



Tampa Bay Estuary Program
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DATA SUMMARY from the TAMPA BAY
INTERAGENCY SEAGRASS MONITORING
PROGRAM THROUGH
YEAR 2003

FINAL REPORT

OCTOBER 2004

Data Summary from the Tampa Bay Interagency Seagrass Monitoring Program Through
Year 2003

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Introduction

The state of Tampa Bay's seagrass meadows have become an important issue in the past three decades as scientists and environmental managers have worked to reverse the detrimental effects of eutrophication upon this important habitat within the estuarine ecosystem. Seagrass coverage in Tampa Bay declined from about 16,000ha in 1950 to near 8800ha in 1982. This decline was a result of anthropogenic impacts such as dredge and fill operations and excessive nutrient discharge to the bay. However, nutrient load reductions began to ameliorate eutrophic conditions during the 1980s and as water clarity improved, seagrass began to recolonize several areas of the bay.

The Tampa Bay National Estuary Program (now named Tampa Bay Estuary Program or TBEP) established restoration goals for Tampa Bay that were to be achieved through reduction and control of nutrients discharged to Tampa Bay. Seagrass was chosen as the "biological barometer" to gauge the effectiveness of the nutrient reduction strategy. It was postulated that improved water clarity resulting from reduced phytoplankton biomass would allow restoration of seagrass coverage. Using the nutrient reduction paradigm, the TBEP set a restoration goal of similar seagrass acreage to that found in 1950.

In 1997, the TBEP coordinated the creation of a bay-wide fixed transect seagrass monitoring program. The primary goal of the program is to document temporal and spatial changes in seagrass species composition, abundance, and distribution along a depth gradient. Several bay area agencies committed personnel and equipment to the program. Data collection from sixty transects began in 1998.

This project was funded by the City of Tampa, the Tampa Bay Estuary Program, and the Tampa Port Authority.

Program Overview

In 1997, 30 fixed seagrass monitoring transects were selected from randomly selected Tampa Bay transects that had previously been used by the Southwest Florida Water Management District Surface Water Improvement and Management (SWIM) program to groundtruth aerial photography interpretation. An additional 27 fixed transects were placed in a nonrandom manner in other areas of interest within Tampa Bay. In 2000, two transects in Middle Tampa Bay and three transects in Lower Tampa Bay were added. Also, in 2000 and 2001, transect S4T1 in Lower Tampa Bay was not monitored due to the impending expansion at Port Manatee. However, data collections along this transect recurred in 2002.

Several transects that were being monitored in Old Tampa Bay did not appear to provide sufficient information to characterize seagrass distribution in several sections of this bay segment. Therefore, monitoring was terminated at transects S1T2, S1T7, S1T10, S1T11, and S1T12 after 2000. Instead, transects S1T13, S1T14, S1T15, S1T16, and S1T17 were established and monitored in 2001 (see Figure 1 for the location of terminated and newly established transects in Old Tampa Bay). Further, transect S4T12 was not sampled during

2003 due to safety concerns caused by its close location to the Tampa Bay Pilots operation area. The location of this transect will be moved in 2004. Finally, 2003 information collected for transects S3T1, S3T7, and S3T8 are not included herein due to quality assurance matters.

Data from 58 seagrass transects monitored in Tampa Bay during 2003 (Figure 1) are presented in this report. The agency responsible for monitoring each transect and the initial monitoring year for that transect is presented in Table 1. These agencies include Hillsborough County Environmental Protection Commission (HCEPC), City of Tampa, Bay Study Group (BSG), Pinellas County Department of Environmental Management (PC), Hillsborough County Cockroach Bay Aquatic Preserve (CB), Florida Fish & Wildlife Conservation Commission, Fish and Wildlife Research Institute (FWRI), Manatee County Environmental Management Department (MC), and Tampa Baywatch, Inc. (TBI).

Report Summary

This report presents an overview of the Tampa Bay Interagency Seagrass Monitoring Program (TBISP) and seagrass distribution within Tampa Bay. Further, a summary of trends in coverage, abundance, and major changes in species composition observed during the course of the monitoring program are included. Water quality, sediment composition, and epiphyte information collected during transect monitoring are not discussed within this report. This information can be obtained through the TBEP.

Results regarding seagrass species abundance, distribution, and zonation over time are presented for the 1997-2003 period in Hillsborough Bay (HB, Figures 15-26) and the 1998-2003 period for Old Tampa Bay (OTB, Figures 3-14), Middle Tampa Bay (MTB, Figures 28-40), Lower Tampa Bay, including Terra Ceia Bay (LTB, Figures 41-56), and Boca Ciega Bay (BCB, Figures 57-68). For each transect, results are presented in a graphic format illustrating annual species composition, abundance, and distribution. Seagrass abundance is presented as percent coverage within a square meter using the Braun Blanquet coverage class system. The coverage classes are as follows: 1) solitary = one short shoot; 2) few = more than one short shoot, but less than 1% seagrass coverage within a meter square; 3) 1 = 1-5% seagrass coverage within a meter square; 4) 2 = 6-25% seagrass coverage within a meter square; 5) 3 = 26-50% seagrass coverage within a meter square; 6) 4 = 51-75% seagrass coverage within a meter square; 7) 5 = 76-100% seagrass coverage within a meter square; 8) 6 = reported seagrass coverage not occurring within a meter square. The “reported” category, though not a Braun Blanquet coverage class, is useful to follow recolonization patterns and to delineate areas of changing species composition.

Additional 2003 transect information, including length of each transect, the number of meter square placements (N) along each transect, and the percent of N in which each seagrass species was found, is presented in Figure 2 for OTB, Figure 15 for HB, Figure 27 for MTB, Figure 41 for LTB, and Figure 57 for BCB.

Training of Participating Agency Personnel:

During the initial development of the seagrass transect monitoring program, concerns were raised about the need to collect comparable data between the participating agencies. To address this concern, a training class is scheduled several weeks prior to the start of each annual monitoring effort to train personnel and review field sampling procedures and protocols.

Results and Discussion

Old Tampa Bay:

Of the twelve transects monitored in Old Tampa Bay during 2003 (Figure 2), only S1T1, S1T3, S1T5, S1T6, S1T8, and S1T9 encompass the six-year data set generated from the onset of the program. Transect S1T4 was established in 1999, while monitoring of transects S1T13, S1T14, S1T15, S1T16, and S1T17 commenced in 2001. Braun Blanquet data from transects monitored during 2003 are presented in Figures 3-14.

All five seagrass species recorded from Tampa Bay have been found in Old Tampa Bay during the course of the monitoring program. Generally, *Halodule wrightii* has been the dominant species found on the transects. However, *Syringodium filiforme* and *Thalassia testudinum* have comprised a substantial portion of the seagrass composition along the eastern shoreline and the western shoreline south of Gandy Bridge. In addition, *Ruppia maritima* coverage increased substantially between 2002-2003. *Halophila engelmanni* was documented in northwest Old Tampa Bay between 1999 and 2002, however, this species was not observed during 2003.

H. wrightii was found on all of the Old Tampa Bay transects during 2003. *H. wrightii* coverage along transect S1T1 recovered following a decline during 2002 and was the only area showing positive gains for *H. wrightii* (Figure 3). In contrast, transect S1T5 continued to lose *H. wrightii* coverage at the seaward edge (Figure 6). Also, declining coverage observed during 2002 along transects S1T13 and S1T17 continued during 2003 (Figures 10 and 14). *H. wrightii* abundance on the shoreward half of transect S1T16 declined in 2003, while coverage along the seaward half of the transect changed little (Figure 13). Little change was also noted in *H. wrightii* coverage along the remaining transects between 2002 and 2003.

Generally, there was little change in *S. filiforme* distribution and abundance along the Old Tampa Bay transects between 2002-2003. Similarly, little change was noted for *T. testudinum* coverage along most transects, though an increase of coverage and abundance occurred along transect S1T8 (Figure 8).

The most notable change in Old Tampa Bay seagrass coverage between 2002 and 2003 was the proliferation of *R. maritima* along transects S1T5 and S1T16 (Figures 3 and 13). At these transects, increased *R. maritima* coverage was observed within the shoreward area of the *H. wrightii* meadow.

The attached alga, *Caulerpa prolifera*, has continued to be present along several transects in Old Tampa Bay during the course of the study. In 2002, *C. prolifera* was a major component of the SAV along transect S1T1, however, by 2003 the alga had disappeared (Figure 3). In contrast, *C. prolifera* abundance along transects S1T8 and S1T9 increased considerably between 2002-2003 (Figures 8 and 9). The alga was also observed on the Weedon Island transect S1T14 (Figure 11).

Hillsborough Bay:

Eleven transects have been monitored in Hillsborough Bay since 1997 (Figure 15). *H. wrightii* has been the dominant species where seagrass coverage was present. Also, *R. maritima* has persisted along the northeastern shoreline and has been observed periodically in most areas of Hillsborough Bay. Braun Blanquet data from the Hillsborough Bay transects are presented in Figures 16-26. A more detailed description of Hillsborough Bay seagrass coverage is available in the City of Tampa's annual report entitled "Seagrass and Caulerpa Monitoring: Fifteenth Annual Report."

Following an increase of *H. wrightii* coverage from about 56ha in 1997 to nearly 86ha in 2001, Hillsborough Bay coverage decreased to about 54ha in 2003, largely due to losses at Catfish Point. In 2003, *H. wrightii* coverage declined nearly 30ha in the Catfish Point area that is traversed by transect S2T112 (Figure 25). Gains and losses in *H. wrightii* coverage have been noted in other areas of Hillsborough Bay since 1997. However, the recolonization and subsequent loss of shoal grass along the southeastern portion of Interbay peninsula have driven the major changes in Hillsborough Bay's seagrass coverage in recent years.

R. maritima has been to be a minor constituent of Hillsborough Bay's seagrass coverage between 1997 and 2003, comprising less than 5% of the total bay seagrass coverage. In 2003, minor *R. maritima* coverage was noted along transects S2T5 and S2T6 (Figures 19 and 20).

C. prolifera was noted along transect S2T12 (Figure 26) in 2002 and 2003. *C. prolifera* was a major constituent of Hillsborough Bay's submerged aquatic vegetation (SAV) between 1986 and 1996 (City of Tampa, 2004).

Middle Tampa Bay:

Thirteen transects have been established in Middle Tampa Bay (Figure 27). Two transects, S3T12 and S3T13, have been monitored since 1997. Two additional transects, S3T10 and S3T11, were established in 2000. Braun Blanquet data from transects monitored during 2003 (with the exception of transects S3T1, S3T7, and S3T8; see project overview) are presented in Figures 28-40.

Four seagrass species, *H. wrightii*, *R. maritima*, *S. filiforme*, and *T. testudinum* were found in Middle Tampa Bay during 2003. *H. wrightii* has been the dominant species in the northeast quadrant of Middle Tampa Bay. Typically, seagrass composition south of the Little Manatee River and along the western side of Middle Tampa Bay has been comprised of *H. wrightii*, *S. filiforme*, and *T. testudinum*. Seagrass coverage for Middle

Tampa Bay has been generally stable, however, gains and/or losses were noted along several transects between 2002-2003. The following discussion illustrates these changes.

Decreases in *H. wrightii* abundance were found along transects S3T2 and S3T12 (Figures 29 and 39) located on the southern end of Interbay peninsula. *H. wrightii* coverage from transect S3T9, located at the mouth of the Little Manatee River, was nearly absent in 2003 (Figure 36). Data from transects S3T11 and S3T13 indicate that the seaward edge of the *H. wrightii* coverage thinned between 2002-2003 (Figures 38 and 40). However, *H. wrightii* abundance increased along transects S3T4, S3T6, and the inshore area of S3T10 (Figures 31, 33, and 37).

S. filiforme abundance increased somewhat along transect S3T6 just north of Port Manatee (Figure 33). Little change was seen for this species elsewhere in Middle Tampa Bay except for the thinning of seaward coverage at S3T11 (Figure 38) in the same area the thinning of *H. wrightii* occurred.

T. testudinum abundance increased at transects S3T3, S3T4, and S3T5 (Figures 30, 31, and 32) which are located in or near Cockroach Bay. Reductions in abundance and occurrence of *T. testudinum* were seen along transects S3T10 and S3T11 on the western side of Middle Tampa Bay (Figures 37 and 38).

The only significant *R. maritima* coverage was found along transect S3T13 (Figure 40), just south of Apollo Beach. This species was also noted at S3T12 south of Interbay peninsula (Figure 39) and at St. Petersburg's Lassing Park in the area of transect S3T8. However, data for S3T8 are not included herein.

C. prolifera coverage was noted in two areas of Middle Tampa Bay during 2003. Sparse coverage of this alga was reported along transect S3T12 (Figure 39) on the southern end of Interbay peninsula. A dense meadow of *C. prolifera* continues to persist at Lassing Park in the area of transect S3T8.

Lower Tampa Bay:

Thirteen transects were assessed for seagrass coverage in Lower Tampa Bay (including Terra Ceia Bay and the Manatee River) during 2003 (Figure 41). *H. wrightii*, *R. maritima*, *S. filiforme*, and *T. testudinum* were found in these bay segments during 2003. *H. engelmanni* was not reported for any transects during 2003, but has been documented along transects S4T7 and S4T8 in previous monitoring years. Braun Blanquet data from transects monitored during 2003 are presented in Figures 42-56.

Generally, seagrass species composition in Lower Tampa Bay has been dominated by *T. testudinum*. *S. filiforme* has not been documented along transects within the Manatee River, however, this species is common in the proximity of Terra Ceia Bay and Egmont Key. *H. wrightii* was present on all transects.

There has been little change in seagrass species composition and abundance along the Lower Tampa Bay transects since the initiation of the monitoring program. However,

shifts in seagrass abundance and coverage along transects S4T2 and S4T9 have been observed.

Transect S4T2, located just south of Bishop Harbor, has lost the seaward edge of seagrass coverage each year since 1999 (Figure 43). Further, the seaward edge shifted from *T. testudinum* dominated to *H. wrightii* dominated between 1999-2001. The seaward edge of the *H. wrightii* coverage continued to recede during 2003.

Seagrass coverage along transect S4T9 had been comprised of moderately abundant *H. wrightii* and *T. testudinum* since monitoring began in 1998 through 2002. However, no seagrass coverage was found along the transect during 2002. Sparse coverage of both species returned in 2003 (Figure 50).

There were shifts in *H. wrightii* abundance and/or coverage in other areas of Lower Tampa Bay during 2003. In Terra Ceia Bay, *H. wrightii* loss was noted along the initial 100m segment of transect S4T5 (Figure 46). Further, *H. wrightii* abundance decreased along transects S4T7, S4T8, and S4T11 (Figures 48, 49, and 52).

S. filiforme occurrence and abundance increased along transects S4T5 and S4T6 during 2003. (Figures 46 and 47). There was little change for this species at the other transect locations.

There was little change noted for *T. testudinum* coverage in Lower Tampa Bay during 2003. However, there was a slight decrease in abundance along transects S4T7 and S4T14 (Figures 48 and 55).

Transect S4T8 has been the only Lower Tampa Bay location where *R. maritima* has been observed during the course of the monitoring program. After being absent since 2001, sparse *R. maritima* coverage returned to this transect during 2003 (Figure 49).

Boca Ciega Bay:

Eleven transects were assessed for seagrass coverage in Boca Ciega Bay in 2003 (Figure 57). *H. wrightii*, *S. filiforme*, and *T. testudinum* were found within this bay segment. Braun Blanquet data from transects monitored during 2003 are presented in Figures 58-68.

Generally, *H. wrightii* has been the dominant species in the northern portion of Boca Ciega Bay. The species coverage transitions to a *T. testudinum* dominated community further south. Only minor fluctuations have been noted within the Boca Ciega Bay seagrass community since the start of the monitoring program. However, an apparent shift from a *T. testudinum* dominated community to a *S. filiforme* meadow occurred between 1999-2000 along transect S5T8 (Figure 65).

Only two transects had notable changes in seagrass abundance during 2003. *H. wrightii* abundance along transect S5T2 increased concomitant with a decrease in *T. testudinum* (Figure 59). Further, both *H. wrightii* and *T. testudinum* abundance increased along transect S5T10 between 2002-2003 (Figure 67).

Transect S5T8 has been the sole site where *C. prolifera* has been found in Boca Ciega Bay. The alga was first noted in 2002, however, it was absent in 2003 (Figure 65).

Summary

We now have six years or more of data from most of the Tampa Bay seagrass monitoring transects. This information suggests that most seagrass meadows in Old Tampa Bay, Middle Tampa Bay, and Lower Tampa Bay have been relatively stable in terms of species composition and abundance. The only major changes detected have been the rapid development and subsequent declines of *H. wrightii* meadows along southeastern Interbay Peninsula in Hillsborough Bay between 1998 and 2003. In addition, *H. wrightii* coverage and abundance in northwest Old Tampa Bay decreased during 2002 and 2003.

Nitrogen management has been the keystone to the recovery of Tampa Bay to date. The need to reduce nitrogen to the bay was identified in the late 1960s and work began to control point source loading. As nitrogen sources were reduced in the late 1970s and early 1980s, there were soon improvements noted such as reductions in macroalgae and phytoplankton biomass. Following these improvements, minor seagrass recolonization began to occur in some areas of Tampa Bay. With the advent of the Tampa Bay National Estuary Program in the early 1990s, work began on establishing acceptable levels of phytoplankton biomass needed to maintain adequate water clarity to promote seagrass recolonization.

Information collected to date from the Tampa Bay Interagency Seagrass Monitoring Program suggests that seagrass coverage in most areas of Tampa Bay has changed little since 1998. However, SWIM reported a large loss in seagrass coverage in Old Tampa Bay between 1996-1999. Most of the transects in areas of loss reported by SWIM did not include the necessary geographic location, directional orientation, or include sufficient length to detect such changes in seagrass coverage.

The loss of *H. wrightii* at Interbay peninsula and northwest Old Tampa Bay may be due, in part to poor water clarity. In Hillsborough Bay, elevated color values due to increased rainfall within the watershed during 2003 may have impacted the deeper *H. wrightii* growing along Interbay peninsula (City of Tampa 2004). Increased color may result in greater water column light attenuation thus reducing light available to the seagrass. For additional discussion of water quality in Old Tampa Bay and its potential effect on seagrass coverage, please see: "Factors Influencing Seagrass Recovery in Feather Sound, Tampa Bay Florida", submitted to the Pinellas County Environmental Foundation in April 2004.

Acknowledgements

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Management Program), Ray Kurz (Post, Buckley, Shue, and Jernigan), and Tom Reis (Scheda Ecological Associates, Inc.) provided guidance in the initial design of the monitoring protocols. Field collections were conducted by personnel from Florida Fish & Wildlife Conservation Commission – Fish and Wildlife Research Institute, Hillsborough County Cockroach Bay Aquatic Preserve, Hillsborough County Environmental Protection Commission, Manatee County Environmental Management Department, Pinellas County Department of Environmental Management, Tampa BayWatch, Inc., and City of Tampa Bay Study Group. The generous contributions from these agencies and the hard work by their personnel have ensured the success of this project. Finally, Robin Lewis (Lewis Environmental Services, Inc.) is acknowledged for early on advocating the need to establish permanent seagrass transects in Tampa Bay and for his continued support of this program.

References

City of Tampa. 2004. Seagrass and *Caulerpa* monitoring in Hillsborough Bay. Fifteenth Annual Report. Prepared for the Florida Department of Environmental Protection. 46p.

Tampa Bay Estuary Program. 2004. Factors Influencing Seagrass Recovery in Feather Sound, Tampa Bay Florida. Prepared for the Pinellas County Environmental Foundation. 29p.

Table 1. Transect monitoring in Tampa Bay by agency and initial monitoring date.

	HCEPC	BSG	PC	CB	FWRI	MC	TBI	
Old Tampa Bay	S1T1	1999						
	S1T3	1998						
	S1T4	1999						
	S1T5	1998						
	S1T6	1998						
	S1T8	1998						
	S1T9	1998						
	S1T13	2001						
	S1T14	2001						
	S1T15	2001						
Hillsborough Bay	S1T16			2001				
	S1T17		2001					
	S2T2		1997					
	S2T3		1997					
	S2T4		1997					
	S2T5		1997					
	S2T6		1997					
	S2T8		1997					
	S2T9		1997					
	S2T10		1997					
Middle Tampa Bay	S2T111		1997					
	S2T112		1997					
	S2T12		1997					
	S3T1					1998		
	S3T2					1998		
	S3T3				1998			
	S3T4				1998			
	S3T5				1998			
	S3T6				1998			
	S3T7					1998		
Lower Tampa Bay	S3T8					1998		
	S3T9				1998			
	S3T10							2000
	S3T11							2000
	S3T12		1997					
	S3T13		1997					
	S4T1						1999	
	S4T2						1998	
	S4T3						1999	
	S4T4						1998	
Boca Ciega Bay	S4T5						1998	
	S4T6						1998	
	S4T7						1998	
	S4T8						1999	
	S4T9						1998	
	S4T10						1998	
	S4T11						1998	
	S4T12		1998					
	S4T13							2000
	S4T14							2000
	S4T15							2000
	S5T1			1998				
	S5T2			1999				
	S5T3			1998				
	S5T4			1998				
	S5T5			1998				
	S5T6			1998				
	S5T7			1998				
	S5T8			1998				
	S5T9			1998				
	S5T10			1998				
	S5T11			1998				

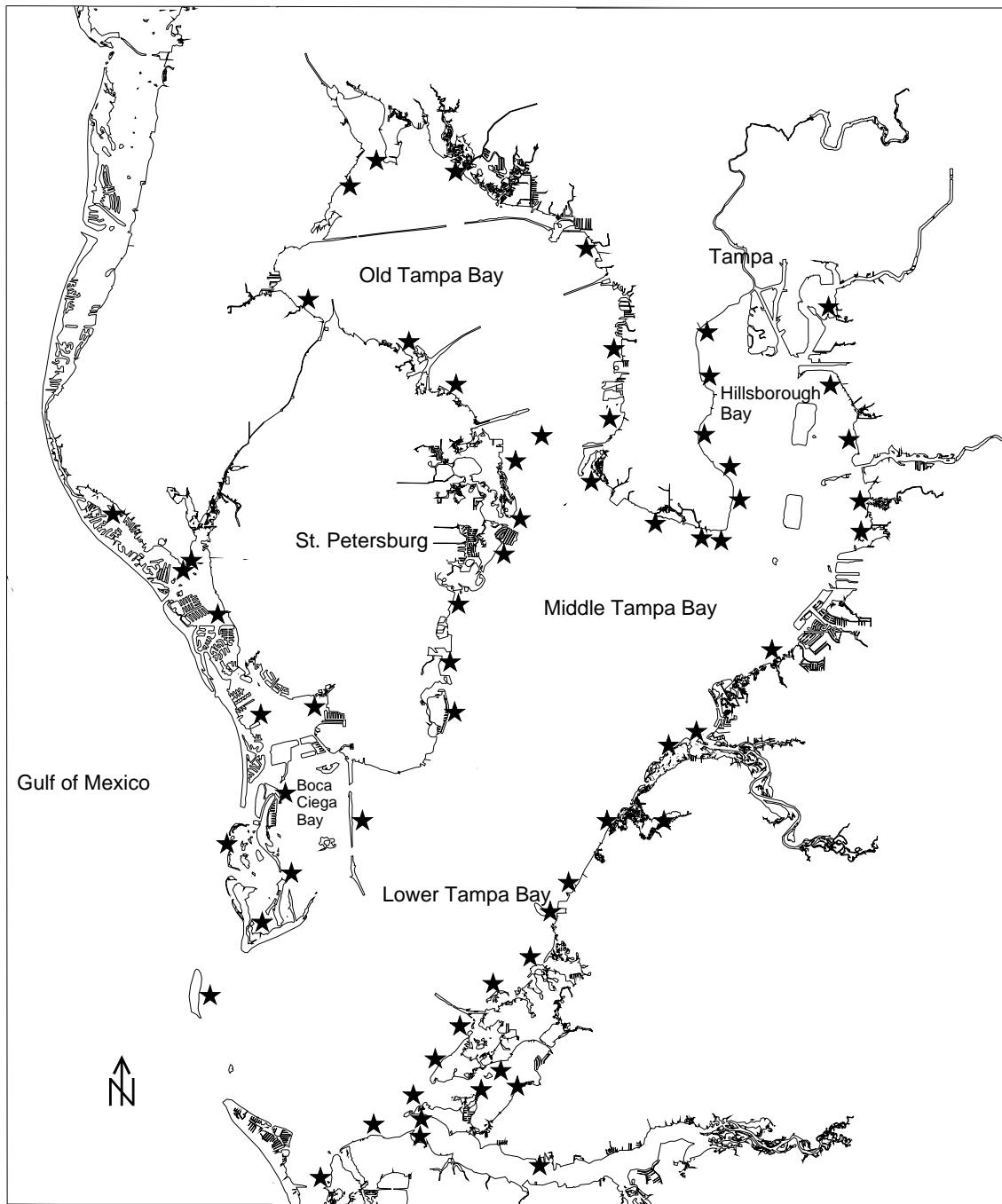


Figure 1. Location of the 62 current seagrass monitoring transects in Tampa Bay.

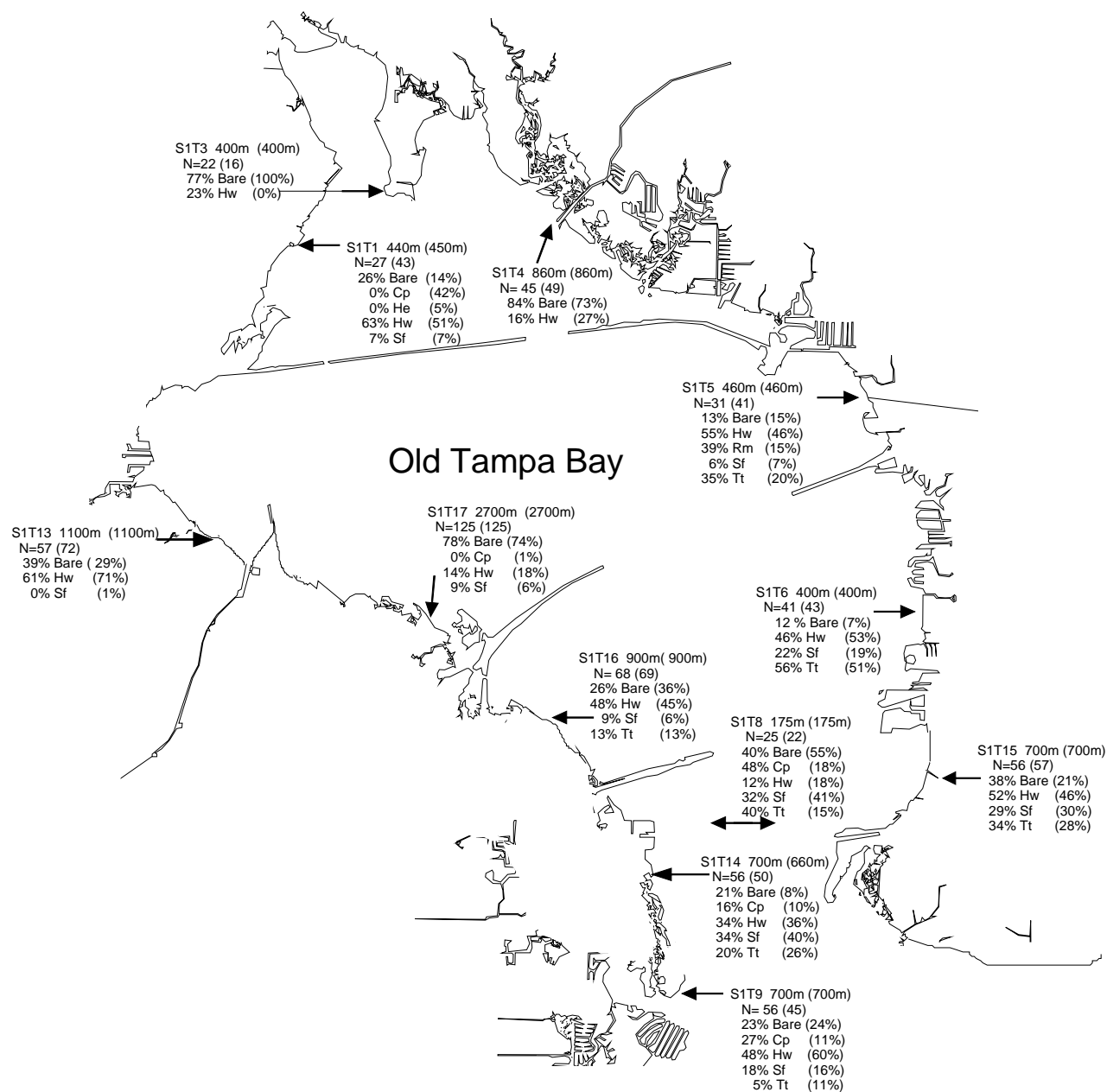


Figure 2. Name, location, length and percent of meter square placements containing each seagrass species along the 12 Old Tampa Bay seagrass monitoring transects in 2003. Results from 2002 in parentheses. N=number of meter square placements; Hw=*Halodule wrightii*; Rm=*Ruppia maritima*; Sf=*Syringodium filiforme*; Tt=*Thalassia testudinum*.

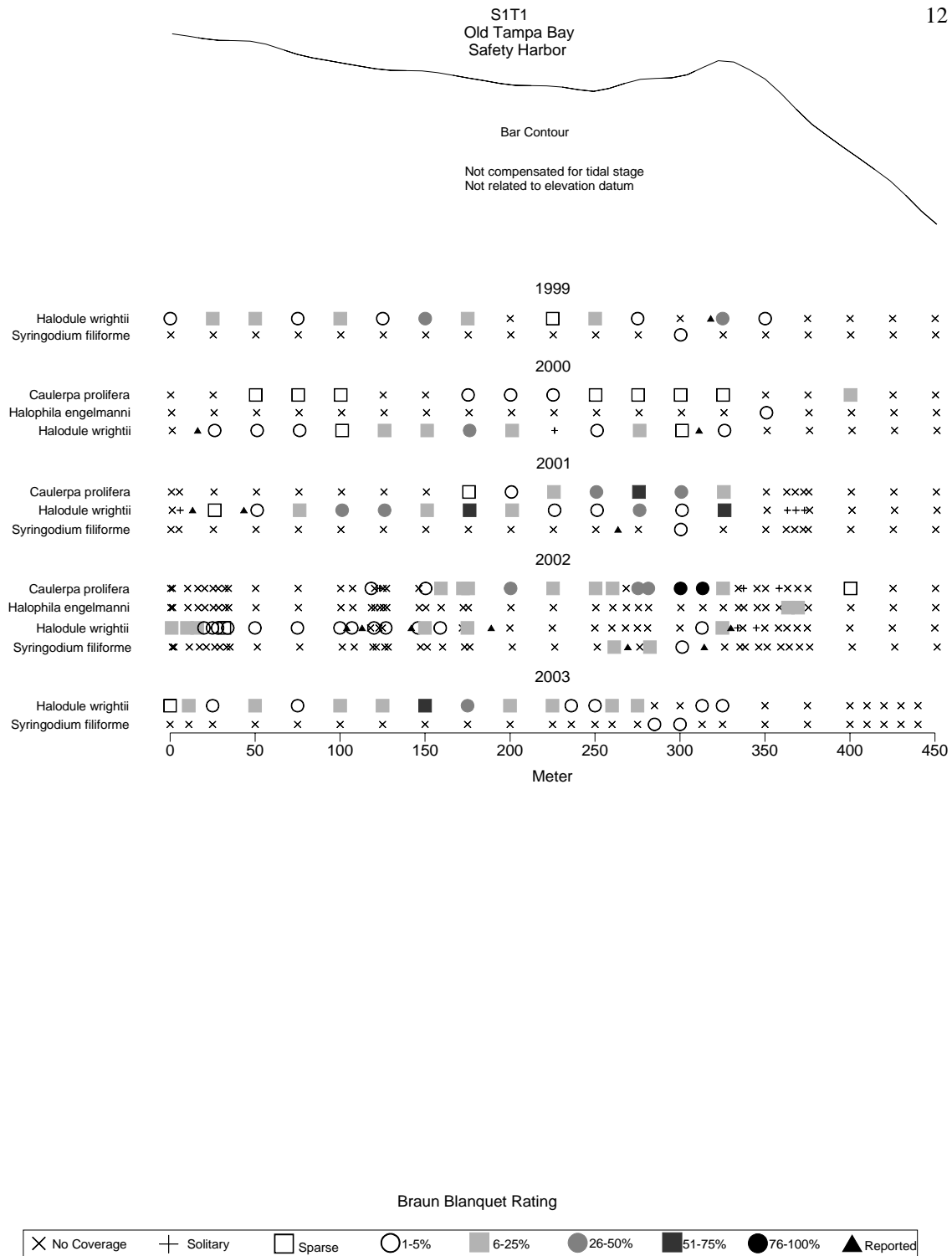


Figure 3. Seagrass species, abundance, and zonation at S1T1 from 1999-2003.

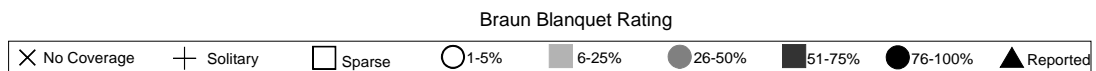
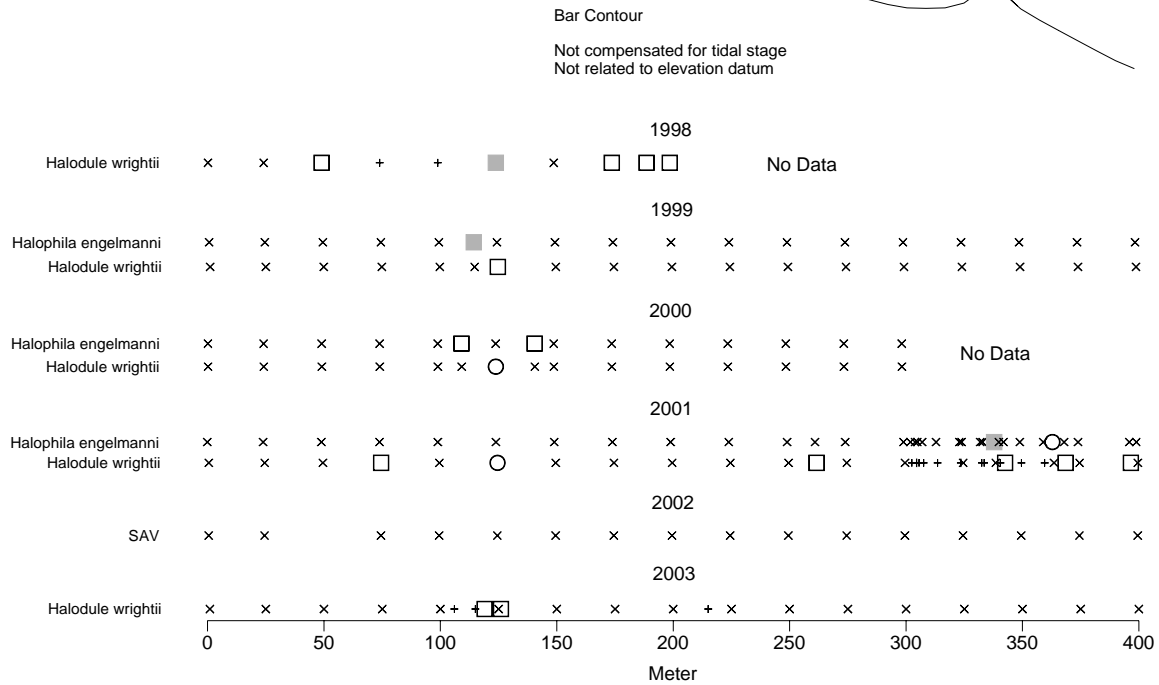


Figure 4. Seagrass species, abundance, and zonation at S1T3 from 1998-2003.

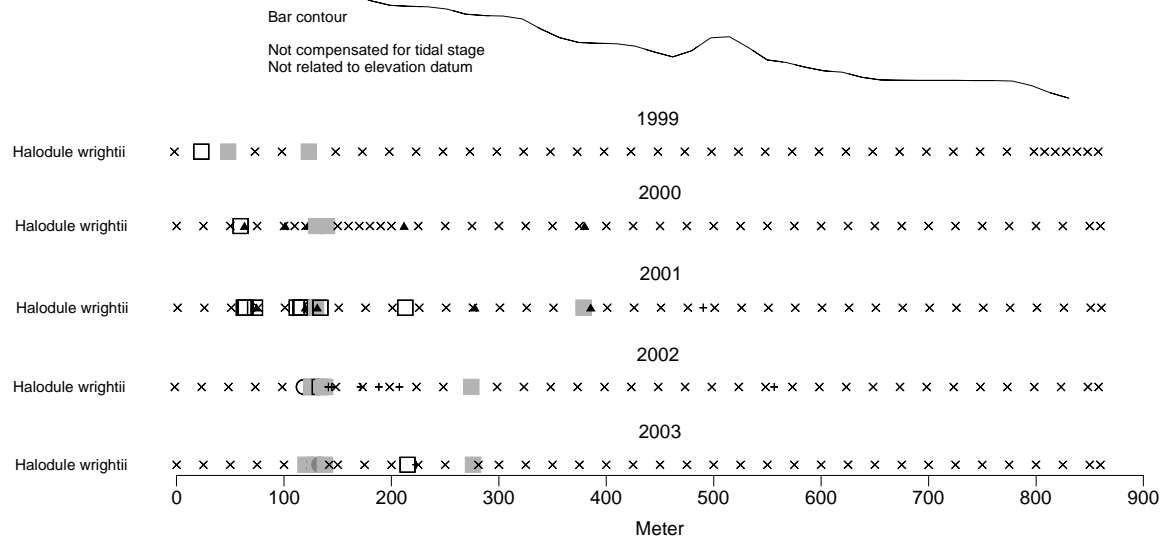


Figure 5. Seagrass species, abundance, and zonation at S1T4 from 1999-2003.

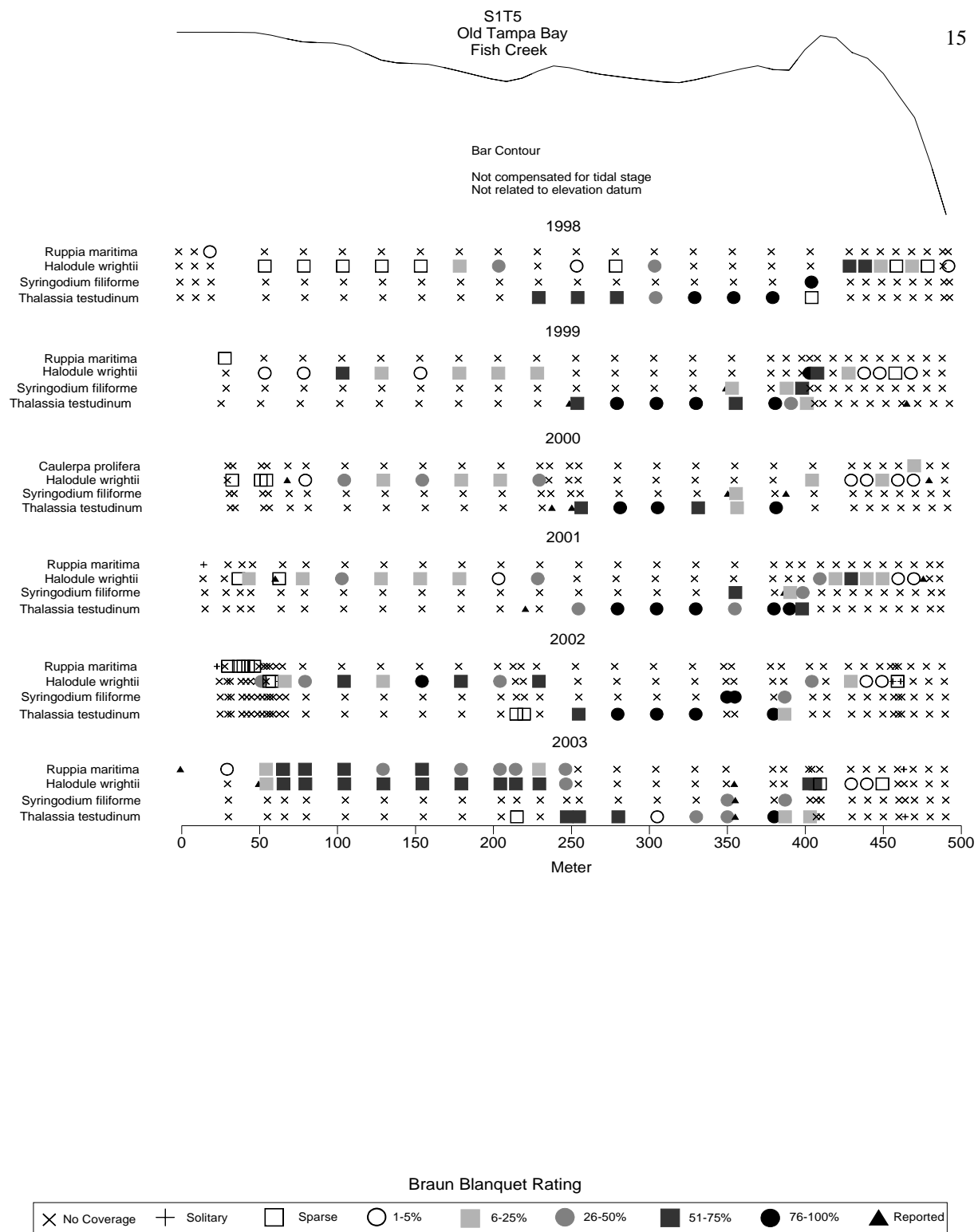


Figure 6. Seagrass species, abundance, and zonation at S1T5 from 1998-2003.

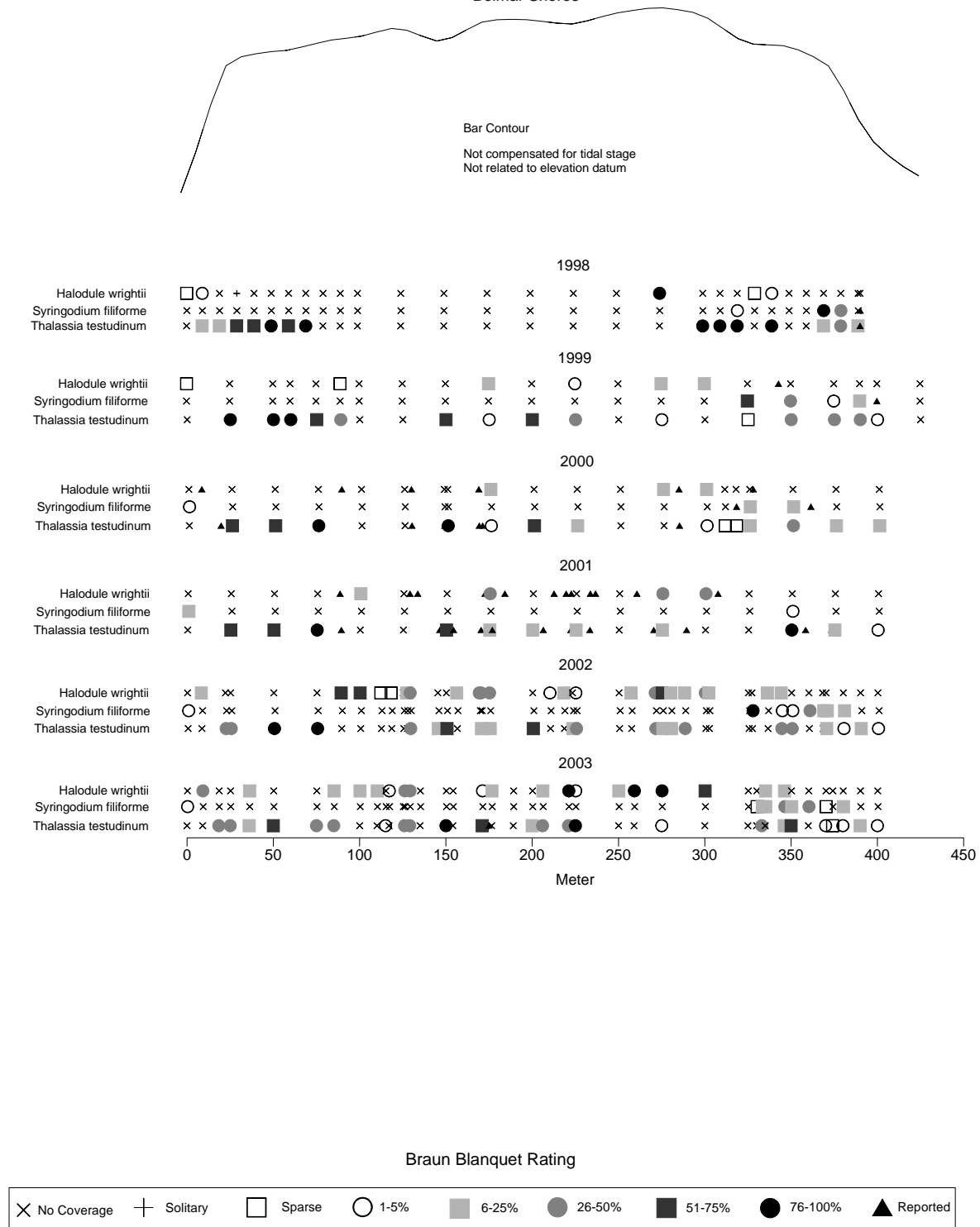
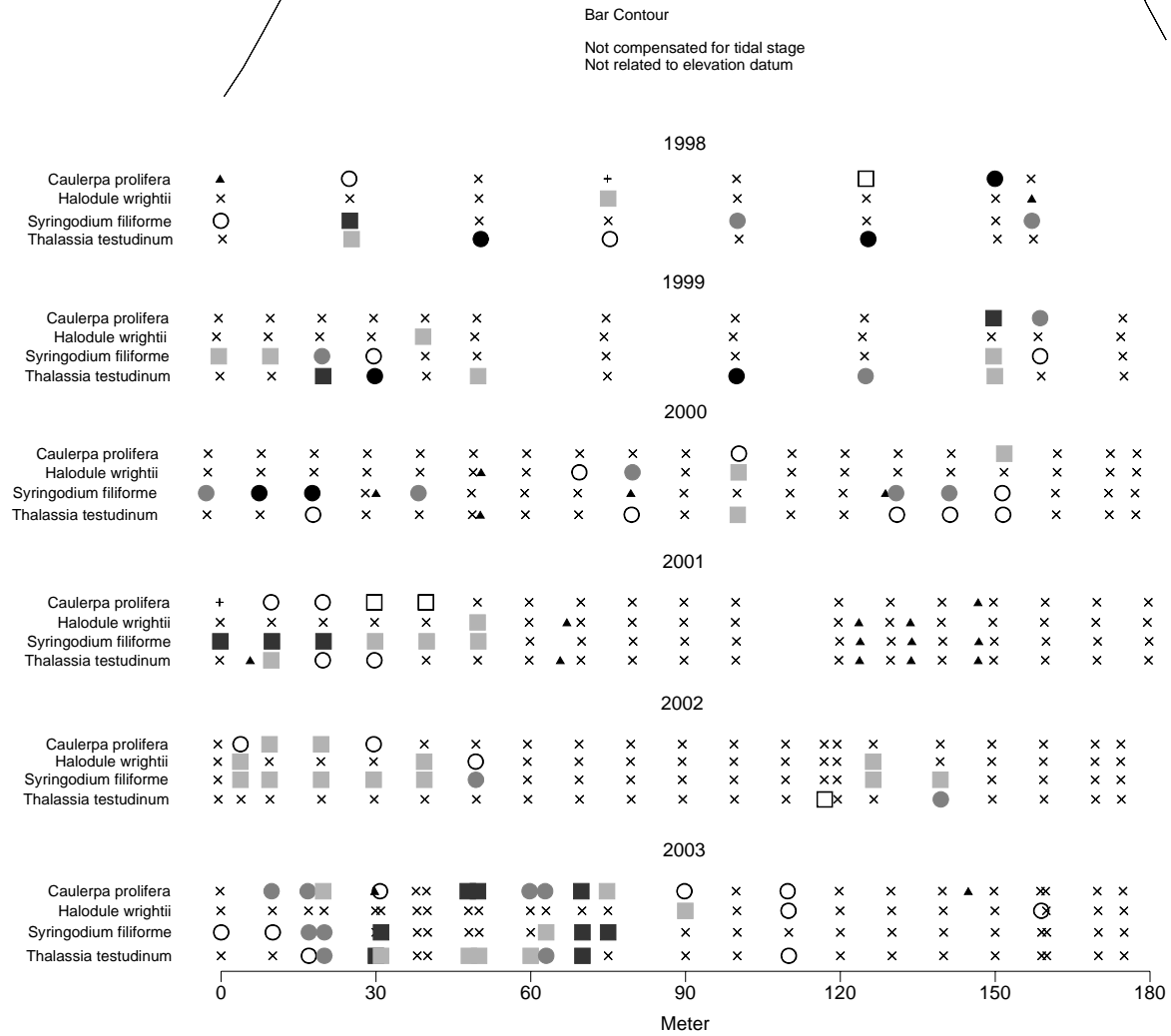


Figure 7. Seagrass species, abundance, and zonation at S1T6 from 1998-2003.



Braun-Blanquet Rating



Figure 8. Seagrass species, abundance, and zonation at S1T8 from 1998-2003.

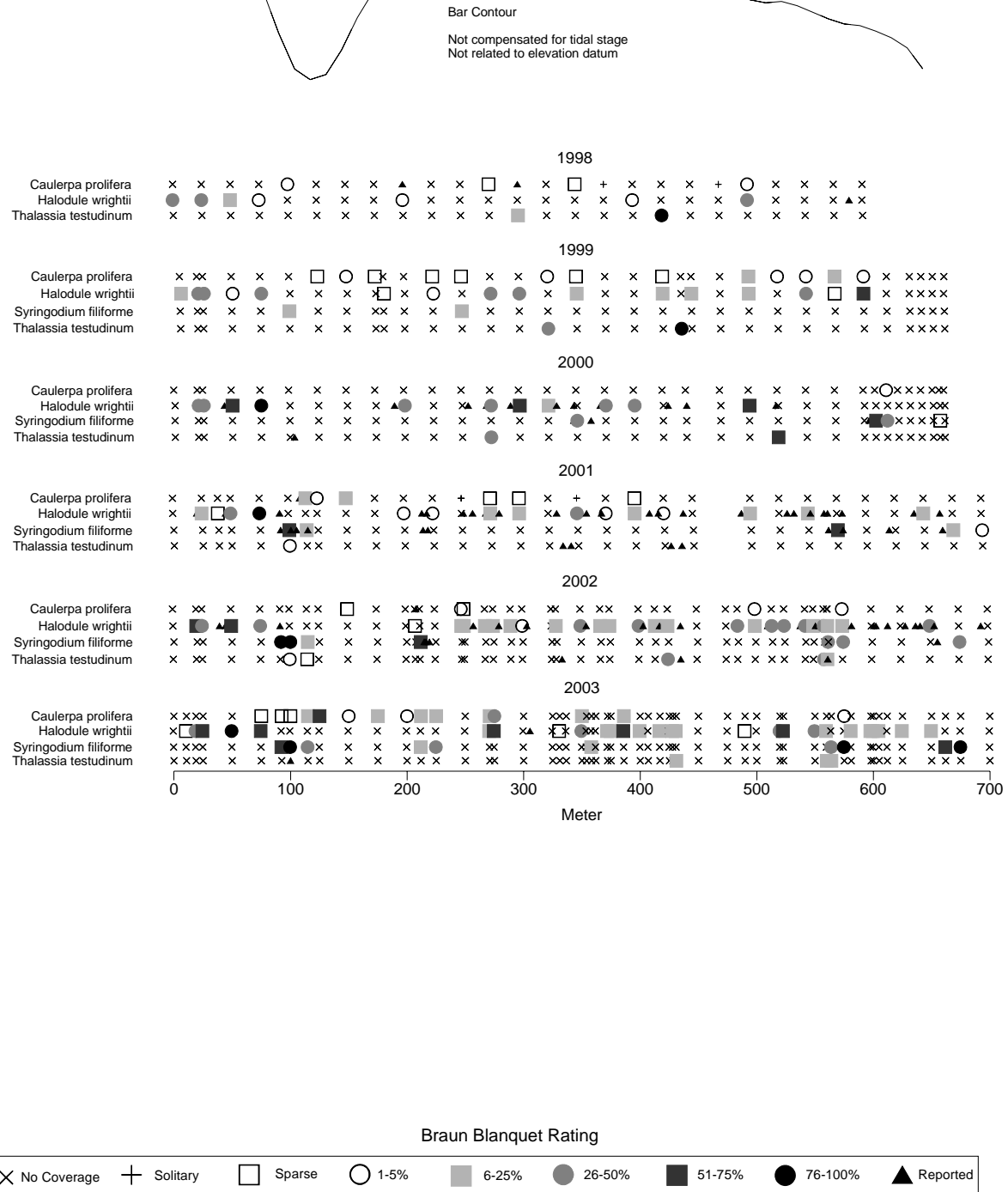


Figure 9. Seagrass species, abundance, and zonation at S1T9 from 1998-2003.

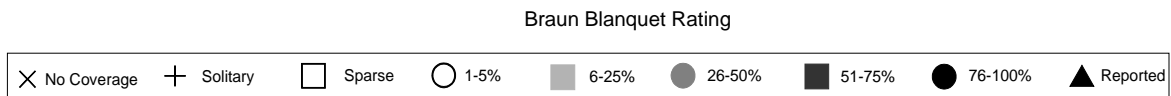
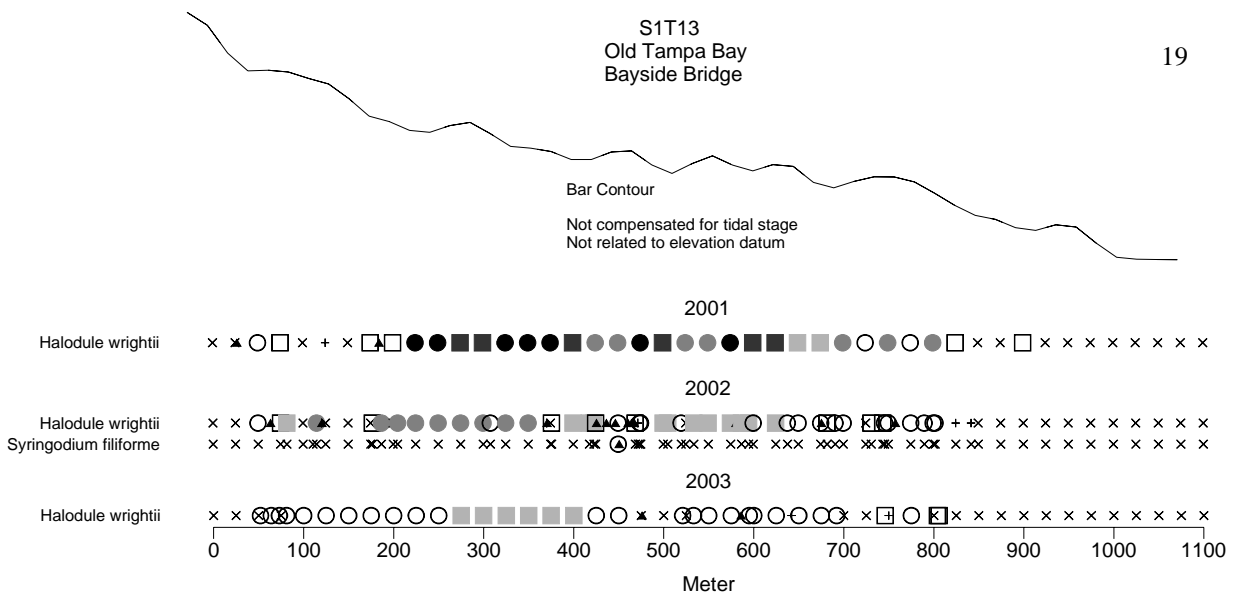


Figure 10. Seagrass species, abundance, and zonation at S1T13 from 2001-2003.

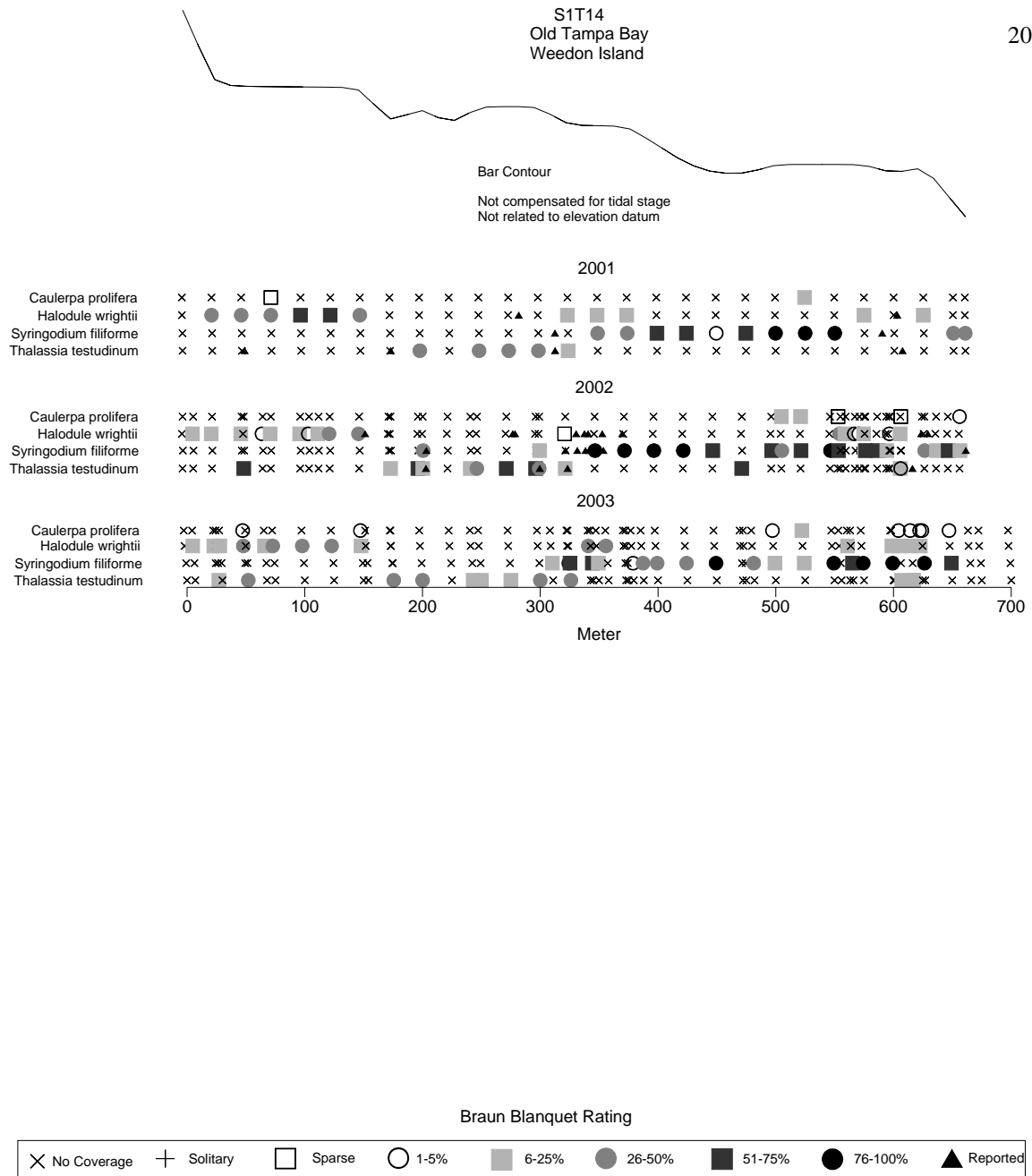


Figure 11. Seagrass species, abundance, and zonation at S1T14 from 2001-2003.

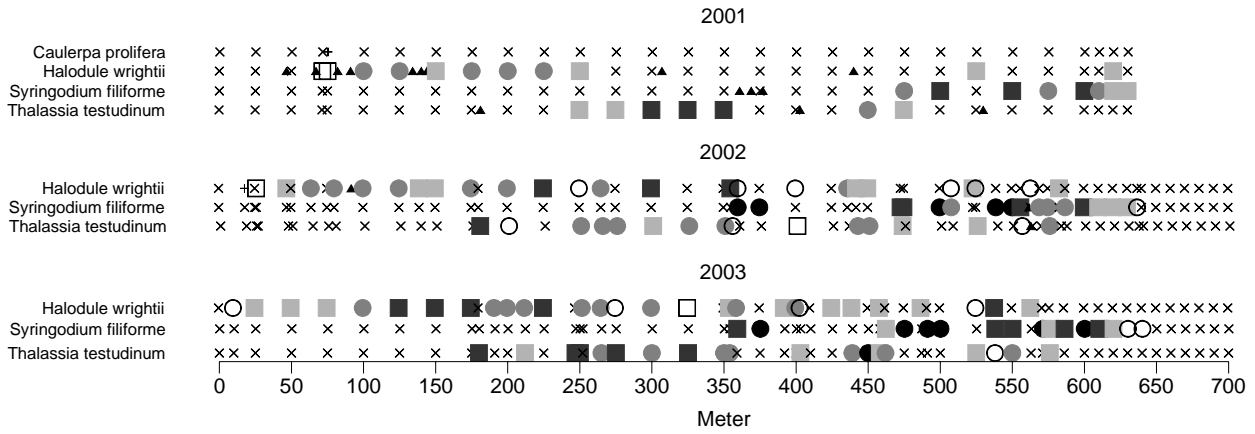


Figure 12. Seagrass species, abundance, and zonation at S1T15 from 2001-2003.

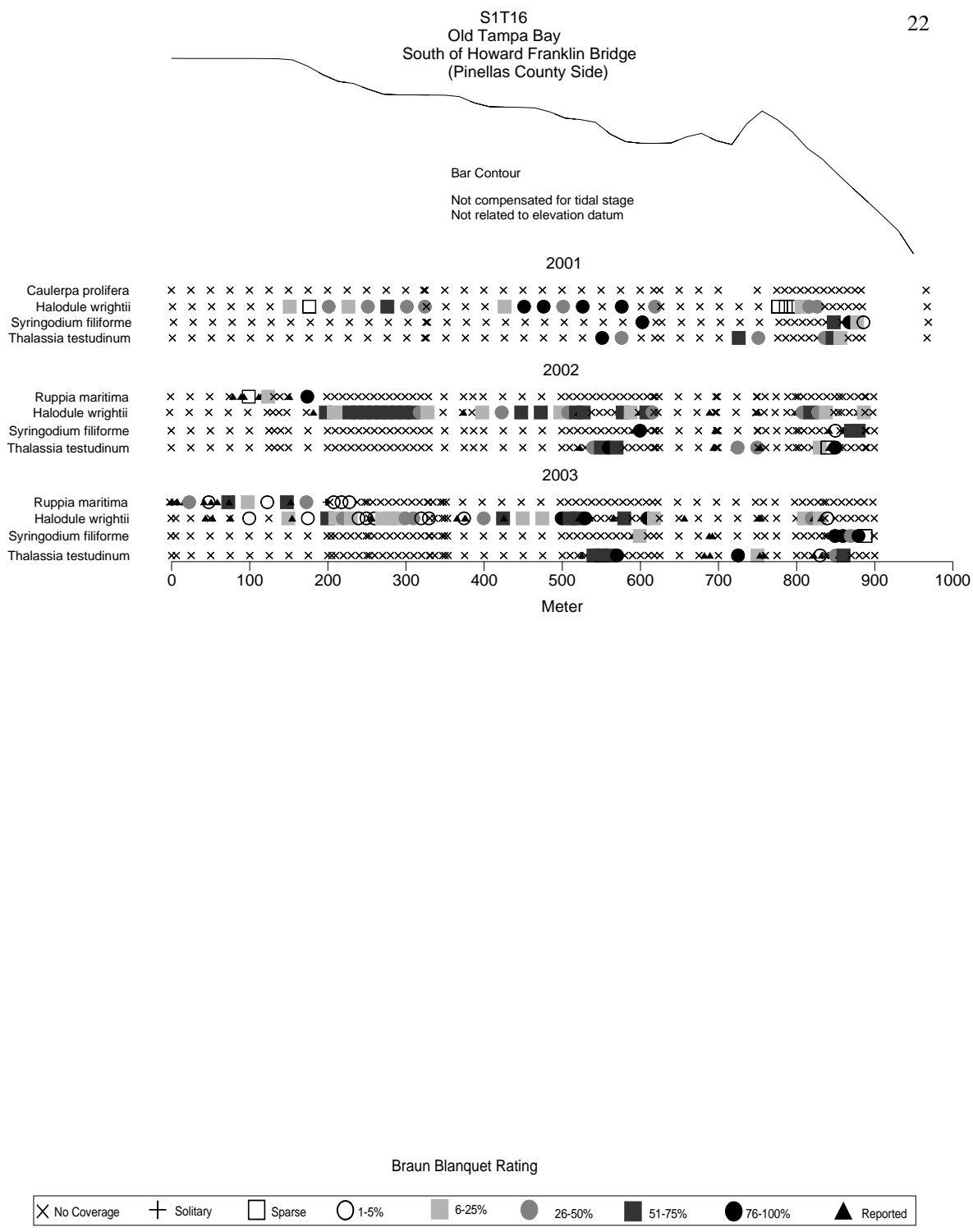


Figure 13. Seagrass species, abundance, and zonation at S1T16 from 2001-2003.

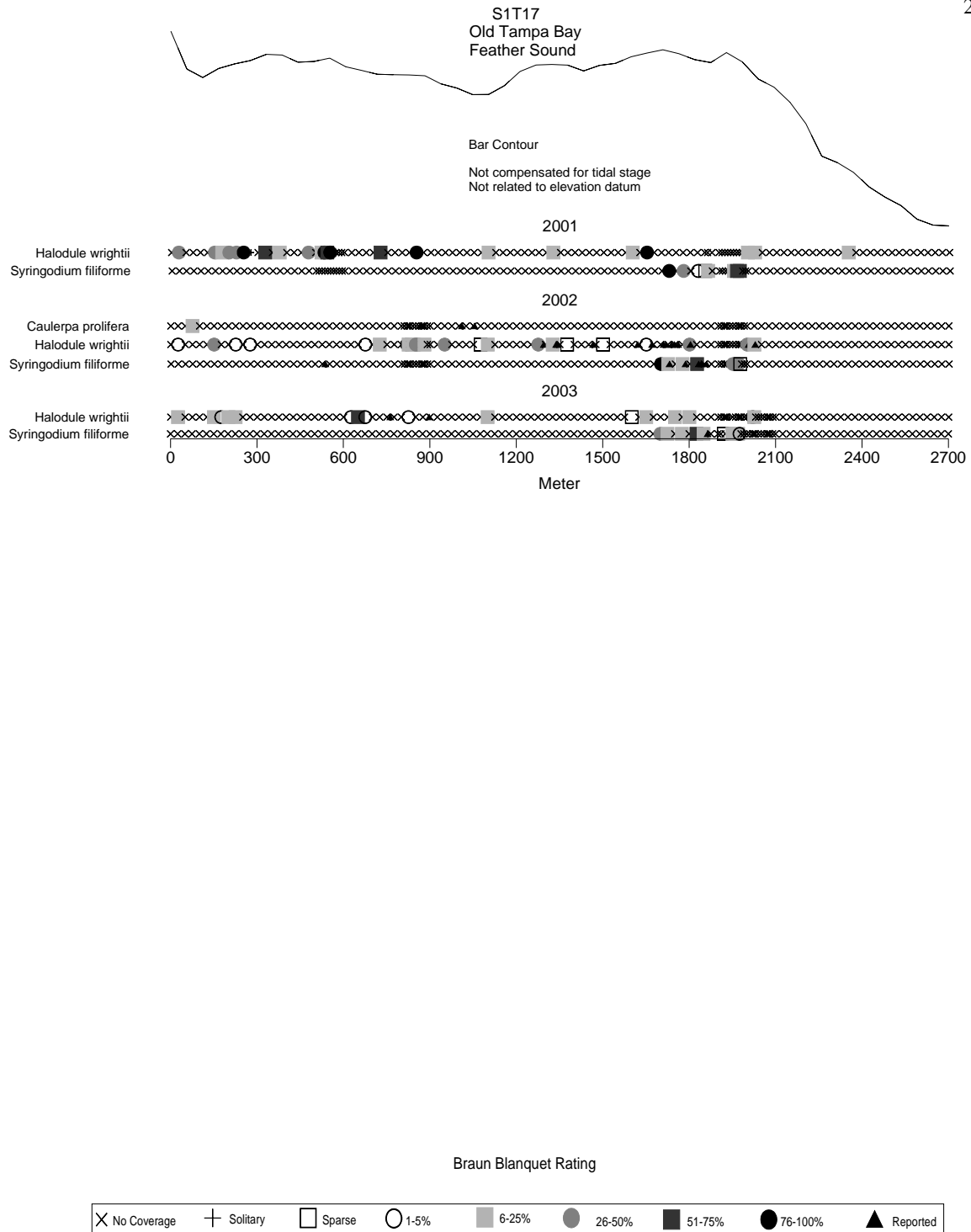


Figure 14. Seagrass species, abundance, and zonation at S1T17 from 2001-2003.

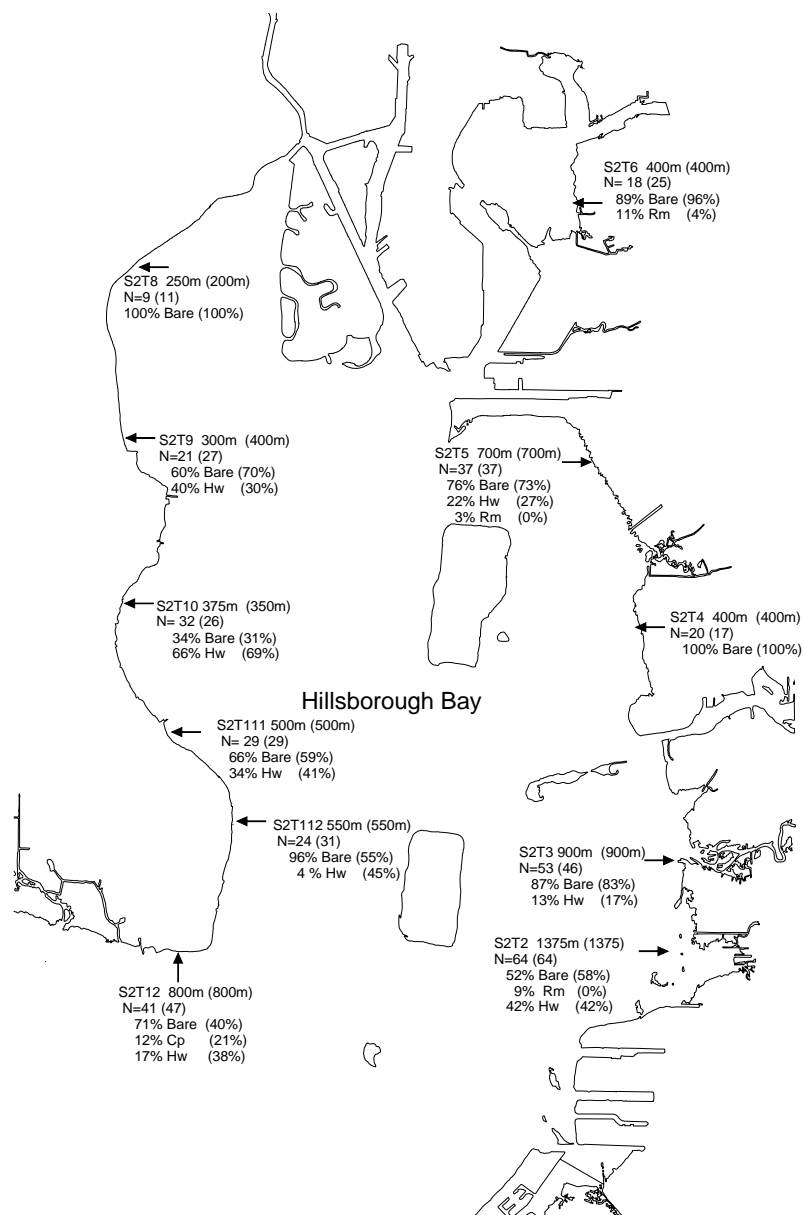


Figure 15. Name, location, length and percent of meter square placements containing each seagrass species along the 11 Hillsborough Bay seagrass monitoring transects in 2003. Results from 2002 in parentheses. N=number of meter square placements; Hw=*Halodule wrightii*; Rm=*Ruppia maritima*; Sf=*Syringodium filiforme*; Tt=*Thalassia testudinum*.

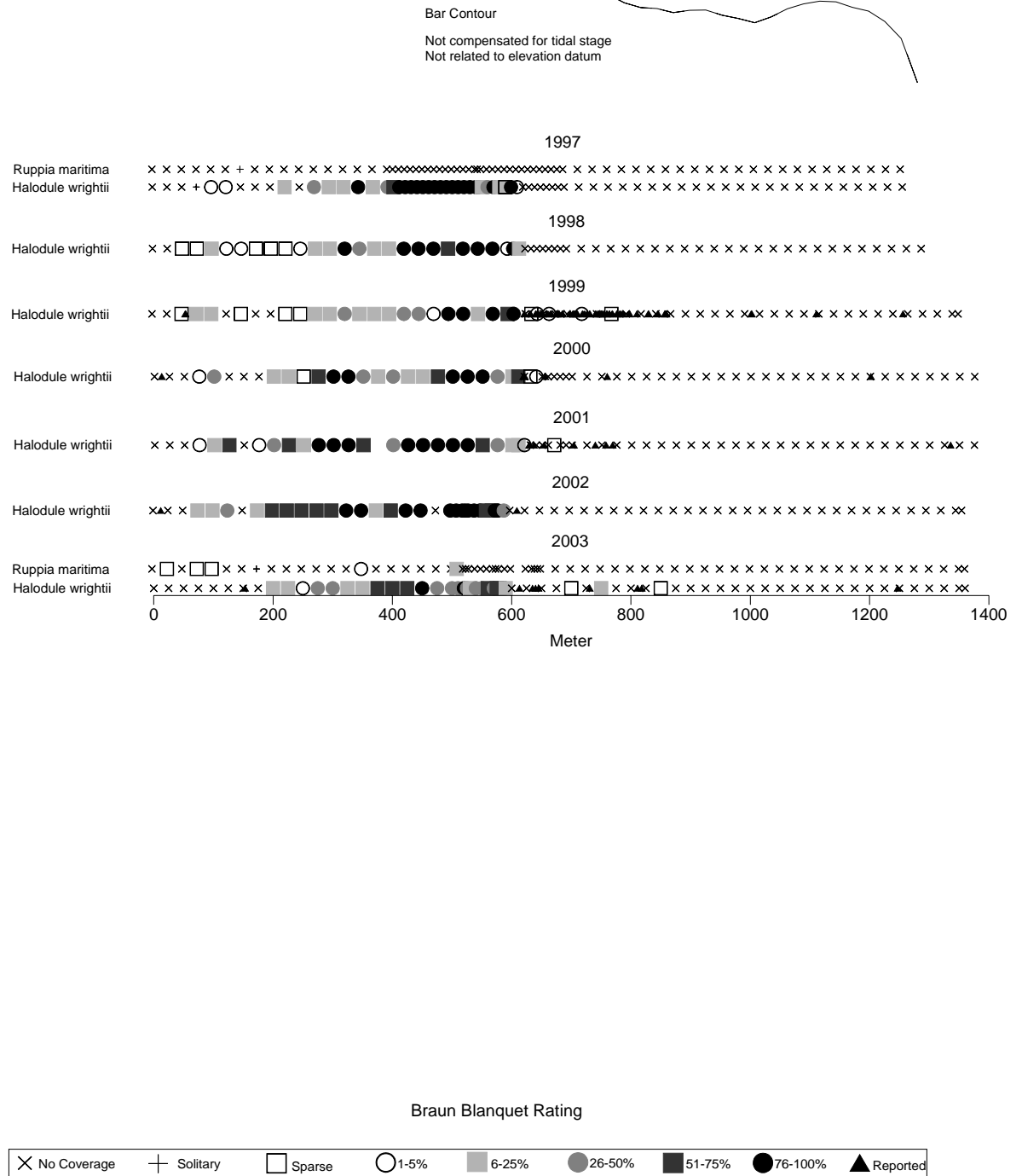
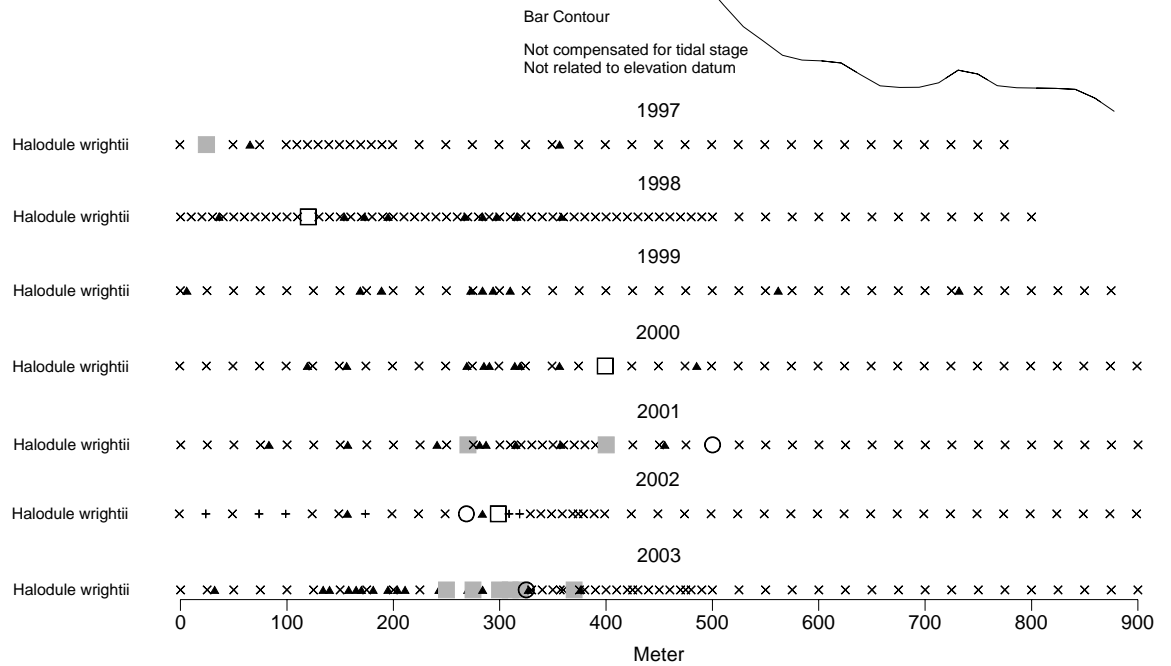


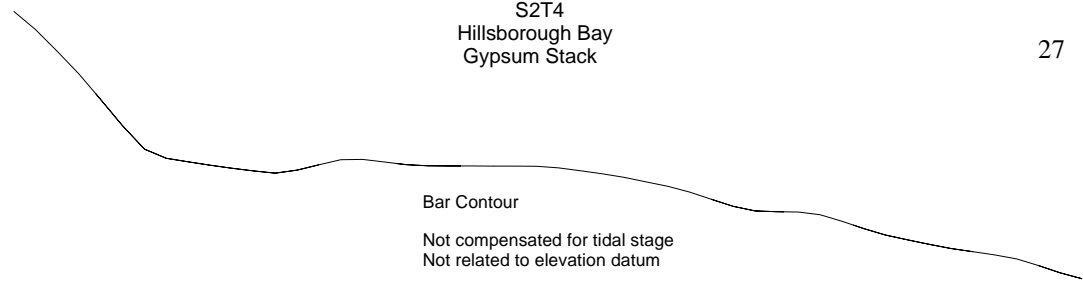
Figure 16. Seagrass species, abundance, and zonation at S2T2 from 1997-2003.



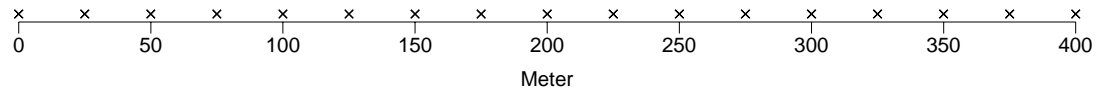
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Figure 17. Seagrass species, abundance, and zonation at S2T3 from 1997-2003.



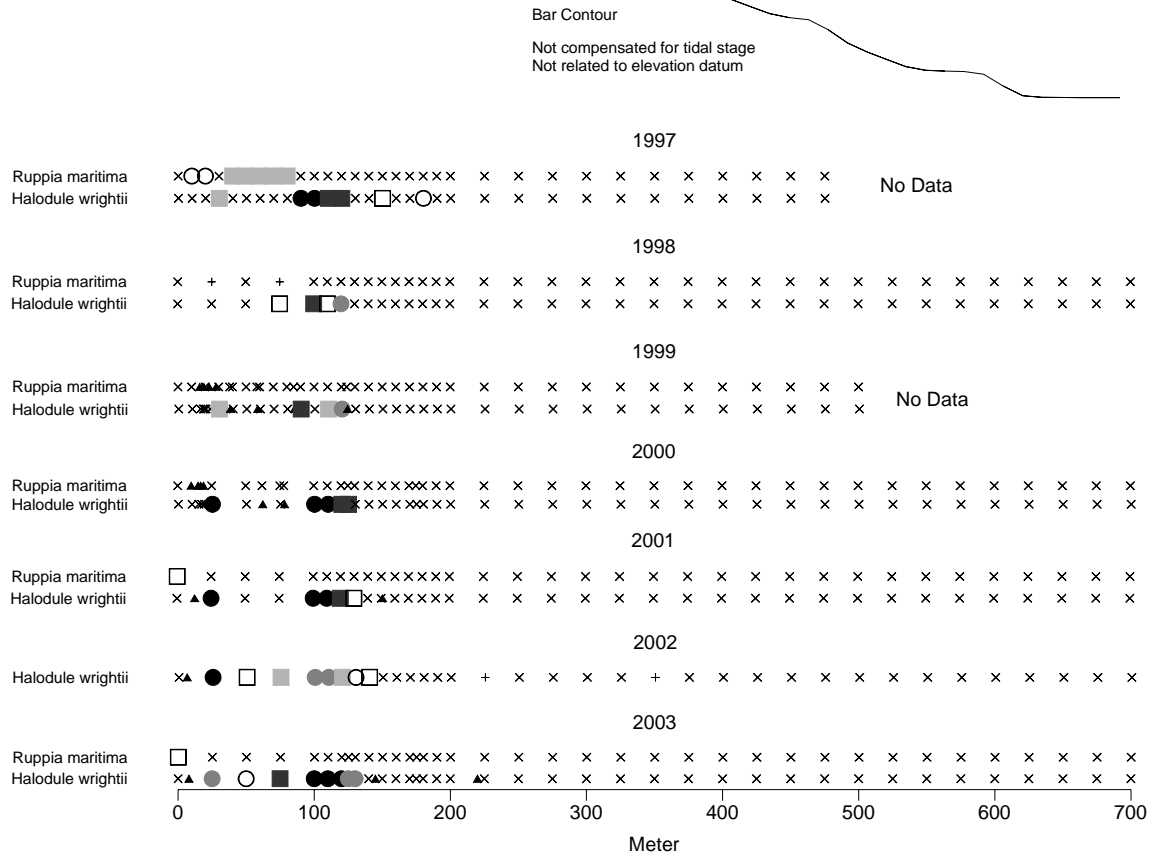
No SAV reported in 1997, 1998, 1999, 2000, 2001, 2002, or 2003.



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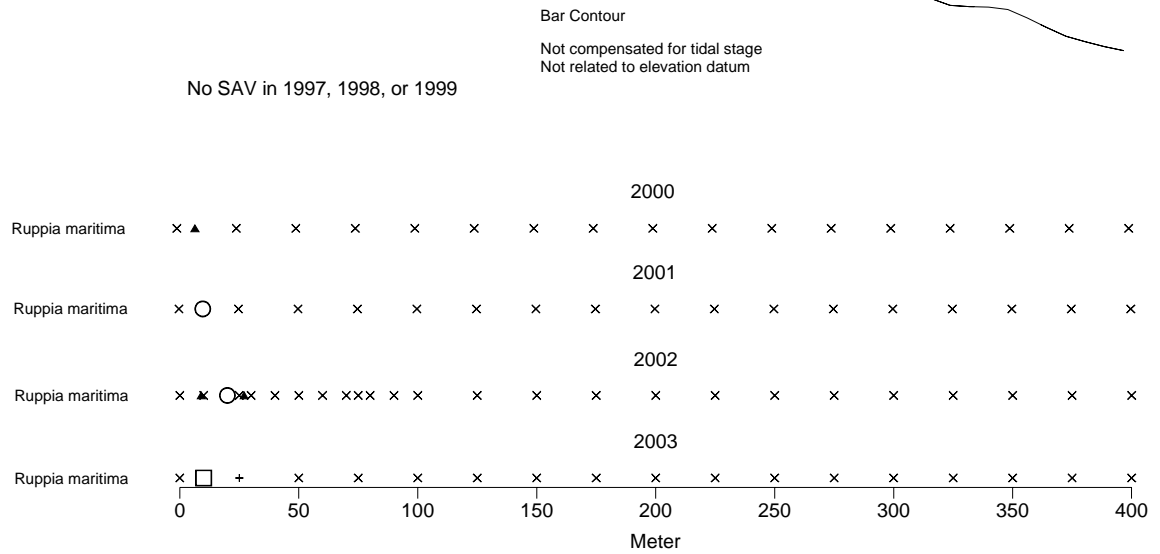
Figure 18. Seagrass species, abundance, and zonation at S2T4 from 1997-2003.



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Figure 19. Seagrass species, abundance, and zonation at S2T5 from 1997-2003.



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Figure 20. Seagrass species, abundance, and zonation at S2T6 from 1997-2003.

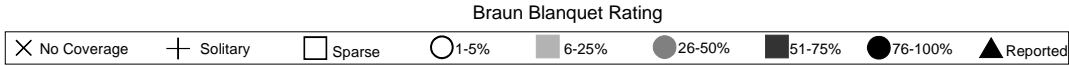
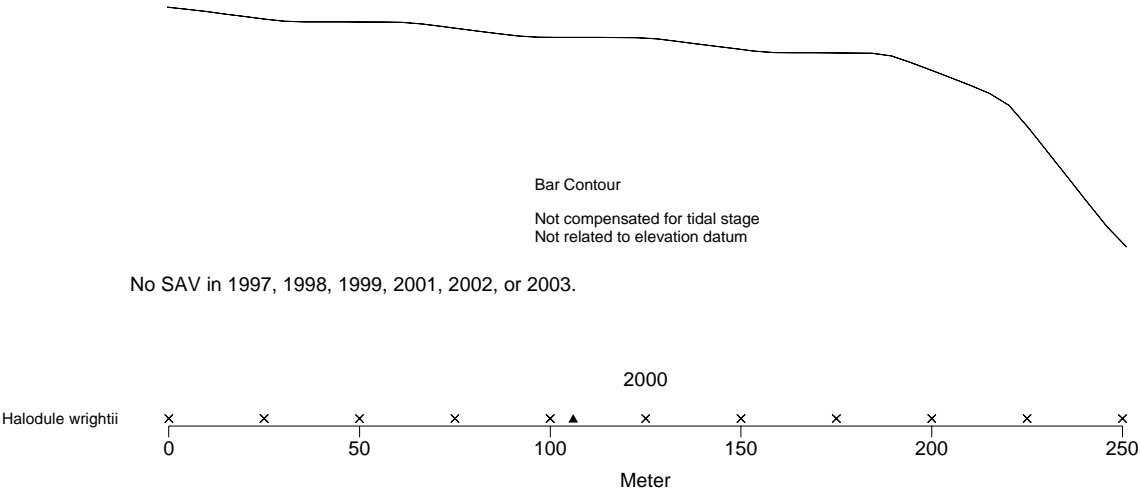
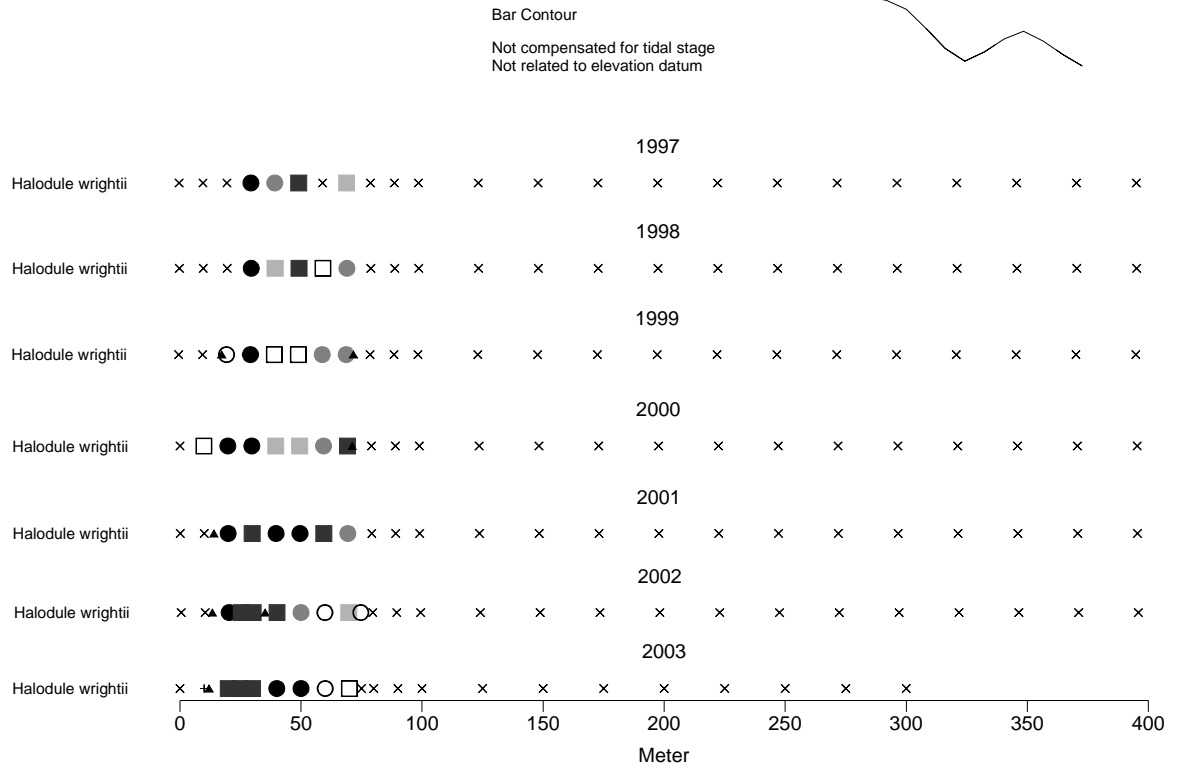


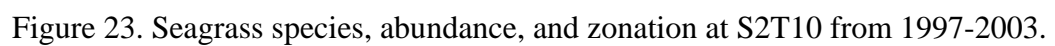
Figure 21. Seagrass species, abundance, and zonation at S2T8 from 1997-2003.

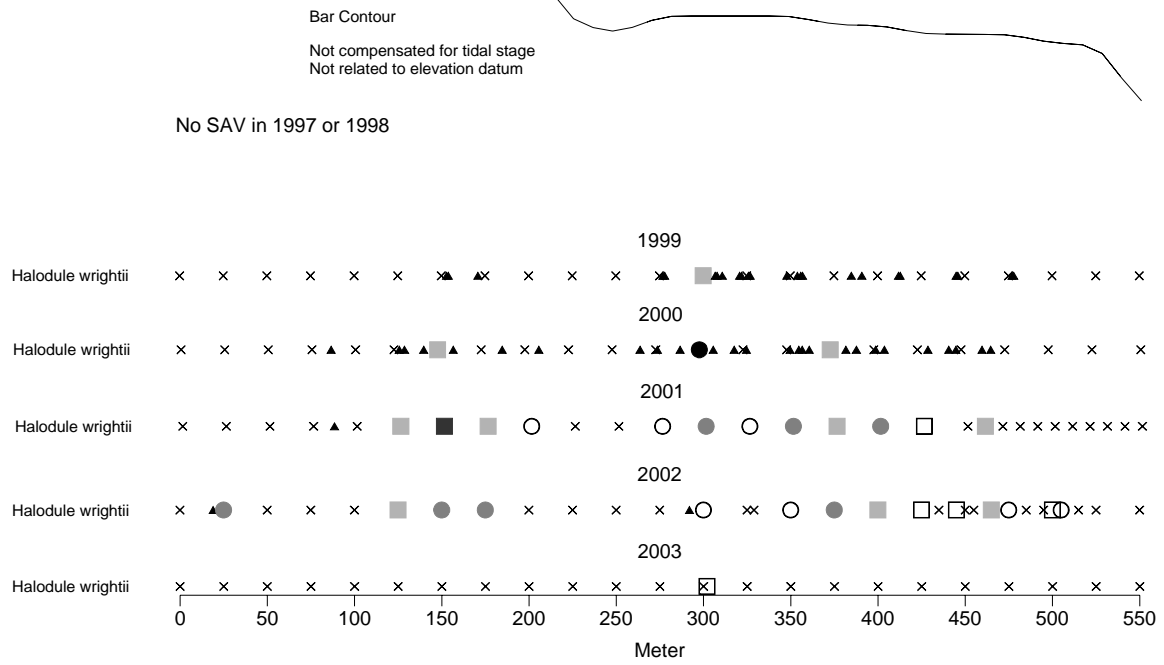


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Figure 22. Seagrass species, abundance, and zonation at S2T9 from 1997-2003.





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Figure 25. Seagrass species, abundance, and zonation at S2T112 from 1997-2003.

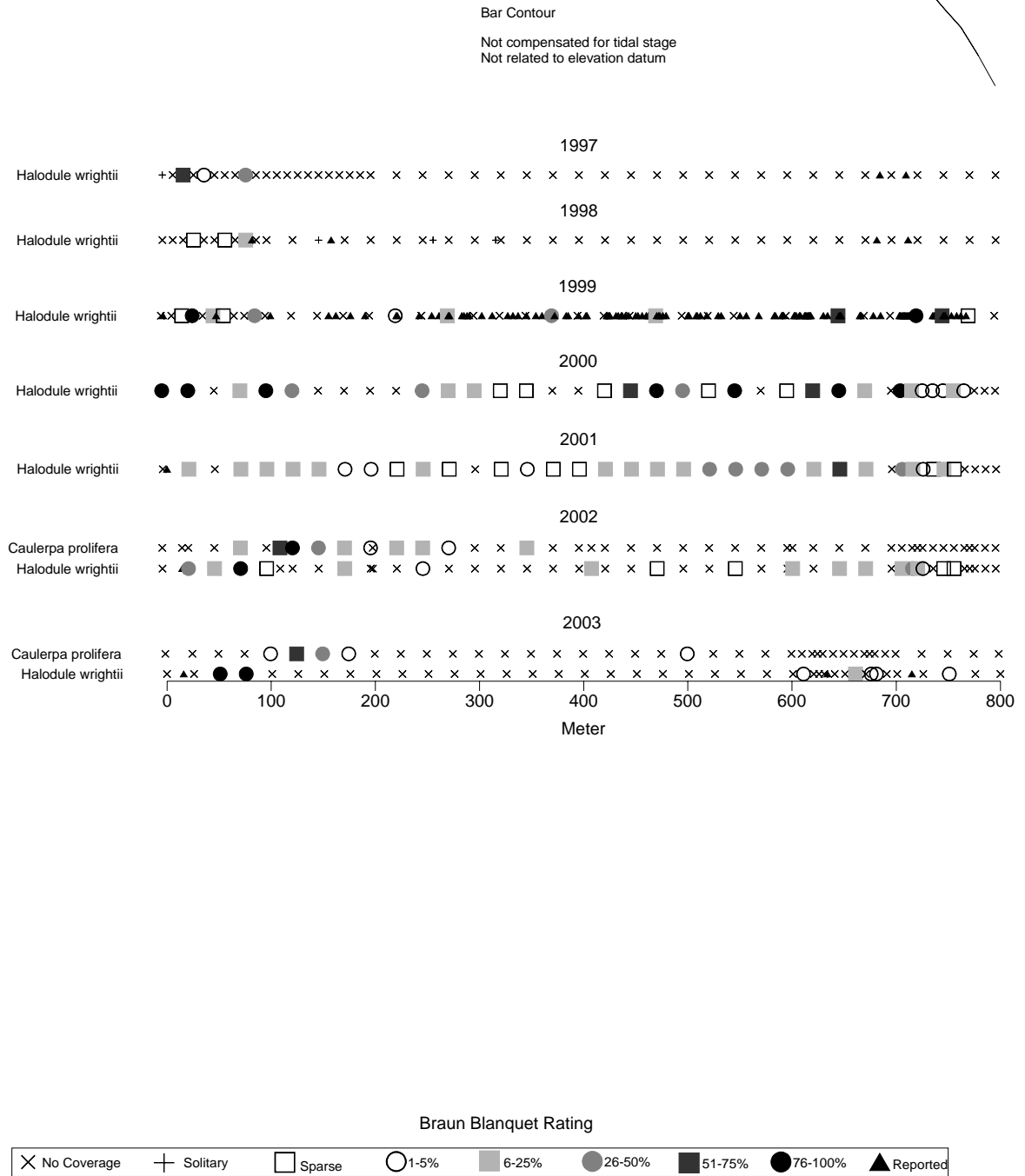


Figure 26. Seagrass species, abundance, and zonation at S2T12 from 1997-2003.

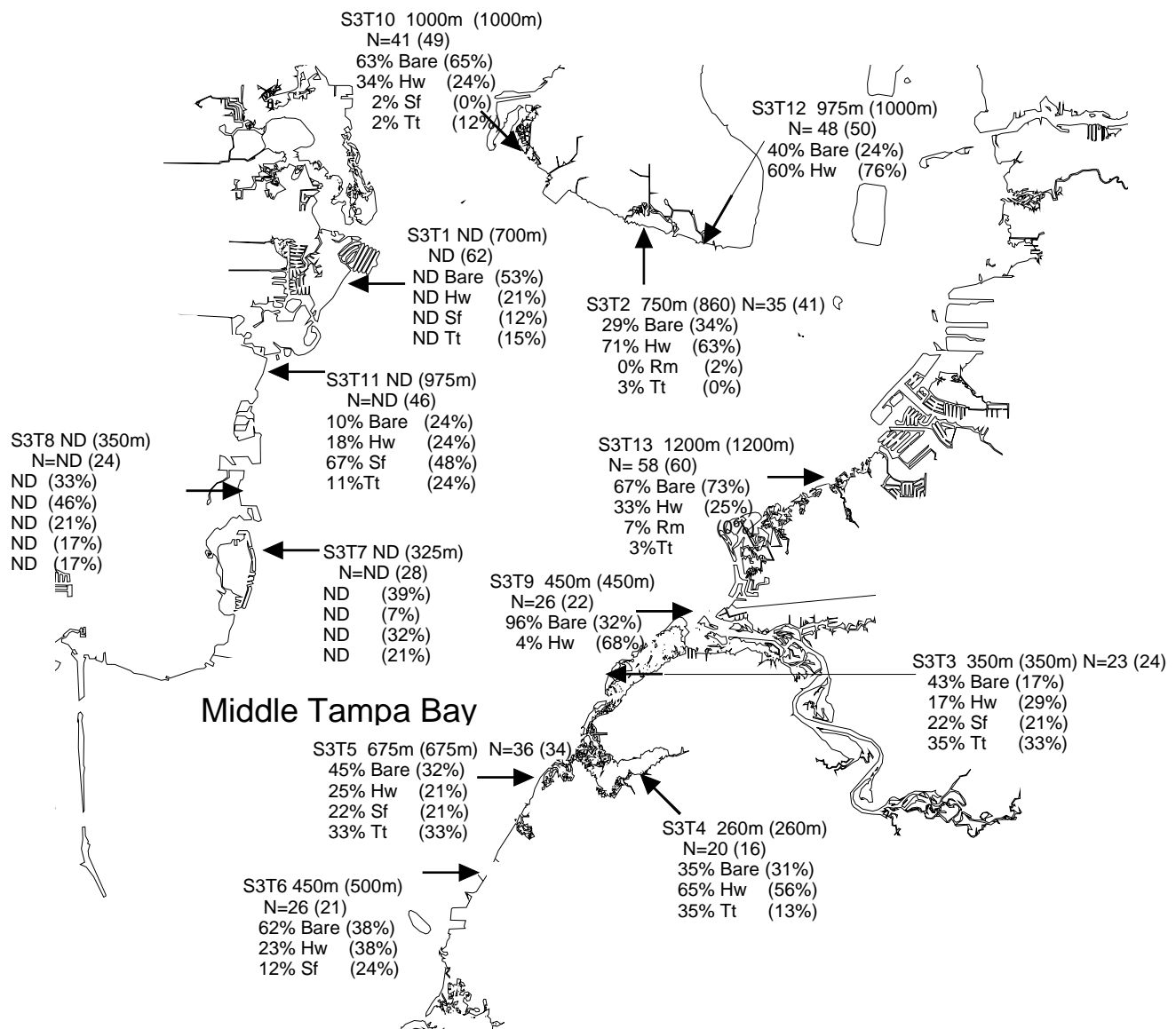


Figure 27. Name, location, length and percent of meter square placements containing each seagrass species along the 13 Middle Tampa Bay seagrass monitoring transects in 2003. Results from 2002 in parentheses. N=number of meter square placements; Hw=*Halodule wrightii*; Rm=*Ruppia maritima*; Sf=*Syringodium filiforme*; Tt=*Thalassia testudinum*.

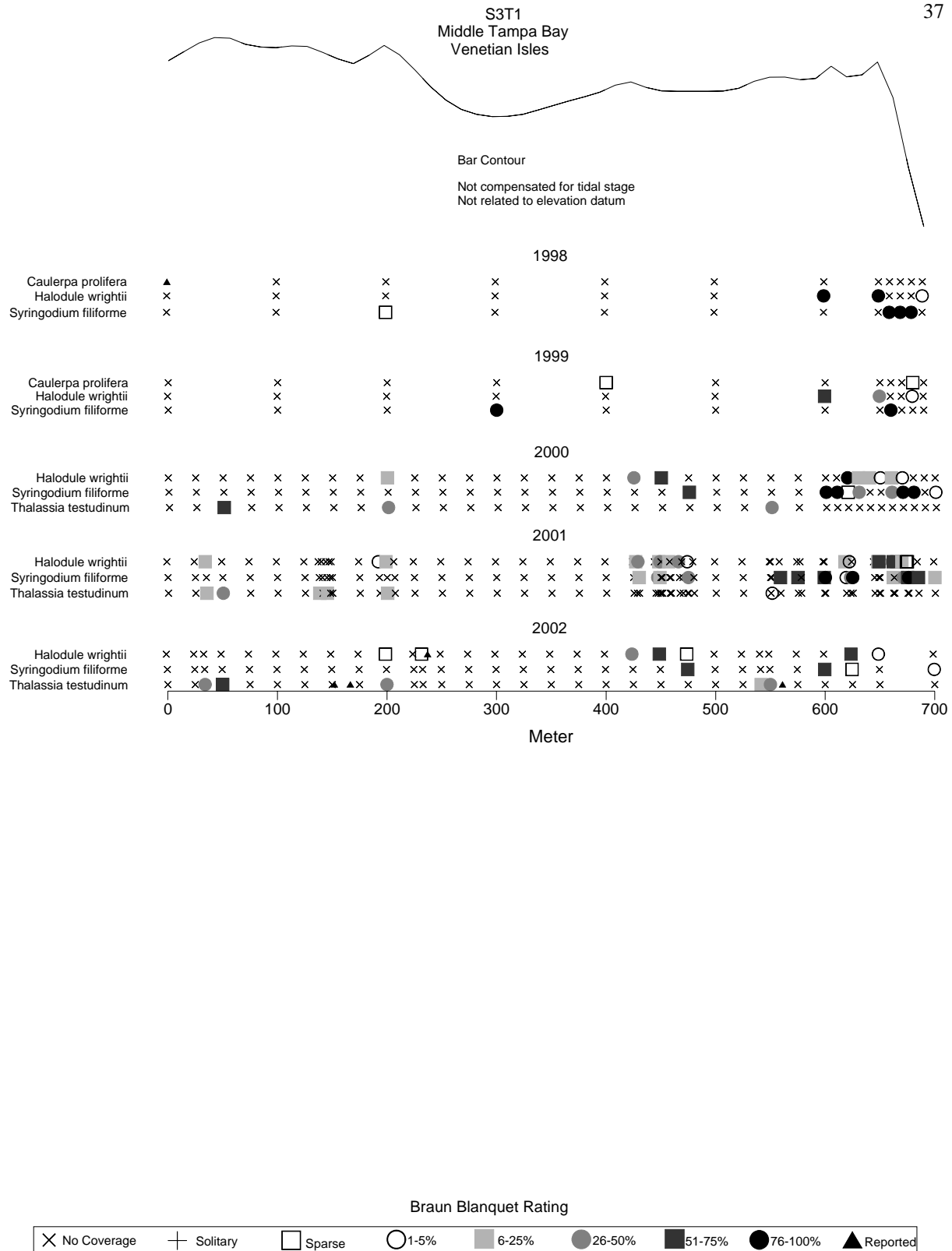
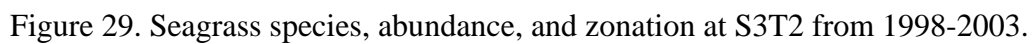


Figure 28. Seagrass species, abundance, and zonation at S3T1 from 1998-2002.
(2003 data not reported.)



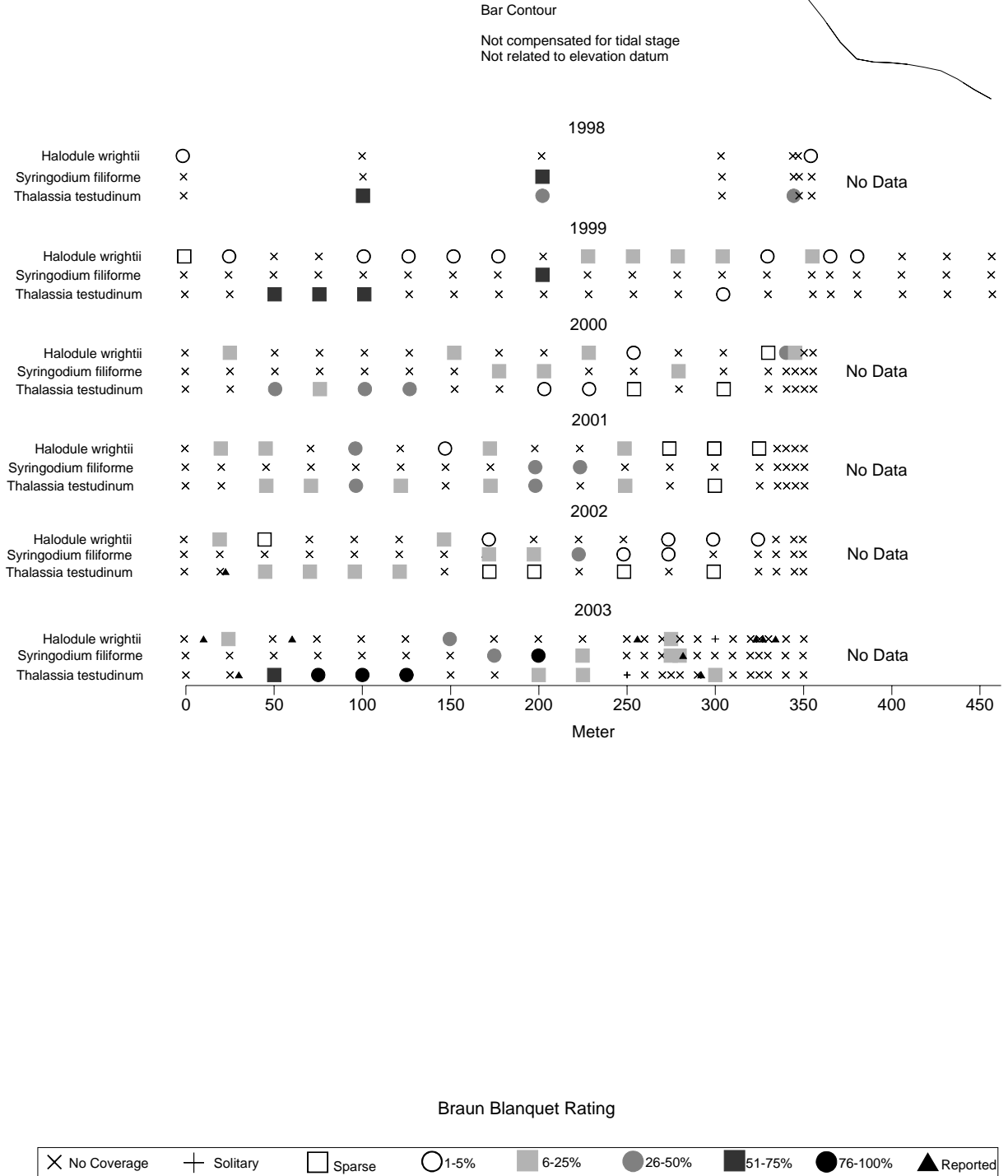


Figure 30. Seagrass species, abundance, and zonation at S3T3 from 1998-2003.

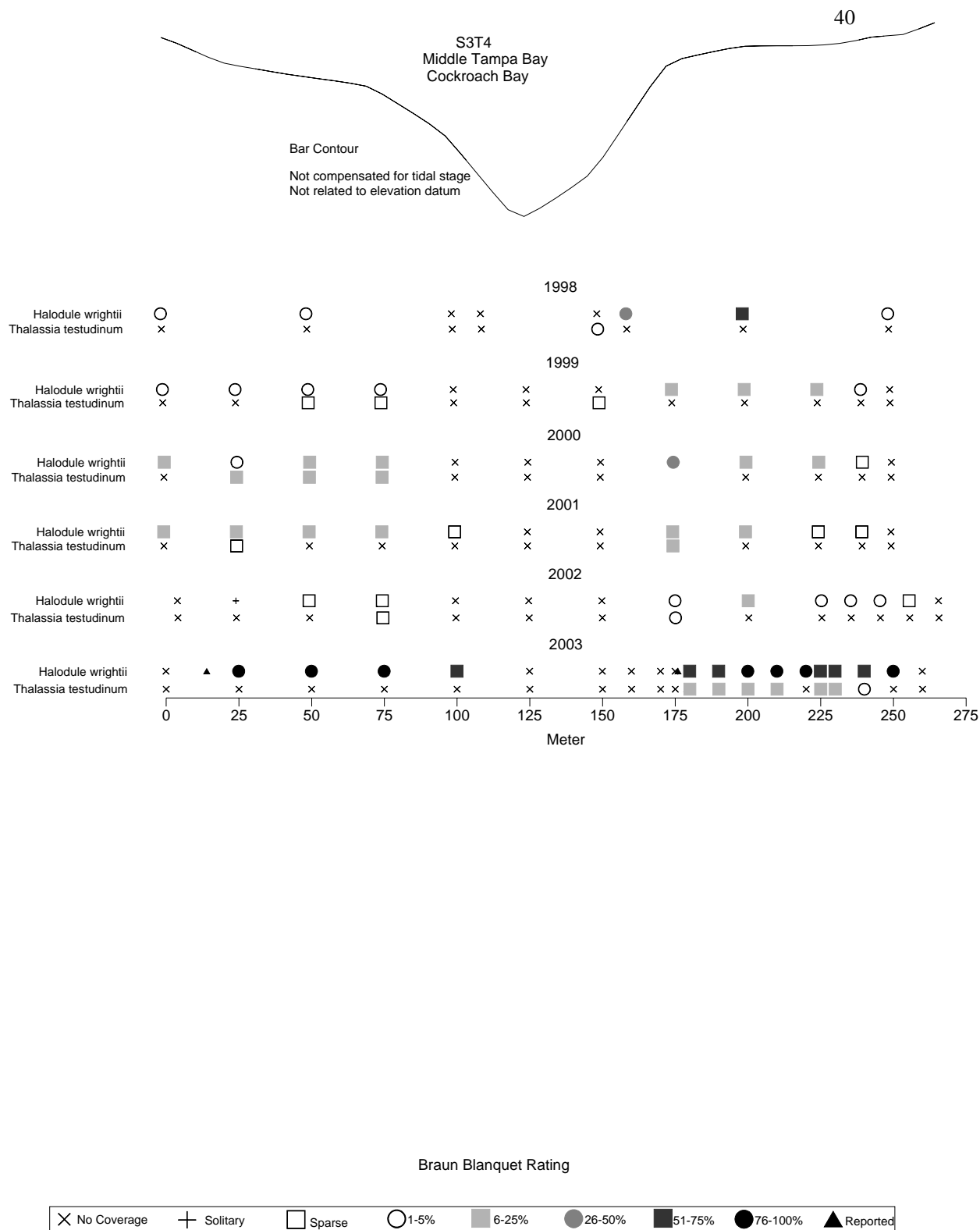


Figure 31. Seagrass species, abundance, and zonation at S3T4 from 1998-2003.

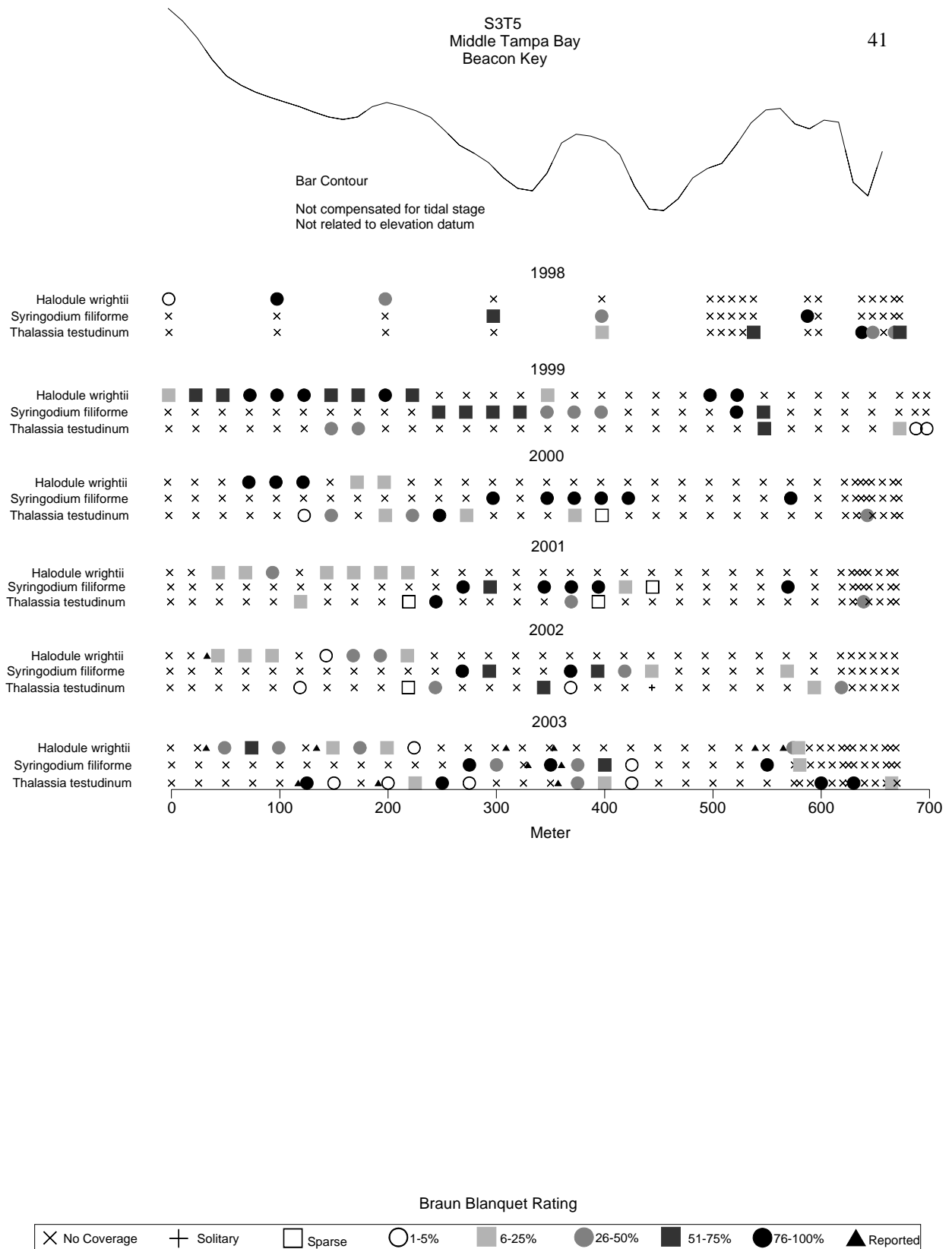


Figure 32. Seagrass species, abundance, and zonation at S3T5 from 1998-2003.

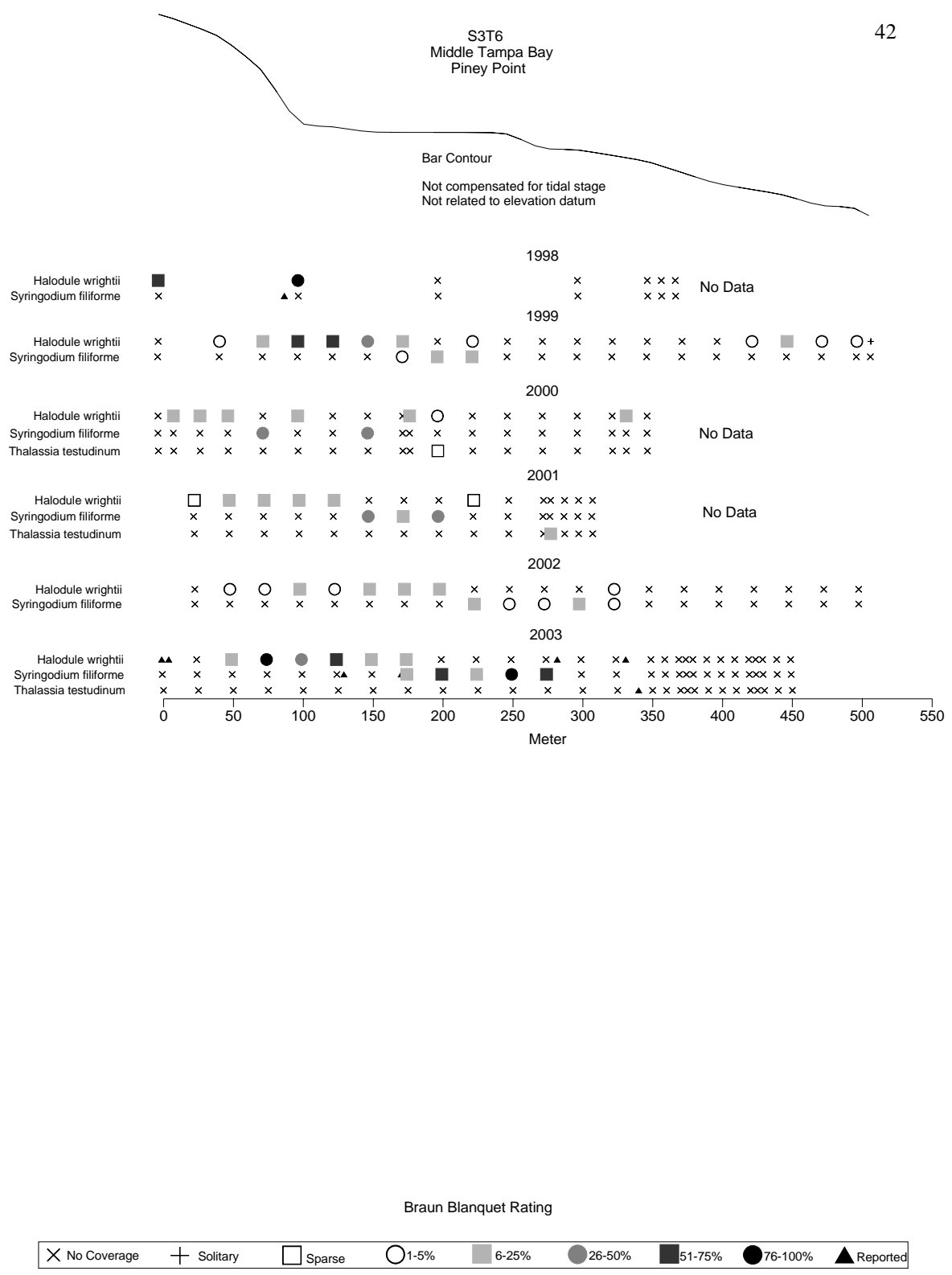


Figure 33. Seagrass species, abundance, and zonation at S3T6 from 1998-2003.

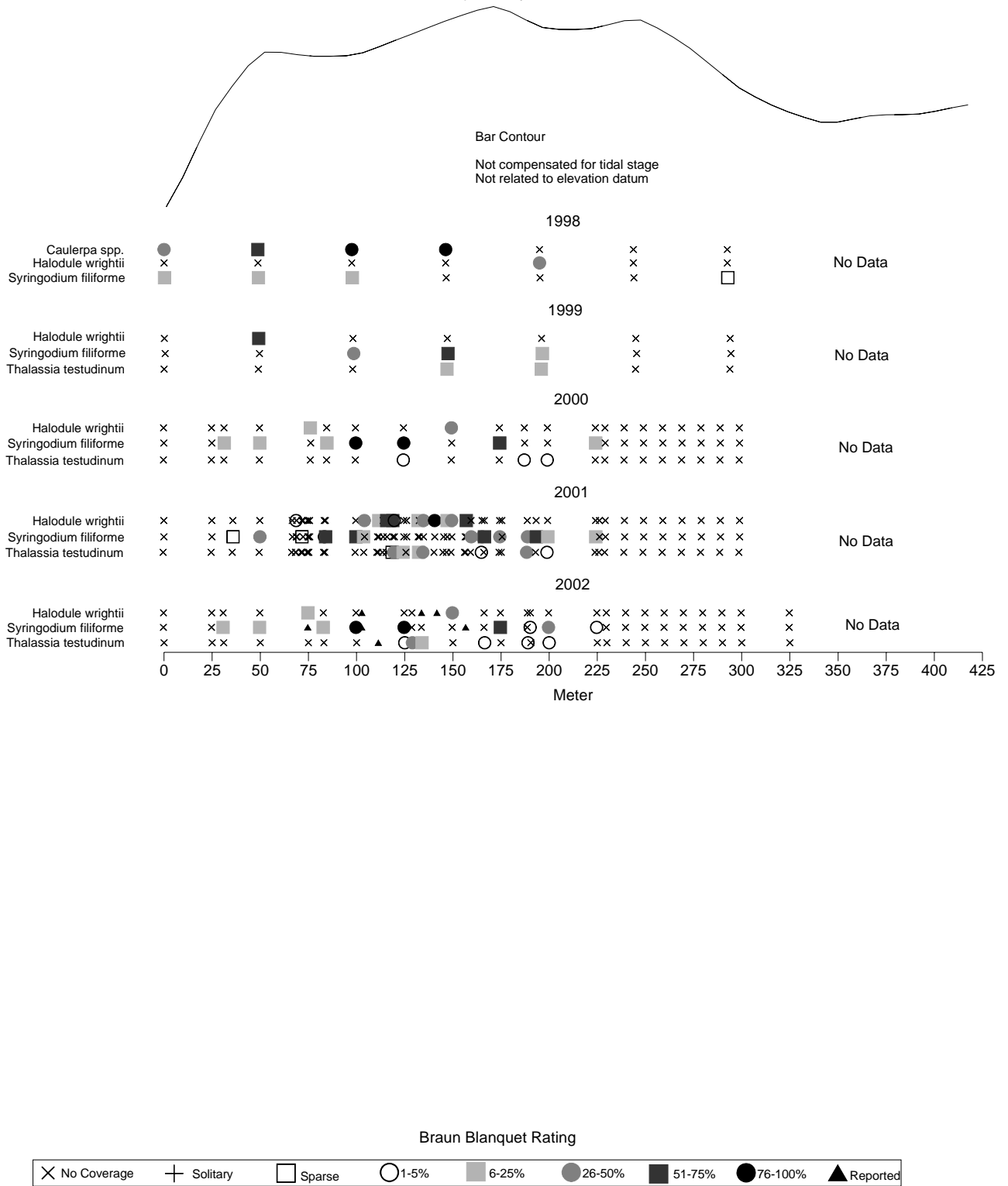


Figure 34. Seagrass species, abundance, and zonation at S3T7 from 1998-2002. (2003 data not reported.)

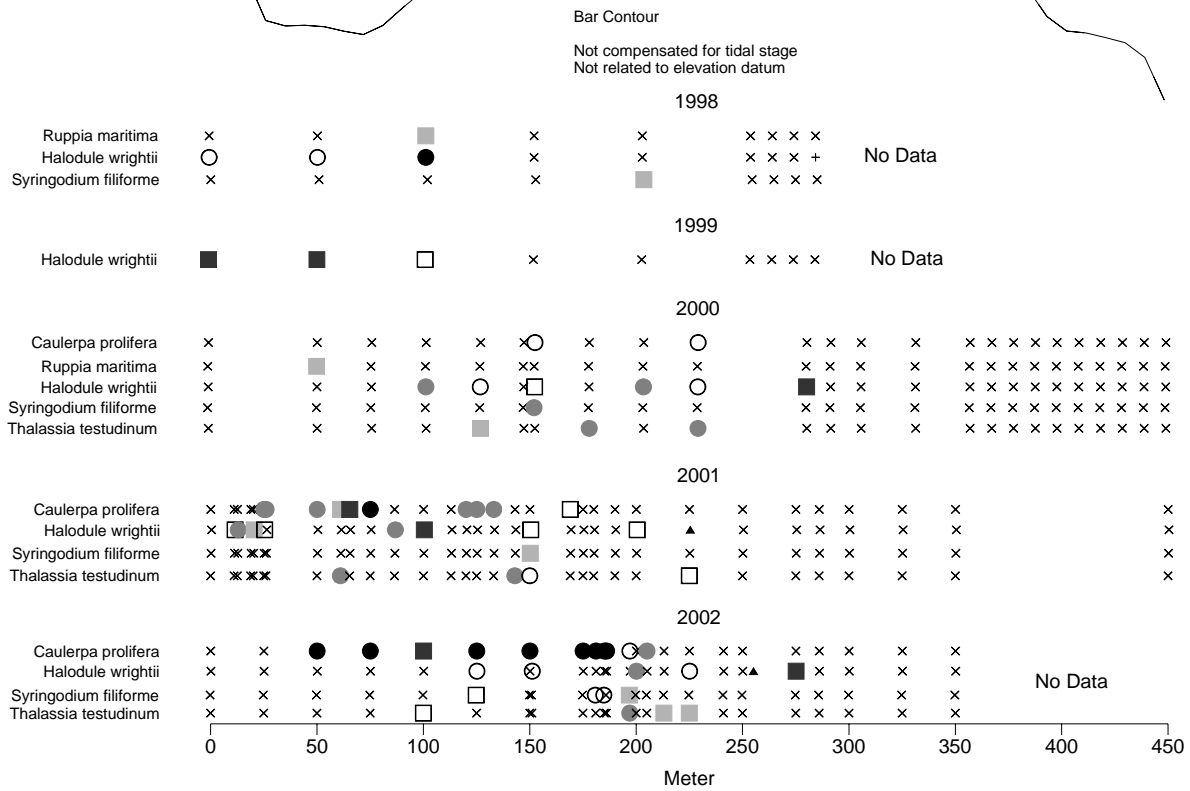
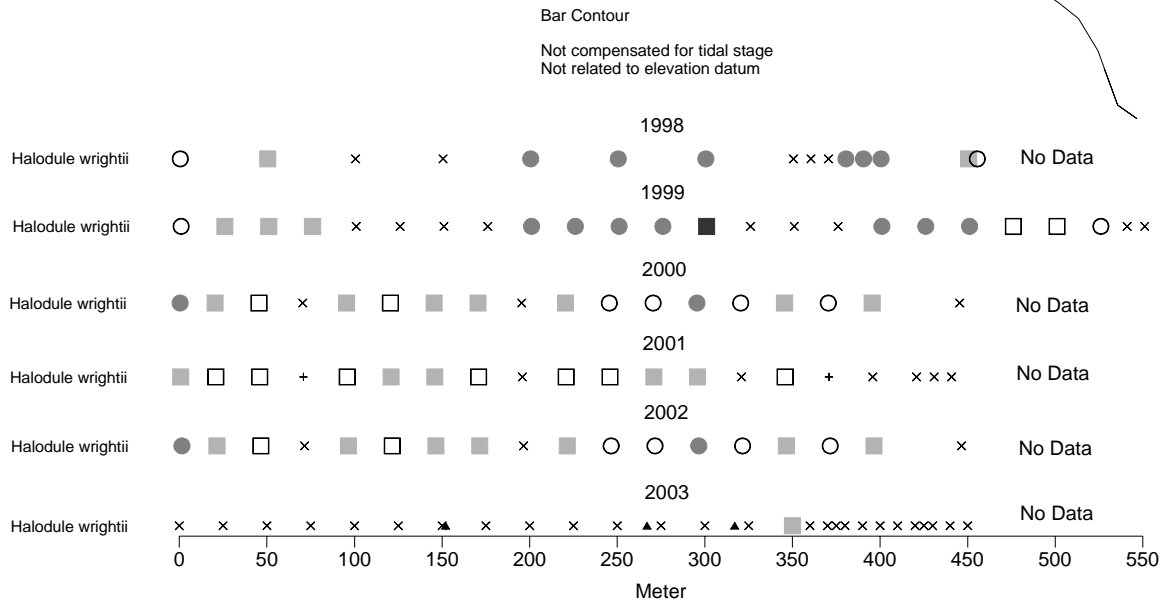


Figure 35. Seagrass species, abundance, and zonation at S3T8 from 1998-2002. (2003 data not reported.)



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Figure 36. Seagrass species, abundance, and zonation at S3T9 from 1998-2003.

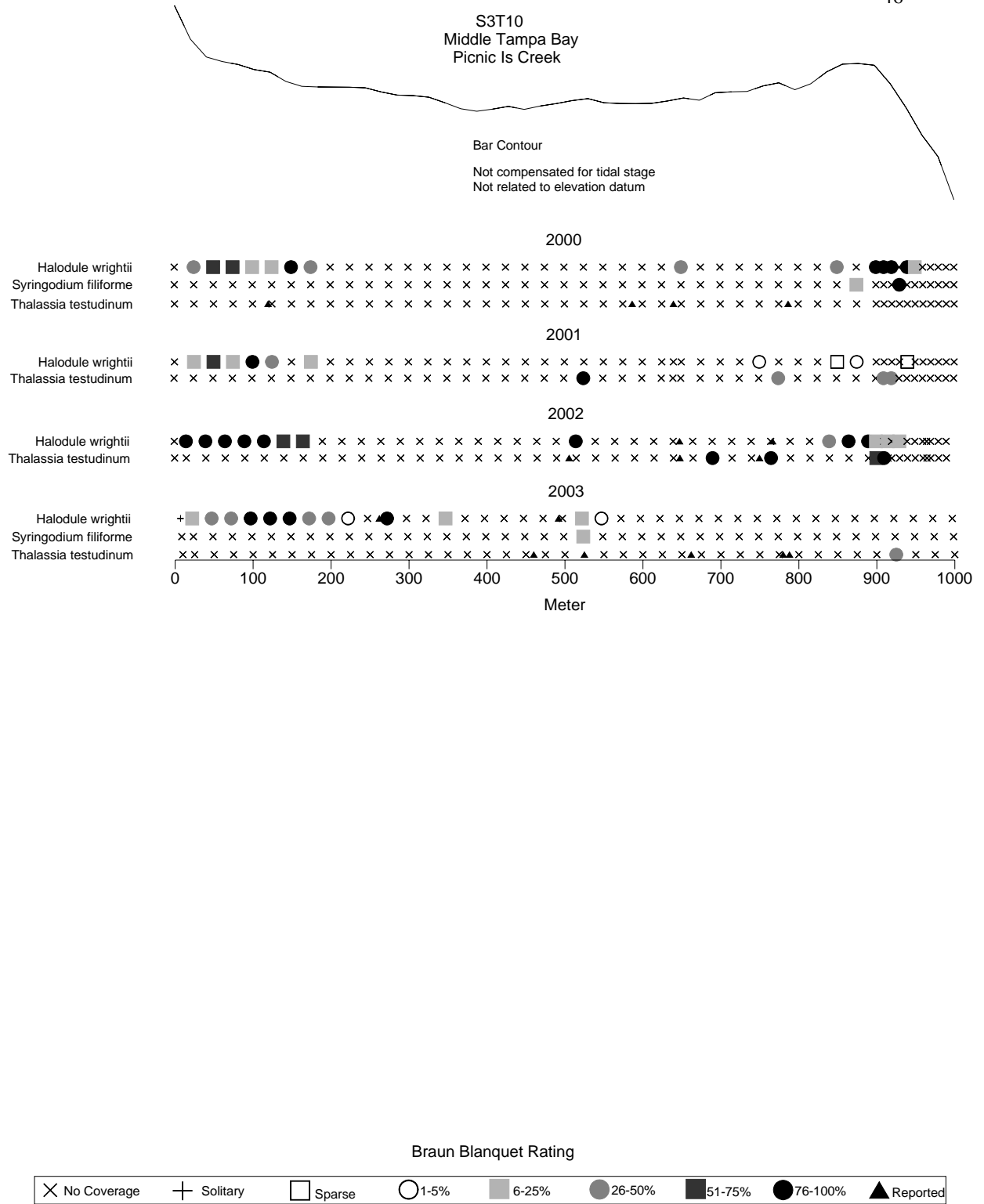


Figure 37. Seagrass species, abundance, and zonation at S3T10 from 2000-2003.

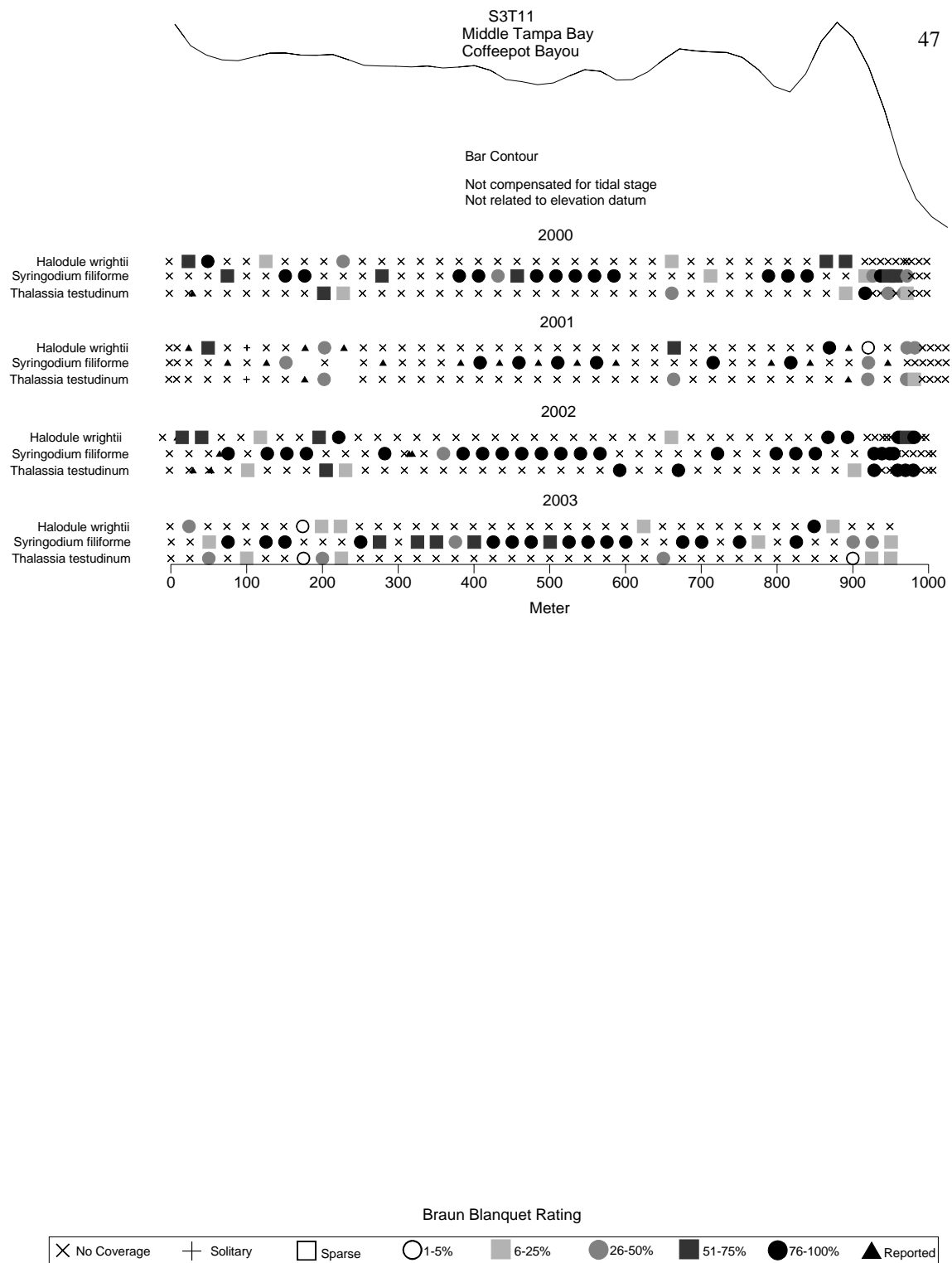
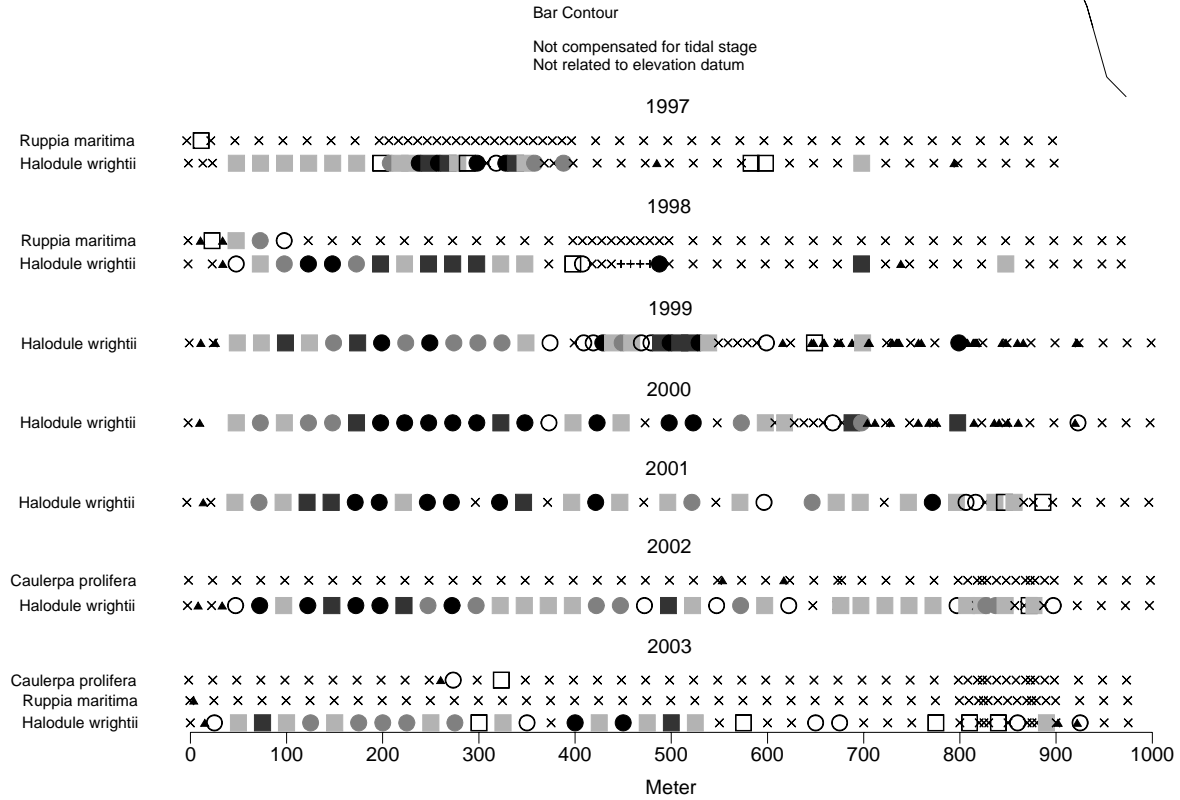


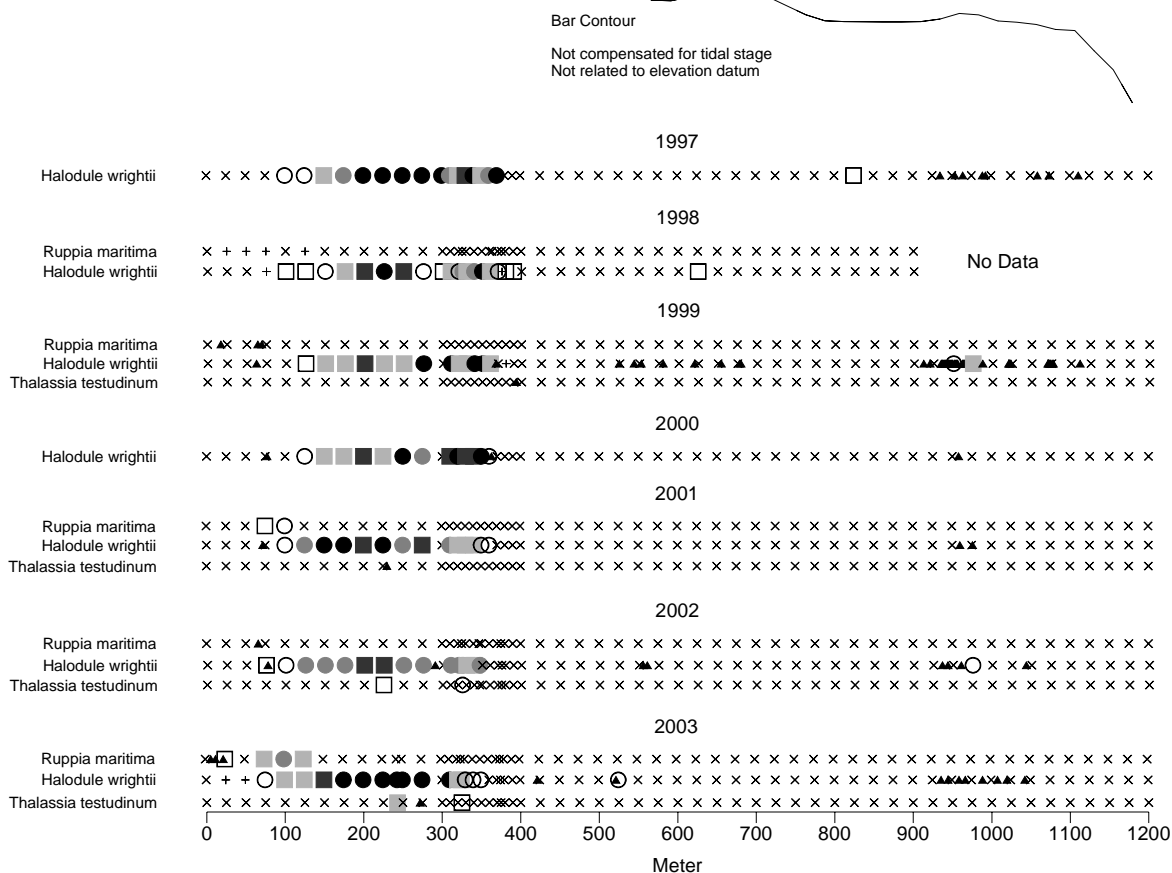
Figure 38. Seagrass species, abundance, and zonation at S3T11 from 2000-2003.



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Figure 39. Seagrass species, abundance, and zonation at S3T12 from 1997-2003.



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Figure 40. Seagrass species, abundance, and zonation at S3T13 from 1997-2003.

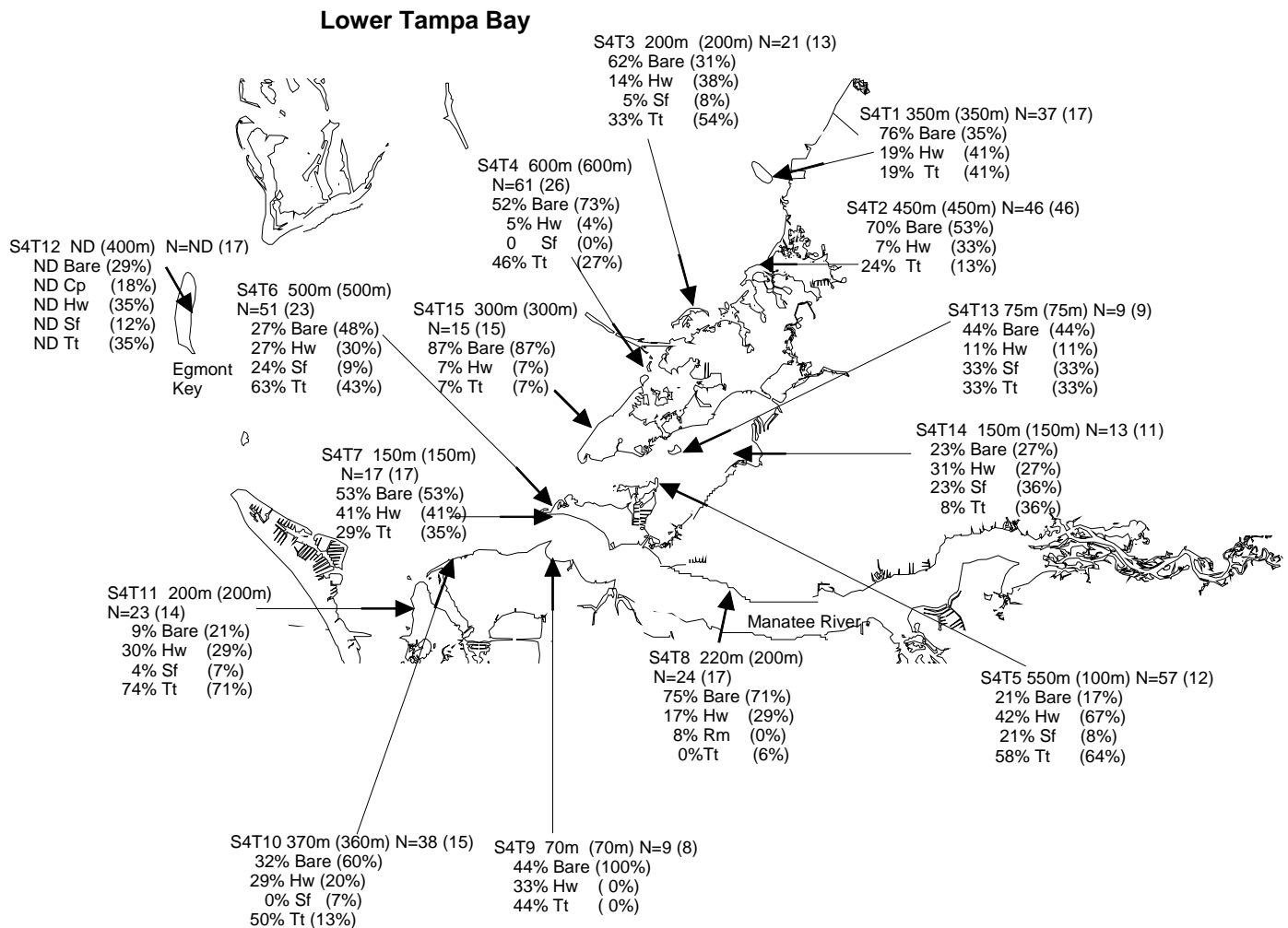


Figure 41. Name, location, length and percent of meter square placements containing each seagrass species along the 14 Lower Tampa Bay seagrass monitoring transects in 2003. Results from 2002 in parentheses. N=number of meter square placements; Hw=*Halodule wrightii*; Rm=*Ruppia maritima*; Sf=*Syringodium filiforme*; Tt=*Thalassia testudinum*, ND=No Data.

Note: Transect not sampled in 2000 or 2001 due to Port construction.

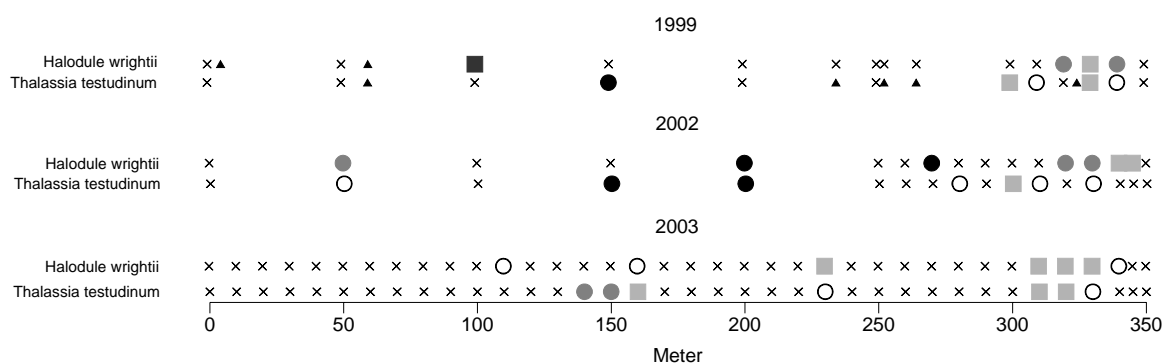
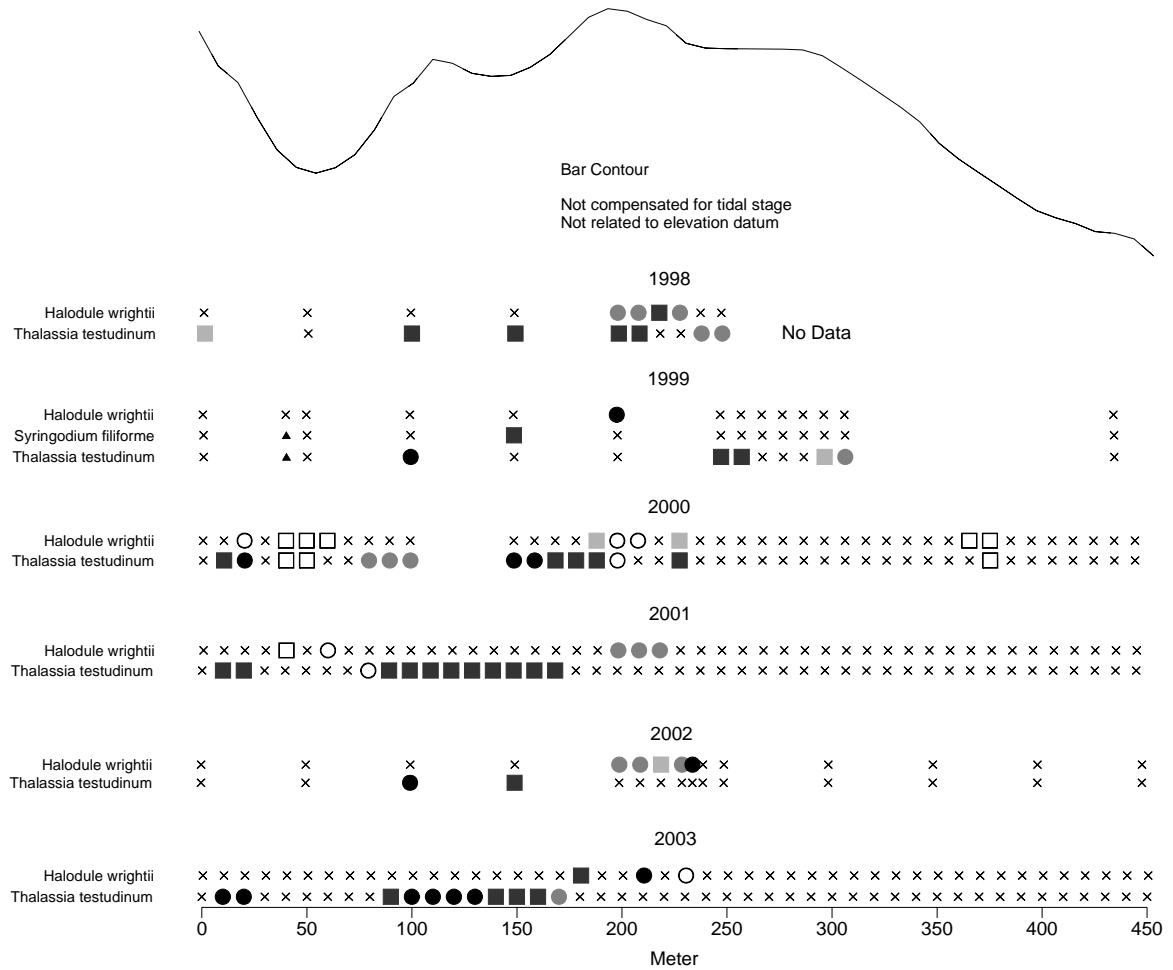


Figure 42. Seagrass species, abundance, and zonation at S4T1 from 1999 and 2002-2003.



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Figure 43. Seagrass species, abundance, and zonation at S4T2 from 1998-2003.

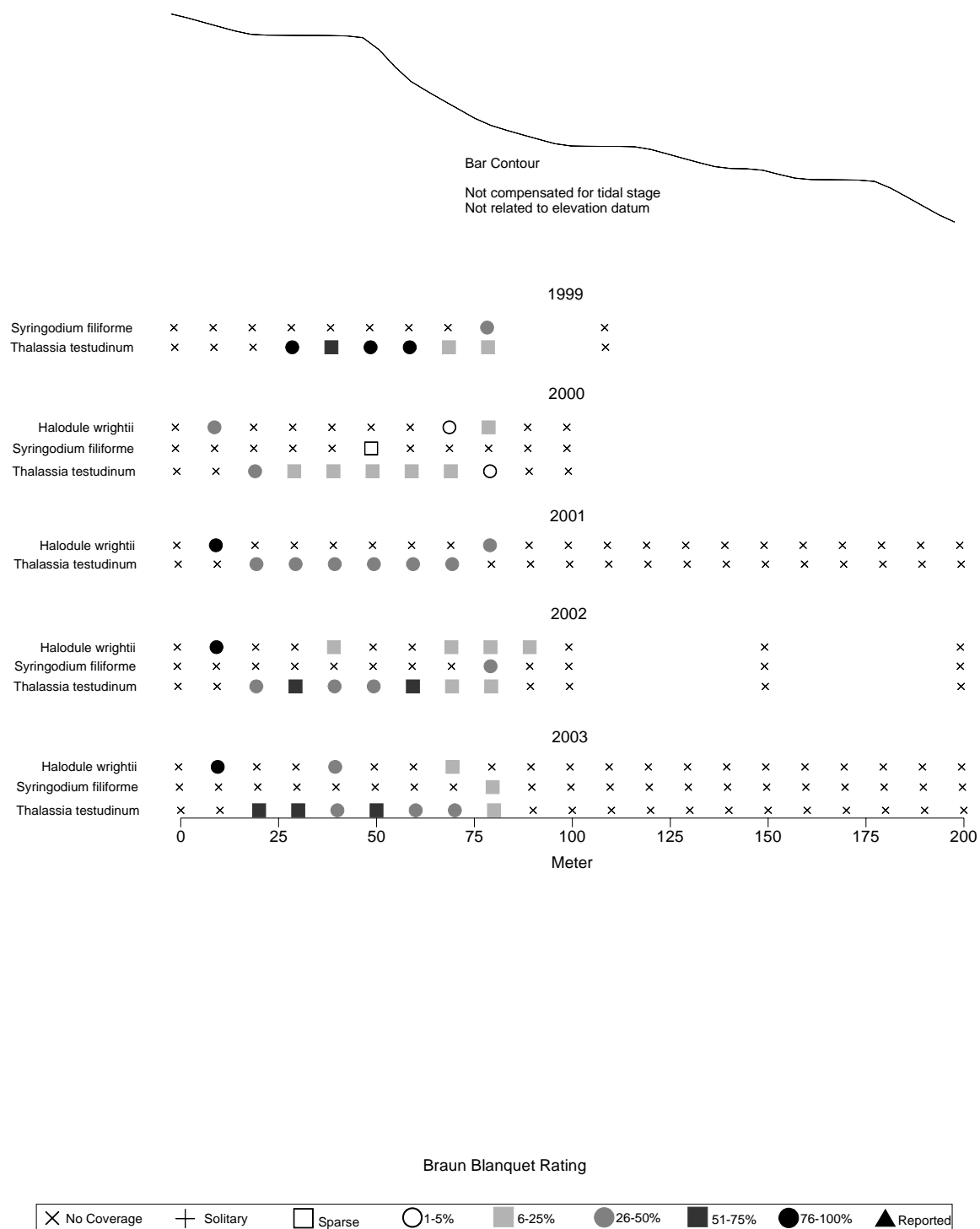


Figure 44. Seagrass species, abundance, and zonation at S4T3 from 1999-2003.

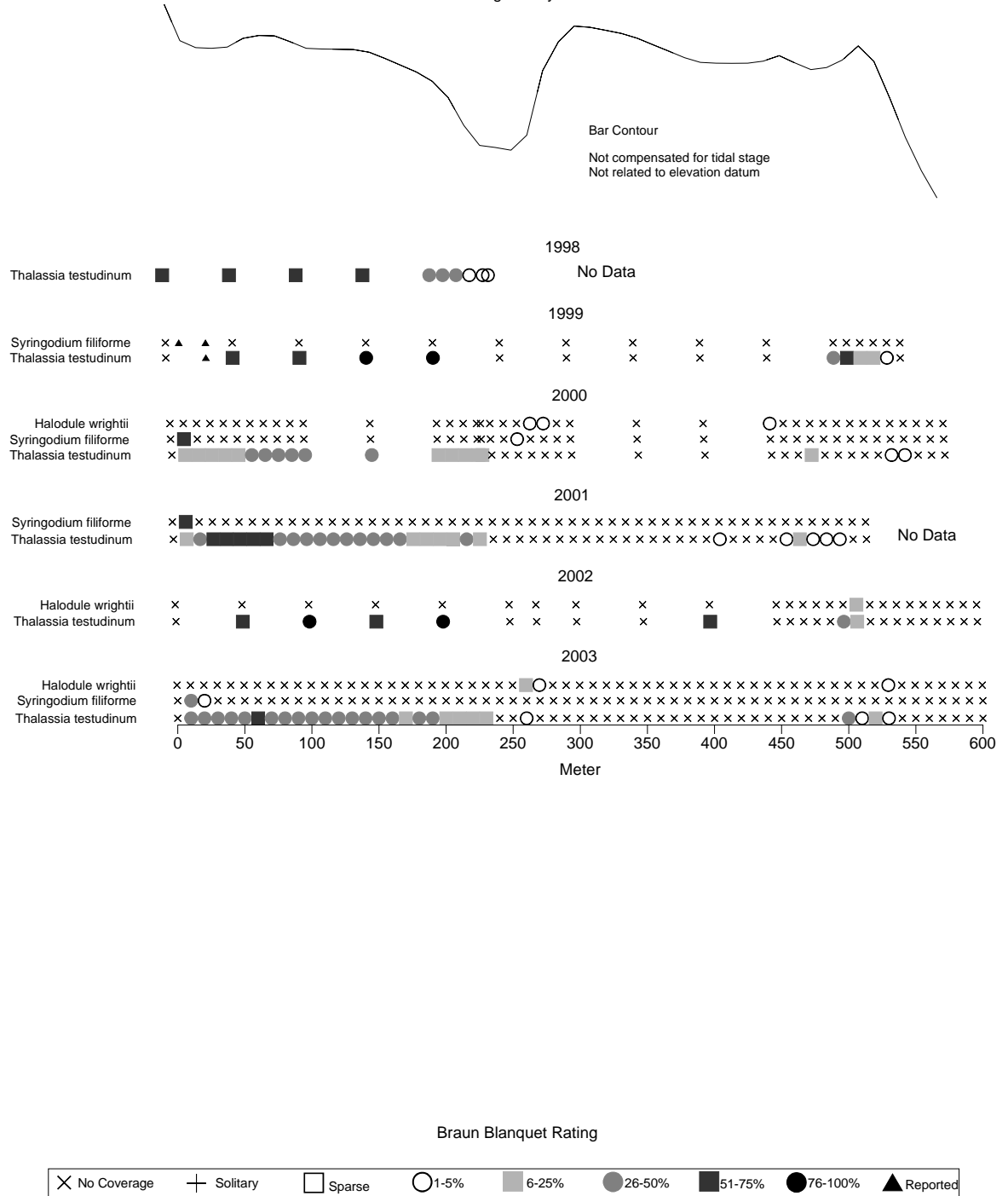
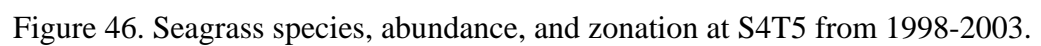
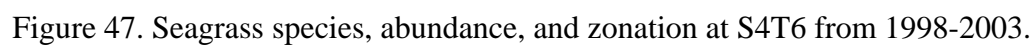


Figure 45. Seagrass species, abundance, and zonation at S4T4 from 1998-2003.





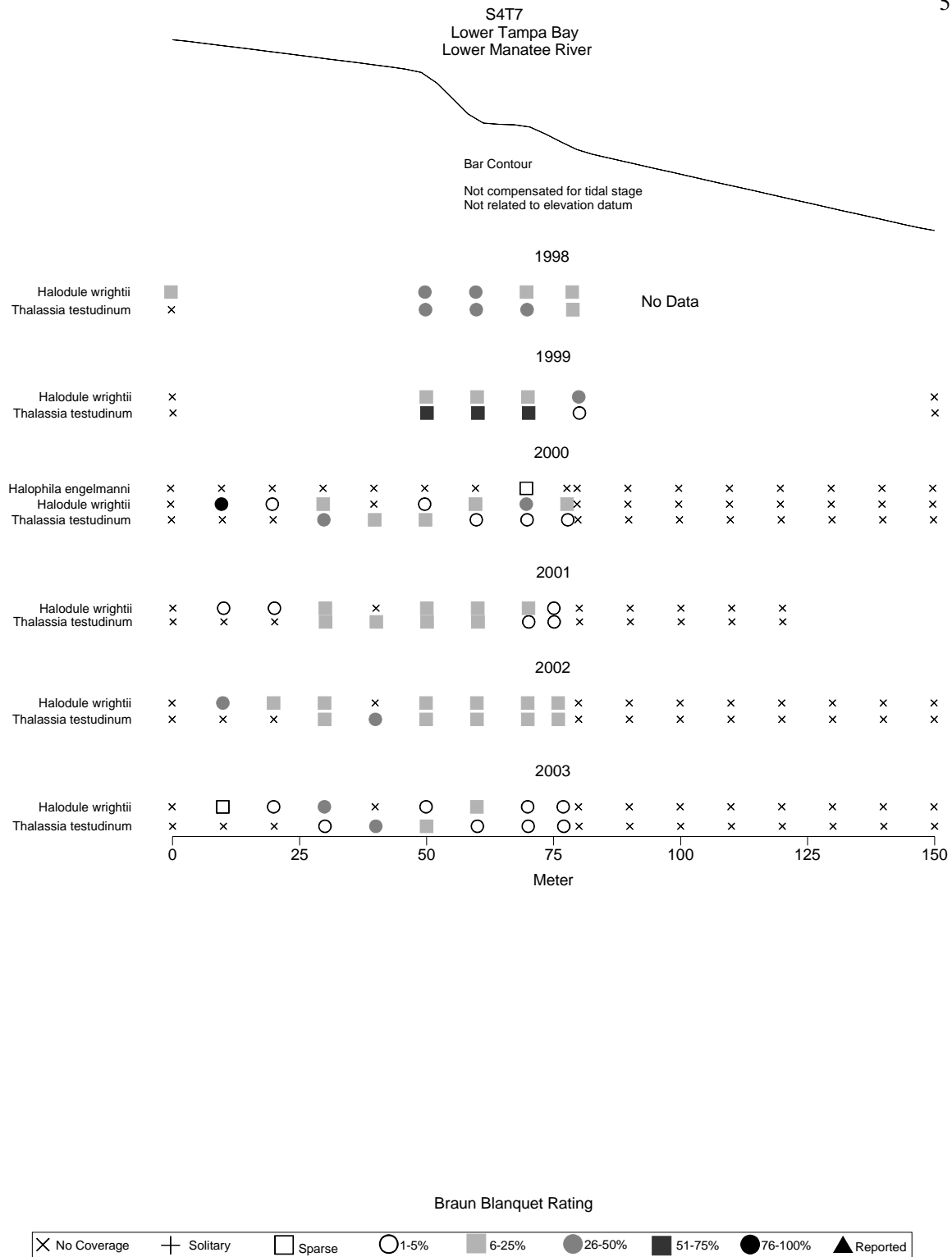


Figure 48. Seagrass species, abundance, and zonation at S4T7 from 1998-2003.

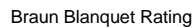


Figure 49. Seagrass species, abundance, and zonation at S4T8 from 1999-2003.

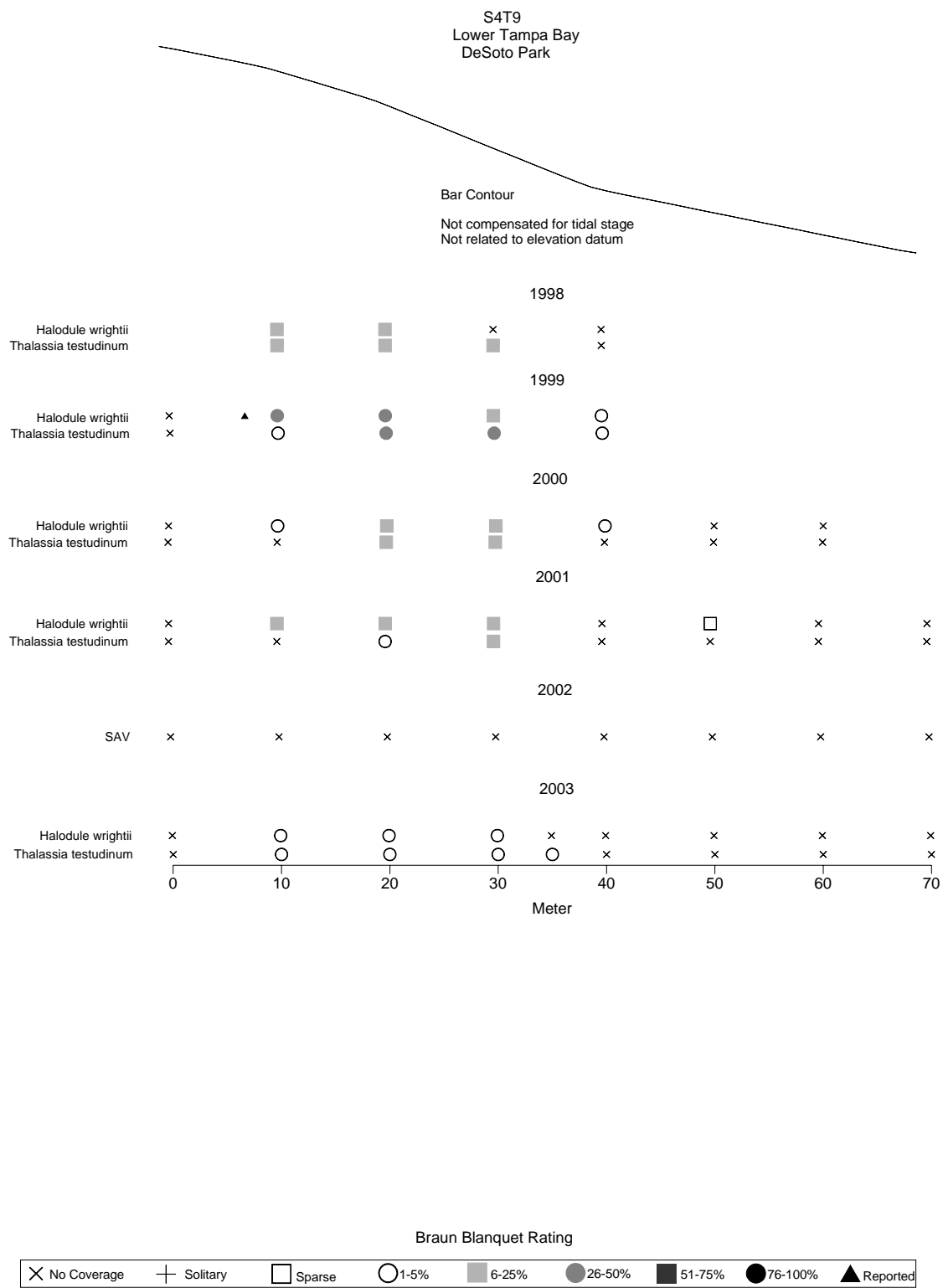


Figure 50. Seagrass species, abundance, and zonation at S4T9 from 1998-2003.

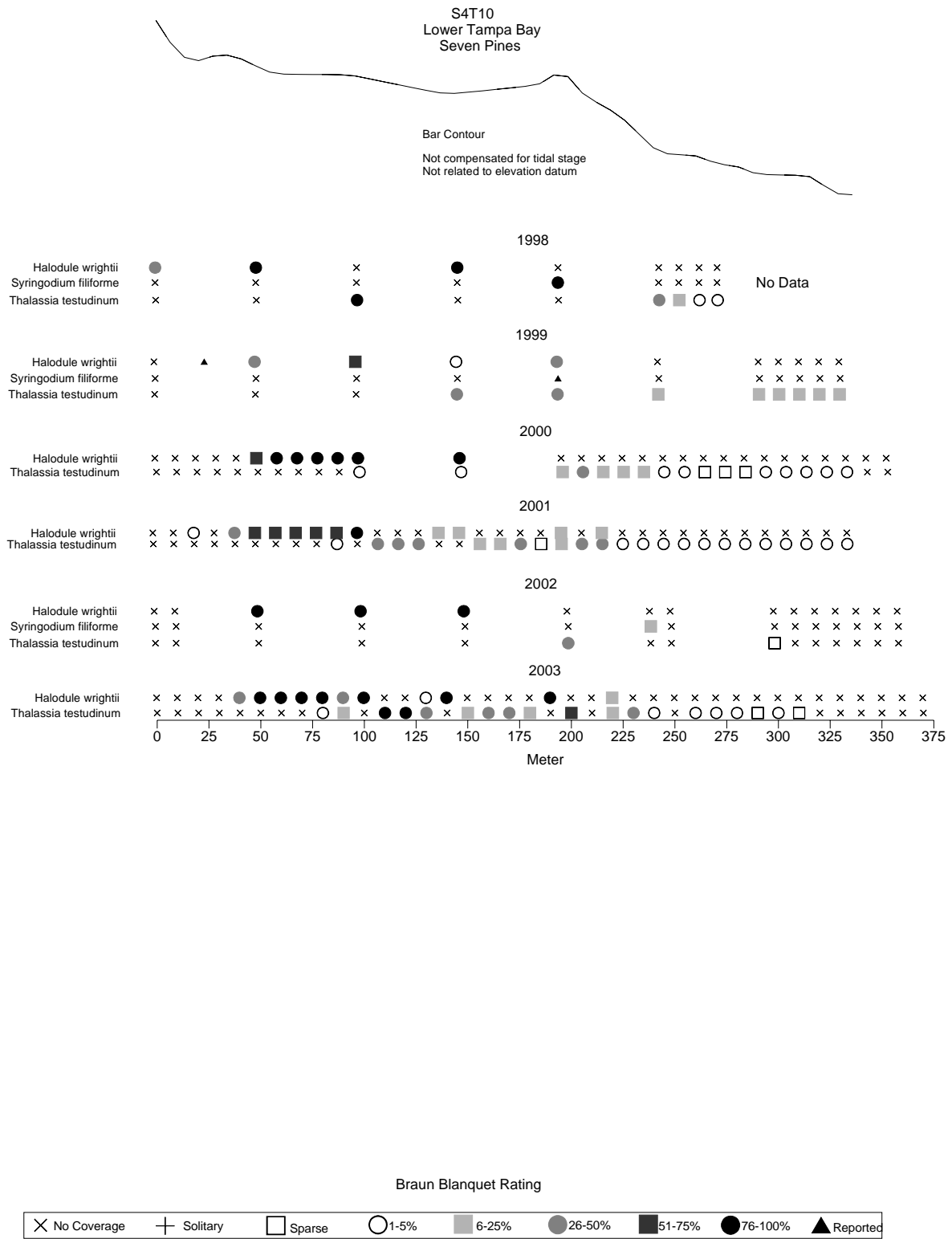


Figure 51. Seagrass species, abundance, and zonation at S4T10 from 1998-2003.

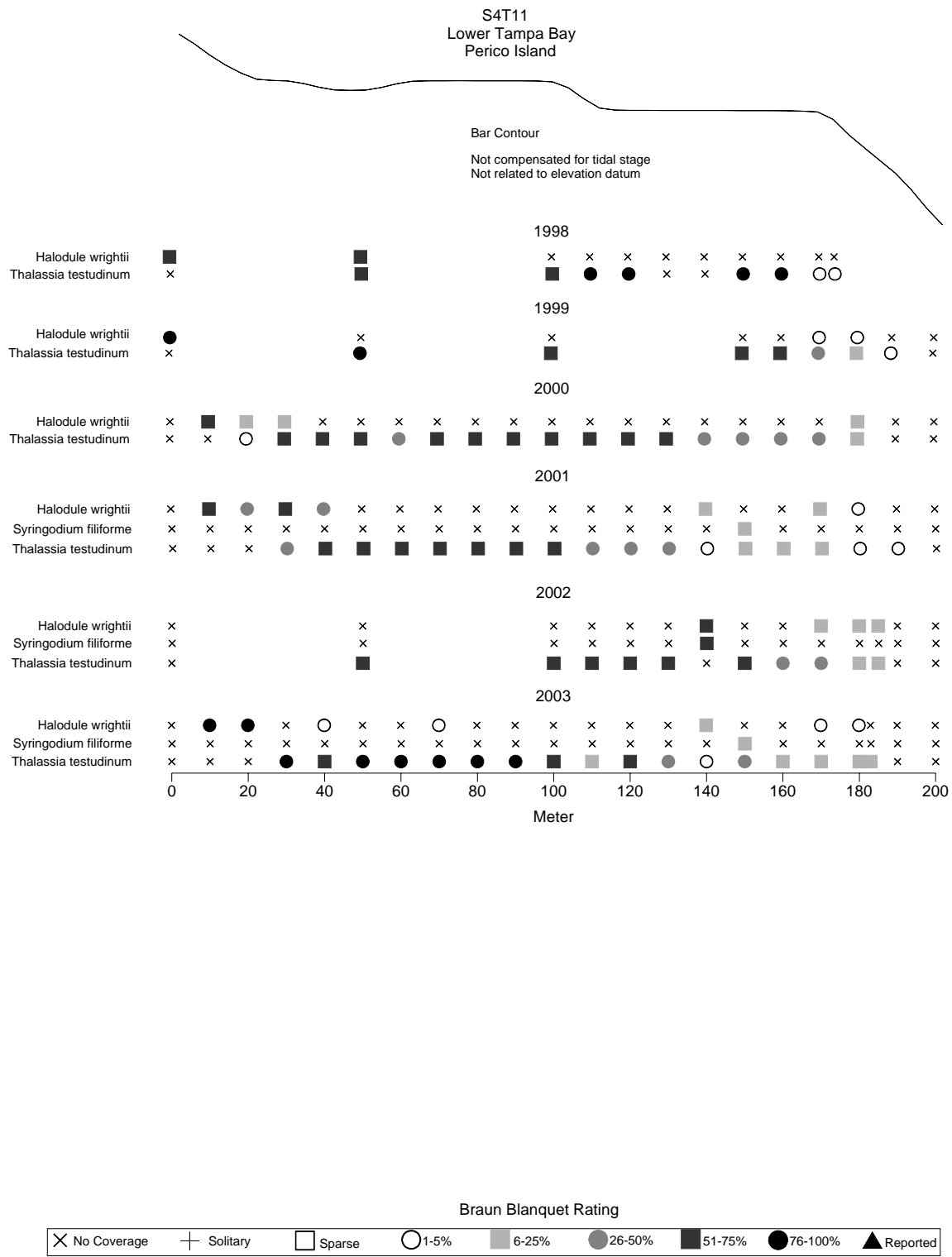


Figure 52. Seagrass species, abundance, and zonation at S4T11 from 1998-2003.

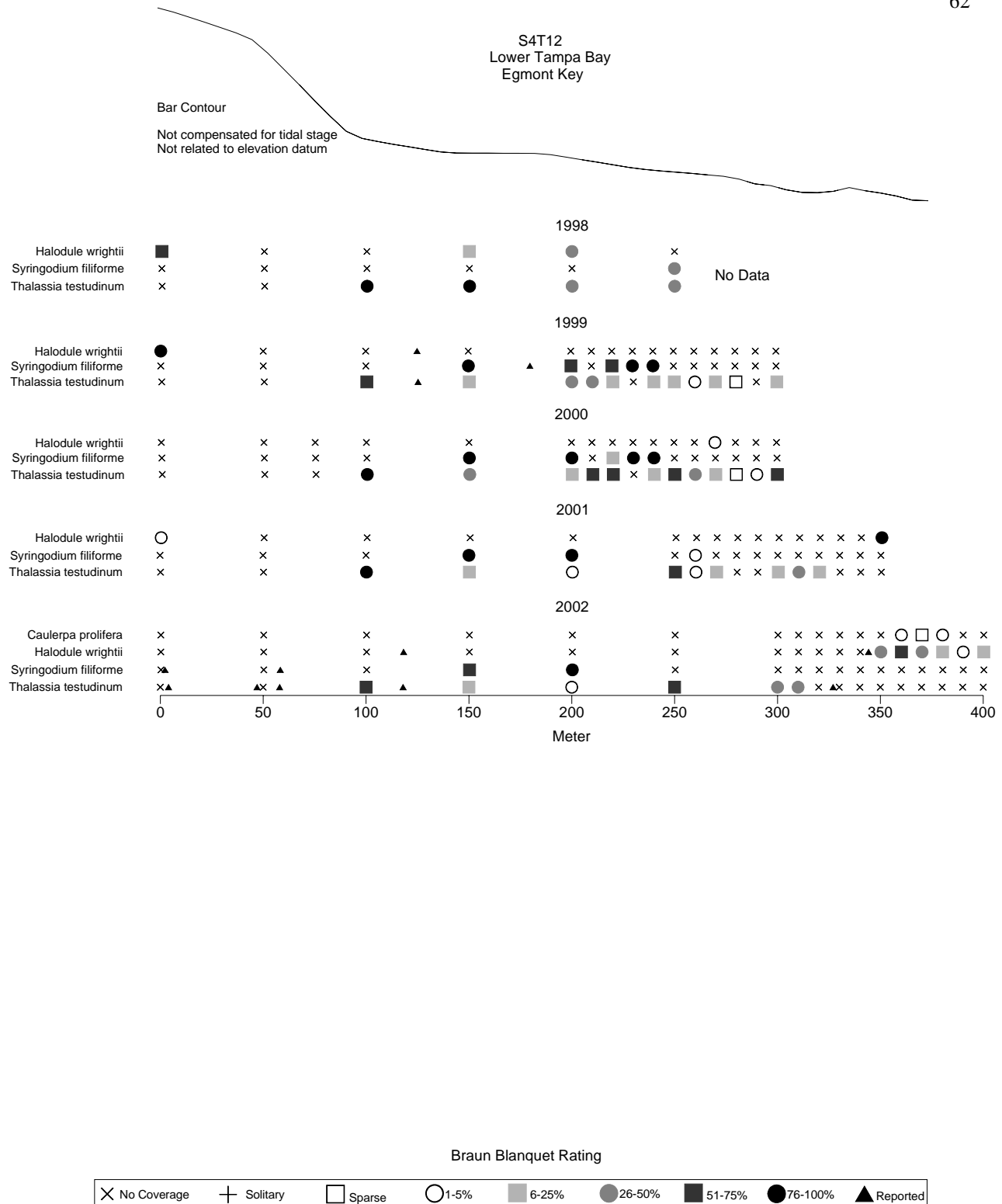


Figure 53. Seagrass species, abundance, and zonation at S4T12 from 1998-2002.
(No data collection during 2003.)

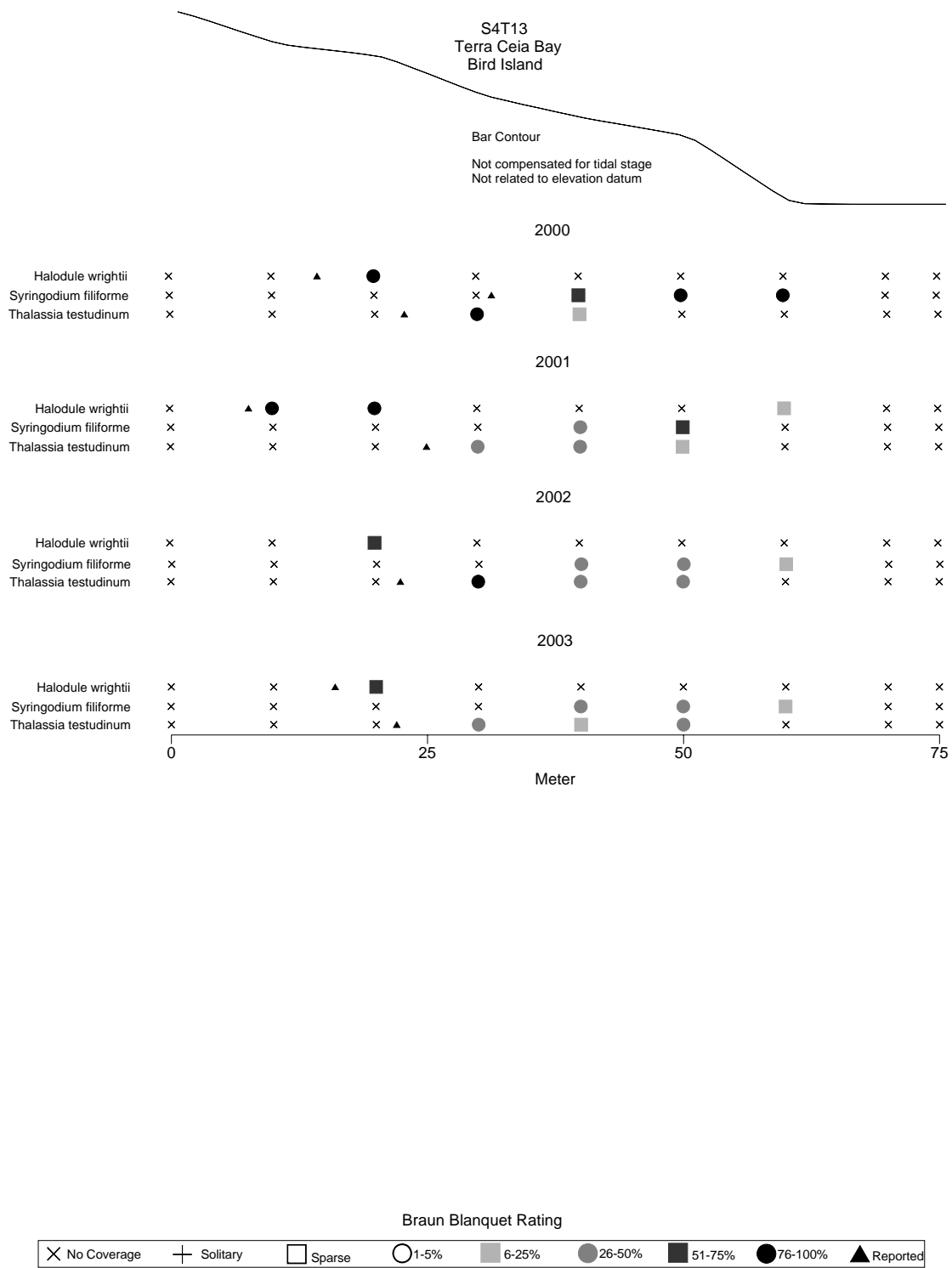


Figure 54. Seagrass species, abundance and zonation at S4T13 from 2000-2003.

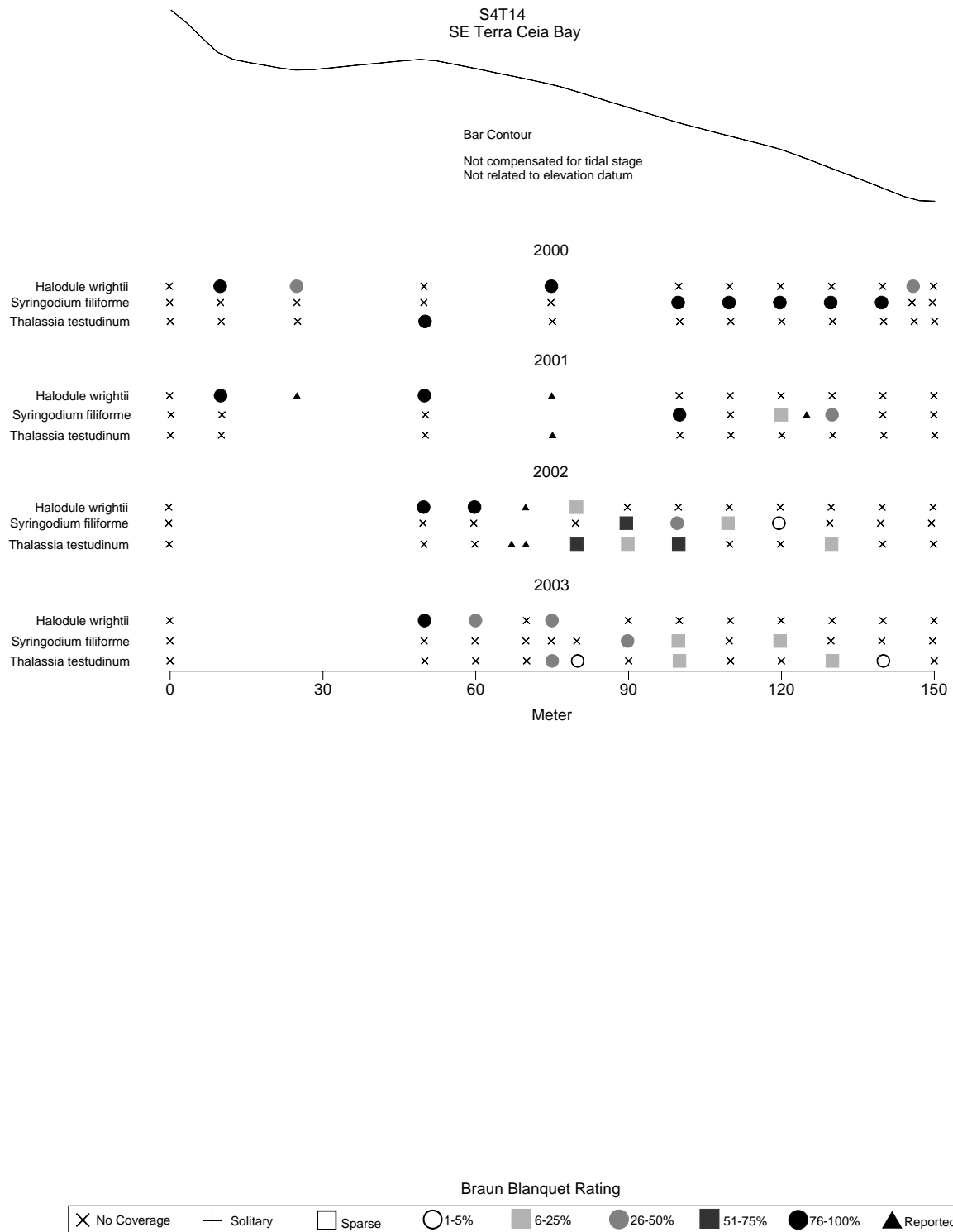


Figure 55. Seagrass species, abundance, and zonation at S4T14 from 2000-2003.

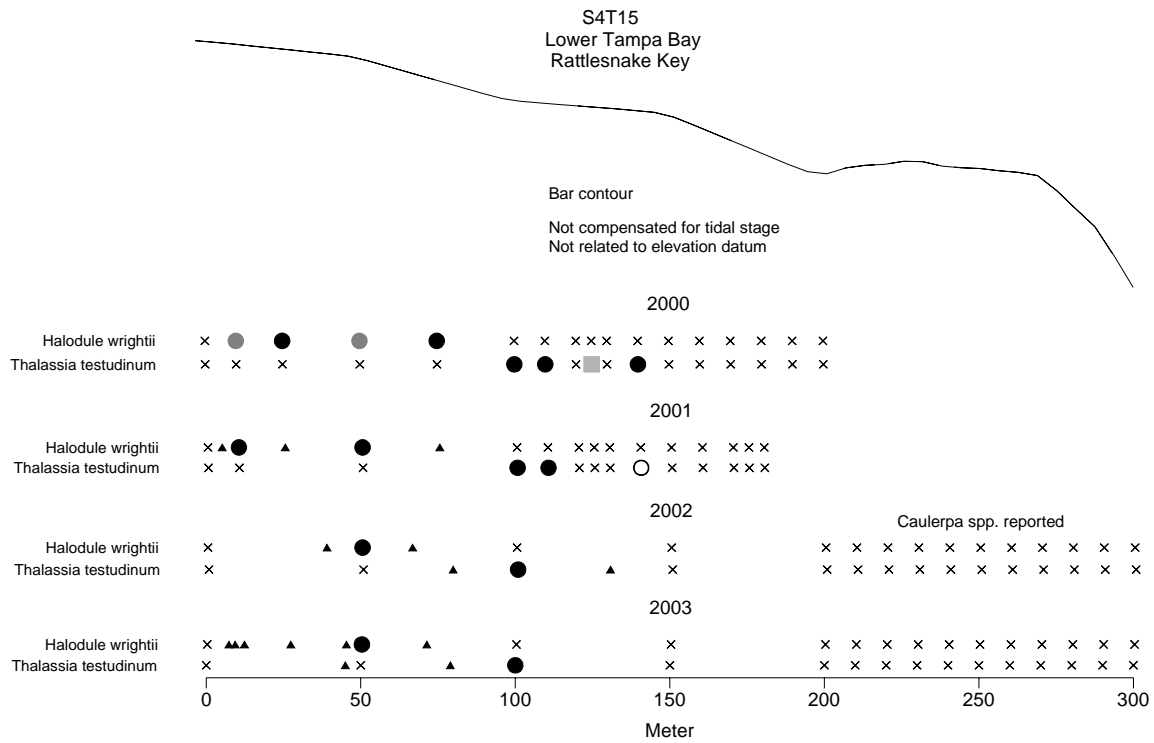


Figure 56. Seagrass species, abundance, and zonation at S4T15 from 2000-2003.

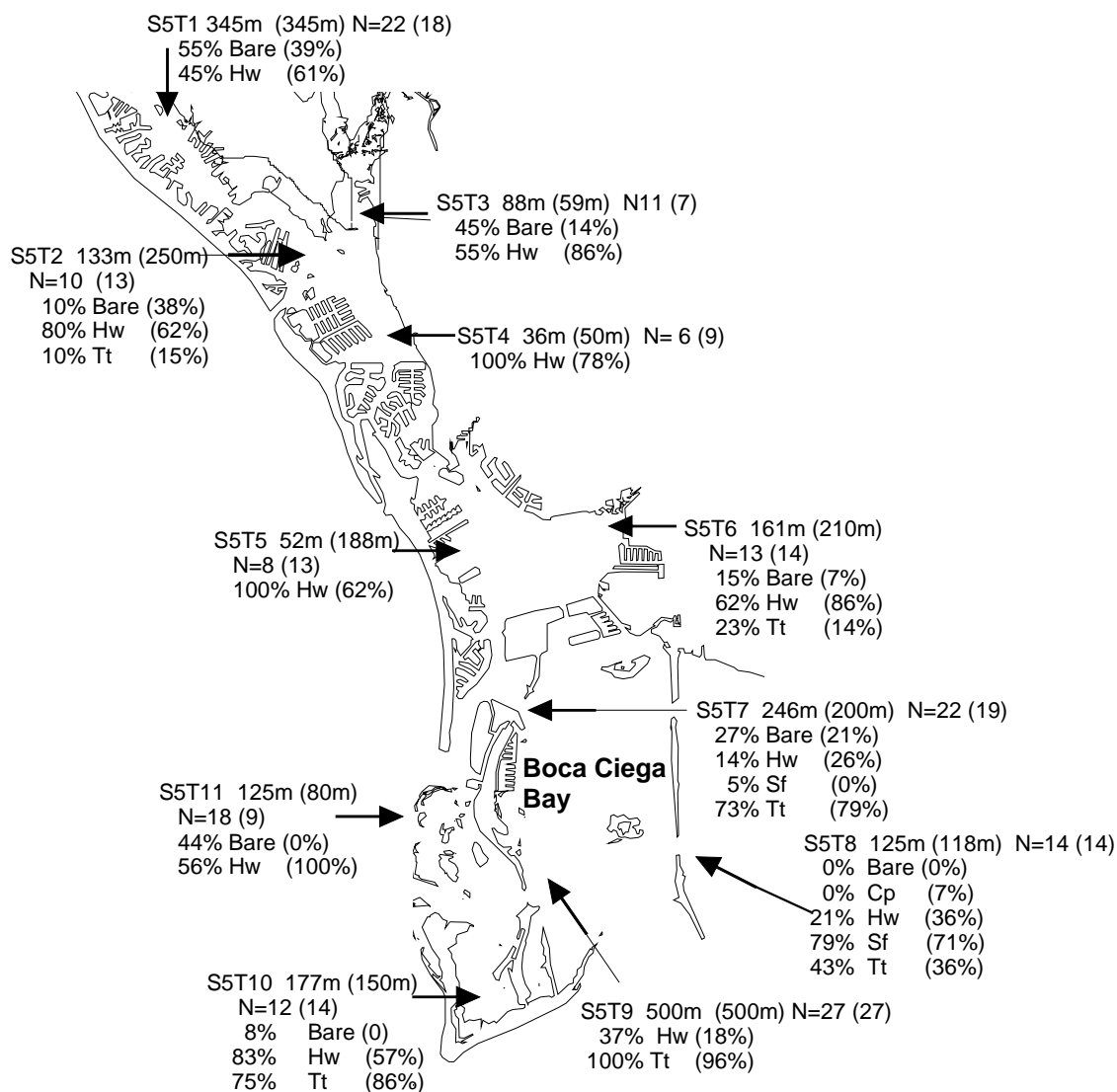


Figure 57. Name, location, length and percent of meter square placements containing each seagrass species along the 11 Boca Ciega Bay seagrass monitoring transects in 2003. Results from 2002 in parentheses. N=number of meter square placements; Hw=*Halodule wrightii*; Rm=*Ruppia maritima*; Sf=*Syringodium filiforme*; Tt=*Thalassia testudinum*.

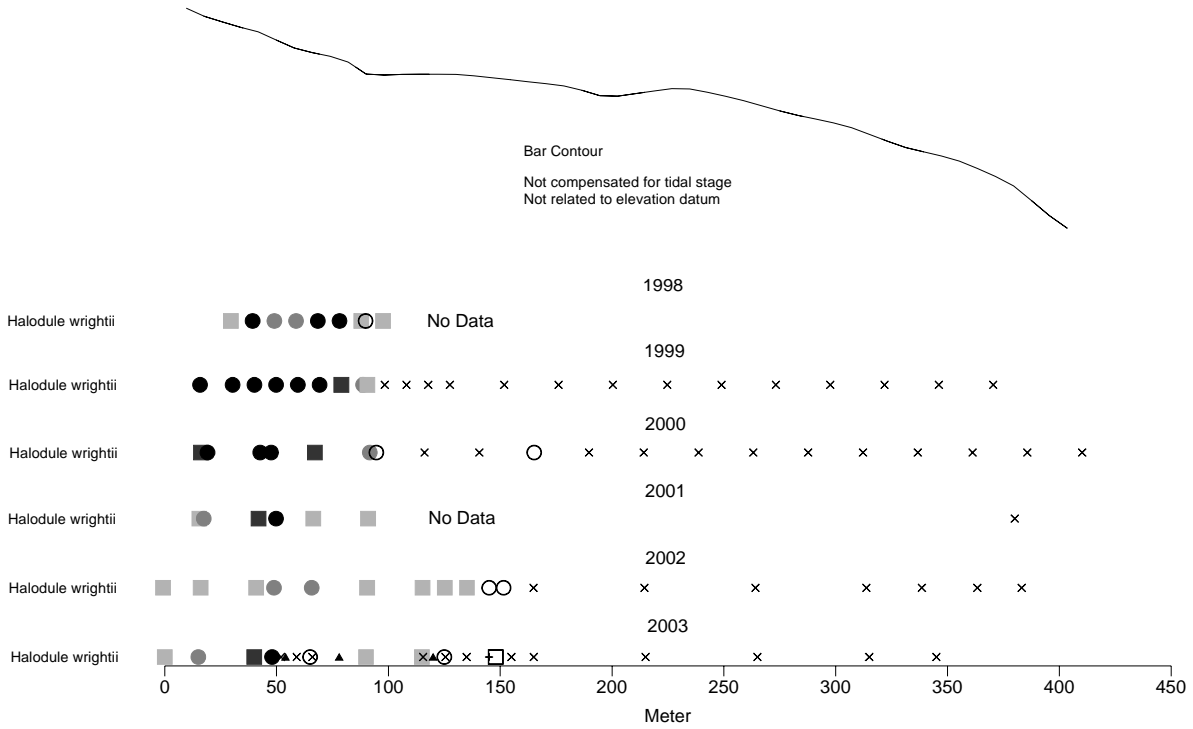


Figure 58. Seagrass species, abundance, and zonation at S5T1 from 1998-2003.

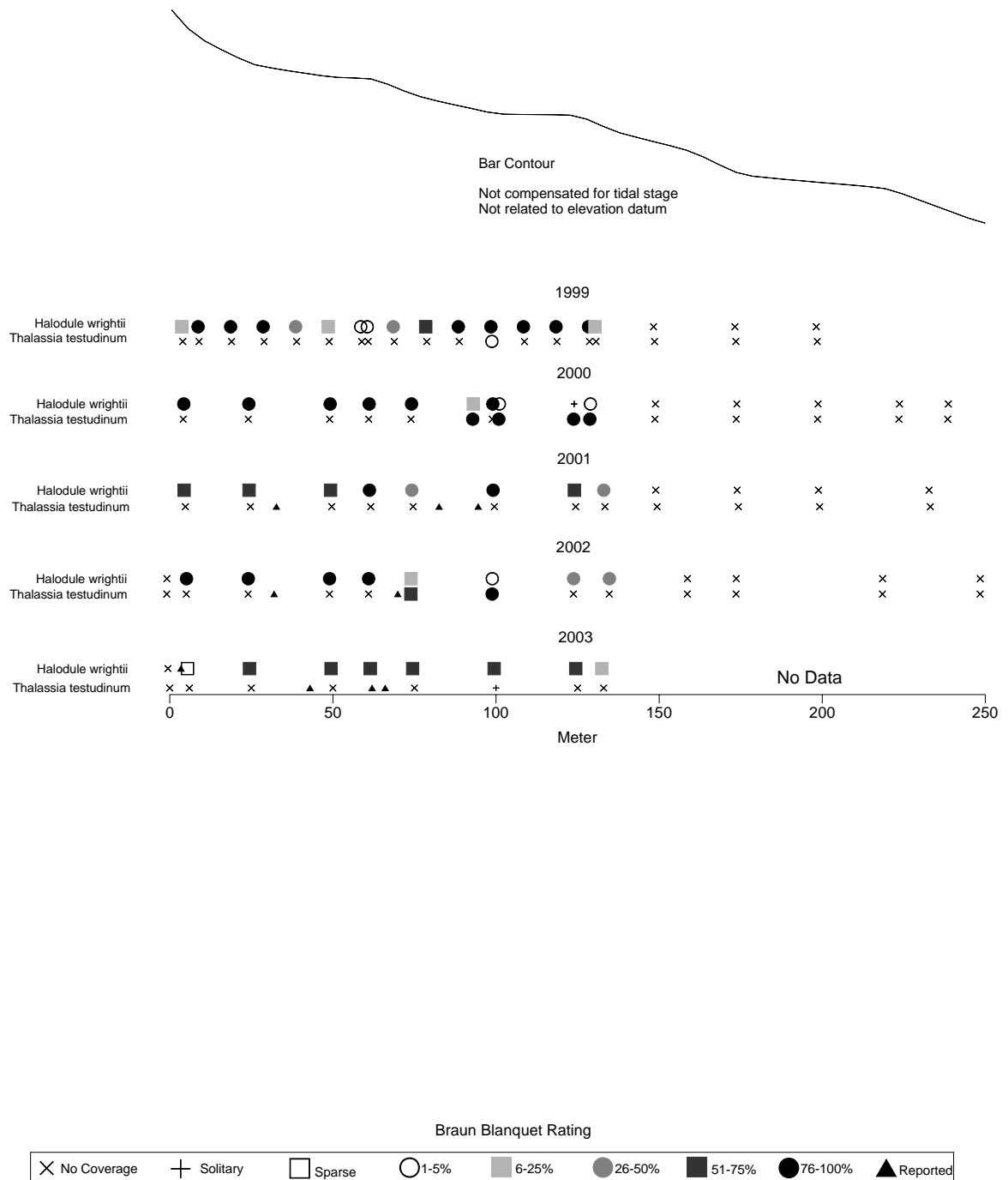


Figure 59. Seagrass species, abundance, and zonation at S5T2 from 1999-2003.

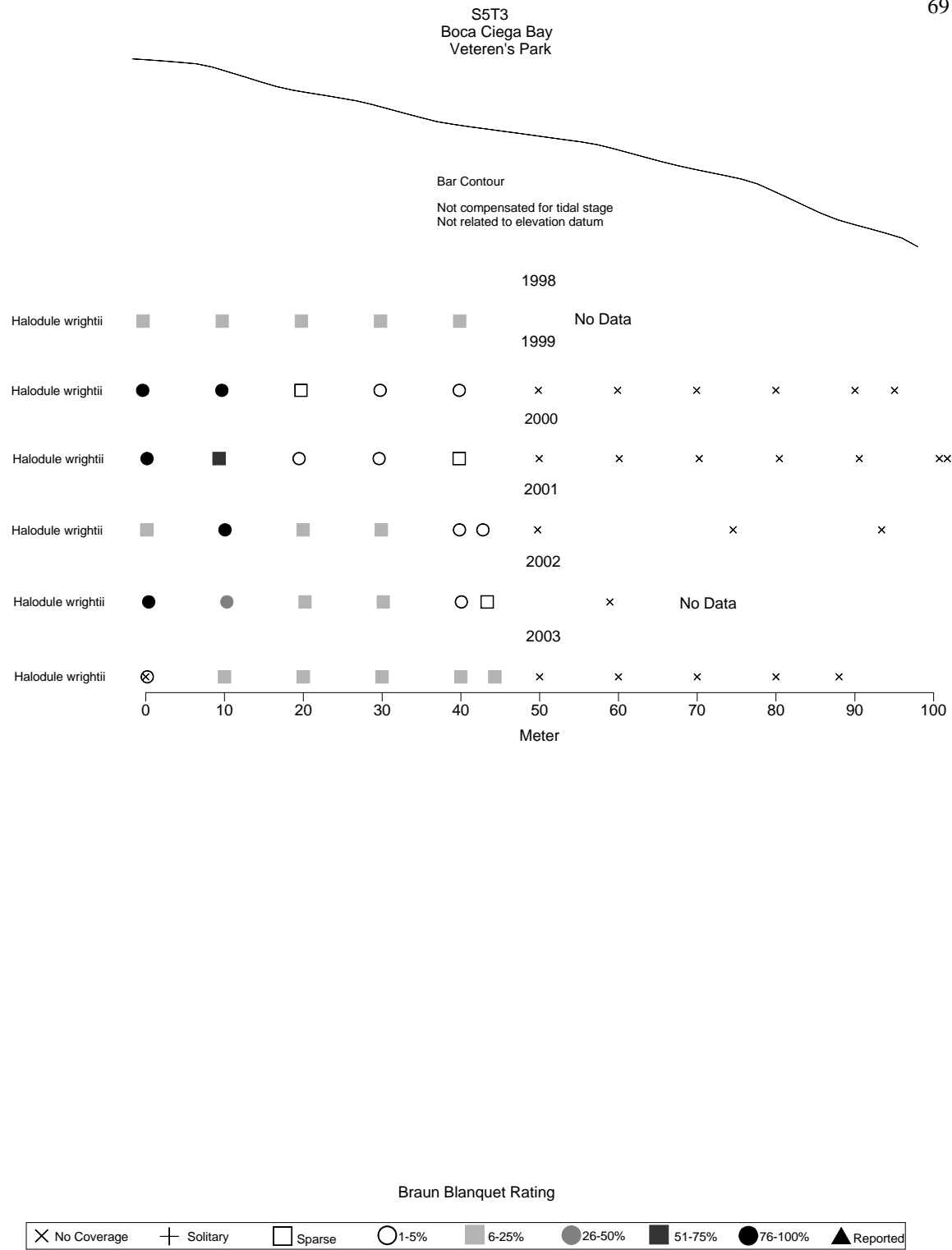


Figure 60. Seagrass species, abundance, and zonation at S5T3 from 1998-2003.

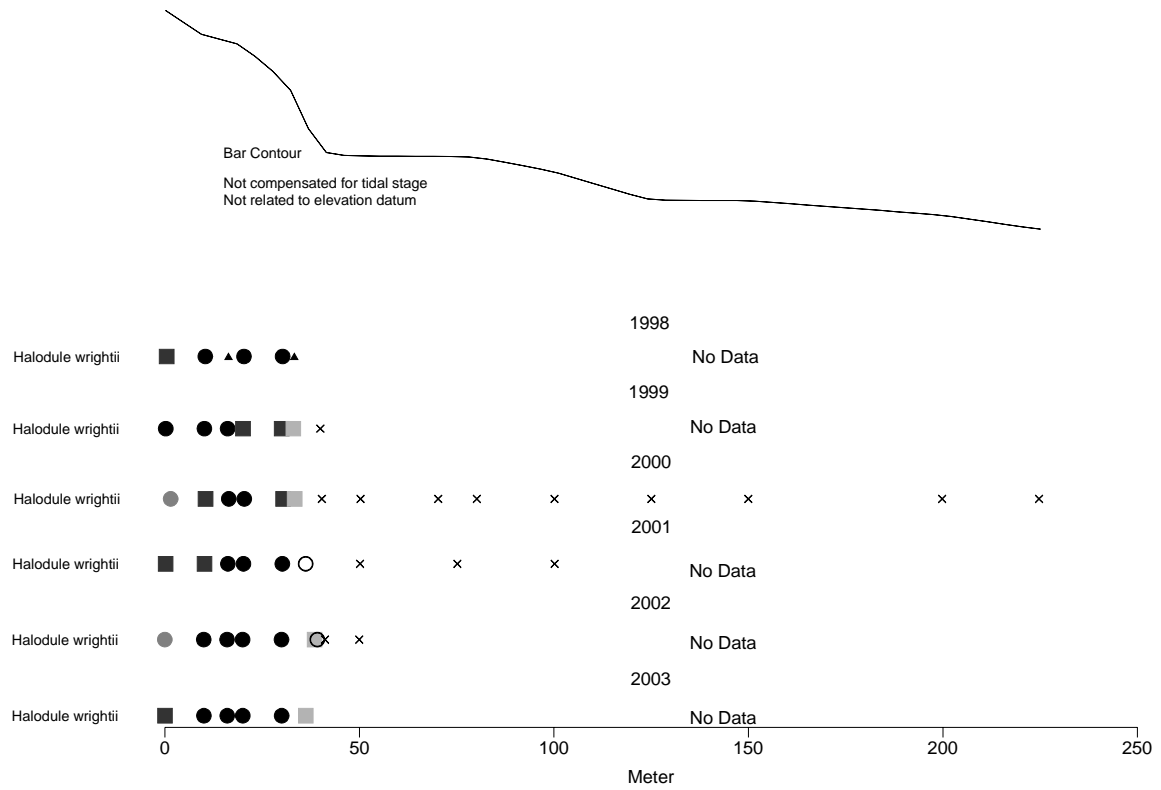
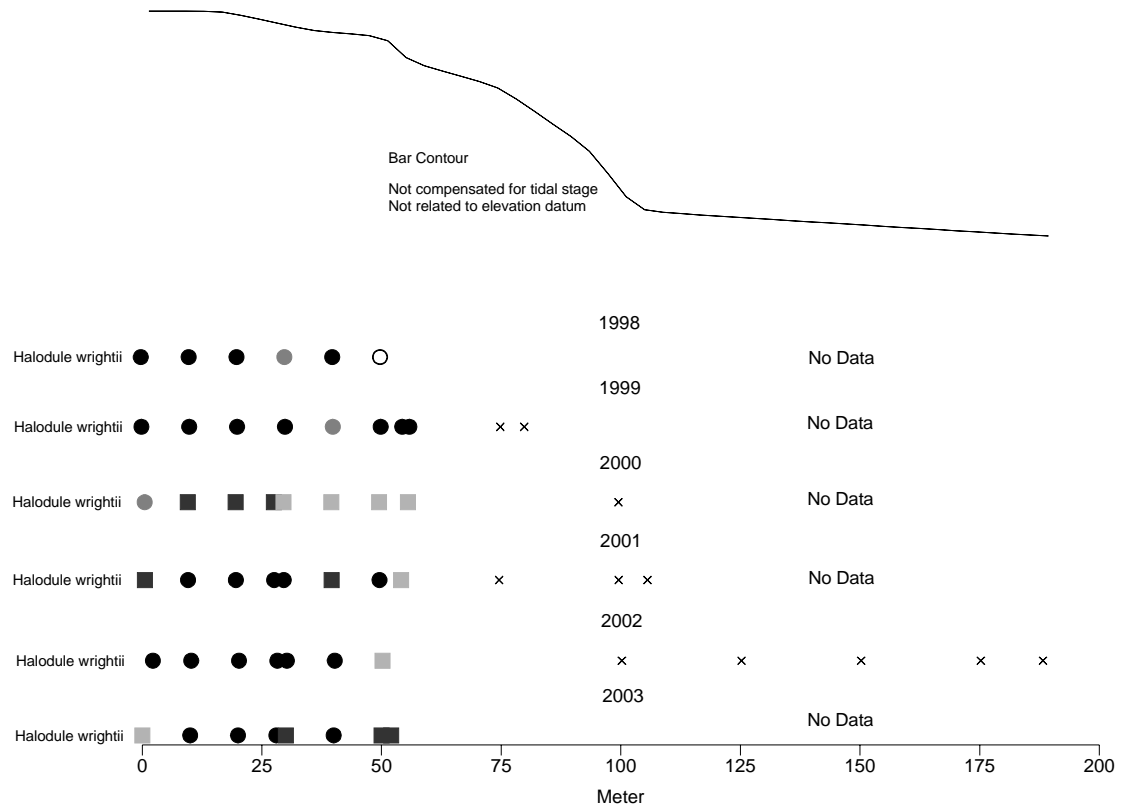


Figure 61. Seagrass species, abundance, and zonation at S5T4 from 1998-2003.



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Figure 62. Seagrass species, abundance, and zonation at S5T5 from 1998-2003.

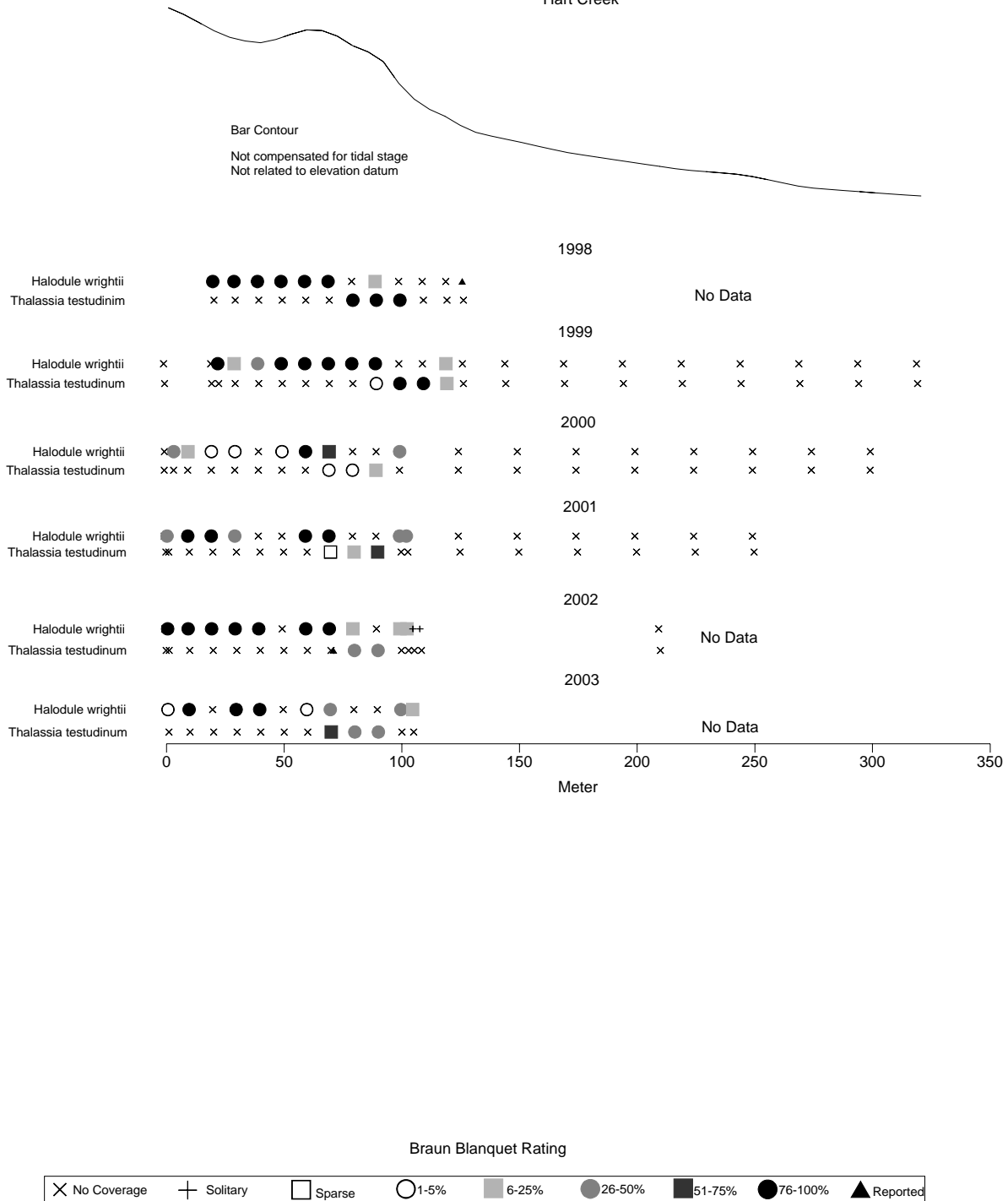


Figure 63. Seagrass species, abundance, and zonation at S5T6 from 1998-2003.

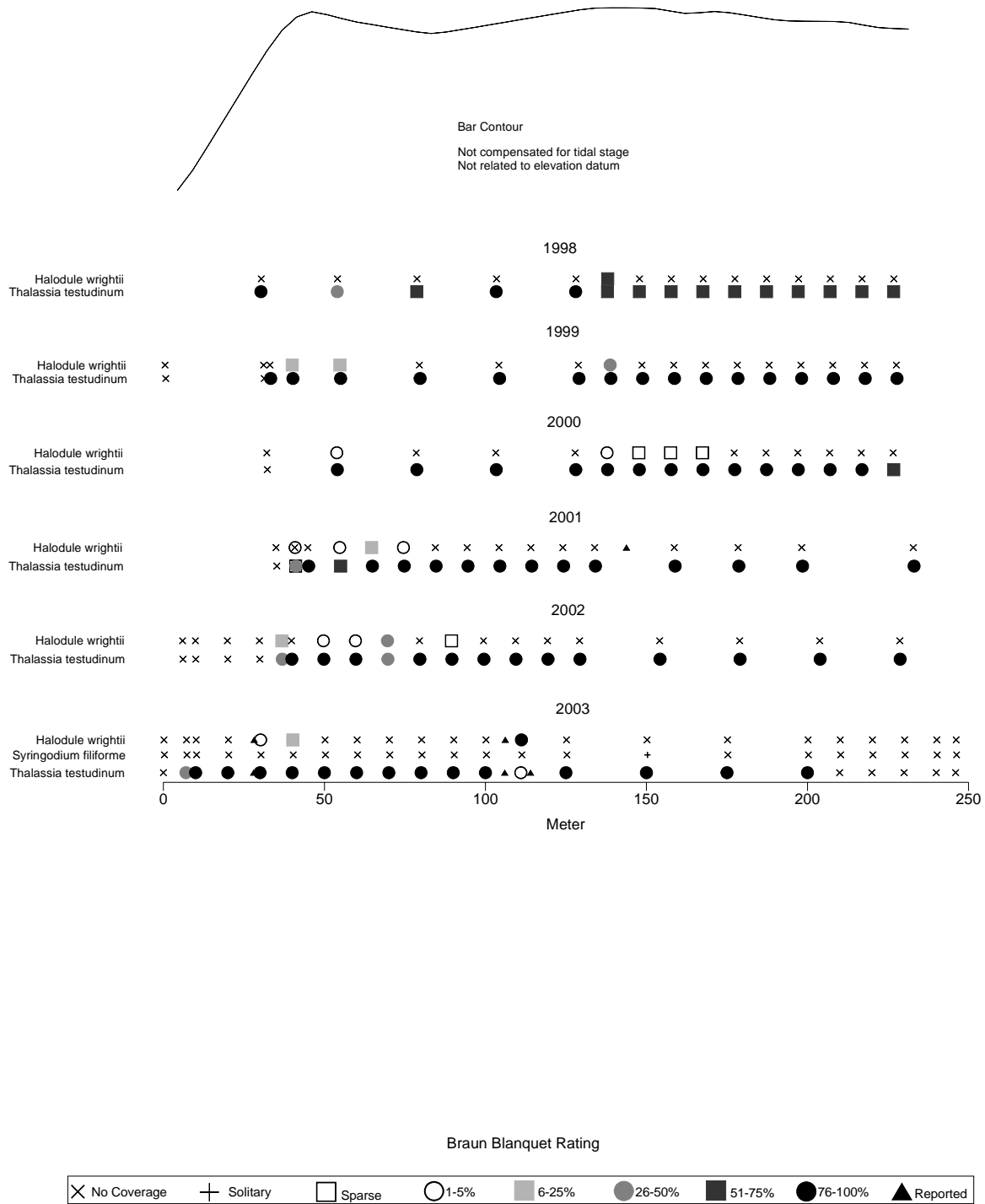


Figure 64. Seagrass species, abundance, and zonation at S5T7 from 1998-2003.

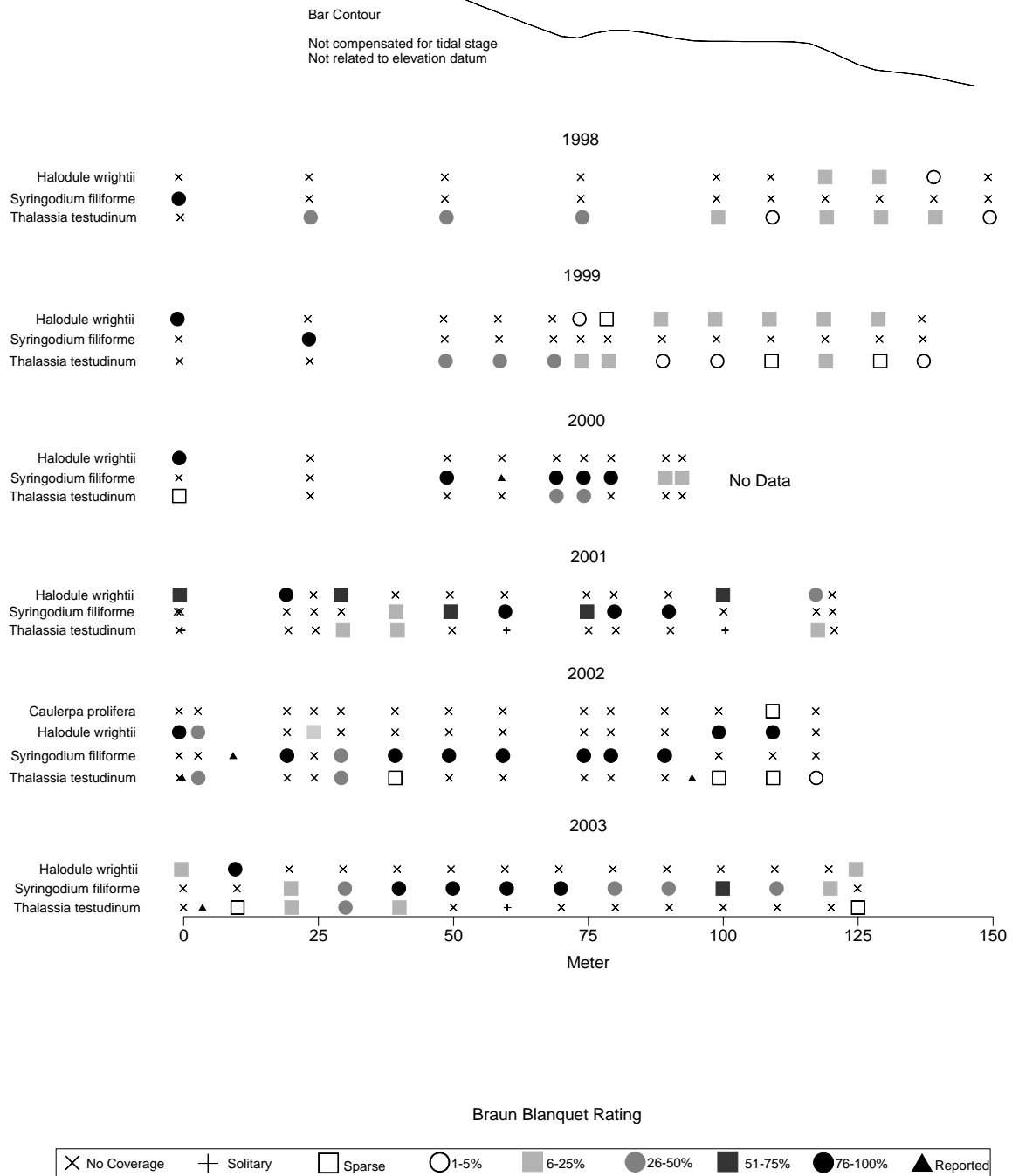


Figure 65. Seagrass species, abundance, and zonation at S5T8 from 1998-2003.

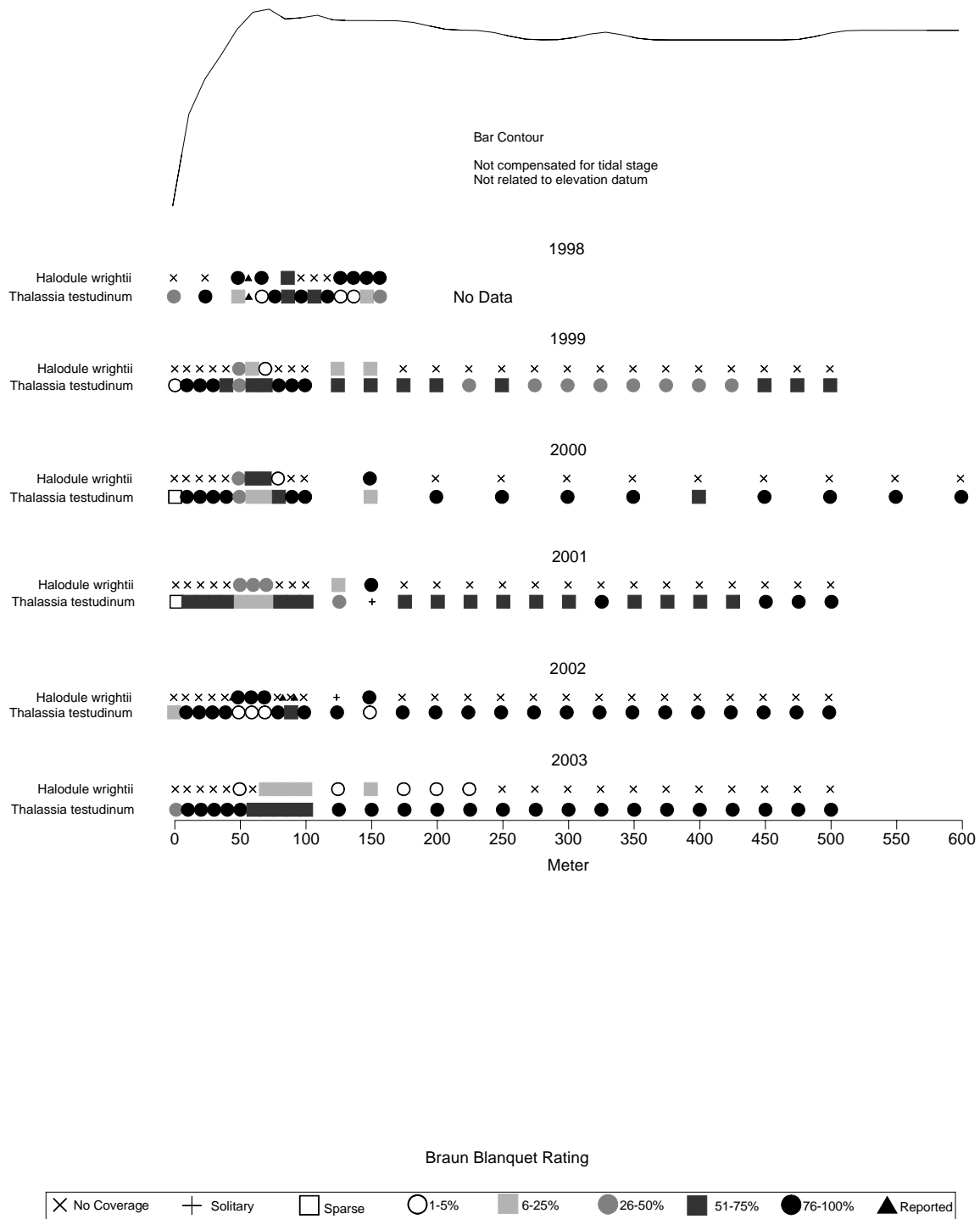


Figure 66. Seagrass species, abundance, and zonation at S5T9 from 1998-2003.

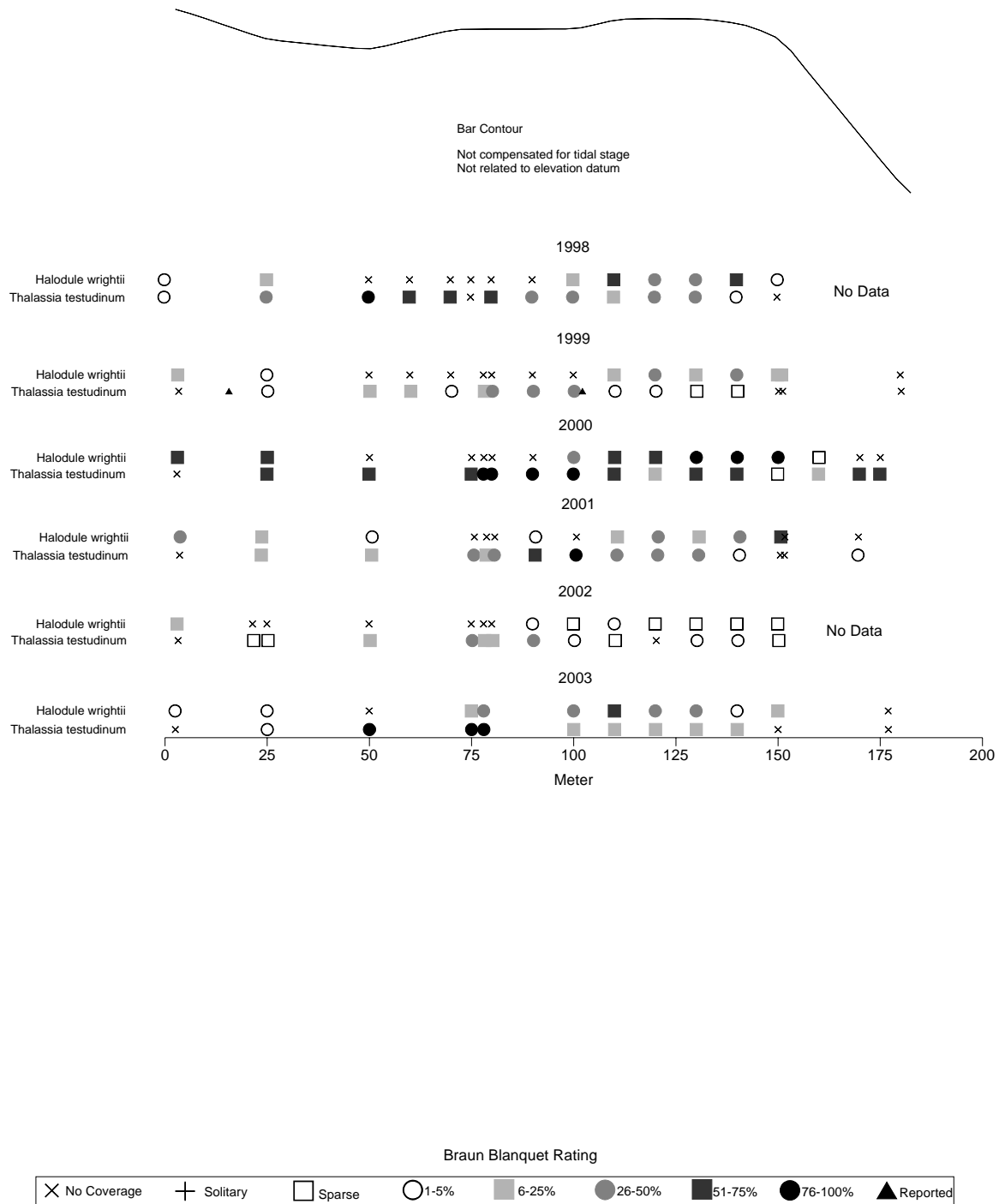


Figure 67. Seagrass species, abundance, and zonation at S5T10 from 1998-2003.

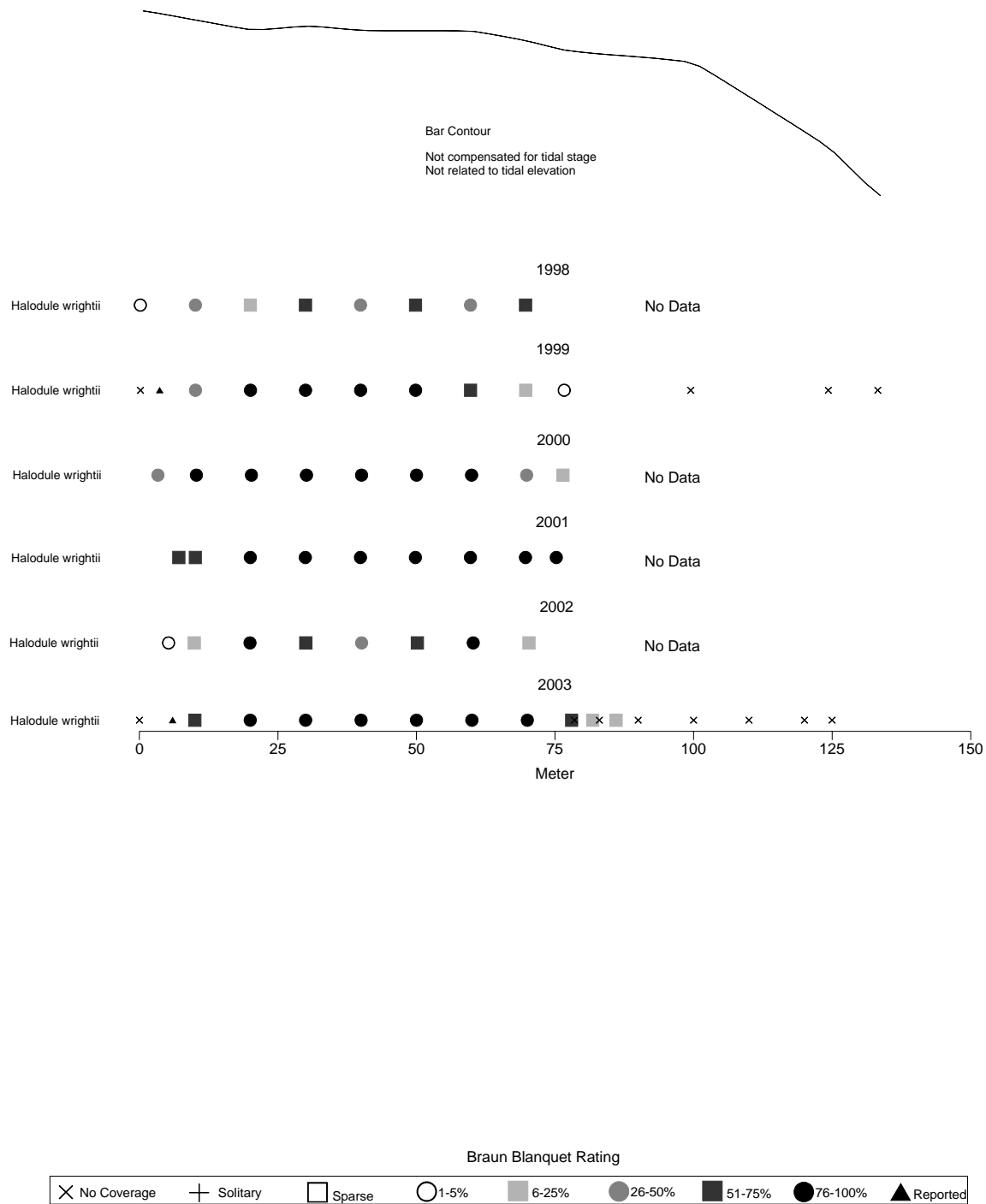


Figure 68. Seagrass species, abundance, and zonation at S5T11 from 1998-2003.