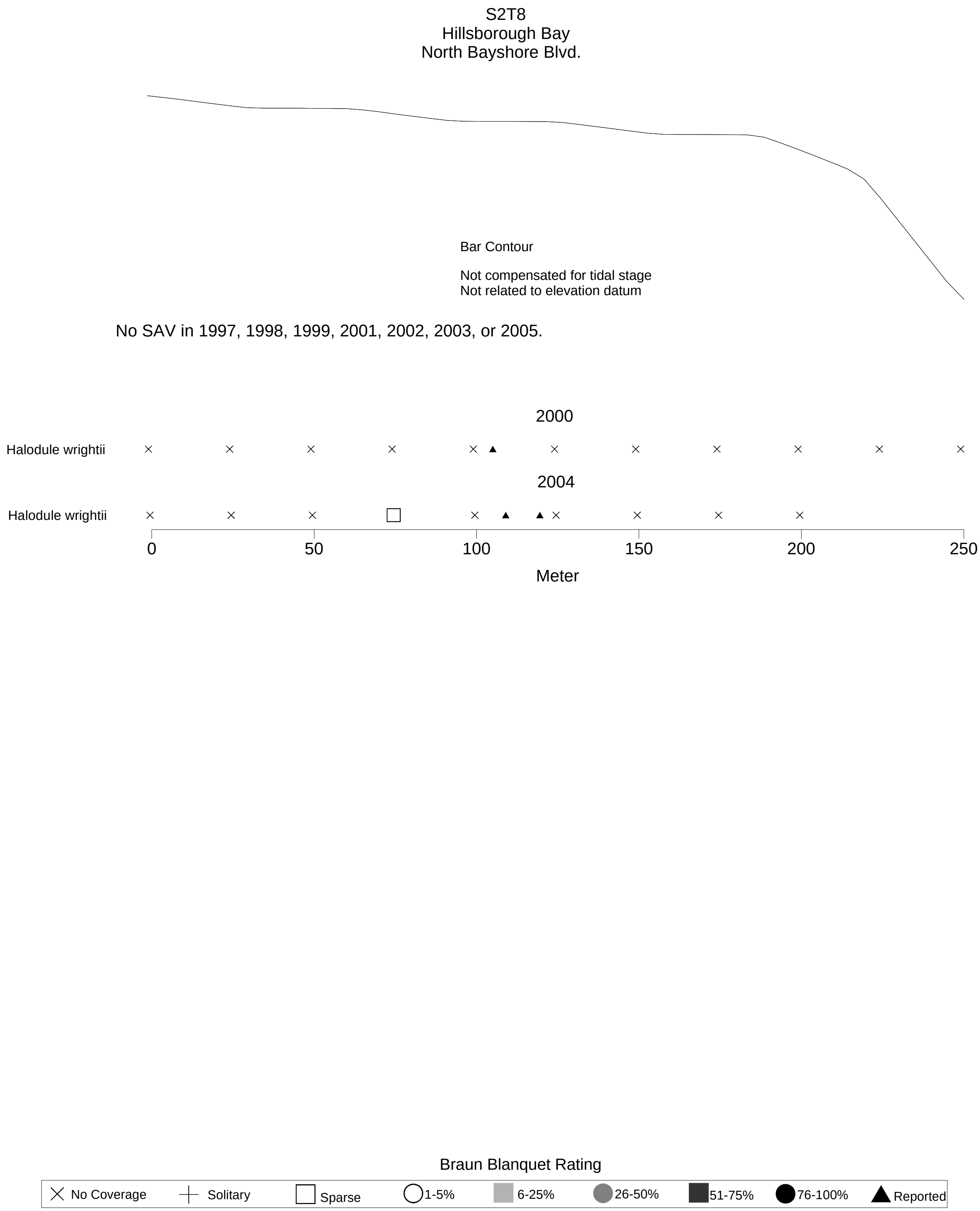
Hillsborough Bay

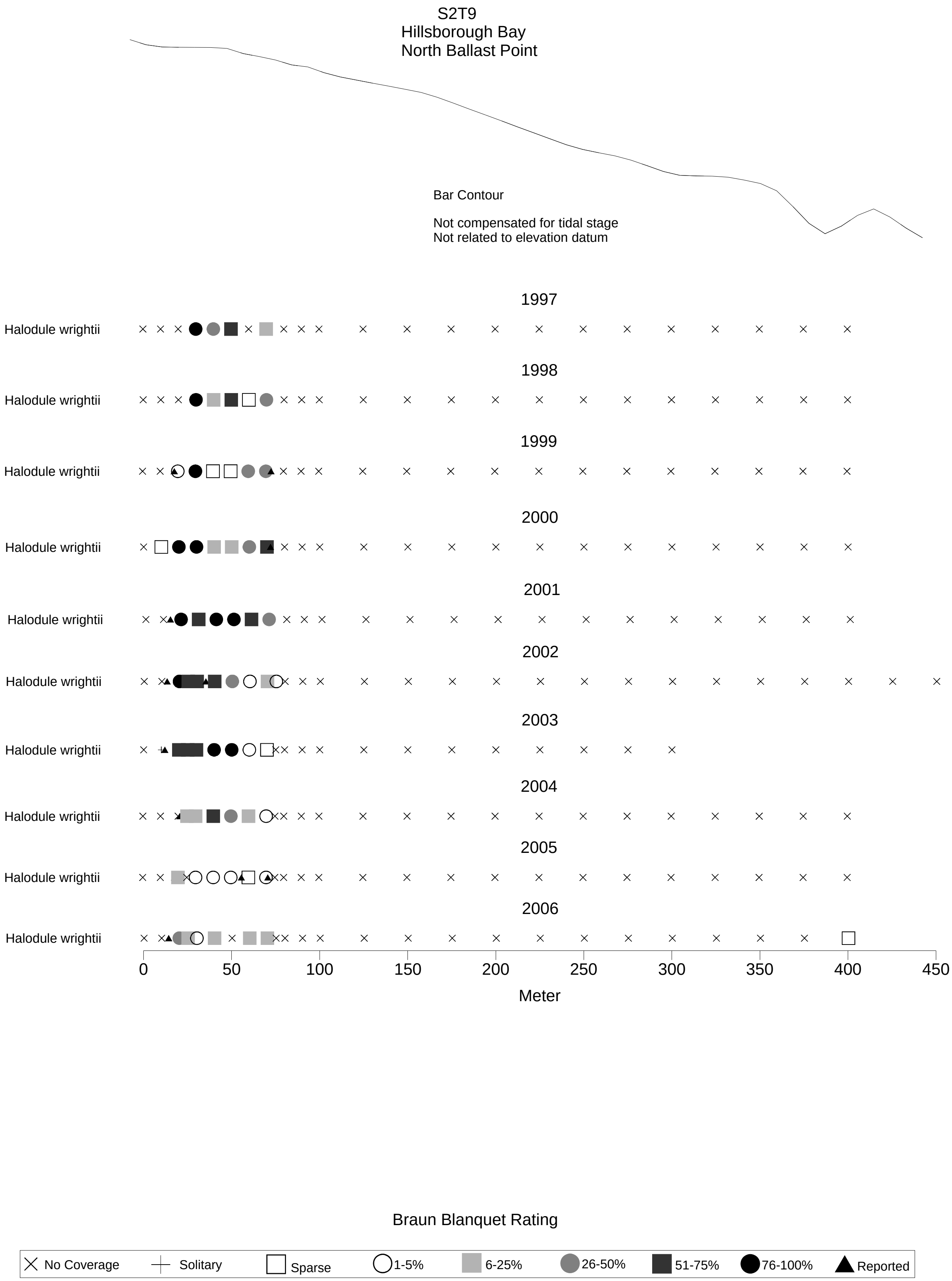
MA1 Transects


S2T6
Hillsborough Bay
McKay Bay
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
No SAV in 1997, 1998, or 1999
2000
Ruppia maritima
2001
Ruppia maritima
2002
Ruppia maritima
2003
Ruppia maritima
2004
Ruppia maritima
2005
Ruppia maritima
2006
Ruppia maritima
0
50
100
150
200
250
300
350
400
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

Hillsborough Bay

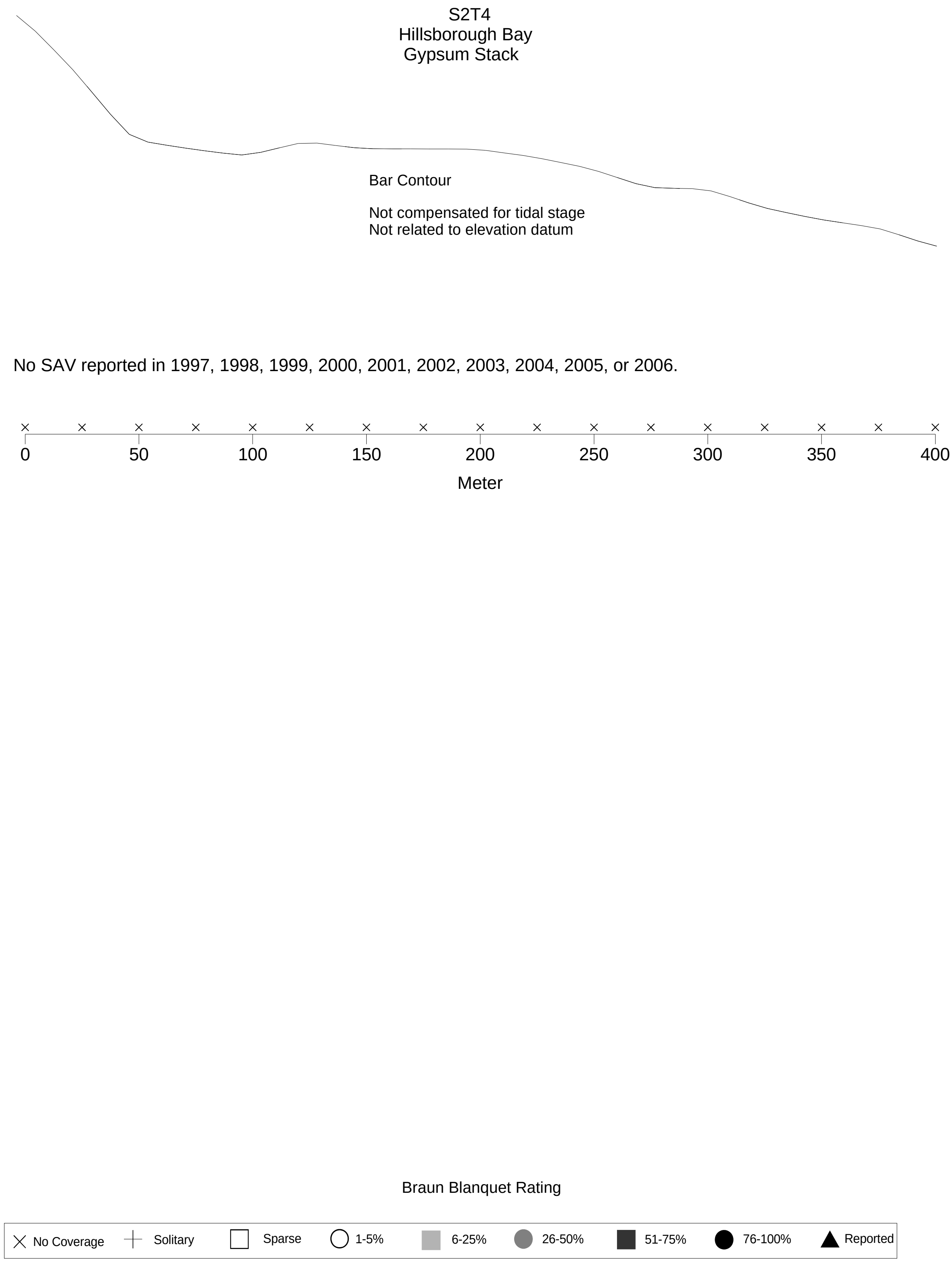
MA2 Transects

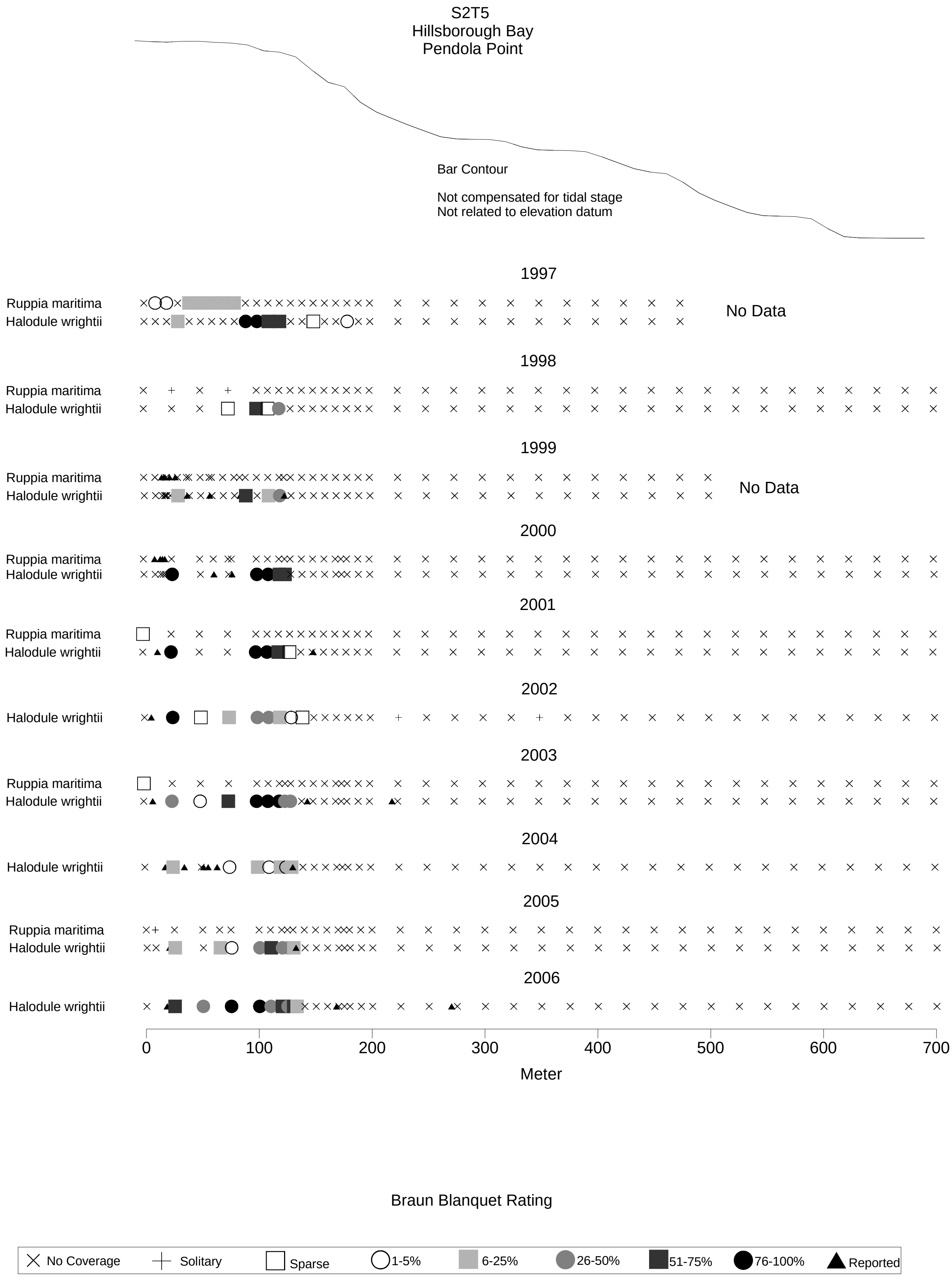

S2T8
Hillsborough Bay
North Bayshore Blvd.
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
No SAV in 1997, 1998, 1999, 2001, 2002, 2003, or 2005.
2000
Halodule wrightii
2004
Halodule wrightii
0
50
100
150
200
250
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported


S2T9
Hillsborough Bay
North Ballast Point
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Halodule wrightii
0
50
100
150
200
250
300
350
400
450
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

Hillsborough Bay

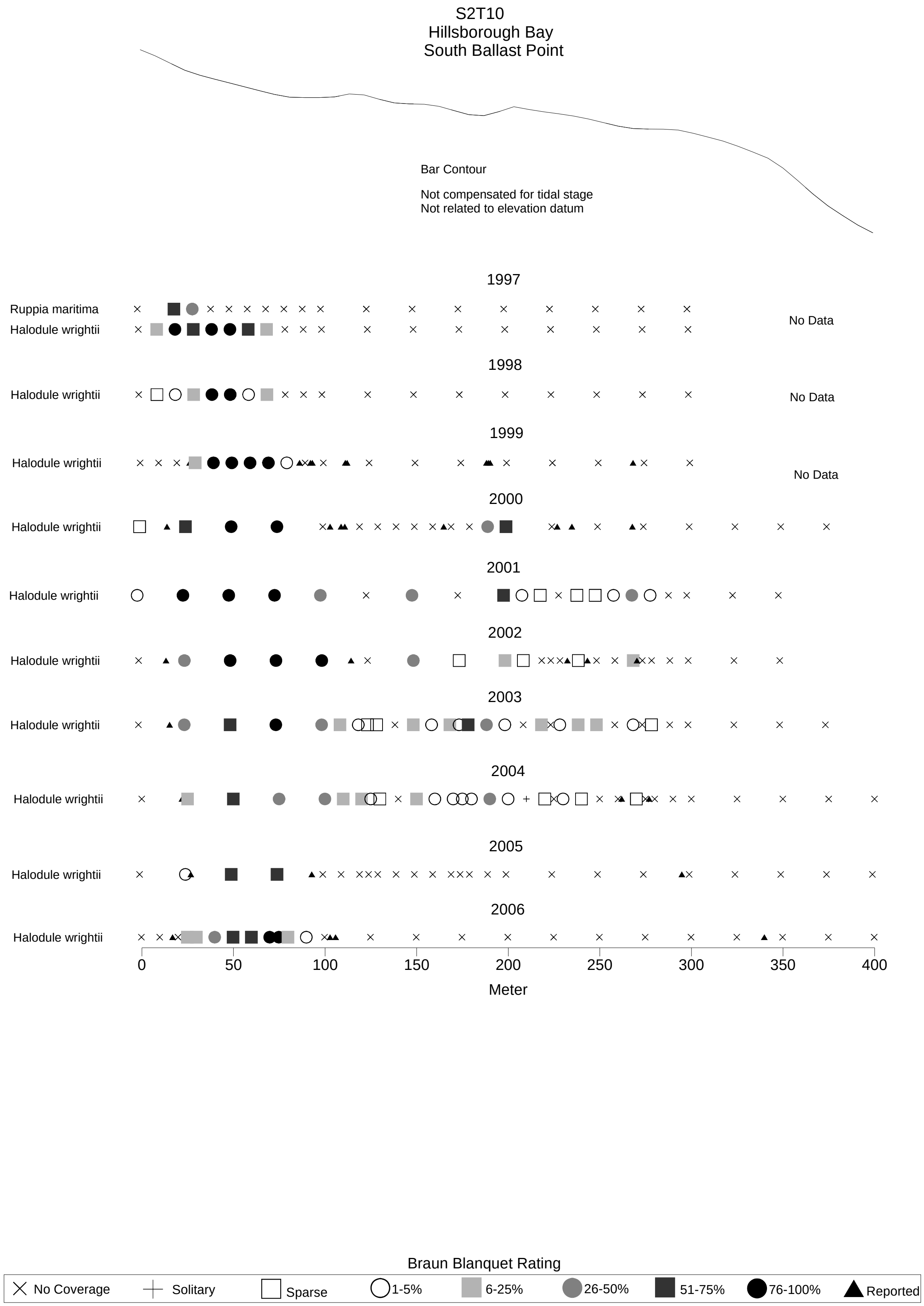
MA3 Transects

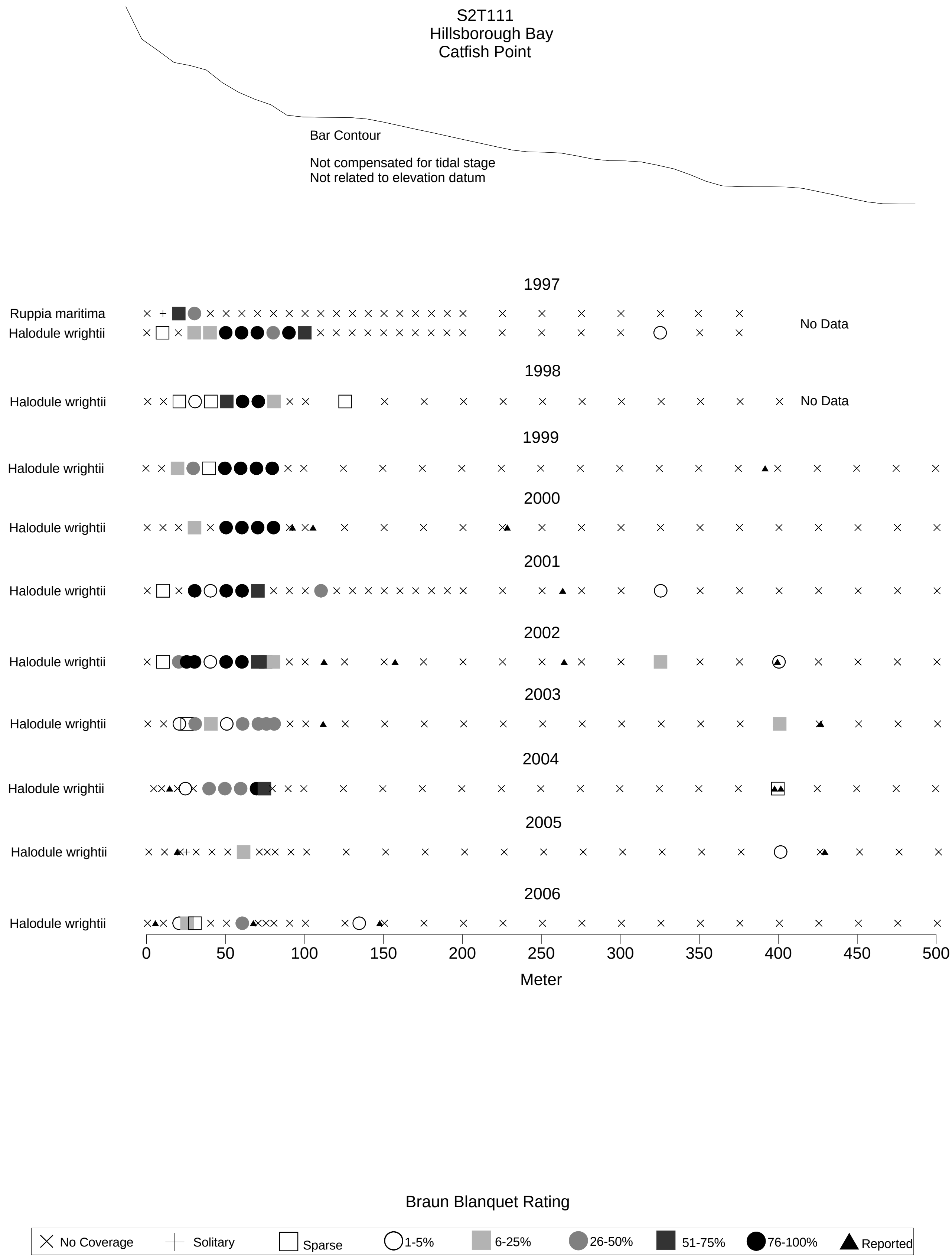

S2T4
Hillsborough Bay
Gypsum Stack
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
No SAV reported in 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, or 2006.
0
50
100
150
200
250
300
350
400
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

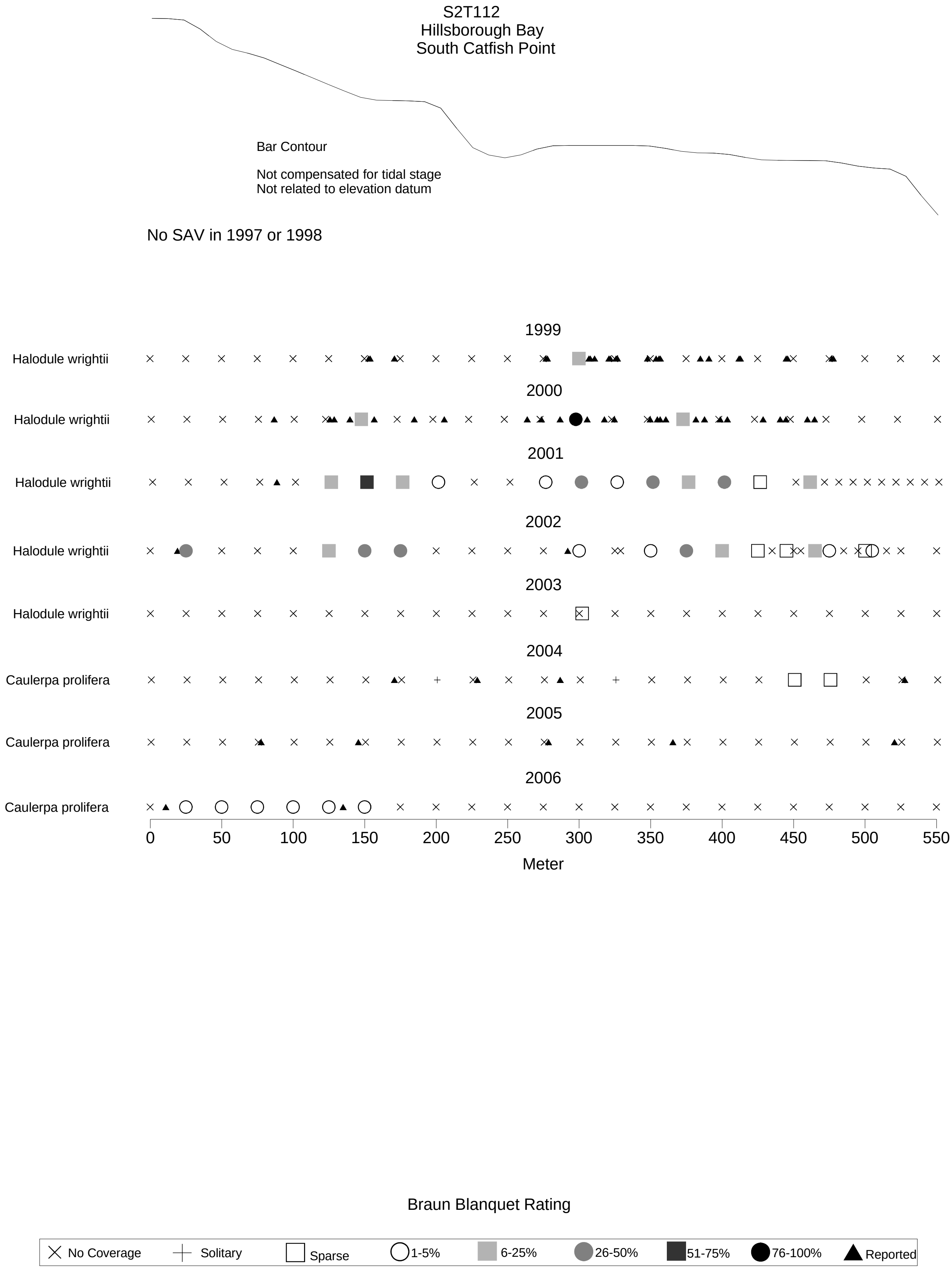

S2T5
Hillsborough Bay
Pendola Point
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1997
Ruppia maritima
Halodule wrightii
No Data
1998
Ruppia maritima
Halodule wrightii
1999
Ruppia maritima
Halodule wrightii
No Data
2000
Ruppia maritima
Halodule wrightii
2001
Ruppia maritima
Halodule wrightii
2002
Halodule wrightii
2003
Ruppia maritima
Halodule wrightii
2004
Halodule wrightii
2005
Ruppia maritima
Halodule wrightii
2006
Halodule wrightii
0
100
200
300
400
500
600
700
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

Hillsborough Bay

MA4 Transects

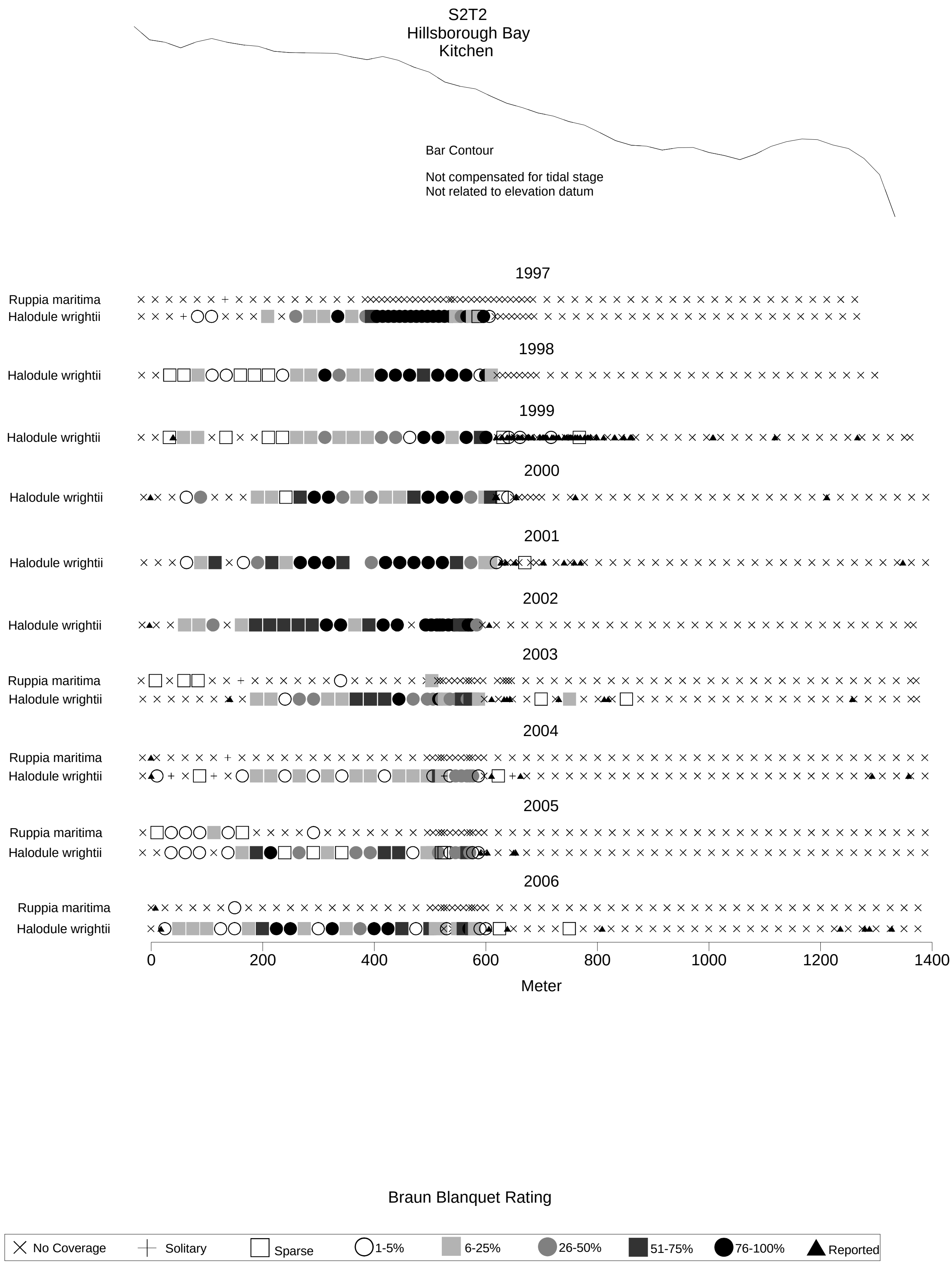

S2T10
Hillsborough Bay
South Ballast Point
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1997
Ruppia maritima
Halodule wrightii
No Data
1998
Halodule wrightii
No Data
1999
Halodule wrightii
No Data
2000
Halodule wrightii
2001
Halodule wrightii
2002
Halodule wrightii
2003
Halodule wrightii
2004
Halodule wrightii
2005
Halodule wrightii
2006
Halodule wrightii
0
50
100
150
200
250
300
350
400
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

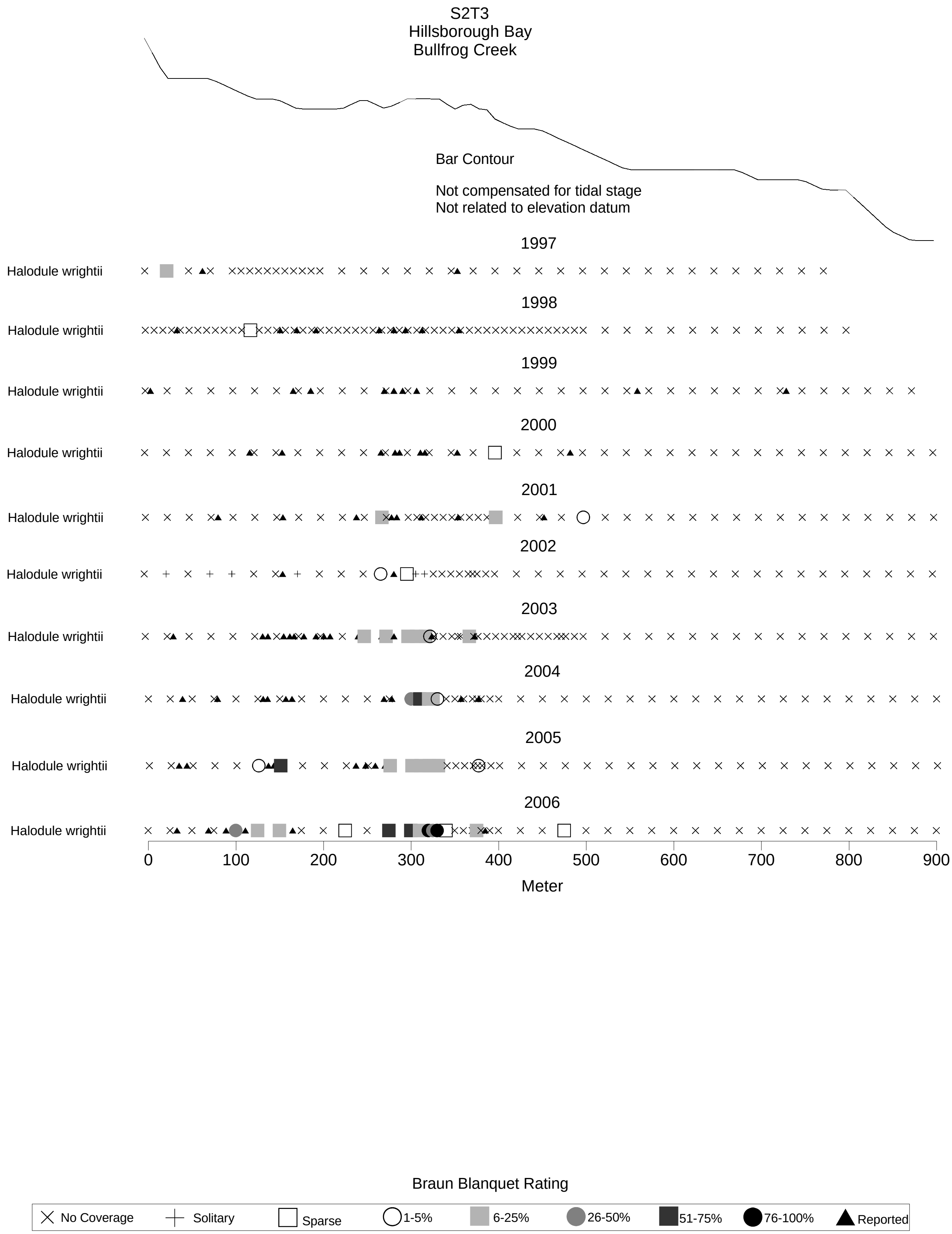

S2T111
Hillsborough Bay
Catfish Point
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1997
Ruppia maritima
Halodule wrightii
No Data
1998
Halodule wrightii
No Data
1999
Halodule wrightii
2000
Halodule wrightii
2001
Halodule wrightii
2002
Halodule wrightii
2003
Halodule wrightii
2004
Halodule wrightii
2005
Halodule wrightii
2006
Halodule wrightii
0 50 100 150 200 250 300 350 400 450 500
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported


S2T112
Hillsborough Bay
South Catfish Point
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
No SAV in 1997 or 1998
1999
Halodule wrightii
2000
Halodule wrightii
2001
Halodule wrightii
2002
Halodule wrightii
2003
Halodule wrightii
2004
Caulerpa prolifera
2005
Caulerpa prolifera
2006
Caulerpa prolifera
0
50
100
150
200
250
300
350
400
450
500
550
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

Hillsborough Bay

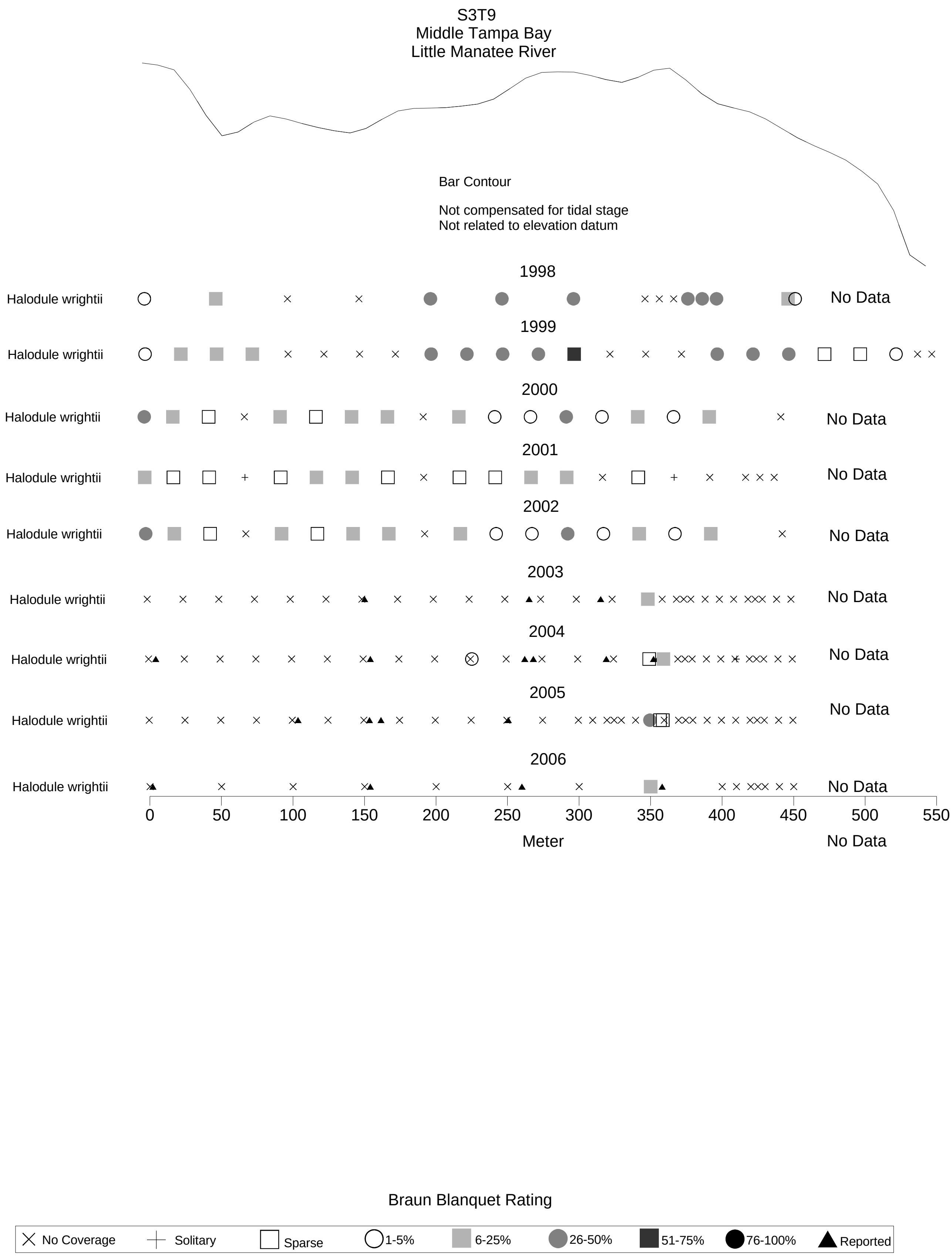
MA5 Transects

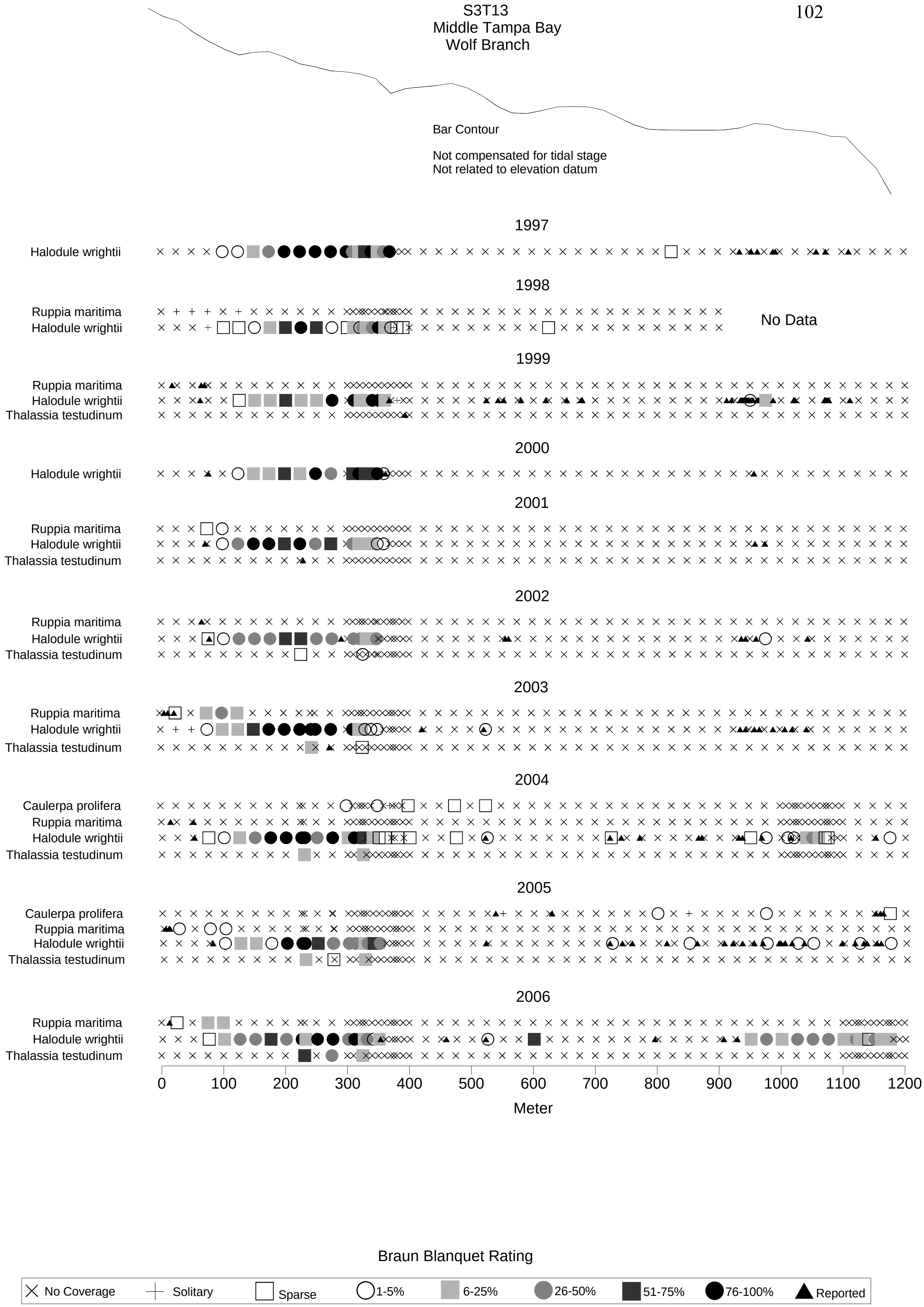

S2T2
Hillsborough Bay
Kitchen
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1997
Ruppia maritima
Halodule wrightii
1998
Halodule wrightii
1999
Halodule wrightii
2000
Halodule wrightii
2001
Halodule wrightii
2002
Halodule wrightii
2003
Ruppia maritima
Halodule wrightii
2004
Ruppia maritima
Halodule wrightii
2005
Ruppia maritima
Halodule wrightii
2006
Ruppia maritima
Halodule wrightii
0
200
400
600
800
1000
1200
1400
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported


S2T3
Hillsborough Bay
Bullfrog Creek
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1997
Halodule wrightii
1998
Halodule wrightii
1999
Halodule wrightii
2000
Halodule wrightii
2001
Halodule wrightii
2002
Halodule wrightii
2003
Halodule wrightii
2004
Halodule wrightii
2005
Halodule wrightii
2006
Halodule wrightii
0
100
200
300
400
500
600
700
800
900
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

Middle Tampa Bay

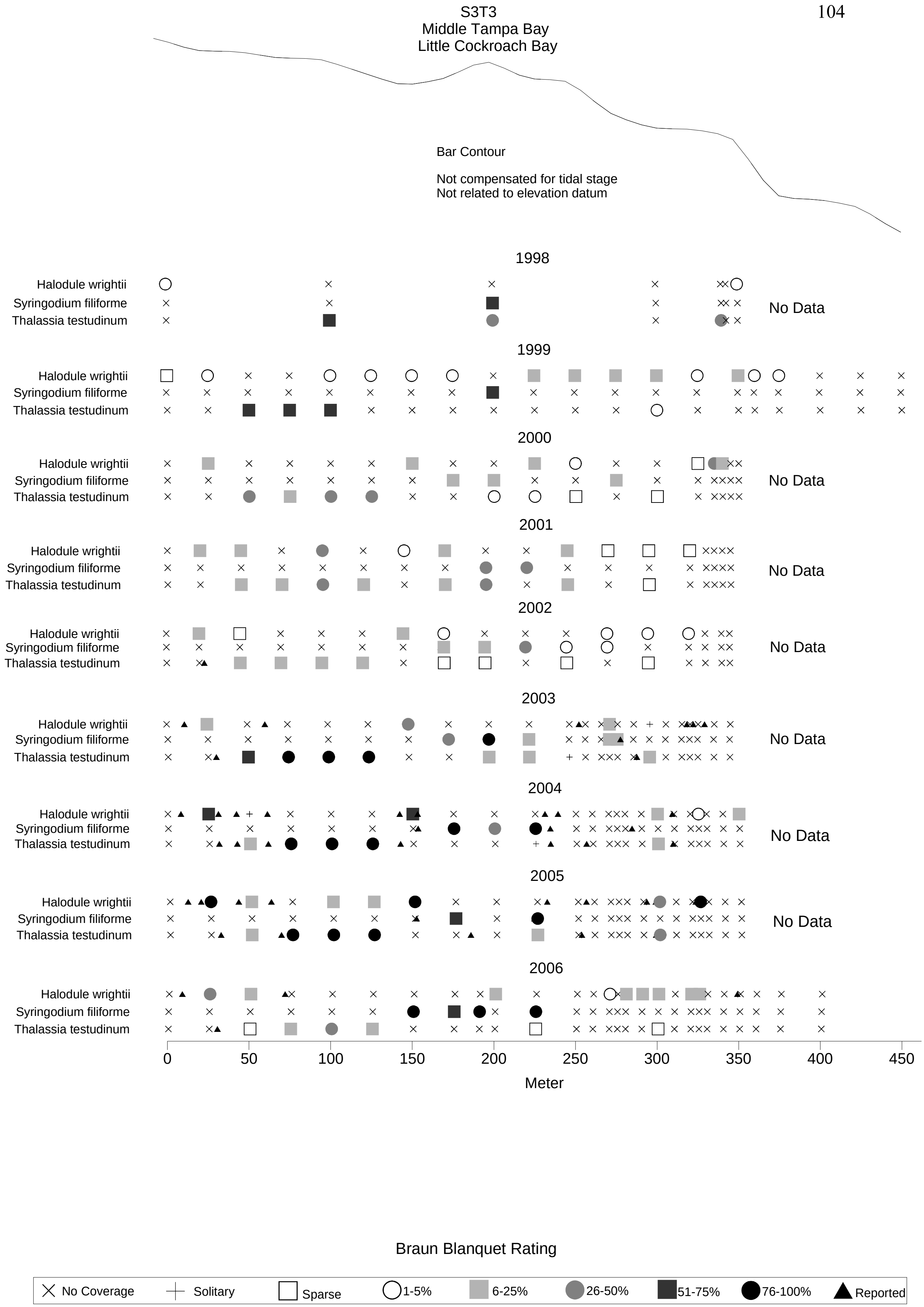
MA6 Transects

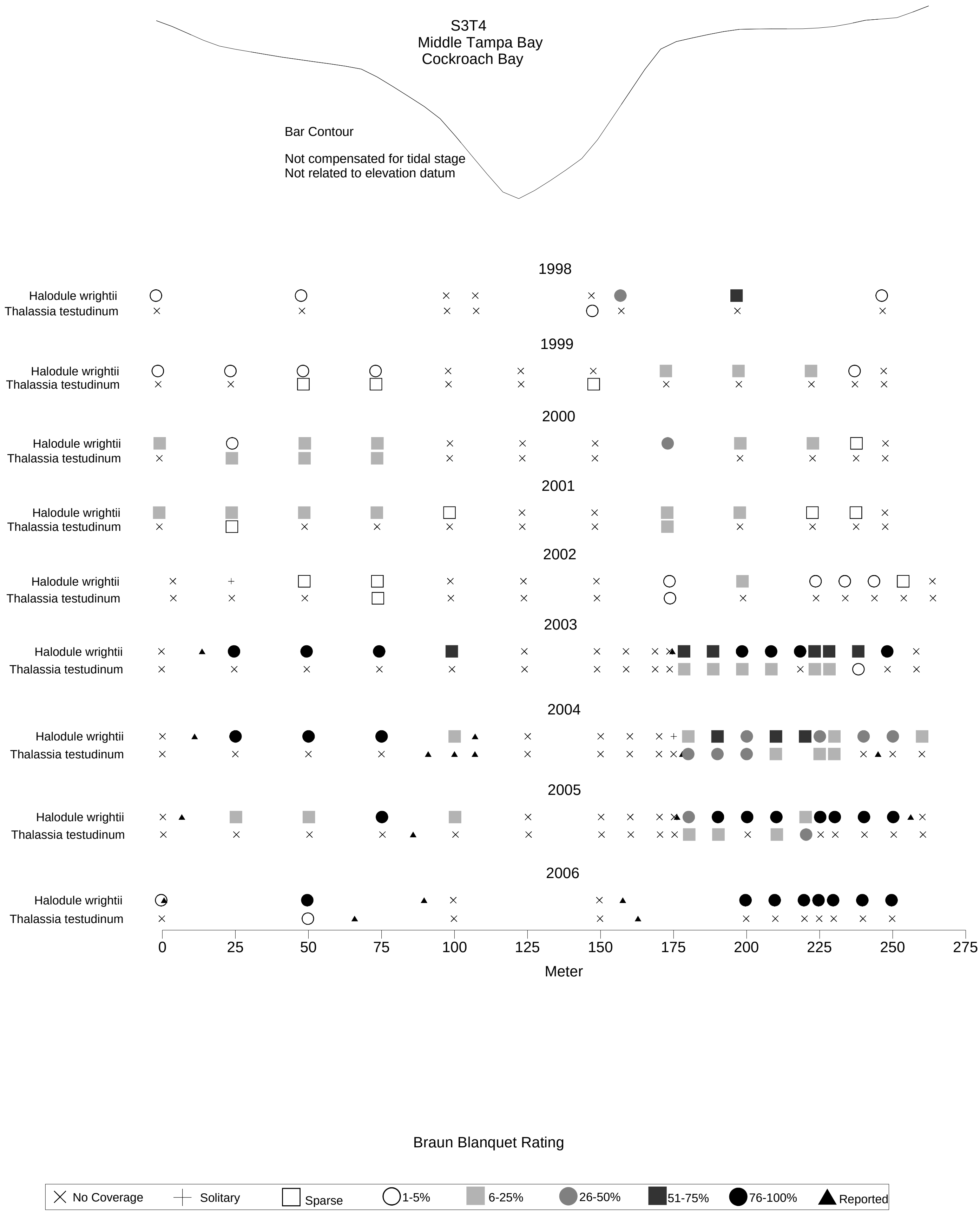

S3T9
Middle Tampa Bay
Little Manatee River
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
Halodule wrightii
No Data
1999
Halodule wrightii
2000
Halodule wrightii
No Data
2001
Halodule wrightii
No Data
2002
Halodule wrightii
No Data
2003
Halodule wrightii
No Data
2004
Halodule wrightii
No Data
2005
Halodule wrightii
No Data
2006
Halodule wrightii
No Data
0
50
100
150
200
250
300
350
400
450
500
550
Meter
No Data
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

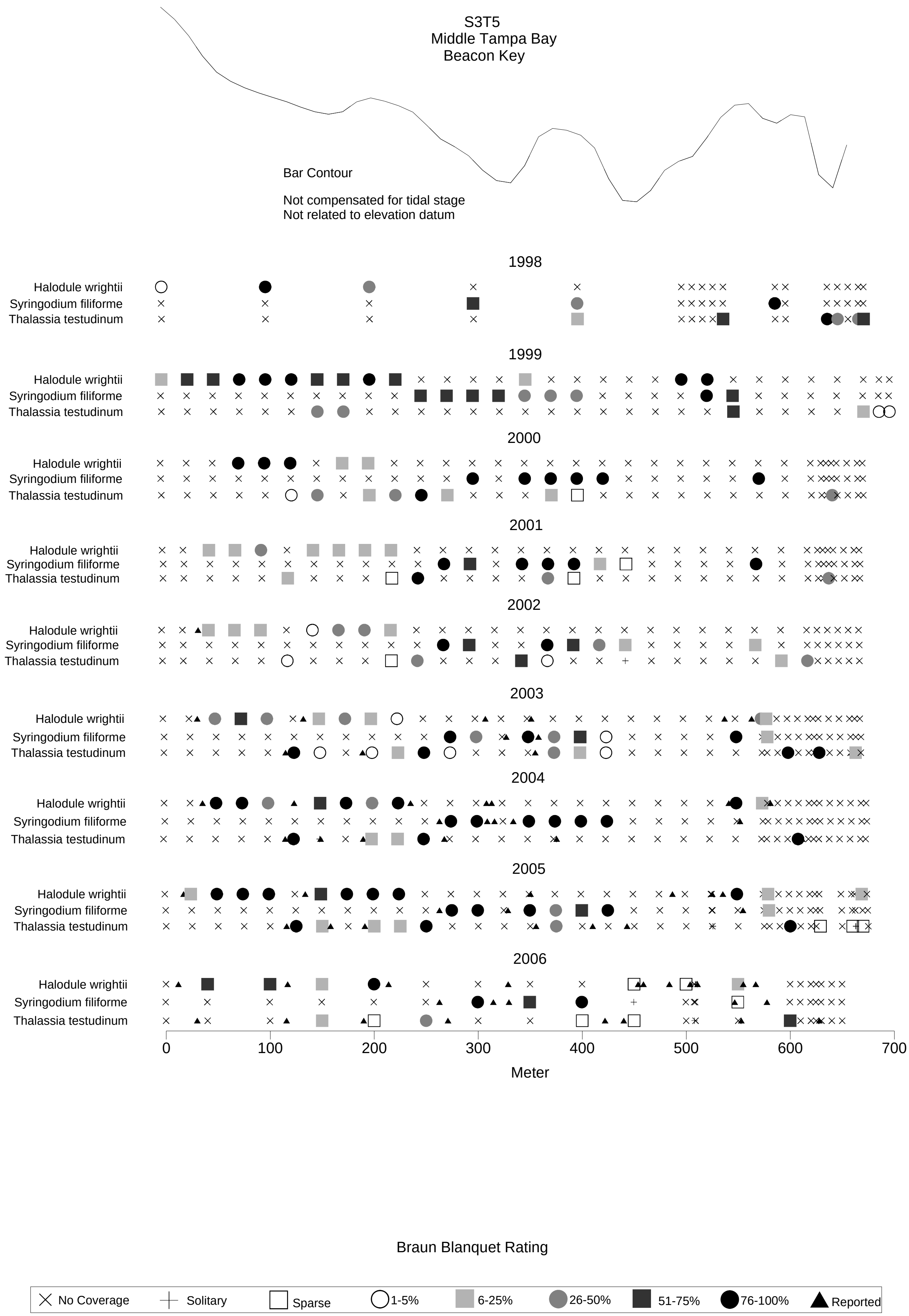

S3T13
Middle Tampa Bay
Wolf Branch
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1997
Halodule wrightii
1998
Ruppia maritima
Halodule wrightii
No Data
1999
Ruppia maritima
Halodule wrightii
Thalassia testudinum
2000
Halodule wrightii
2001
Ruppia maritima
Halodule wrightii
Thalassia testudinum
2002
Ruppia maritima
Halodule wrightii
Thalassia testudinum
2003
Ruppia maritima
Halodule wrightii
Thalassia testudinum
2004
Caulerpa prolifera
Ruppia maritima
Halodule wrightii
Thalassia testudinum
2005
Caulerpa prolifera
Ruppia maritima
Halodule wrightii
Thalassia testudinum
2006
Ruppia maritima
Halodule wrightii
Thalassia testudinum
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

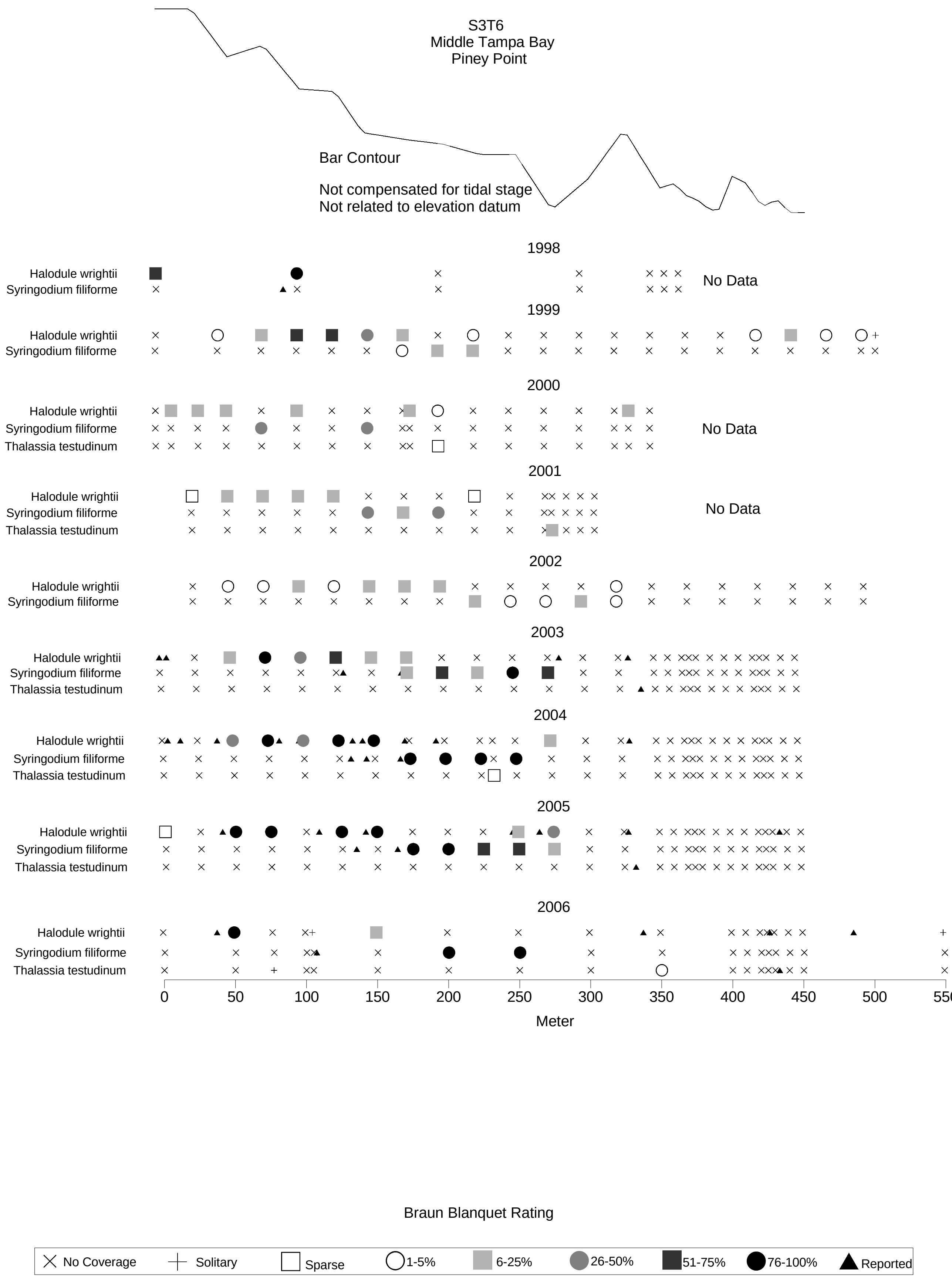
Middle Tampa Bay

MA7 Transects


S3T3
Middle Tampa Bay
Little Cockroach Bay
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
1999
2000
2001
2002
2003
2004
2005
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
No Data
0
50
100
150
200
250
300
350
400
450
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

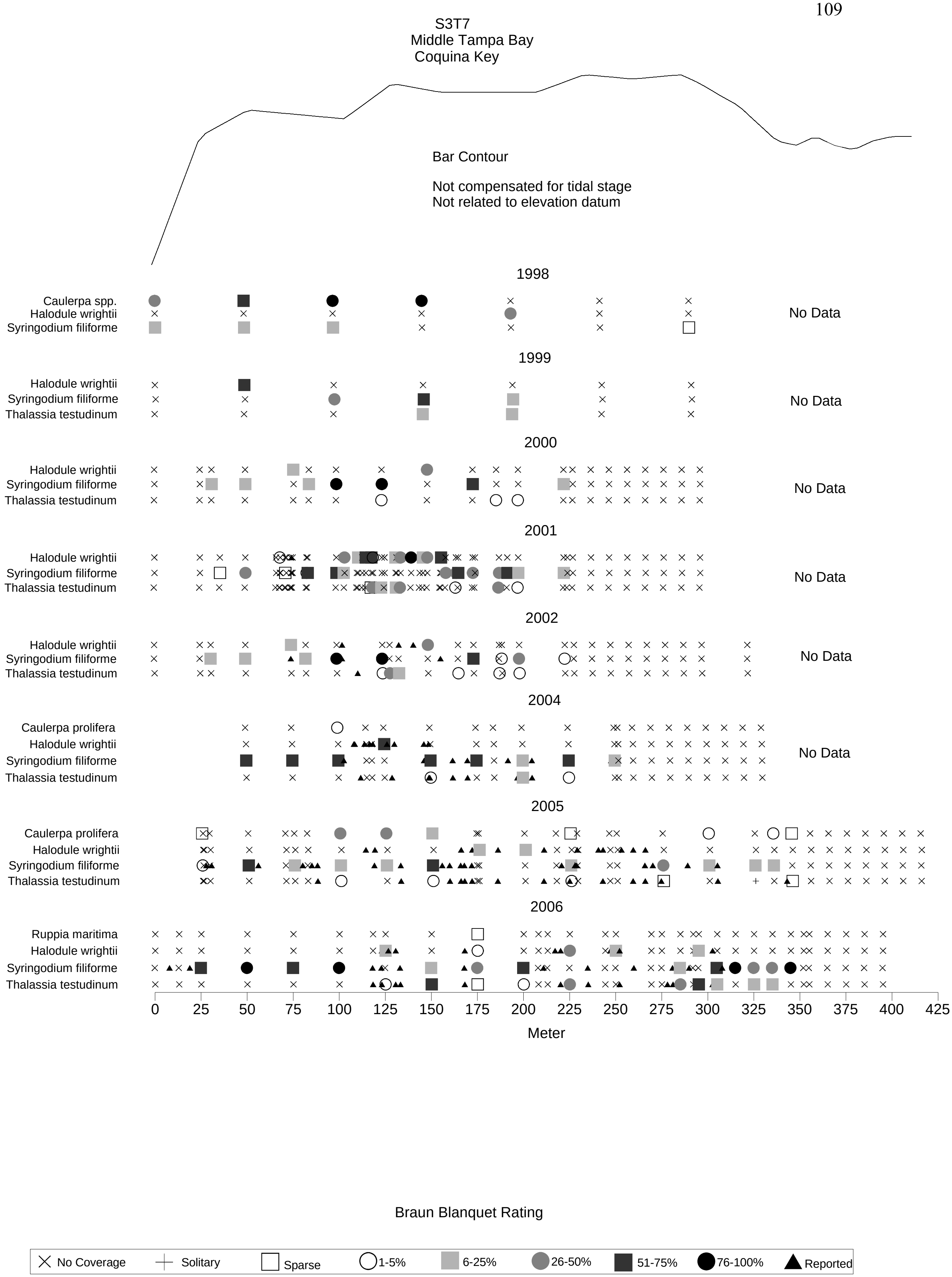

S3T4
Middle Tampa Bay
Cockroach Bay
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
1999
2000
2001
2002
2003
2004
2005
2006
Halodule wrightii
Thalassia testudinum
0
25
50
75
100
125
150
175
200
225
250
275
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

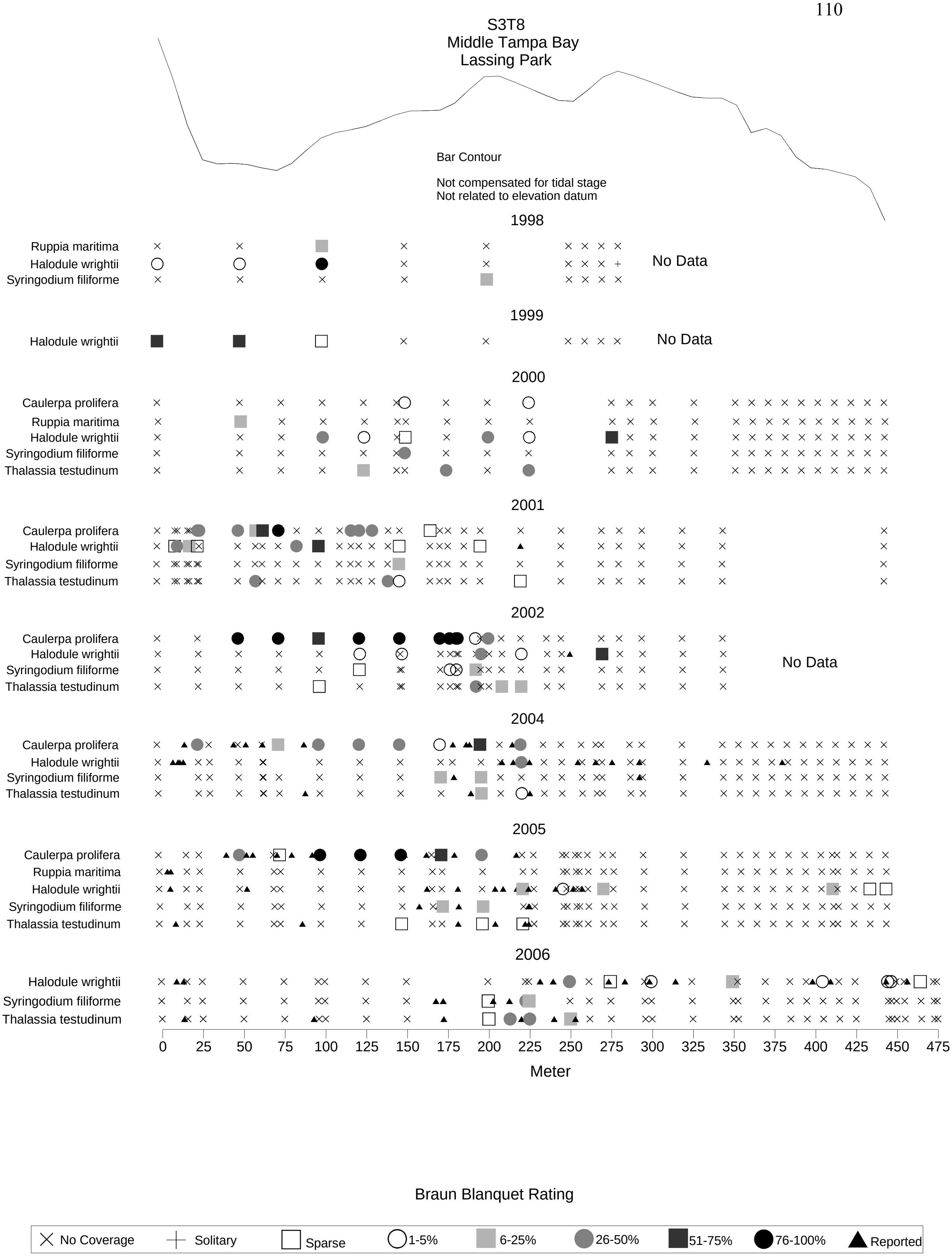

S3T5
Middle Tampa Bay
Beacon Key
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
1999
2000
2001
2002
2003
2004
2005
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0
100
200
300
400
500
600
700
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported


S3T6
Middle Tampa Bay
Piney Point
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
Halodule wrightii
Syringodium filiforme
No Data
1999
Halodule wrightii
Syringodium filiforme
2000
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
No Data
2001
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
No Data
2002
Halodule wrightii
Syringodium filiforme
2003
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2004
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2005
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0
50
100
150
200
250
300
350
400
450
500
550
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

Middle Tampa Bay

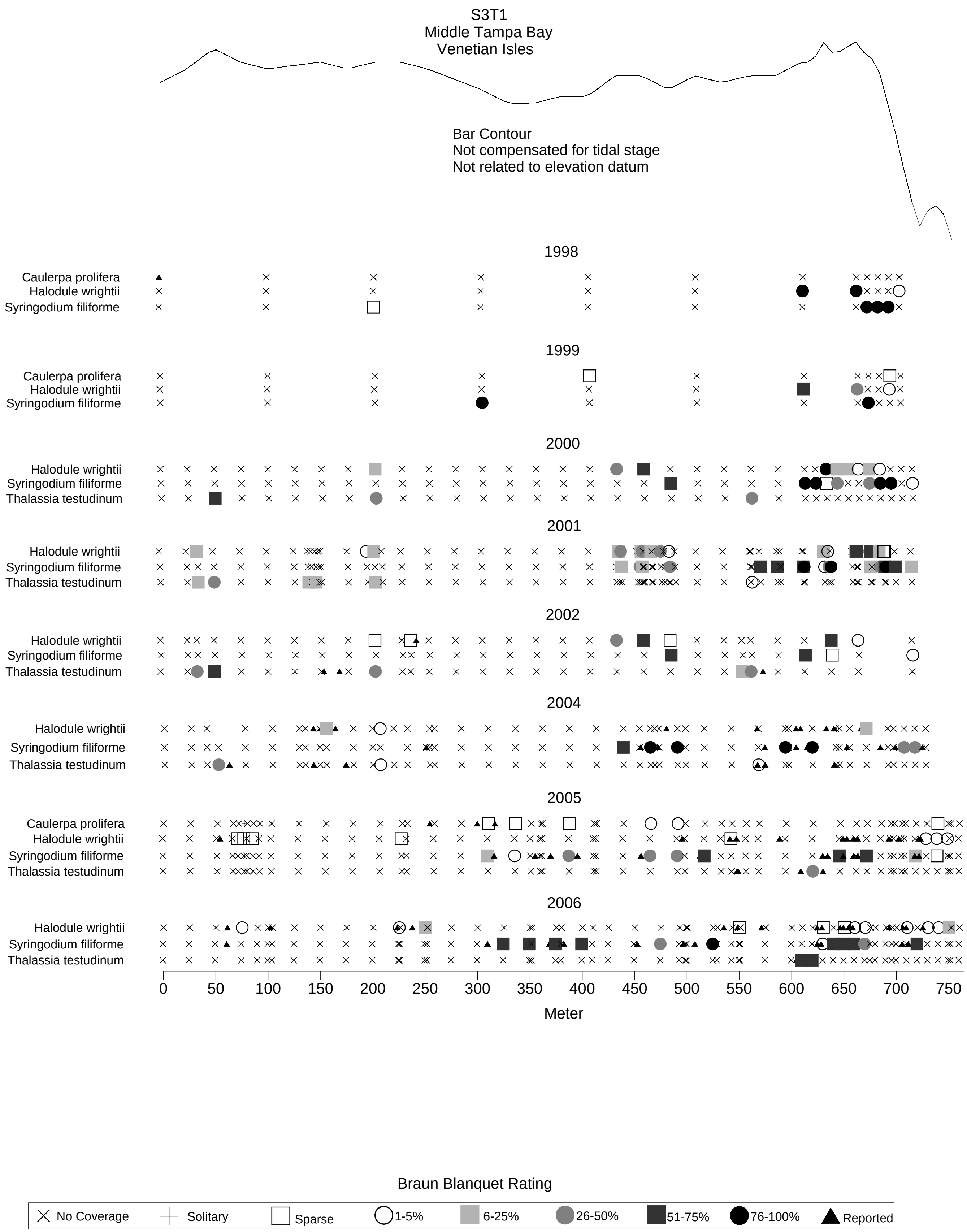
MA17 Transects


S3T7
Middle Tampa Bay
Coquina Key
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
Caulerpa spp.
Halodule wrightii
Syringodium filiforme
No Data
1999
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
No Data
2000
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
No Data
2001
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
No Data
2002
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
No Data
2004
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
No Data
2005
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2006
Ruppia maritima
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
425
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

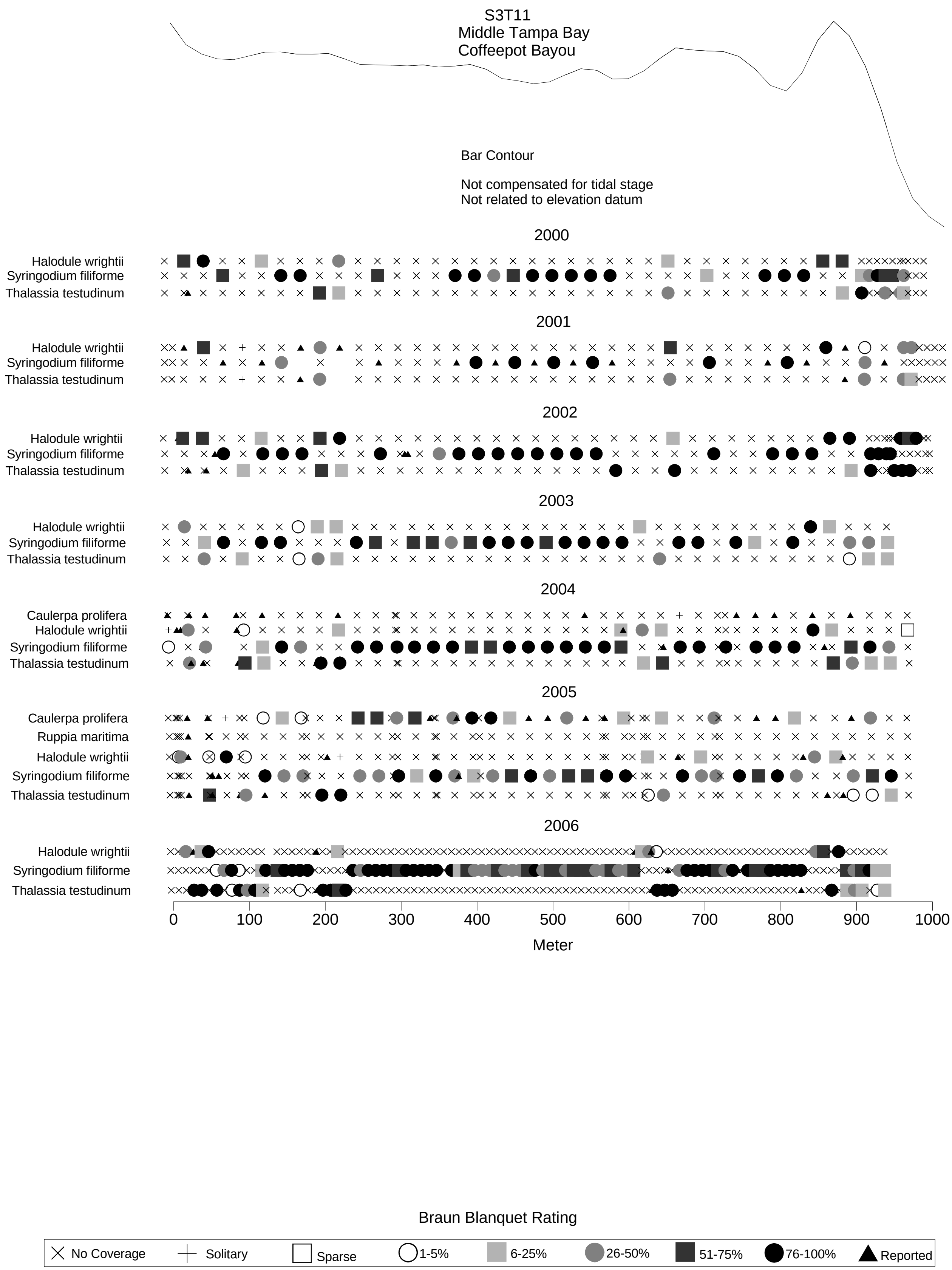

S3T8
Middle Tampa Bay
Lassing Park
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
Ruppia maritima
Halodule wrightii
Syringodium filiforme
No Data
1999
Halodule wrightii
No Data
2000
Caulerpa prolifera
Ruppia maritima
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2001
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2002
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
No Data
2004
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2005
Caulerpa prolifera
Ruppia maritima
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0 25 50 75 100 125 150 175 200 225 250 275 300 325 350 375 400 425 450 475
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

Middle Tampa Bay

MA18 Transects



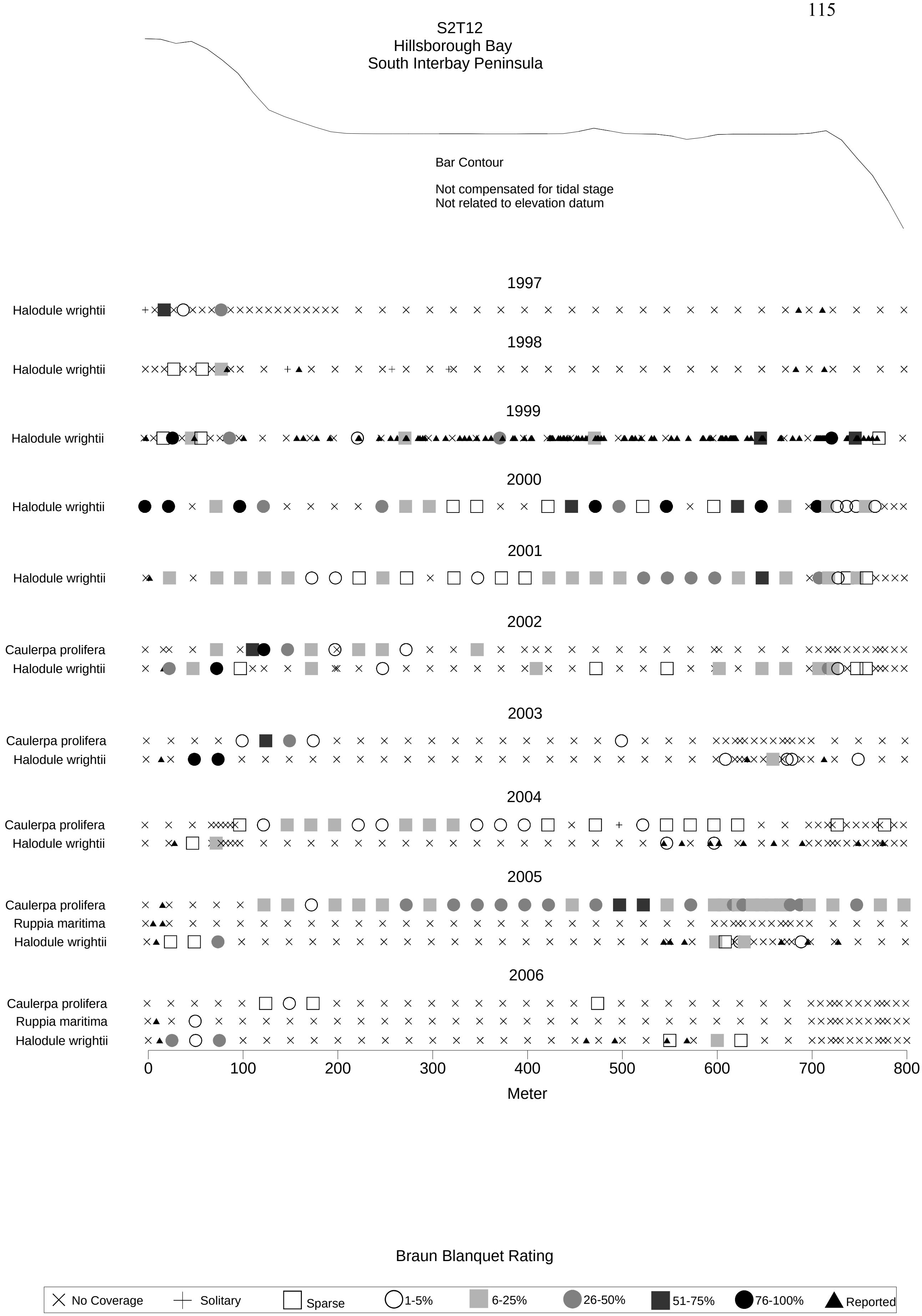
S3T1
Middle Tampa Bay
Venetian Isles
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
1999
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
2000
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2001
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2002
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2004
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2005
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

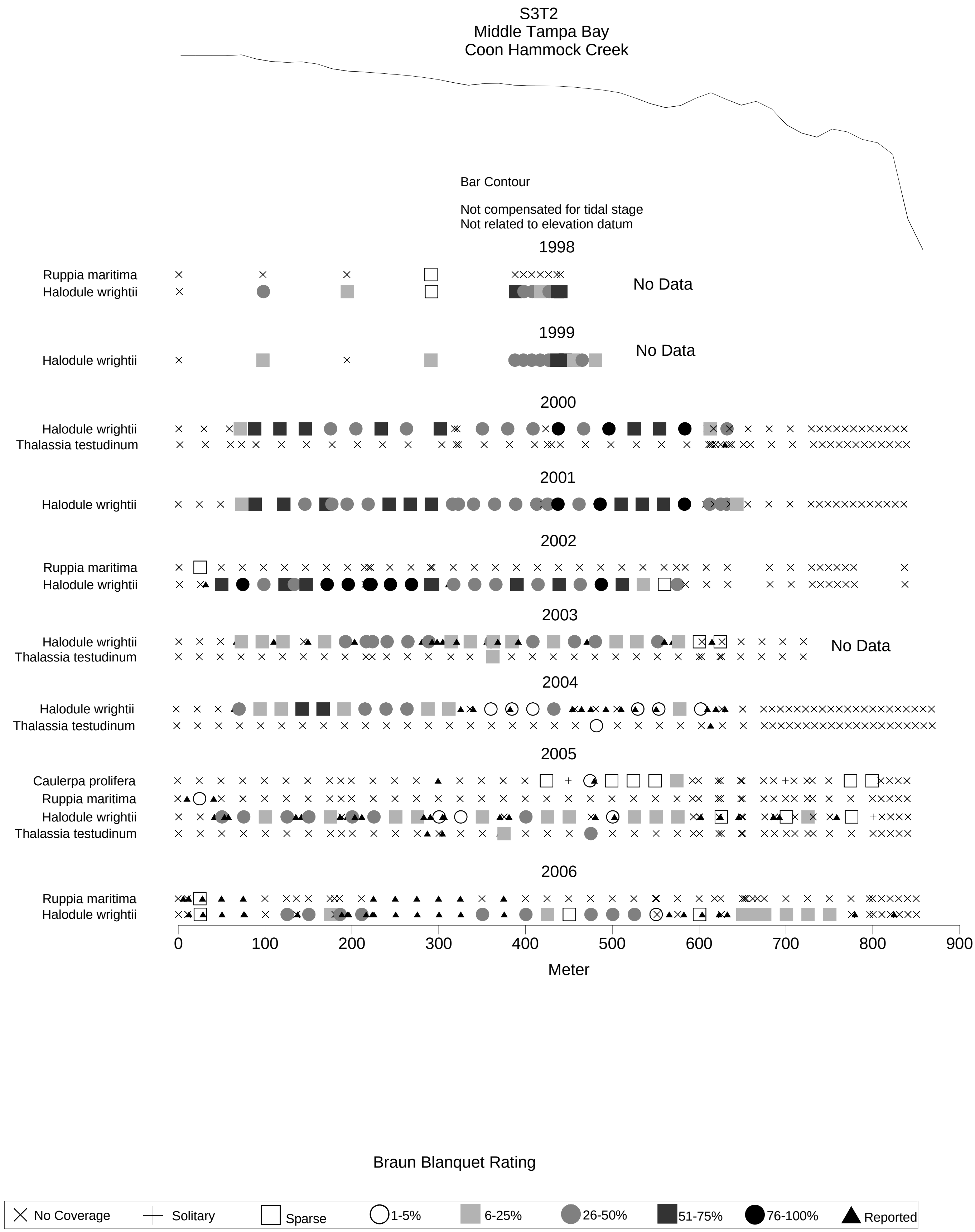


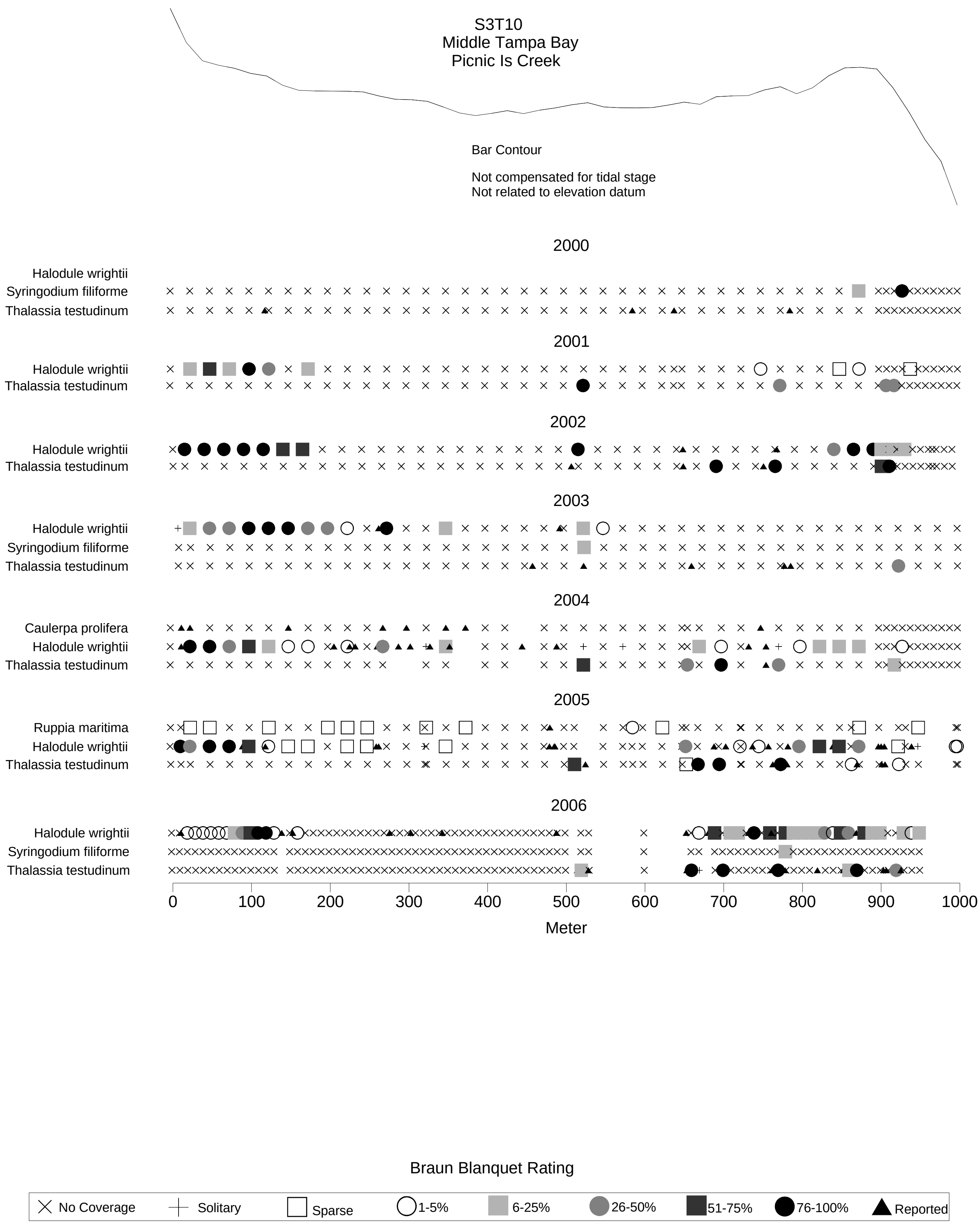
S3T11
Middle Tampa Bay
Coffeepot Bayou
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
2000
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2001
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2002
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2003
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2004
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2005
Caulerpa prolifera
Ruppia maritima
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0
100
200
300
400
500
600
700
800
900
1000
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

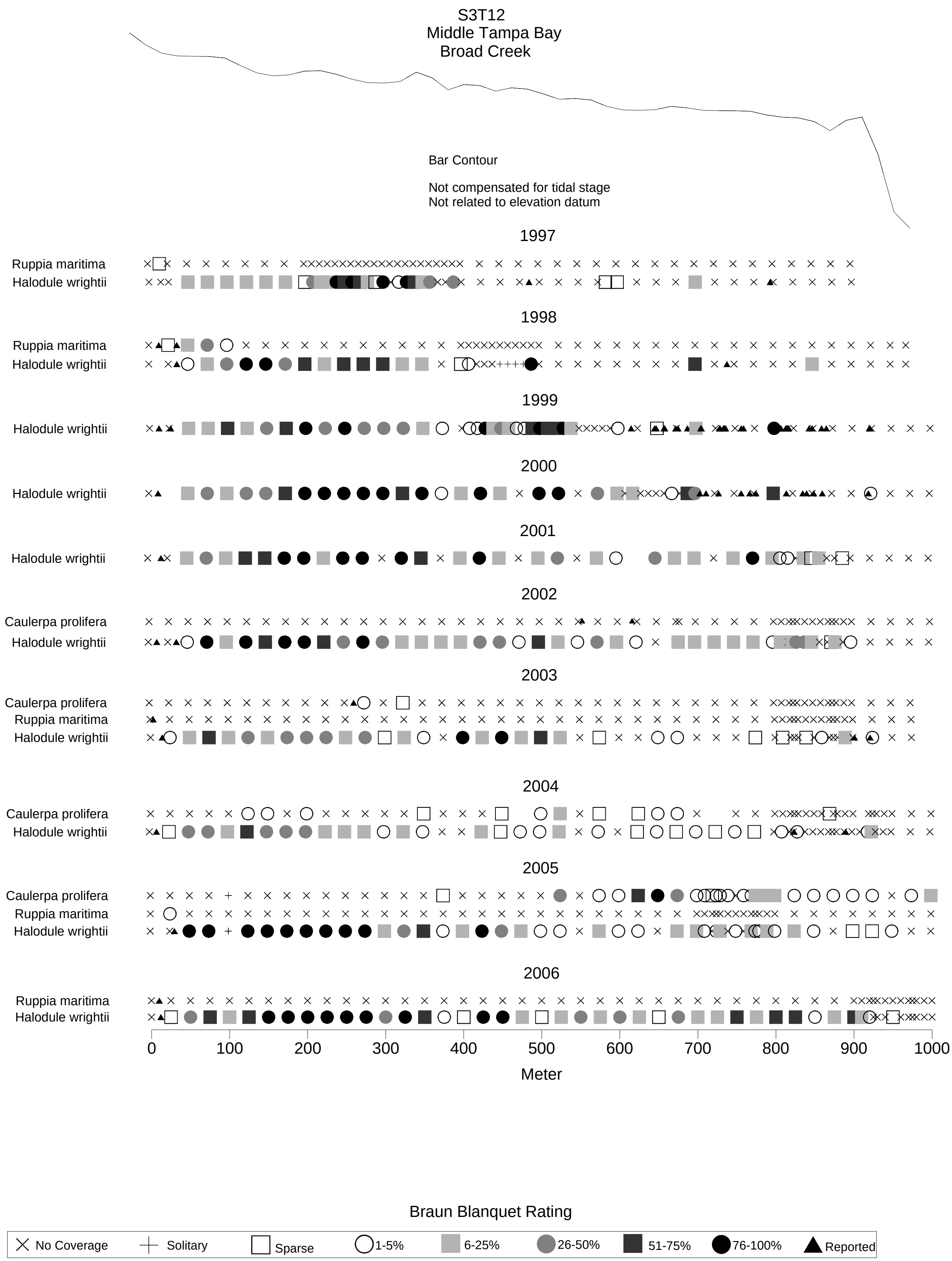
Middle Tampa Bay

MA27 Transects


S2T12
Hillsborough Bay
South Interbay Peninsula
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1997
Halodule wrightii
1998
Halodule wrightii
1999
Halodule wrightii
2000
Halodule wrightii
2001
Halodule wrightii
2002
Caulerpa prolifera
Halodule wrightii
2003
Caulerpa prolifera
Halodule wrightii
2004
Caulerpa prolifera
Halodule wrightii
2005
Caulerpa prolifera
Ruppia maritima
Halodule wrightii
2006
Caulerpa prolifera
Ruppia maritima
Halodule wrightii
0
100
200
300
400
500
600
700
800
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

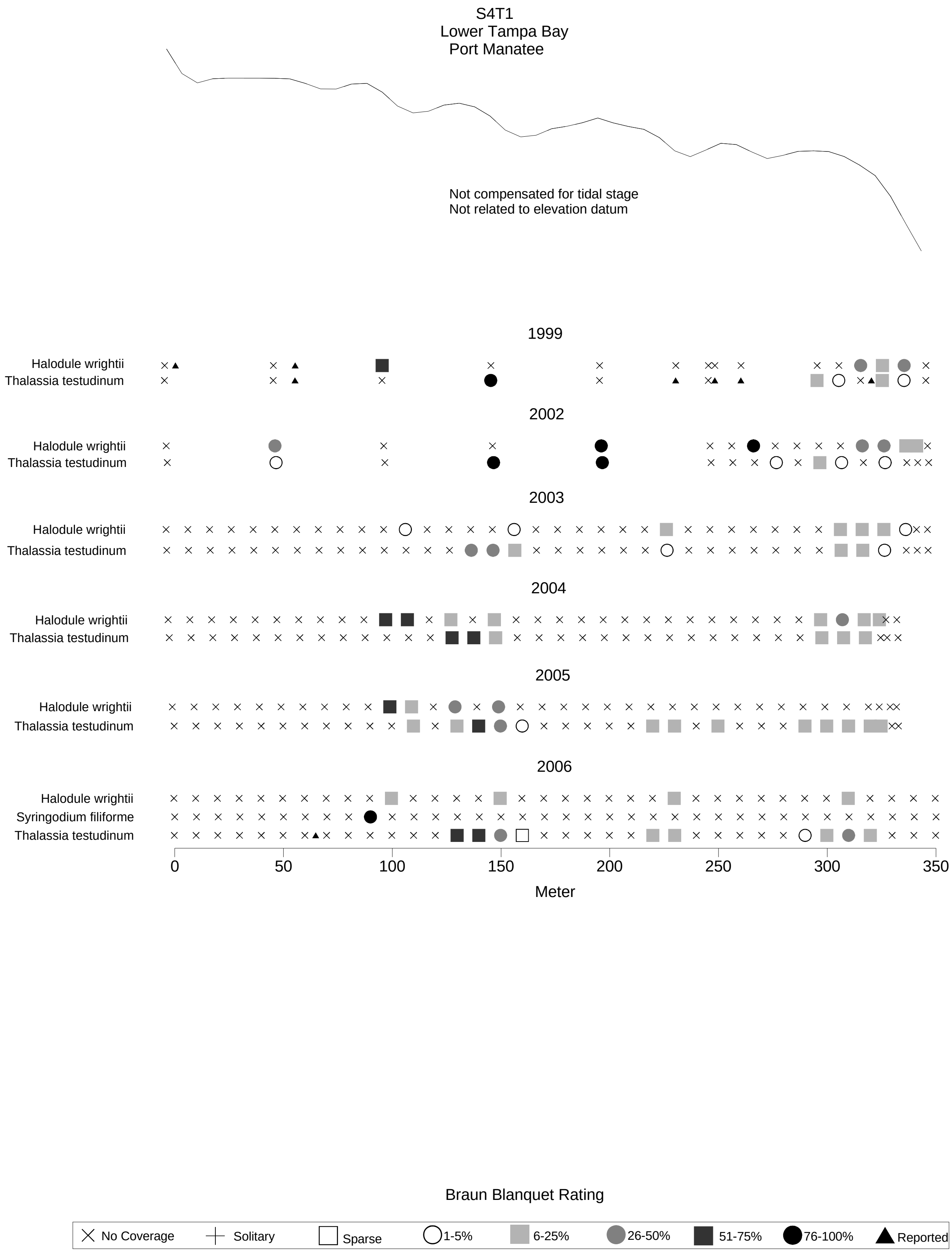

S3T2
Middle Tampa Bay
Coon Hammock Creek
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
Ruppia maritima
Halodule wrightii
No Data
1999
Halodule wrightii
No Data
2000
Halodule wrightii
Thalassia testudinum
2001
Halodule wrightii
2002
Ruppia maritima
Halodule wrightii
2003
Halodule wrightii
Thalassia testudinum
No Data
2004
Halodule wrightii
Thalassia testudinum
2005
Caulerpa prolifera
Ruppia maritima
Halodule wrightii
Thalassia testudinum
2006
Ruppia maritima
Halodule wrightii
0
100
200
300
400
500
600
700
800
900
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

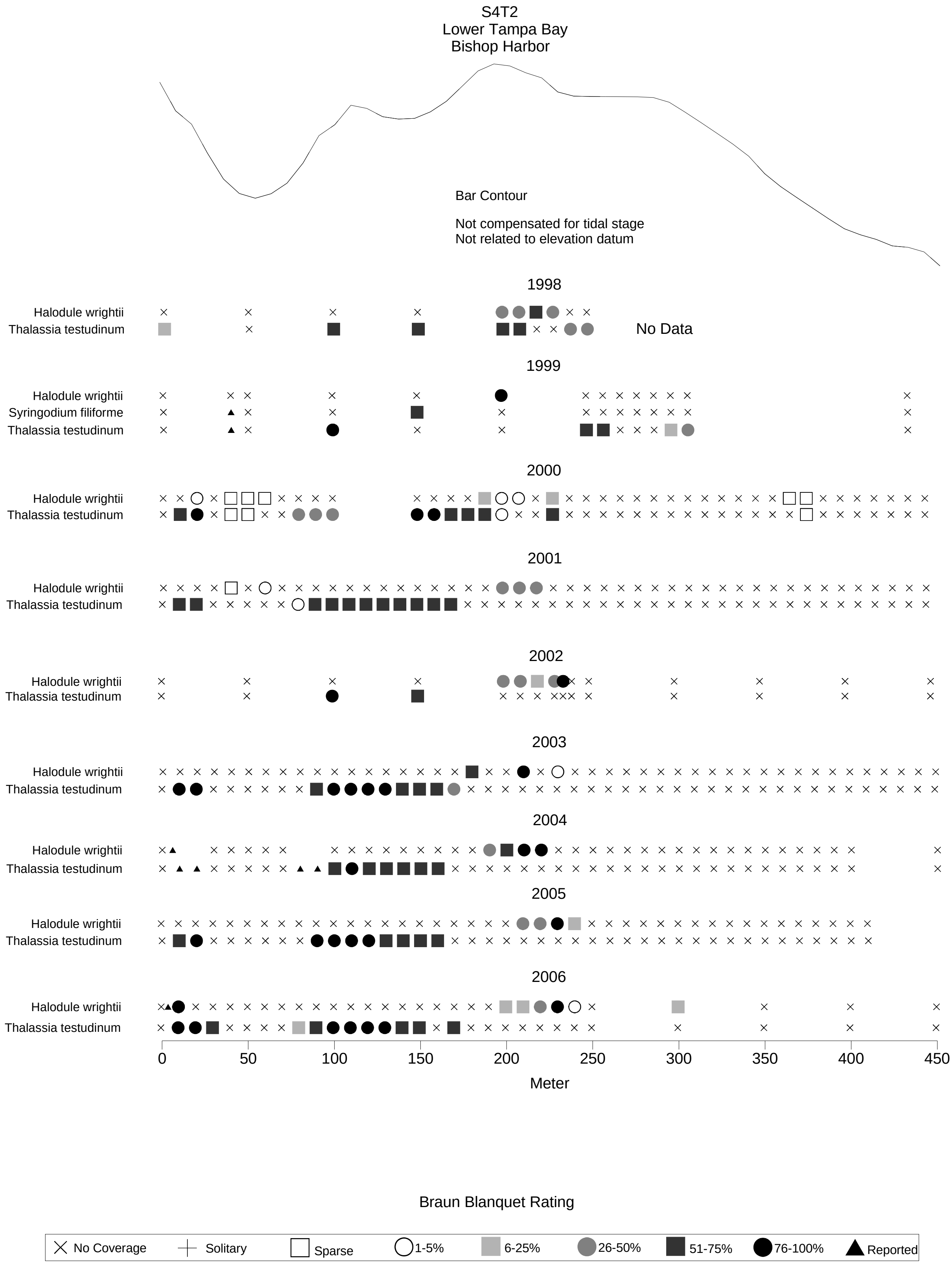

S3T10
Middle Tampa Bay
Picnic Is Creek
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
2000
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2001
Halodule wrightii
Thalassia testudinum
2002
Halodule wrightii
Thalassia testudinum
2003
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2004
Caulerpa prolifera
Halodule wrightii
Thalassia testudinum
2005
Ruppia maritima
Halodule wrightii
Thalassia testudinum
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0
100
200
300
400
500
600
700
800
900
1000
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported


S3T12
Middle Tampa Bay
Broad Creek
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1997
Ruppia maritima
Halodule wrightii
1998
Ruppia maritima
Halodule wrightii
1999
Halodule wrightii
2000
Halodule wrightii
2001
Halodule wrightii
2002
Caulerpa prolifera
Halodule wrightii
2003
Caulerpa prolifera
Ruppia maritima
Halodule wrightii
2004
Caulerpa prolifera
Halodule wrightii
2005
Caulerpa prolifera
Ruppia maritima
Halodule wrightii
2006
Ruppia maritima
Halodule wrightii
0
100
200
300
400
500
600
700
800
900
1000
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

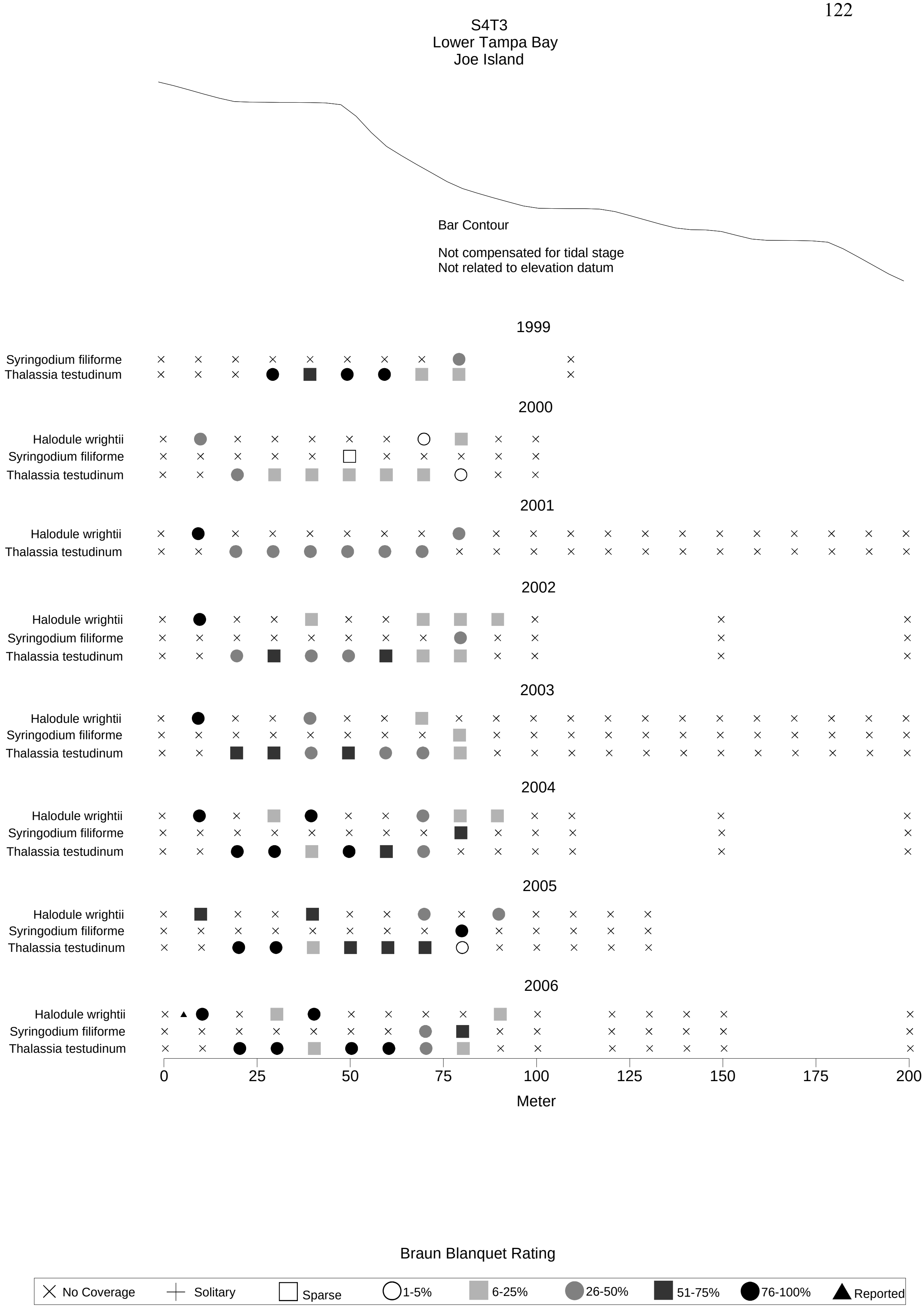
Lower Tampa Bay

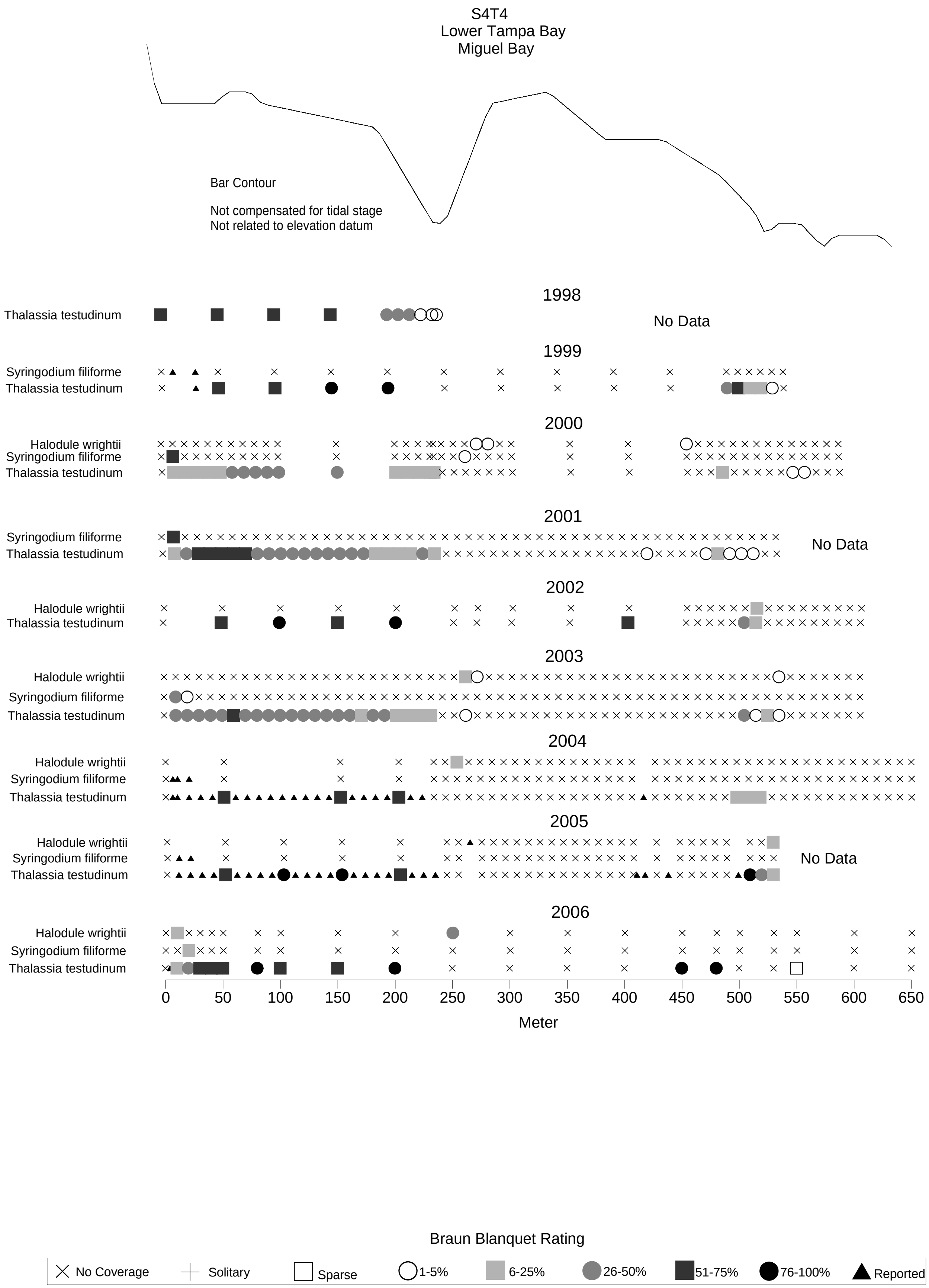
MA8 Transects

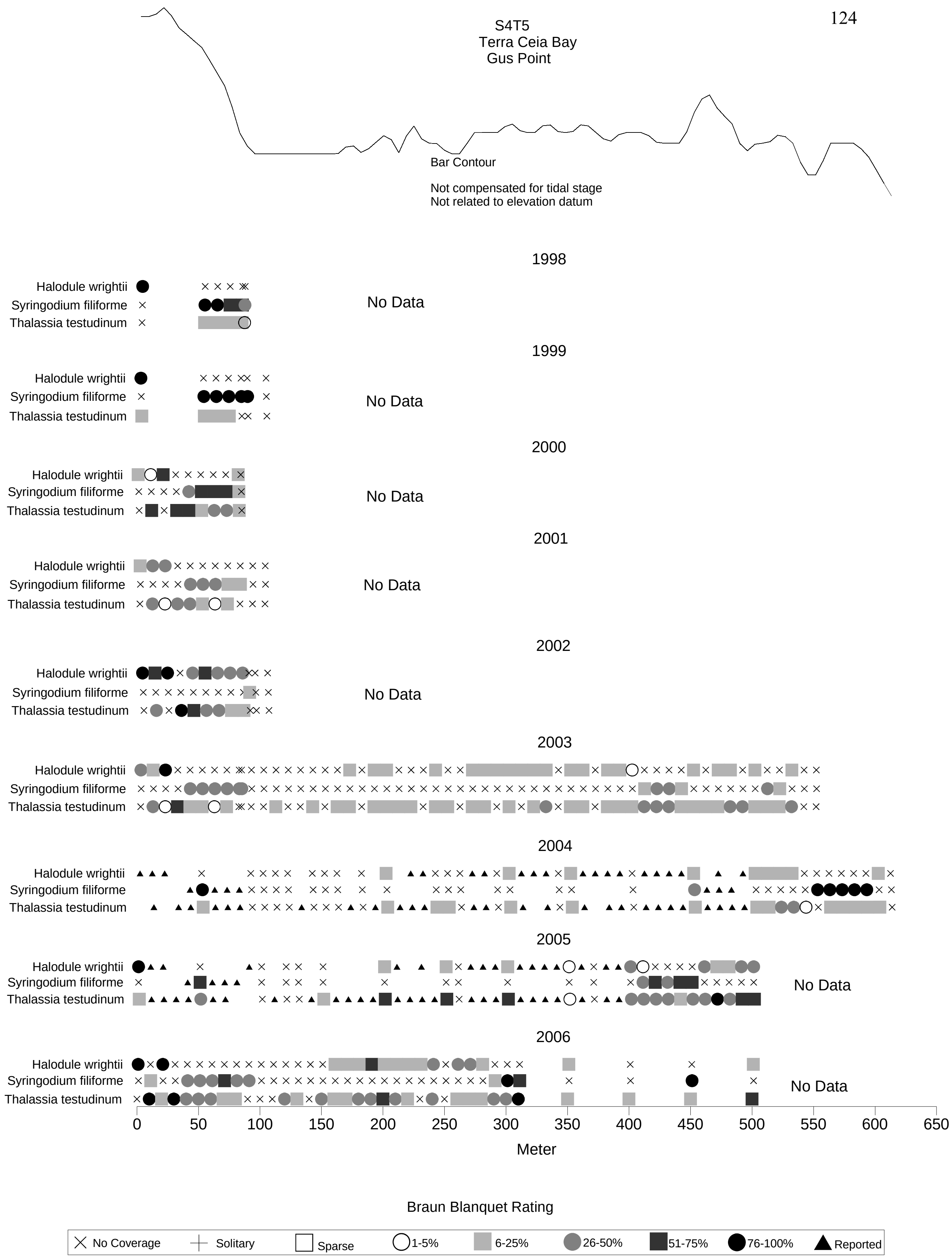

S4T1
Lower Tampa Bay
Port Manatee
Not compensated for tidal stage
Not related to elevation datum
1999
Halodule wrightii
Thalassia testudinum
2002
Halodule wrightii
Thalassia testudinum
2003
Halodule wrightii
Thalassia testudinum
2004
Halodule wrightii
Thalassia testudinum
2005
Halodule wrightii
Thalassia testudinum
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0
50
100
150
200
250
300
350
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

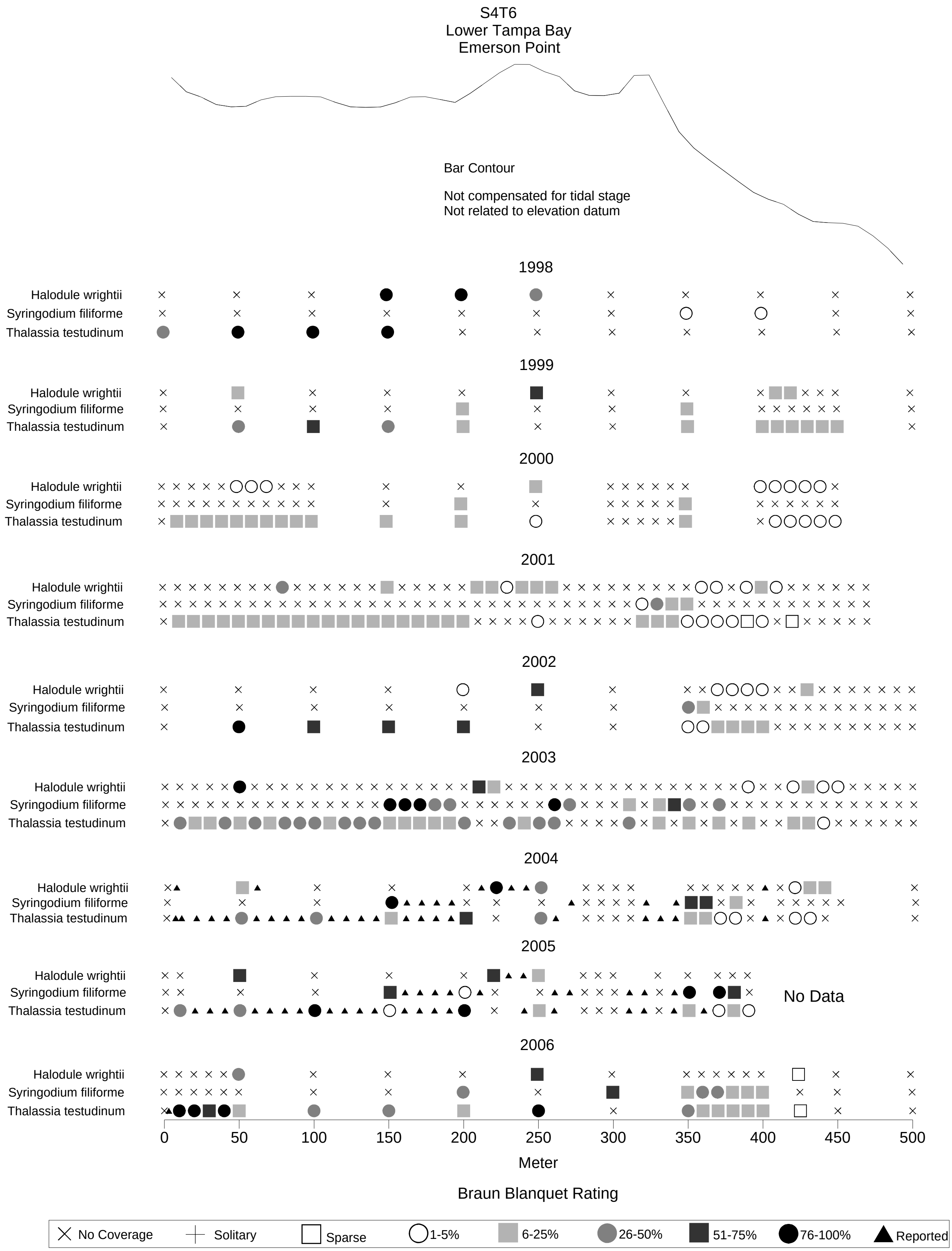


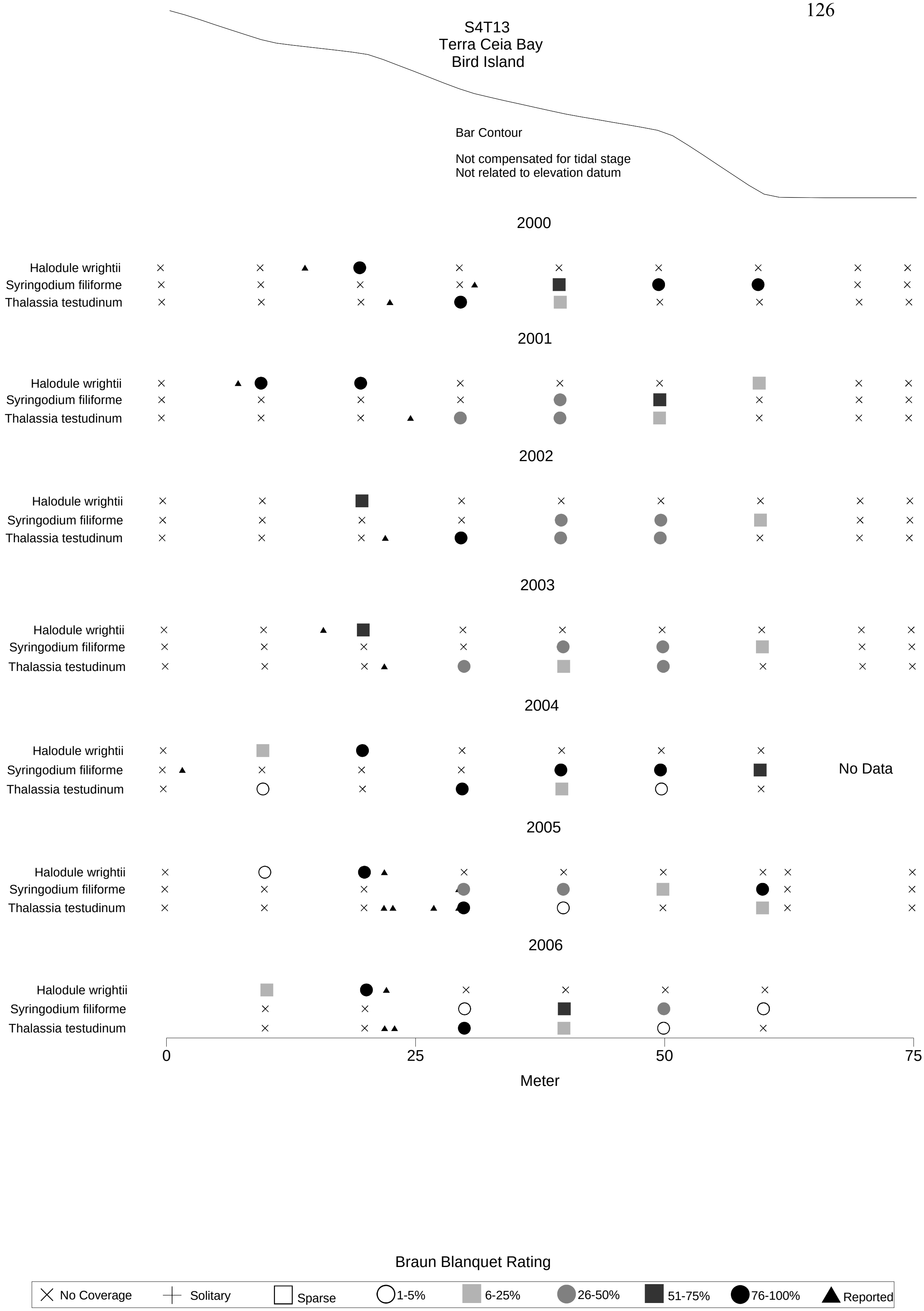
S4T2
Lower Tampa Bay
Bishop Harbor
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
Halodule wrightii
Thalassia testudinum
No Data
1999
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2000
Halodule wrightii
Thalassia testudinum
2001
Halodule wrightii
Thalassia testudinum
2002
Halodule wrightii
Thalassia testudinum
2003
Halodule wrightii
Thalassia testudinum
2004
Halodule wrightii
Thalassia testudinum
2005
Halodule wrightii
Thalassia testudinum
2006
Halodule wrightii
Thalassia testudinum
0
50
100
150
200
250
300
350
400
450
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported


S4T3
Lower Tampa Bay
Joe Island
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1999
2000
2001
2002
2003
2004
2005
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0
25
50
75
100
125
150
175
200
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

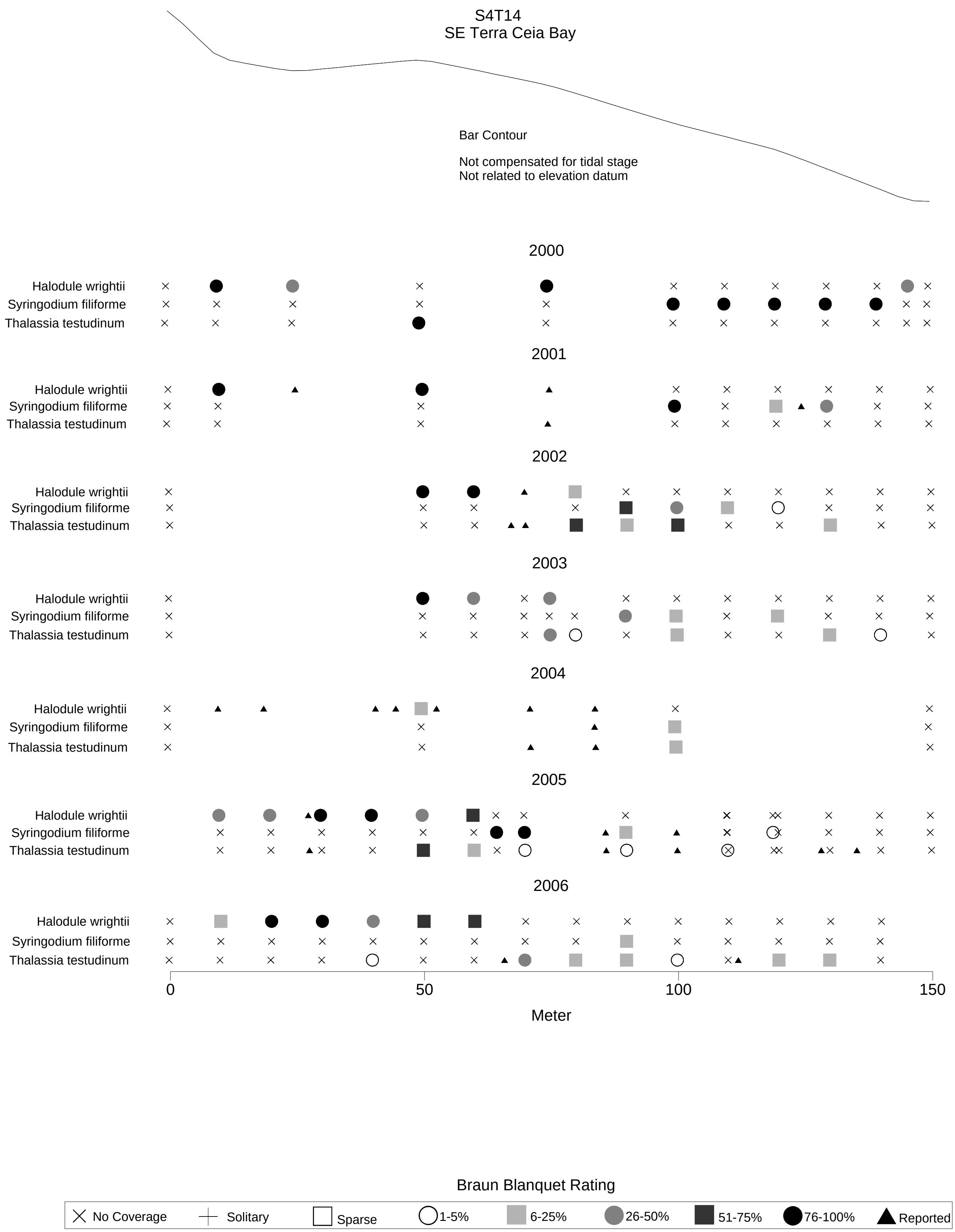

S4T4
Lower Tampa Bay
Miguel Bay
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
Thalassia testudinum
No Data
1999
Syringodium filiforme
Thalassia testudinum
2000
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2001
Syringodium filiforme
Thalassia testudinum
No Data
2002
Halodule wrightii
Thalassia testudinum
2003
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2004
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2005
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
No Data
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0
50
100
150
200
250
300
350
400
450
500
550
600
650
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

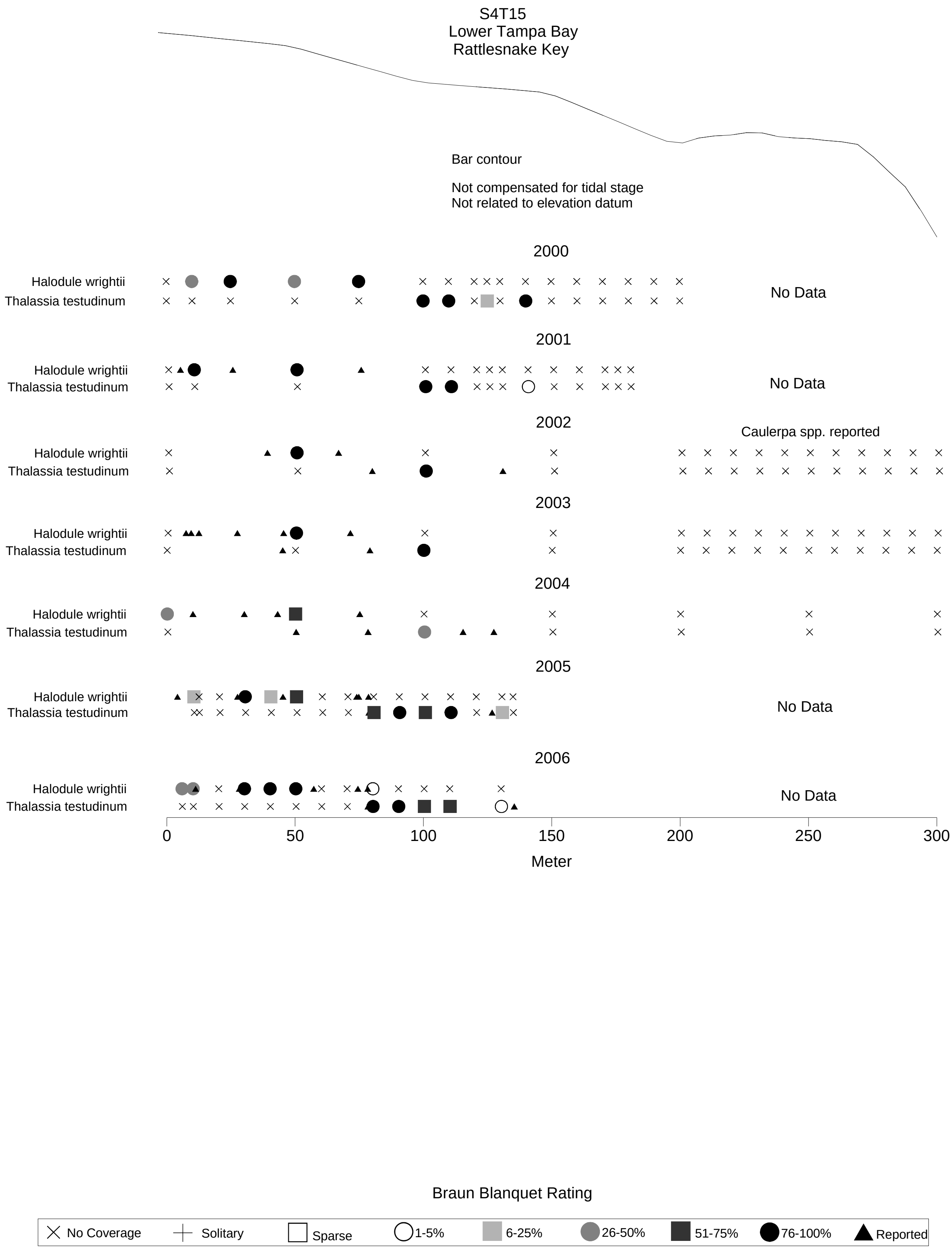

S4T5
Terra Ceia Bay
Gus Point
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
1999
2000
2001
2002
2003
2004
2005
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
No Data
0
50
100
150
200
250
300
350
400
450
500
550
600
650
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported


S4T6
Lower Tampa Bay
Emerson Point
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
1999
2000
2001
2002
2003
2004
2005
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
No Data
0
50
100
150
200
250
300
350
400
450
500
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported



S4T13
Terra Ceia Bay
Bird Island
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
2000
2001
2002
2003
2004
2005
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
No Data
0
25
50
75
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

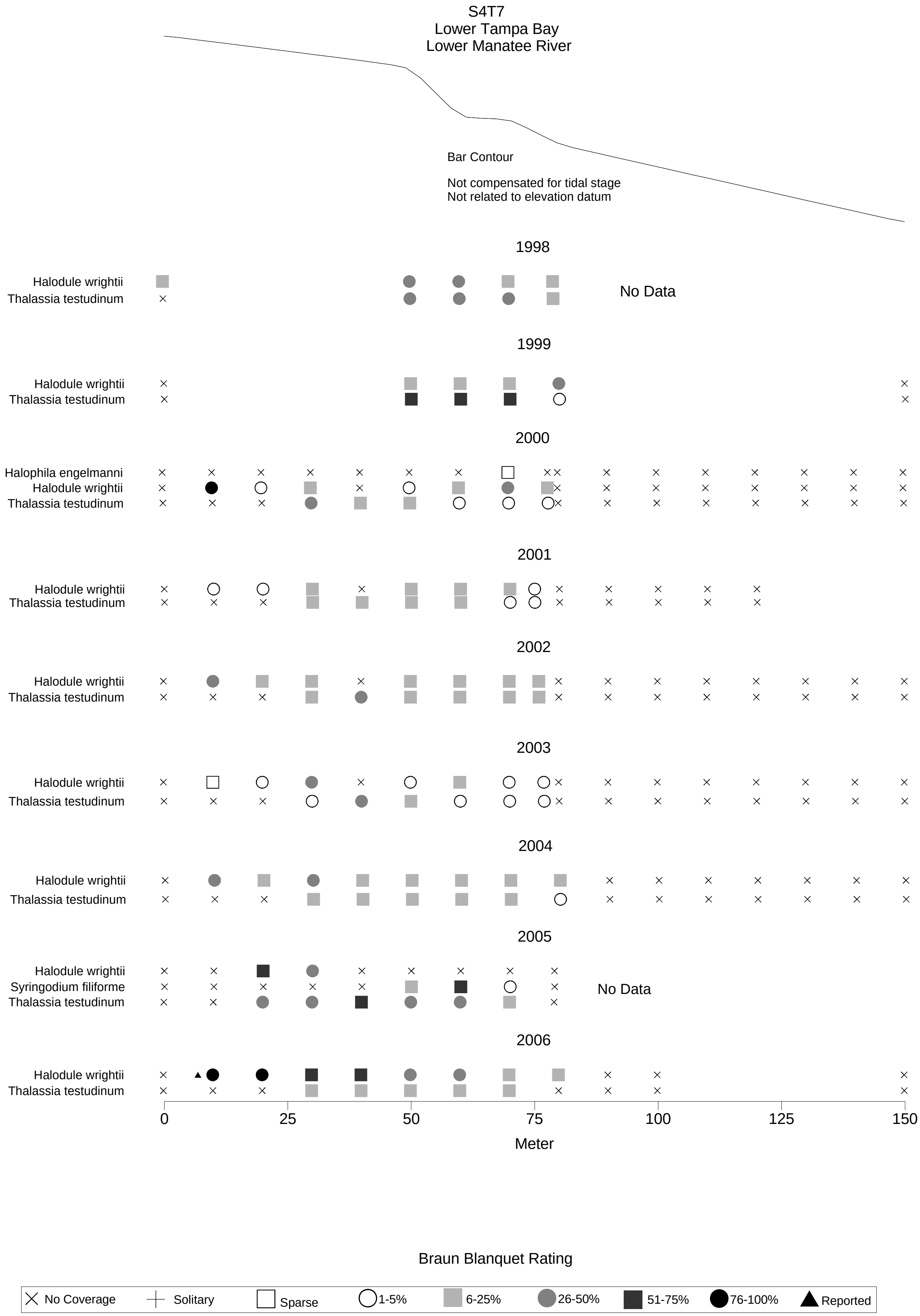

S4T14
SE Terra Ceia Bay
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
2000
2001
2002
2003
2004
2005
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0
50
100
150
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

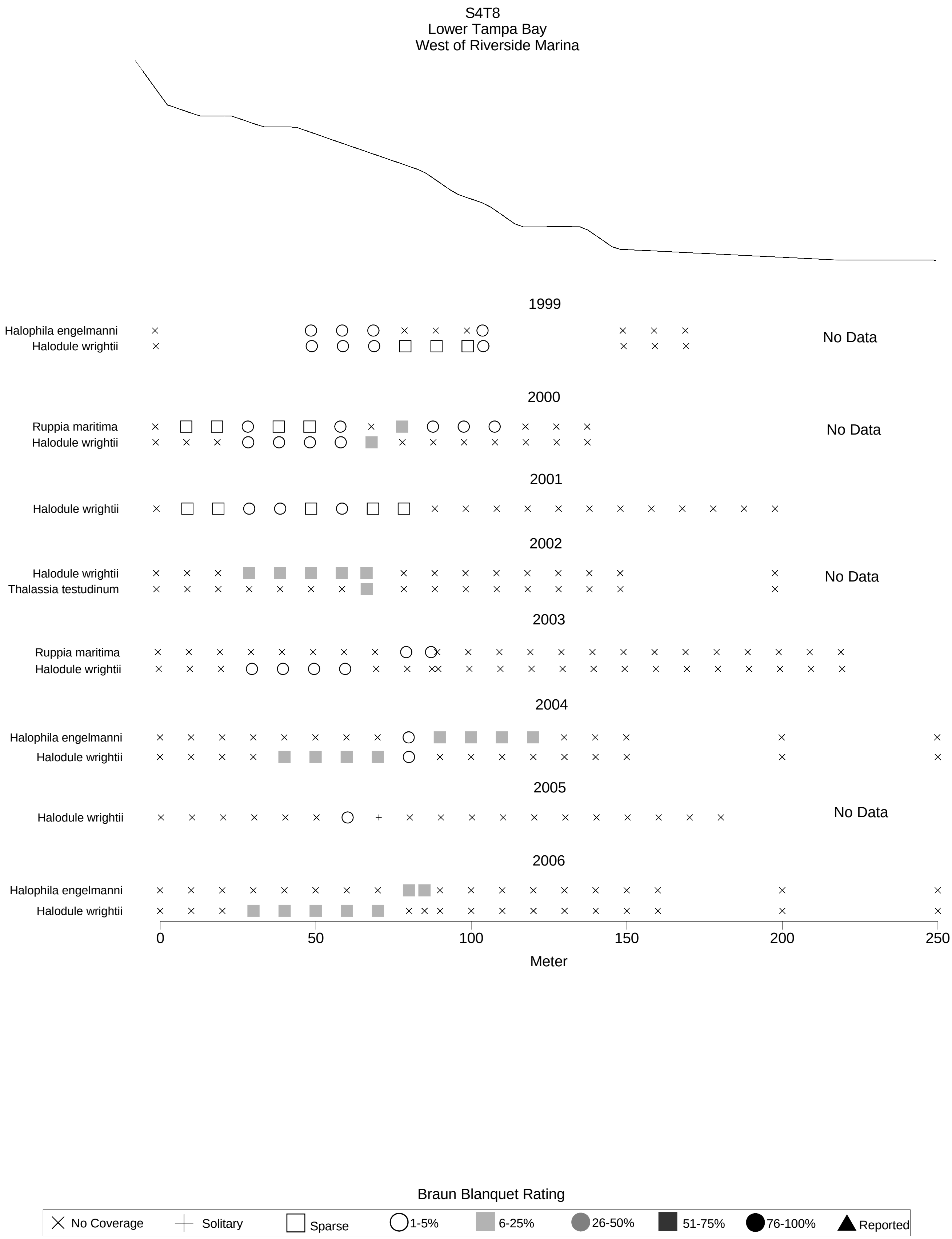


S4T15
Lower Tampa Bay
Rattlesnake Key
Bar contour
Not compensated for tidal stage
Not related to elevation datum
2000
Halodule wrightii
Thalassia testudinum
No Data
2001
Halodule wrightii
Thalassia testudinum
No Data
2002
Caulerpa spp. reported
Halodule wrightii
Thalassia testudinum
2003
Halodule wrightii
Thalassia testudinum
2004
Halodule wrightii
Thalassia testudinum
2005
Halodule wrightii
Thalassia testudinum
No Data
2006
Halodule wrightii
Thalassia testudinum
No Data
0
50
100
150
200
250
300
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

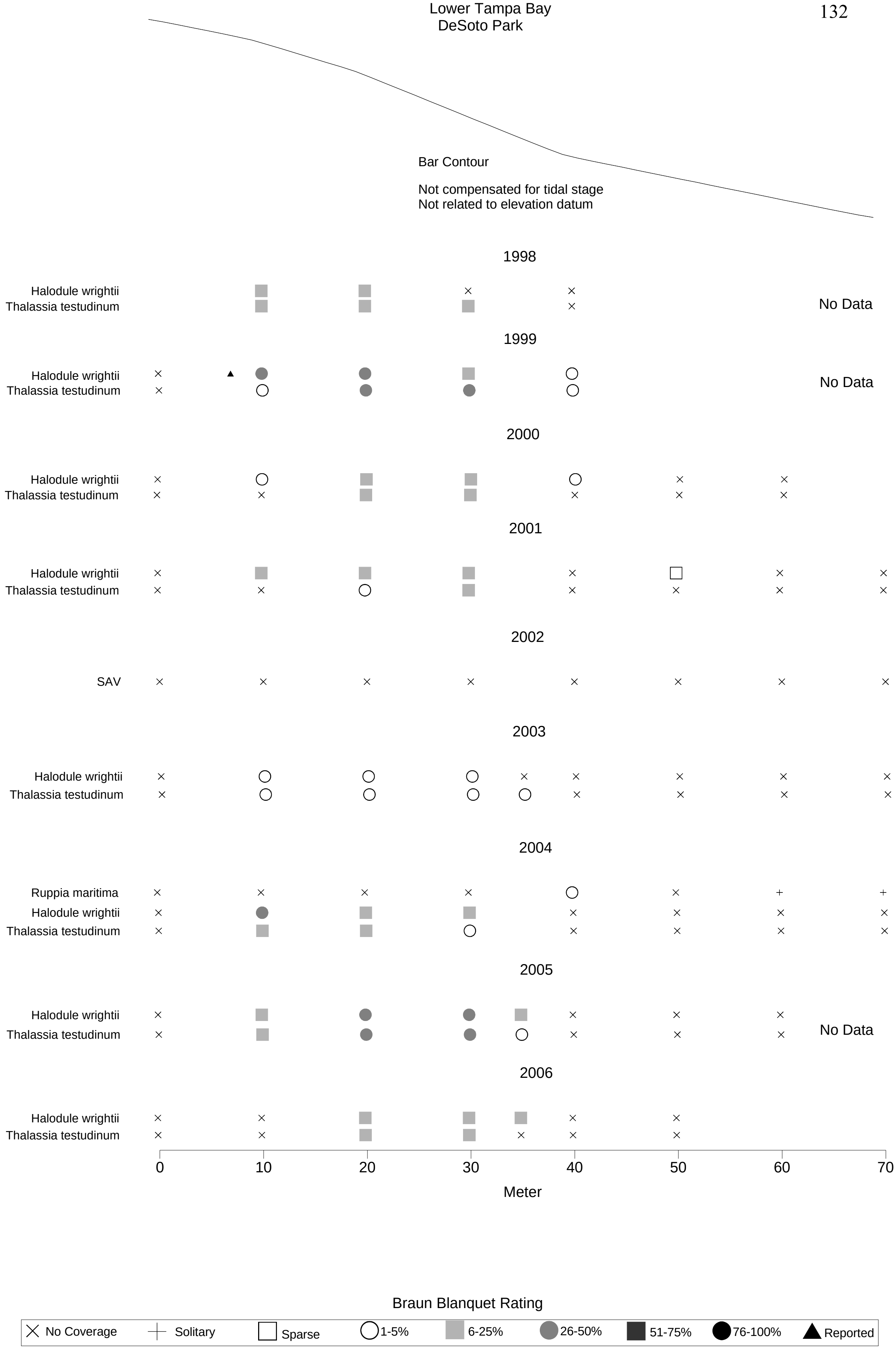
Lower Tampa Bay

MA9 Transects


S4T7
Lower Tampa Bay
Lower Manatee River
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
Halodule wrightii
Thalassia testudinum
No Data
1999
Halodule wrightii
Thalassia testudinum
2000
Halophila engelmanni
Halodule wrightii
Thalassia testudinum
2001
Halodule wrightii
Thalassia testudinum
2002
Halodule wrightii
Thalassia testudinum
2003
Halodule wrightii
Thalassia testudinum
2004
Halodule wrightii
Thalassia testudinum
2005
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
No Data
2006
Halodule wrightii
Thalassia testudinum
0
25
50
75
100
125
150
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

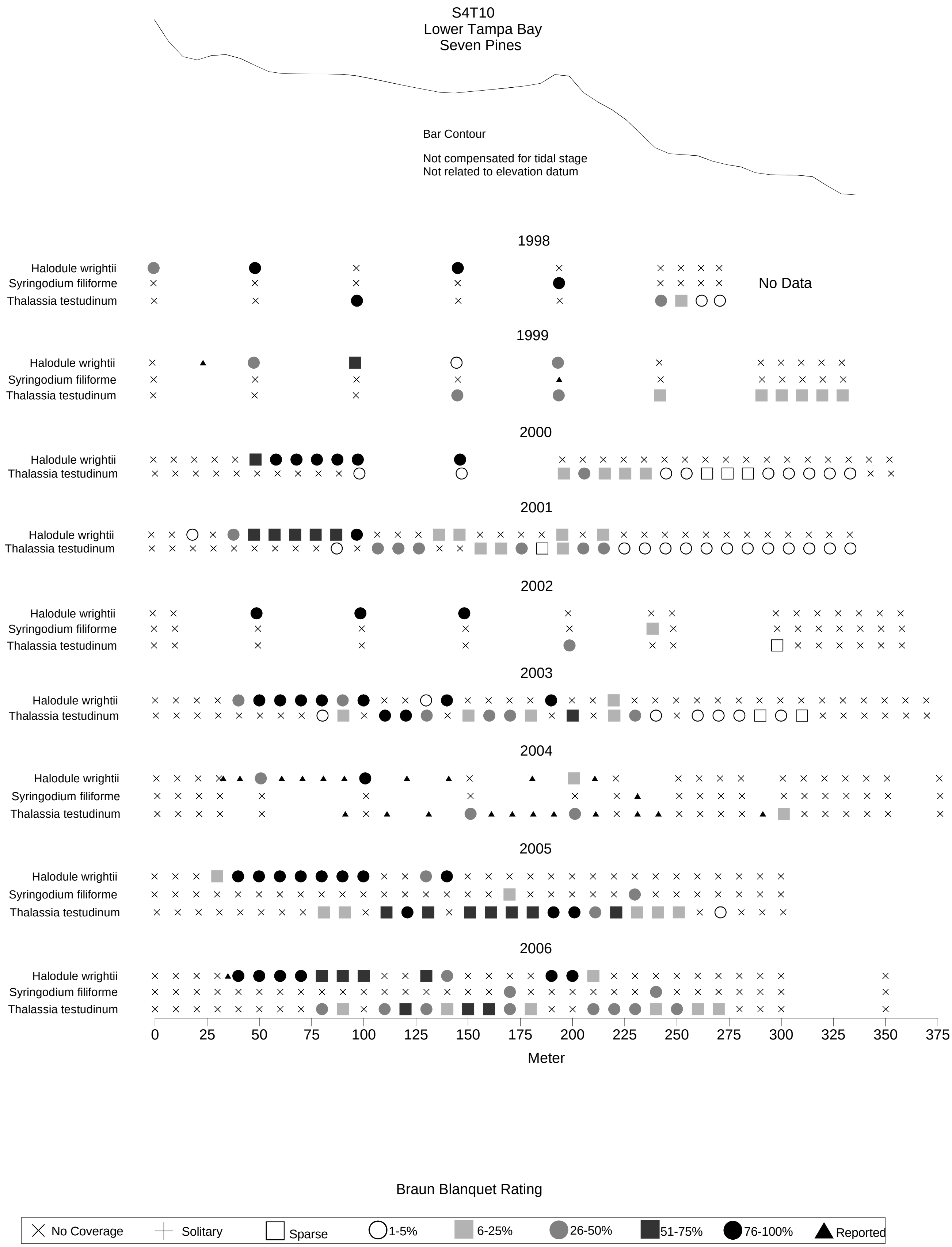

S4T8
Lower Tampa Bay
West of Riverside Marina
1999
Halophila engelmanni
Halodule wrightii
No Data
2000
Ruppia maritima
Halodule wrightii
No Data
2001
Halodule wrightii
2002
Halodule wrightii
Thalassia testudinum
No Data
2003
Ruppia maritima
Halodule wrightii
2004
Halophila engelmanni
Halodule wrightii
2005
Halodule wrightii
No Data
2006
Halophila engelmanni
Halodule wrightii
0
50
100
150
200
250
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

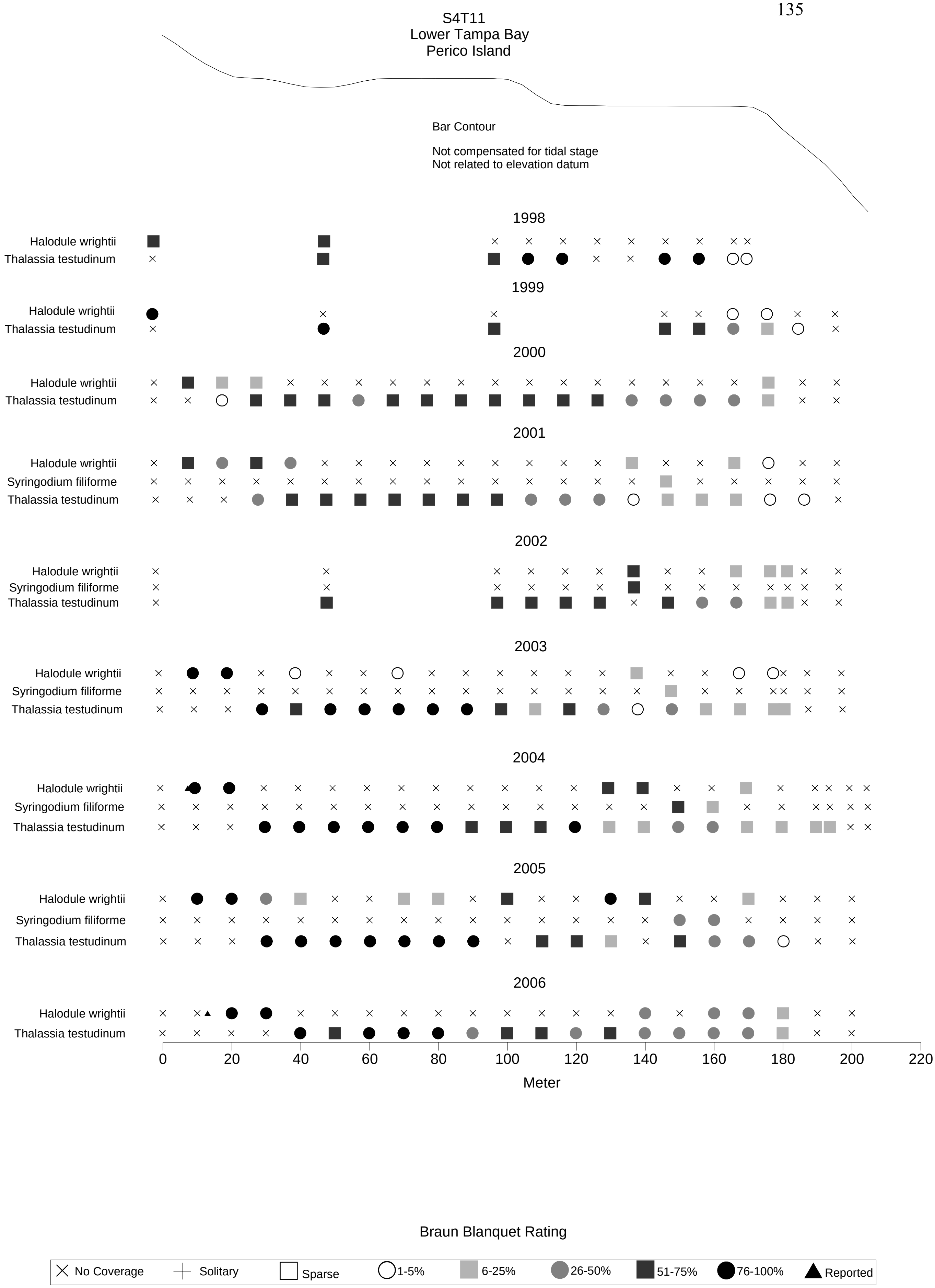
S4T9
Lower Tampa Bay
DeSoto Park



Lower Tampa Bay

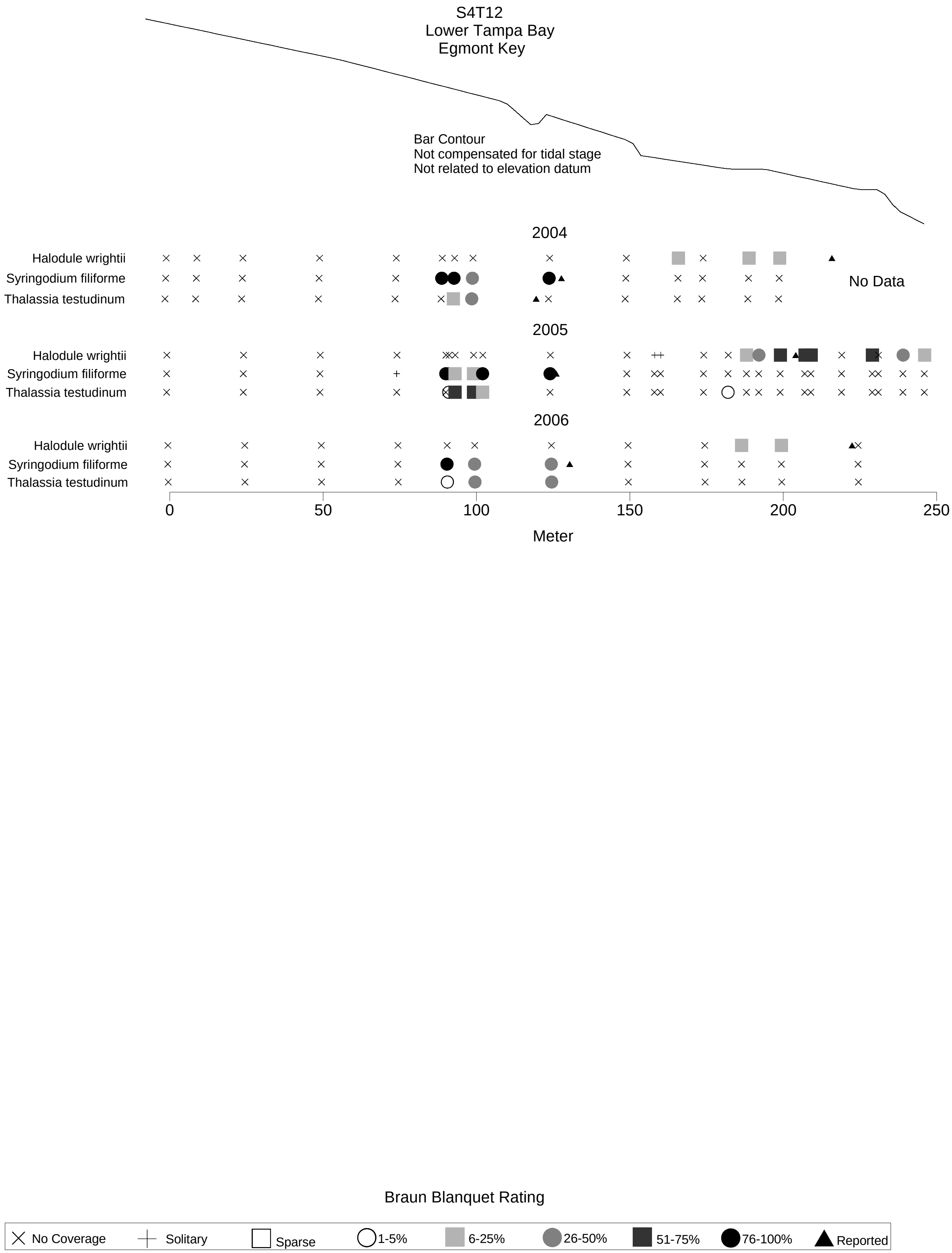
MA10 Transects


S4T10
Lower Tampa Bay
Seven Pines
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
No Data
1999
2000
2001
2002
2003
2004
2005
2006
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported


S4T11
Lower Tampa Bay
Perico Island
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
1999
2000
2001
2002
2003
2004
2005
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0
20
40
60
80
100
120
140
160
180
200
220
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

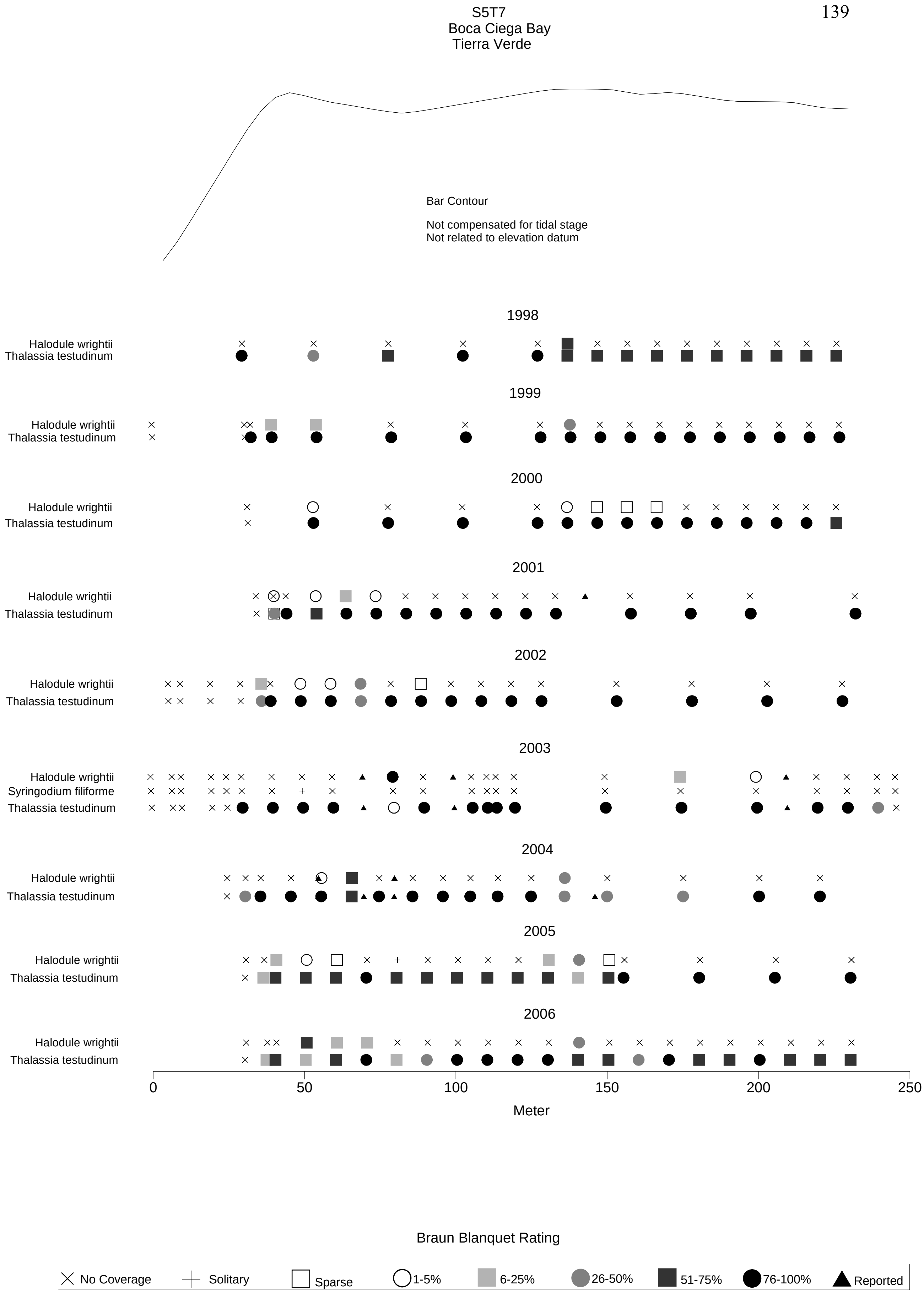
Lower Tampa Bay

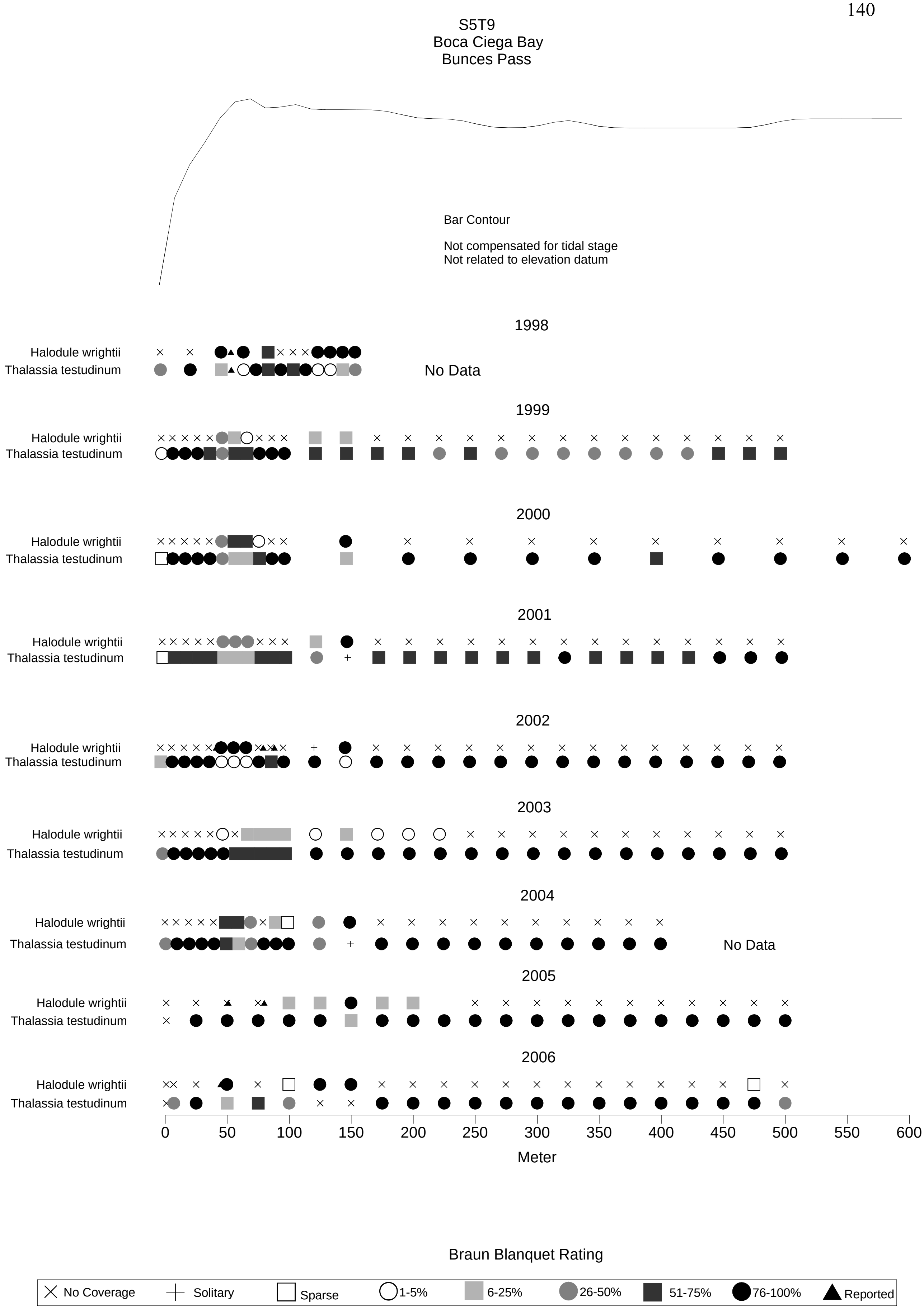
MA11 Transects


S4T12
Lower Tampa Bay
Egmont Key
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
2004
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
No Data
2005
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2006
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0
50
100
150
200
250
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

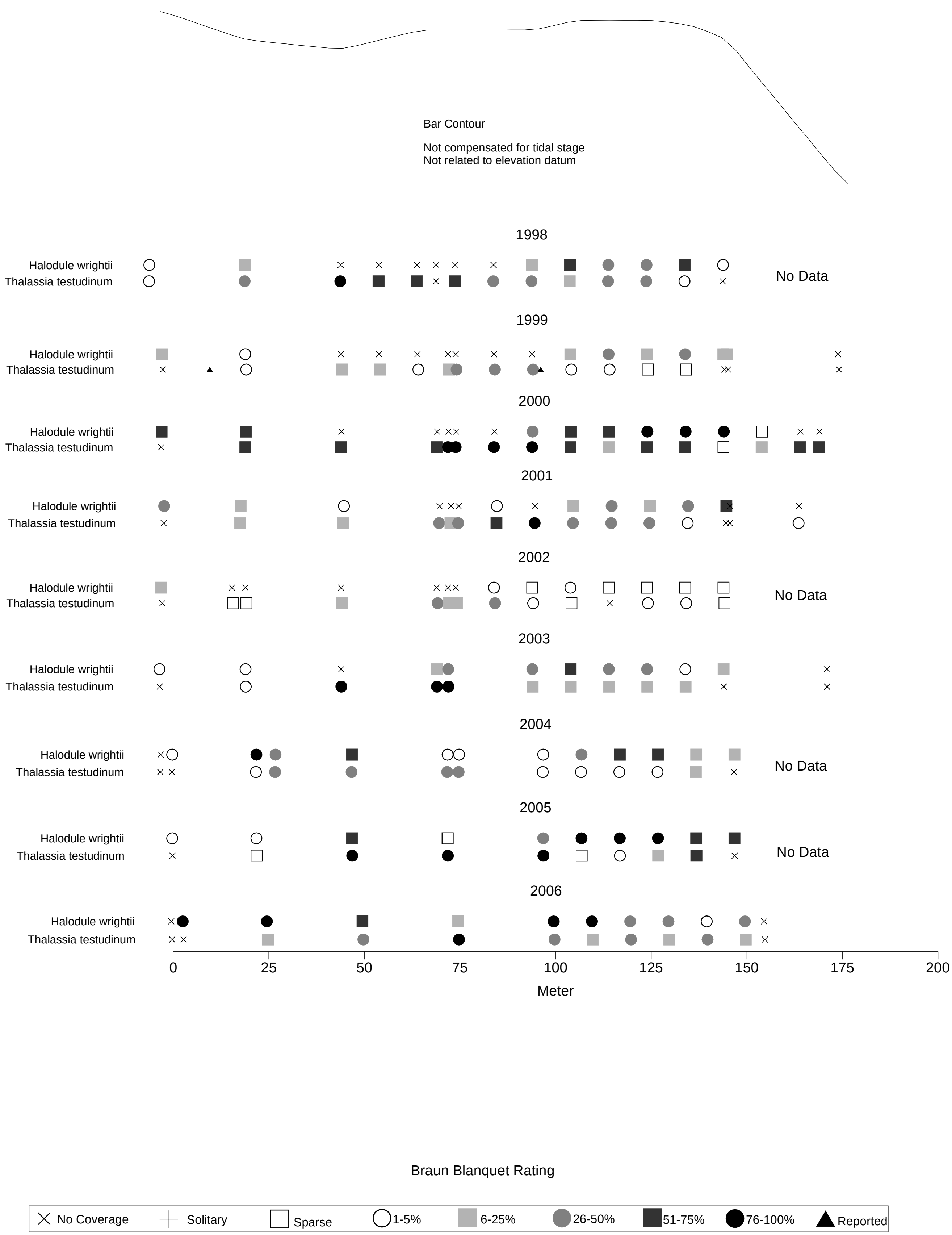
Boca Ciega Bay

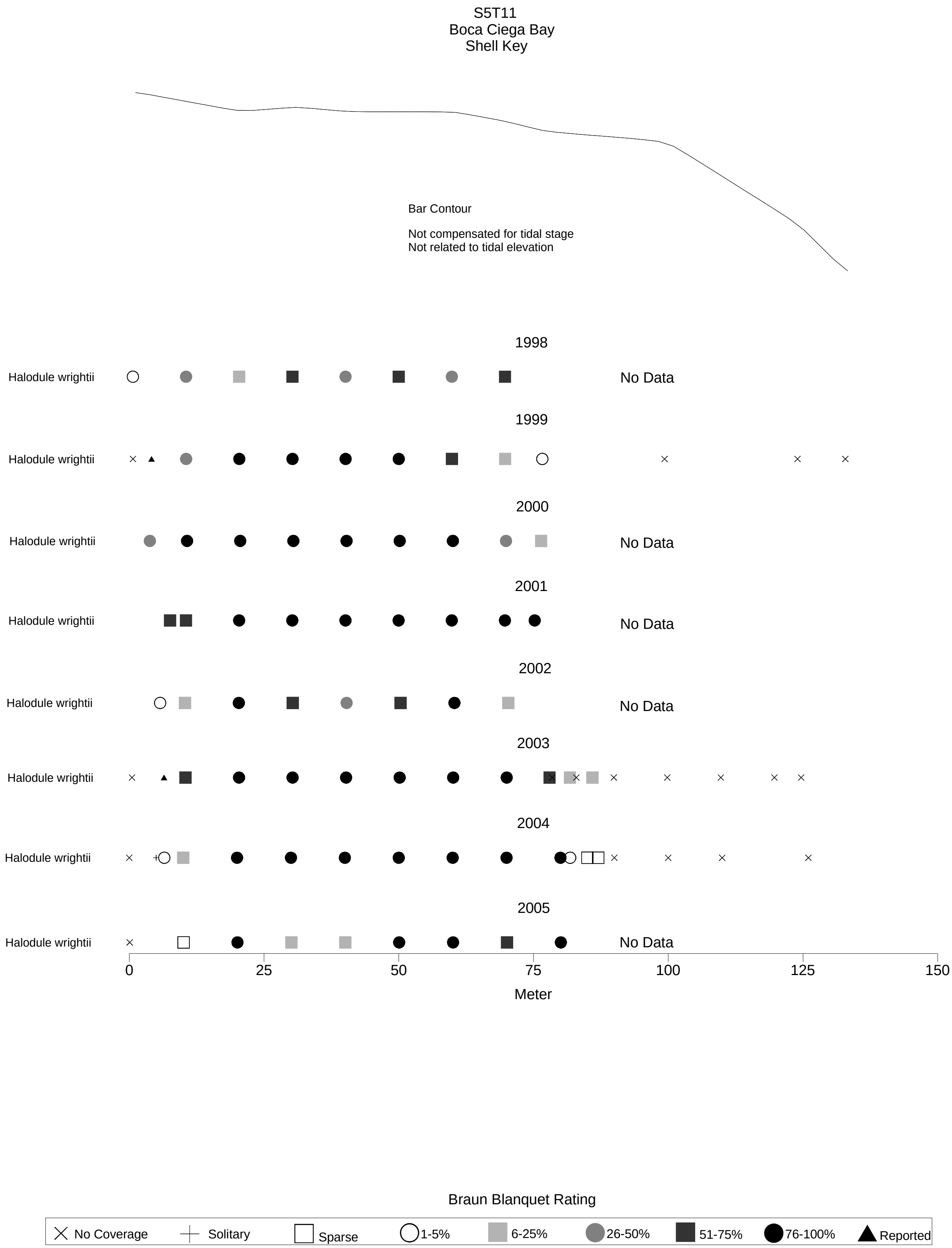
MA12 Transects


S5T7
Boca Ciega Bay
Tierra Verde
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
Halodule wrightii
Thalassia testudinum
1999
Halodule wrightii
Thalassia testudinum
2000
Halodule wrightii
Thalassia testudinum
2001
Halodule wrightii
Thalassia testudinum
2002
Halodule wrightii
Thalassia testudinum
2003
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
2004
Halodule wrightii
Thalassia testudinum
2005
Halodule wrightii
Thalassia testudinum
2006
Halodule wrightii
Thalassia testudinum
0
50
100
150
200
250
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported


S5T9
Boca Ciega Bay
Bunces Pass
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
Halodule wrightii
Thalassia testudinum
No Data
1999
2000
2001
2002
2003
2004
No Data
2005
2006
0
50
100
150
200
250
300
350
400
450
500
550
600
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

S5T10
Boca Ciega Bay
Mullet Key Bayou



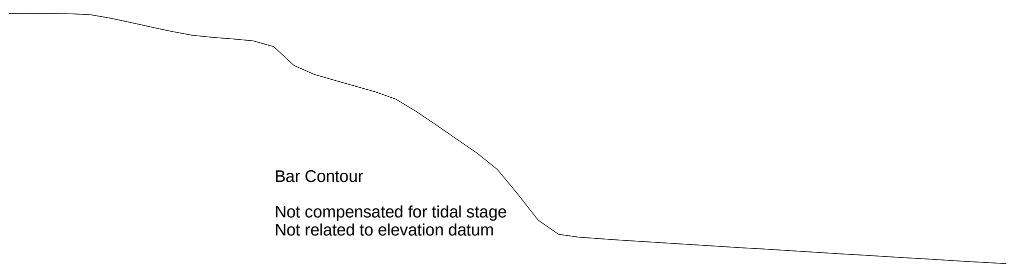


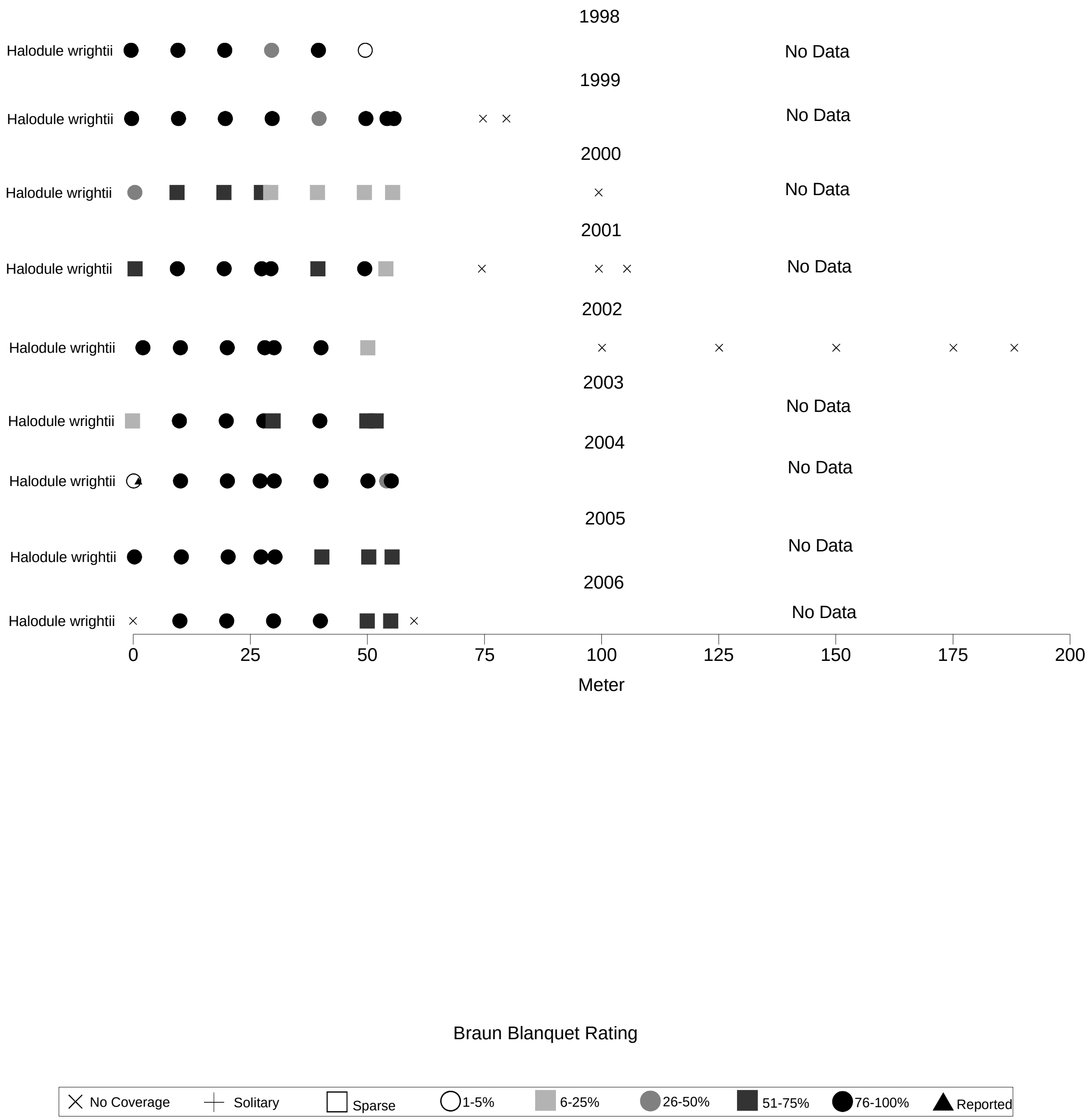
S5T11
Boca Ciega Bay
Shell Key
Bar Contour
Not compensated for tidal stage
Not related to tidal elevation
1998
Halodule wrightii
No Data
1999
Halodule wrightii
2000
Halodule wrightii
No Data
2001
Halodule wrightii
No Data
2002
Halodule wrightii
No Data
2003
Halodule wrightii
2004
Halodule wrightii
2005
Halodule wrightii
No Data
0
25
50
75
100
125
150
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

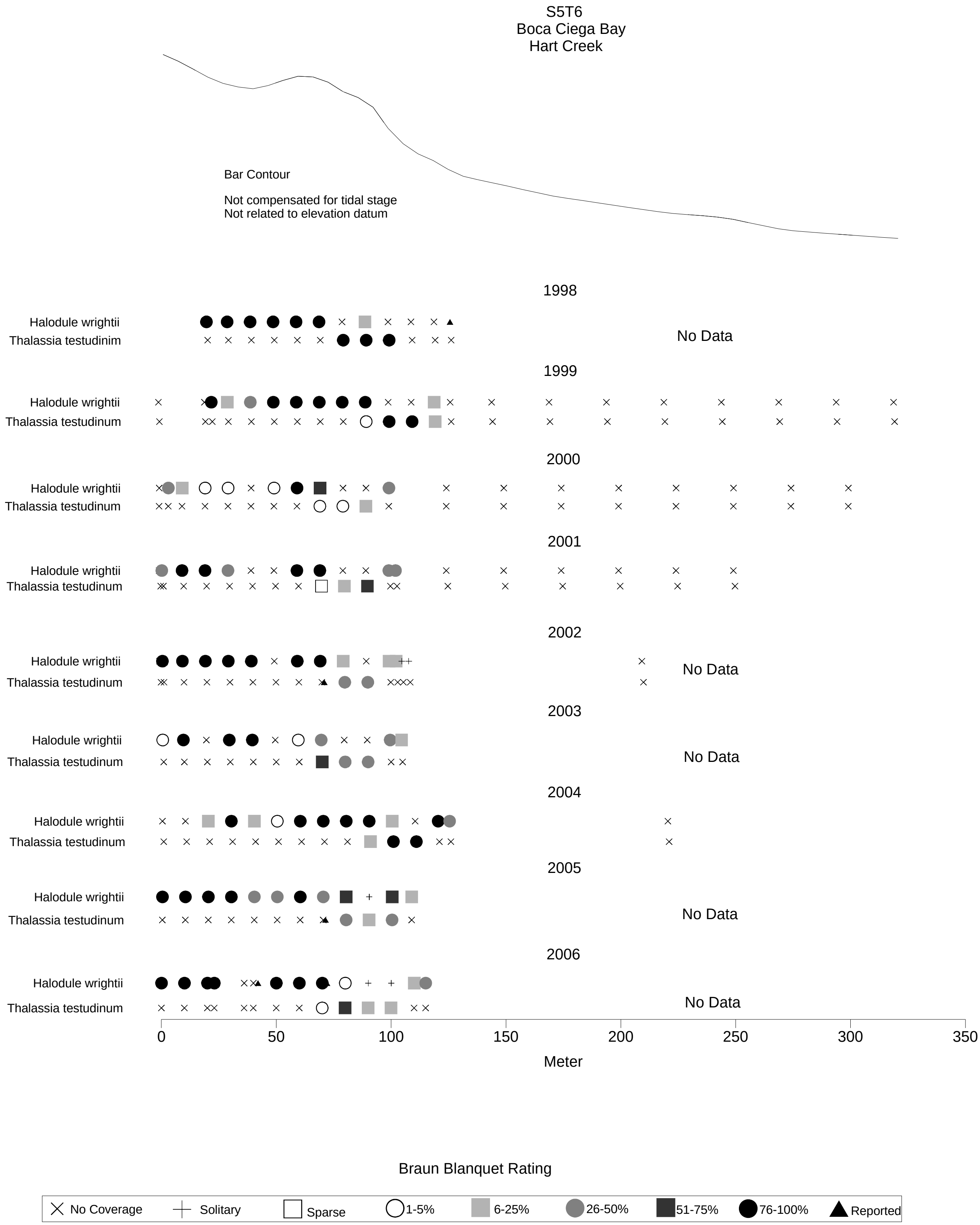
Boca Ciega Bay

MA13 Transects

S5T5
Boca Ciega Bay
Long Key



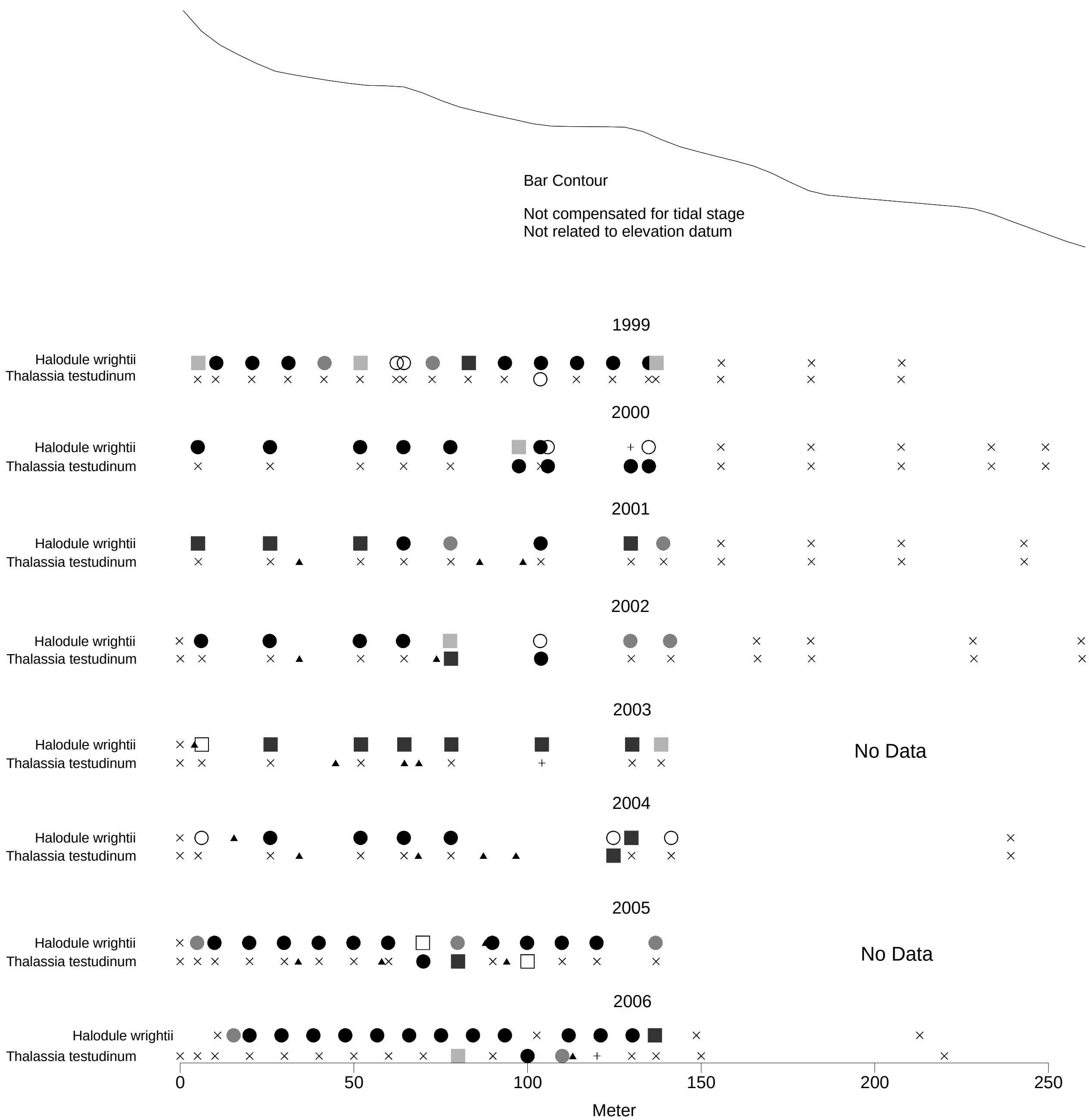


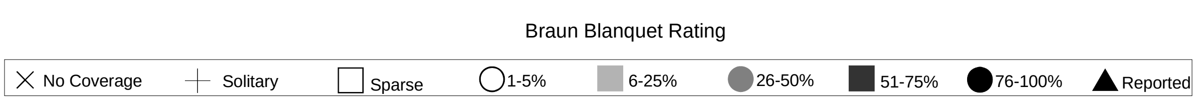

S5T6
Boca Ciega Bay
Hart Creek
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
Halodule wrightii
Thalassia testudinim
No Data
1999
Halodule wrightii
Thalassia testudinum
2000
Halodule wrightii
Thalassia testudinum
2001
Halodule wrightii
Thalassia testudinum
2002
Halodule wrightii
Thalassia testudinum
No Data
2003
Halodule wrightii
Thalassia testudinum
No Data
2004
Halodule wrightii
Thalassia testudinum
2005
Halodule wrightii
Thalassia testudinum
No Data
2006
Halodule wrightii
Thalassia testudinum
No Data
0
50
100
150
200
250
300
350
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

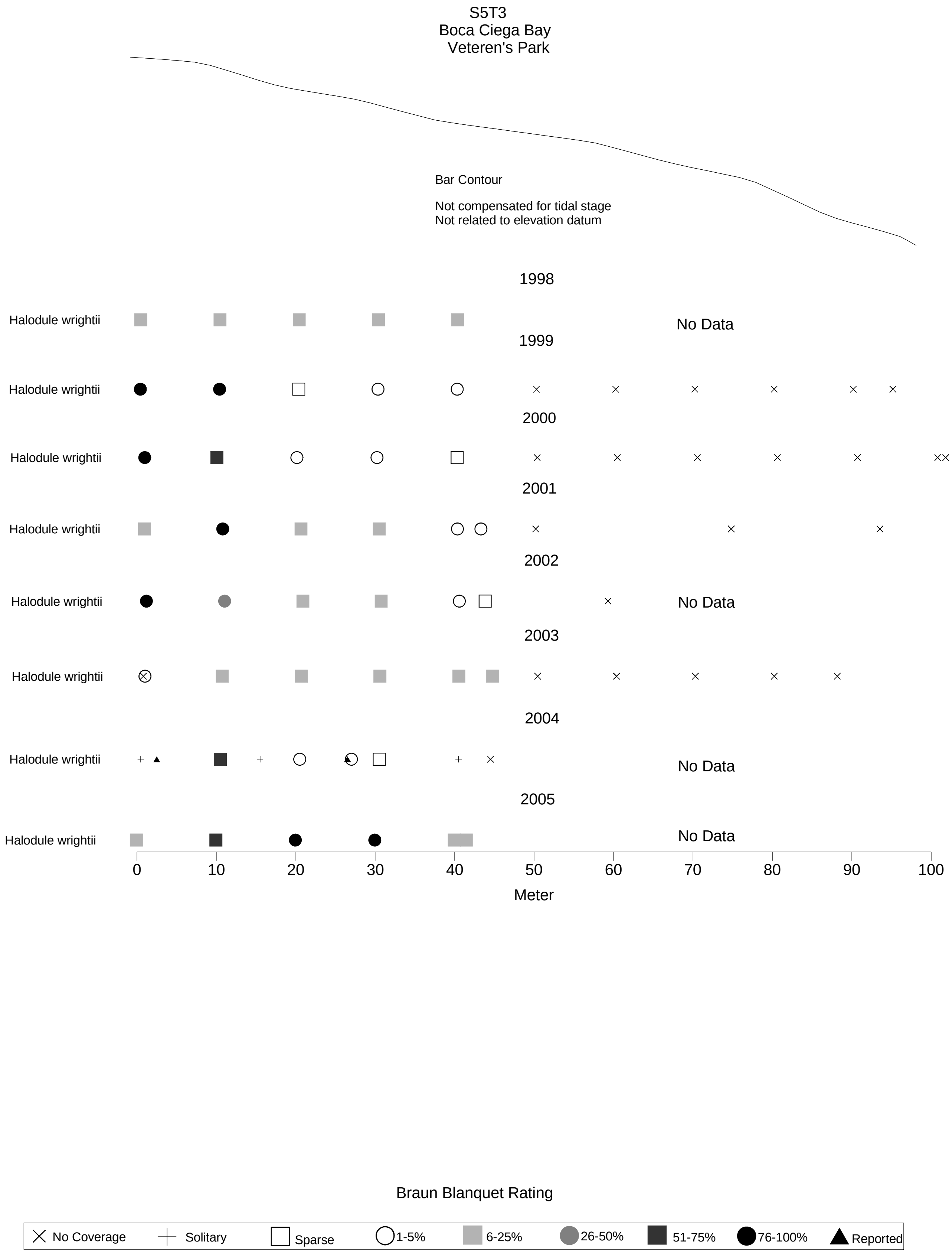
Boca Ciega Bay

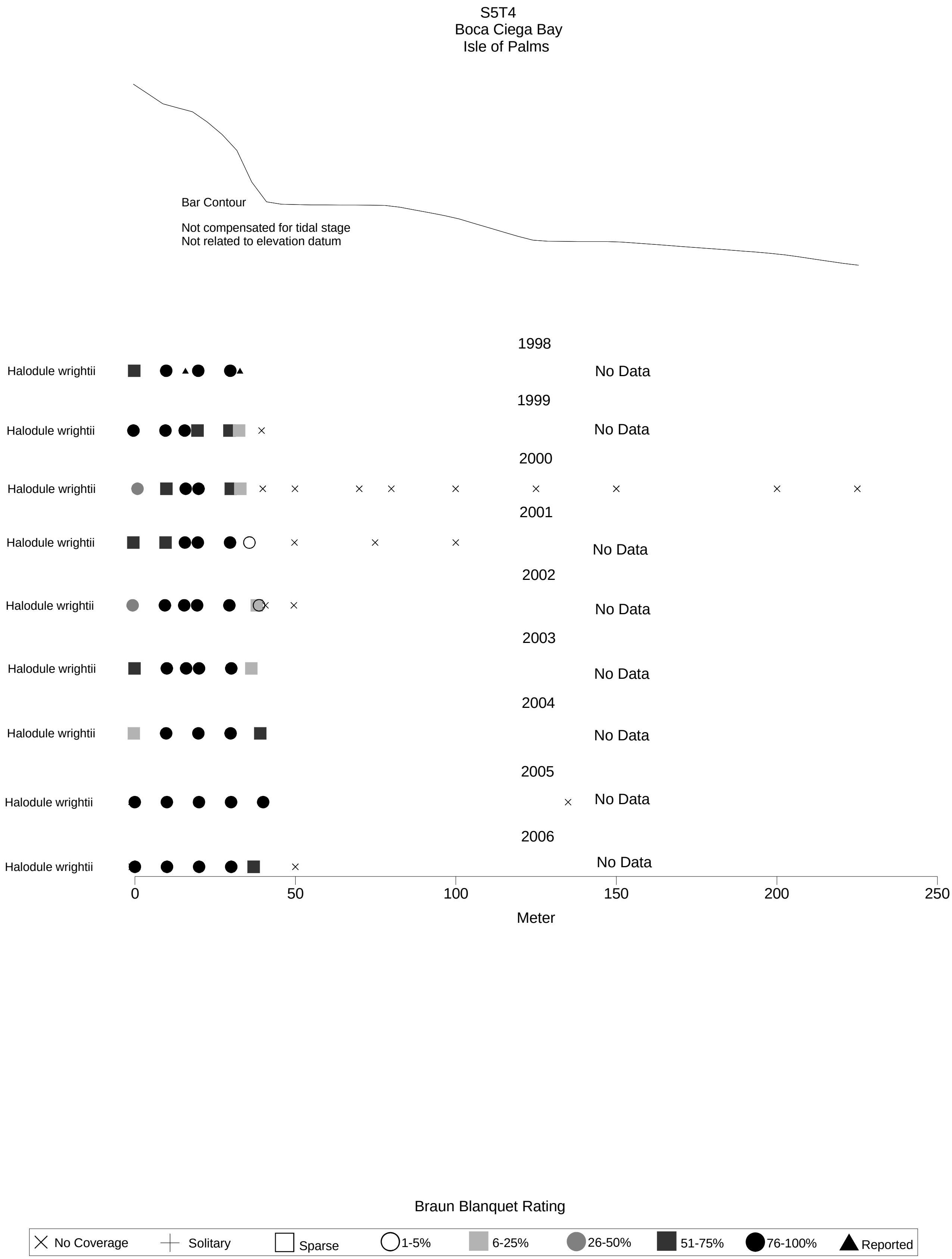
MA14 Transects

S5T2
Boca Ciega Bay
Turtle Crawl Point



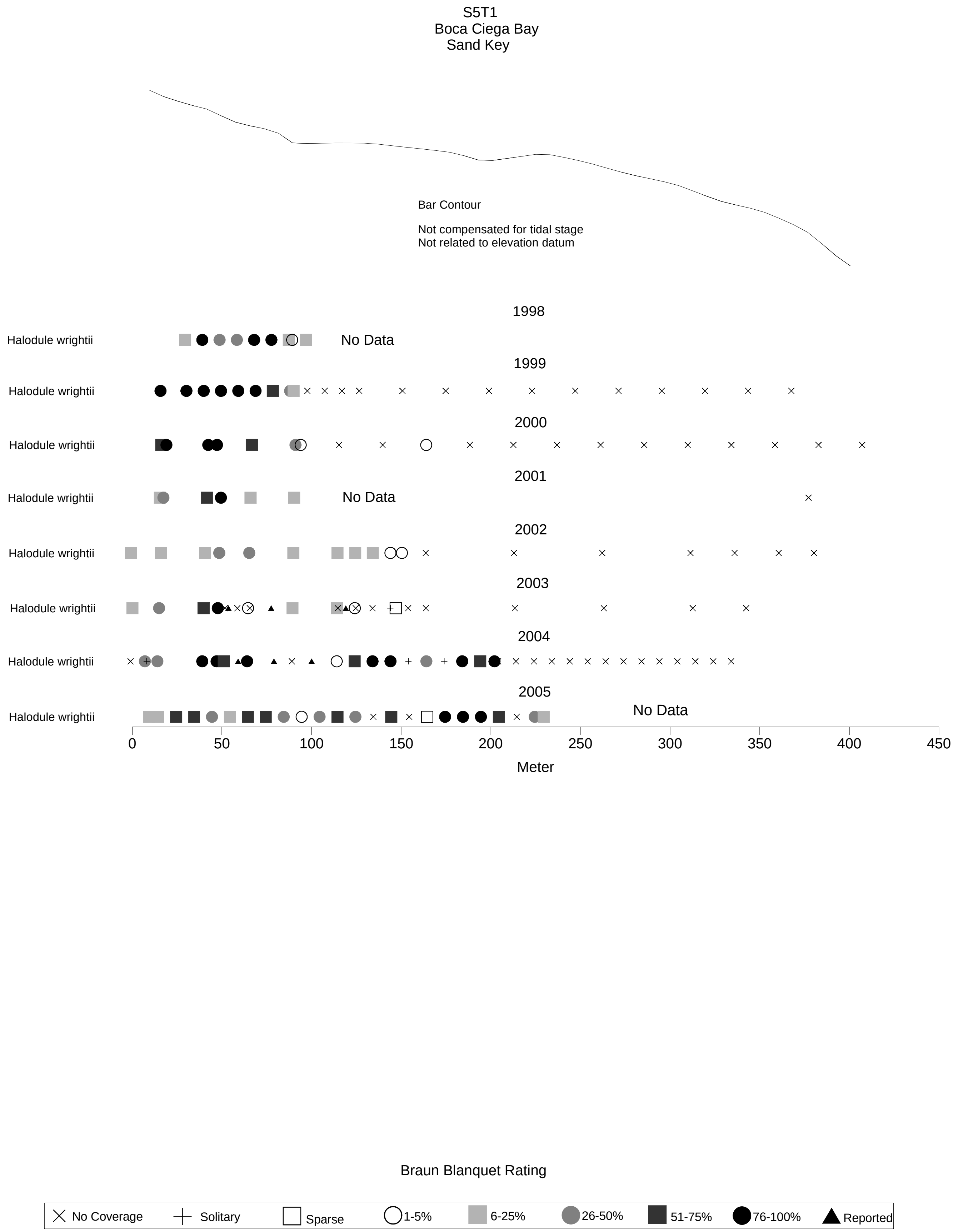



S5T3
Boca Ciega Bay
Veteren's Park
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
Halodule wrightii
No Data
1999
Halodule wrightii
2000
Halodule wrightii
2001
Halodule wrightii
2002
Halodule wrightii
No Data
2003
Halodule wrightii
2004
Halodule wrightii
No Data
2005
Halodule wrightii
No Data
0
10
20
30
40
50
60
70
80
90
100
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported


S5T4
Boca Ciega Bay
Isle of Palms
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
Halodule wrightii
No Data
1999
Halodule wrightii
No Data
2000
Halodule wrightii
2001
Halodule wrightii
No Data
2002
Halodule wrightii
No Data
2003
Halodule wrightii
No Data
2004
Halodule wrightii
No Data
2005
Halodule wrightii
No Data
2006
Halodule wrightii
No Data
0
50
100
150
200
250
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

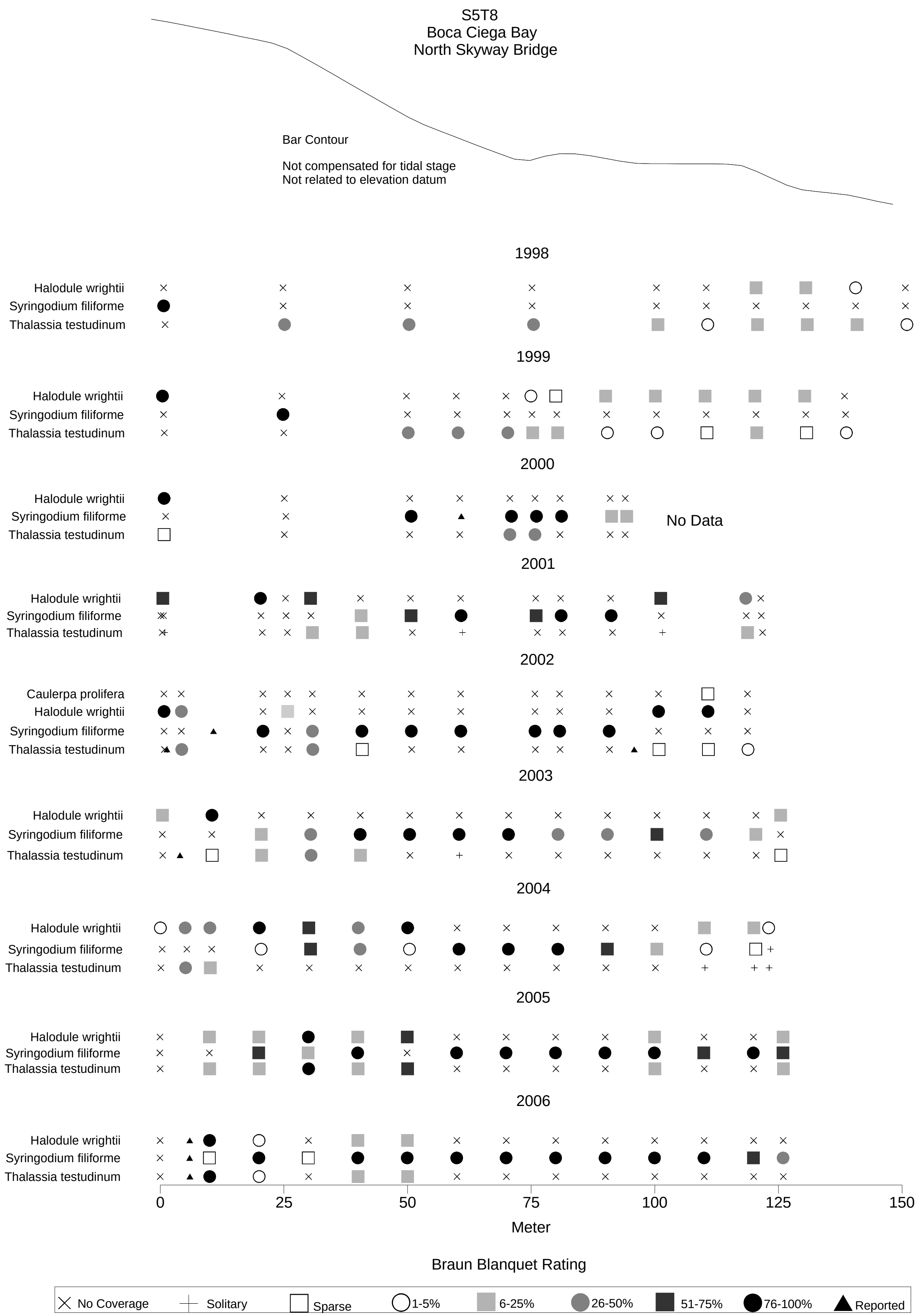
Boca Ciega Bay

MA15 Transects


S5T1
Boca Ciega Bay
Sand Key
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
Halodule wrightii
No Data
1999
Halodule wrightii
2000
Halodule wrightii
2001
Halodule wrightii
No Data
2002
Halodule wrightii
2003
Halodule wrightii
2004
Halodule wrightii
2005
Halodule wrightii
No Data
0
50
100
150
200
250
300
350
400
450
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported

Boca Ciega Bay

MA16 Transects


S5T8
Boca Ciega Bay
North Skyway Bridge
Bar Contour
Not compensated for tidal stage
Not related to elevation datum
1998
1999
2000
No Data
2001
2002
2003
2004
2005
2006
Caulerpa prolifera
Halodule wrightii
Syringodium filiforme
Thalassia testudinum
0
25
50
75
100
125
150
Meter
Braun Blanquet Rating
No Coverage
Solitary
Sparse
1-5%
6-25%
26-50%
51-75%
76-100%
Reported