Tampa Bay Estuary Program
Technical Report #03-03

Data Summary from the Tampa Bay Interagency Seagrass Monitoring Program Through the Year 2002

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by
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Introduction

The state of Tampa Bay's seagrass meadows have become an important issue in the past three decades as scientist and environmental managers have worked to reverse the detrimental effect 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 by advocating control of nutrients discharged to Tampa Bay thus controlling conditions that potentially could allow Tampa Bay to digress back into a more eutrophic system. 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 began along sixty transects in 1998.

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 the every other year aerial photographic surveys. 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 was collected along this transect 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).

In total, 62 seagrass transects were monitored in Tampa Bay during 2002 (Figure 1). 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, Florida Marine Research Institute (FMRI), Manatee County Environmental Management Department (MC), and Tampa Baywatch, Inc. (TBI).

Report Summary

This paper presents a general overview of the Tampa Bay Interagency Seagrass Monitoring Program (TBISP) and results concerning seagrass distribution within Tampa Bay. Further, a summary of trends in areal coverage and major changes in species composition observed during the course of the monitoring program are also included. Data collected during the course of the program pertaining to water quality, sediment composition, and epiphytes are not discussed within this report. All information collected during the monitoring program may be obtained through the TBEP.

Results regarding seagrass species abundance, distribution, and zonation over time are presented for the 1997-2002 period in Hillsborough Bay (HB, Figures 15-26) and the 1998-2002 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 42-56), and Boca Ciega Bay (BCB, Figures 58-68). 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 in following recolonization patterns or delineating areas with changes in species composition.

Additional 2002 transect information for each bay segment is presented in Figures 2 (OTB), 15 (HB), 27 (MTB), 41 (LTB), and 57 (BCB). These data include the length of each transect, the number of meter square placements (N) along each transect, and the percent of N which each seagrass species was found.

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 in field sampling procedures and protocols.

Results and Discussion

Old Tampa Bay:

Of the twelve transects monitored in Old Tampa Bay during 2002 (Figure 2), only S1T1, S1T3, S1T5, S1T6, S1T8, and S1T9 have data that encompass the five 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 2001 are presented in Figures 3-14.

All five seagrass species found in Tampa Bay were found in Old Tampa Bay during 2002. Generally, *Halodule wrightii* (Shoal grass) has been the dominant species found along each transect. However, *Thalassia testudinum* (Turtle grass) and *Syringodium filiforme* (Manatee grass) have comprised a substantial portion of the seagrass composition along the eastern shoreline and the western shoreline south of Gandy Bridge. Sparse *Ruppia maritima* (Widgeon grass) and *Halophila engelmanni* (Star grass) have been documented in northeast and northwest Old Tampa Bay, respectively.

Transects S1T1 (Figure), S1T3 (Figure), and S1T17 (Figure) had extensive loss of *H. wrightii* coverage between 2001-2002. However, only minor changes in species composition and distribution were noted among the remaining transects.

The attached alga, *Caulerpa prolifera*, has been noted along several transects in Old Tampa Bay during the course of the study. In 2002, this alga was found along transects S1T1, S1T9, S1T14, and S1T17. *C. prolifera* was found in 42 percent of the meter square placements along S1T1, however, it was a minor component in the remaining three transects.

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 noted periodically in most areas of Hillsborough Bay. Braun Blanquet data from the Hillsborough Bay transects are presented in Figures 16-26.

Hillsborough Bay seagrass coverage increased over 50 percent from about 56ha in 1997 to nearly 86ha in 2001 (City of Tampa 2002), largely due to rapid *H. wrightii* recolonization around southeastern Interbay Peninsula (Figures 25, and 26). In 2002, *H. wrightii* coverage declined in the area traversed by transect S2T12. In contrast, *H. wrightii* coverage along transect S2T112 expanded somewhat between 2001-2002

reflecting the 30% increase in areal coverage in that area of Hillsborough Bay (City of Tampa 2002). There has been little coverage change in other areas of Hillsborough Bay since 1997.

C. prolifera was noted along transect S2T12 (Figure 26) in 2002. Although this was the first time this alga was documented during the course of the TBISP program. *C. prolifera* has been a major constituent of Hillsborough Bay's submerged aquatic vegetation (SAV) between 1986 and 1996 (City of Tampa, 2003).

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 2002 are presented in Figures 28-40.

Four seagrass species, *H. wrightii*, *R. maritima*, *S. filiforme*, and *T. testudinum* were documented in Middle Tampa Bay during 2002. *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*.

In general, there has been little variation in seagrass species composition and abundance in Middle Tampa Bay. Only transect S3T12 (Figure 39) has had substantial increase in seagrass coverage. The seaward edge of the *H. wrightii* meadow along this transect has advanced 500m since 1997. In contrast, there has been apparent thinning and loss of the seaward edge of *H. wrightii* coverage near Wolf Branch (transect S3T13; Figure 40). The edge of this meadow has retreated nearly 40m since 1998.

C. prolifera coverage was noted along transect S3T8 (Figure 35) between 2000-2002. The algal coverage was the dominant SAV component along this transect in 2002. Further, *C. prolifera* was seen on transect S3T12 during 2002.

Lower Tampa Bay:

Fourteen transects were assessed for seagrass coverage in 2002 (Figure 41). *H. wrightii*, *S. filiforme*, and *T. testudinum* were the only species reported in Lower Tampa Bay (including Terra Ceia Bay) during 2002, although *H. engelmanni* and *R. maritima* have been documented in the Manatee River in previous monitoring years. Braun Blanquet data from transects monitored during 2002 are presented in Figures 42-56.

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

In general, there has been little variation in seagrass species composition and abundance along the Lower Tampa Bay transects. However, a species shift from *S. filiforme* to *H. wrightii* occurred at transect S4T5 (Figure 46) between 2001 and 2002. Further, the seaward edge of the *T. testudinum* meadow at transect S4T10 (Figure 51) retreated about 40m between 2001-2002. Finally, during 2002, no SAV was present along transect S4T9 (Figure 50) in the Manatee River.

C. prolifera was documented on transect S4T12 (Figure 53) for the first time in 2002. This was the only Lower Tampa Bay transect reporting this species.

Boca Ciega Bay:

Eleven transects have been assessed for seagrass coverage in Boca Ciega Bay (Figure 58). *H. wrightii*, *S. filiforme*, and *T. testudinum* have been documented within this bay segment. Braun Blanquet data from transects monitored during 2002 are presented in Figures 58-68.

Generally, *H. wrightii* has been the dominant species in the northern portion of Boca Ciega Bay and 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. Between 2001-2002, *H. wrightii* coverage expanded somewhat along transect S5T1 (Figure 58). In contrast, T. testudinum abundance on the seaward portion of transect S5T10 (Figure 67) has thinned since 2000. Finally, there has been an apparent shift from a *T. testudinum* dominated community present along transect S5T8 (Figure 65) in 1998 to a *S. filiforme* meadow.

C. prolifera was documented on transect S5T8 (Figure 65) for the first time in 2002. This was the only Boca Ciega Bay transect reporting this species.

Conclusion

We now have five years or more of data from most of the Tampa Bay seagrass monitoring transects. The collected 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 change detected has been the rapid development and subsequent decline of *H. wrightii* meadows along southeastern Interbay Peninsula in Hillsborough Bay and Middle Tampa Bay between 1998 and 2002.

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 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.

Phytoplankton biomass between 1999-2001 has been near or below target levels set for all bay segments (City of Tampa; unpublished data). 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, though SWIM reported a large loss in seagrass coverage in Old Tampa Bay between 1996-1999. In 2001, an eighteen month study of Old Tampa Bay was initiated with a goal to discern additional factors that may affect seagrass health.

Acknowledgements

This project has been made possible through the auspices of the Tampa Bay Estuary Program. Special thanks are extended to Holly Greening who has facilitated the coordination and implementation of the seagrass monitoring program. Also, Dave Tomasko (Southwest Florida Water Management District-Surface Water Improvement 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 - Florida Marine 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. 2003. Seagrass and *Caulerpa* monitoring in Hillsborough Bay. Fourteenth Annual Report. Prepared for the Florida Department of Environmental Protection. 46pp.

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

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

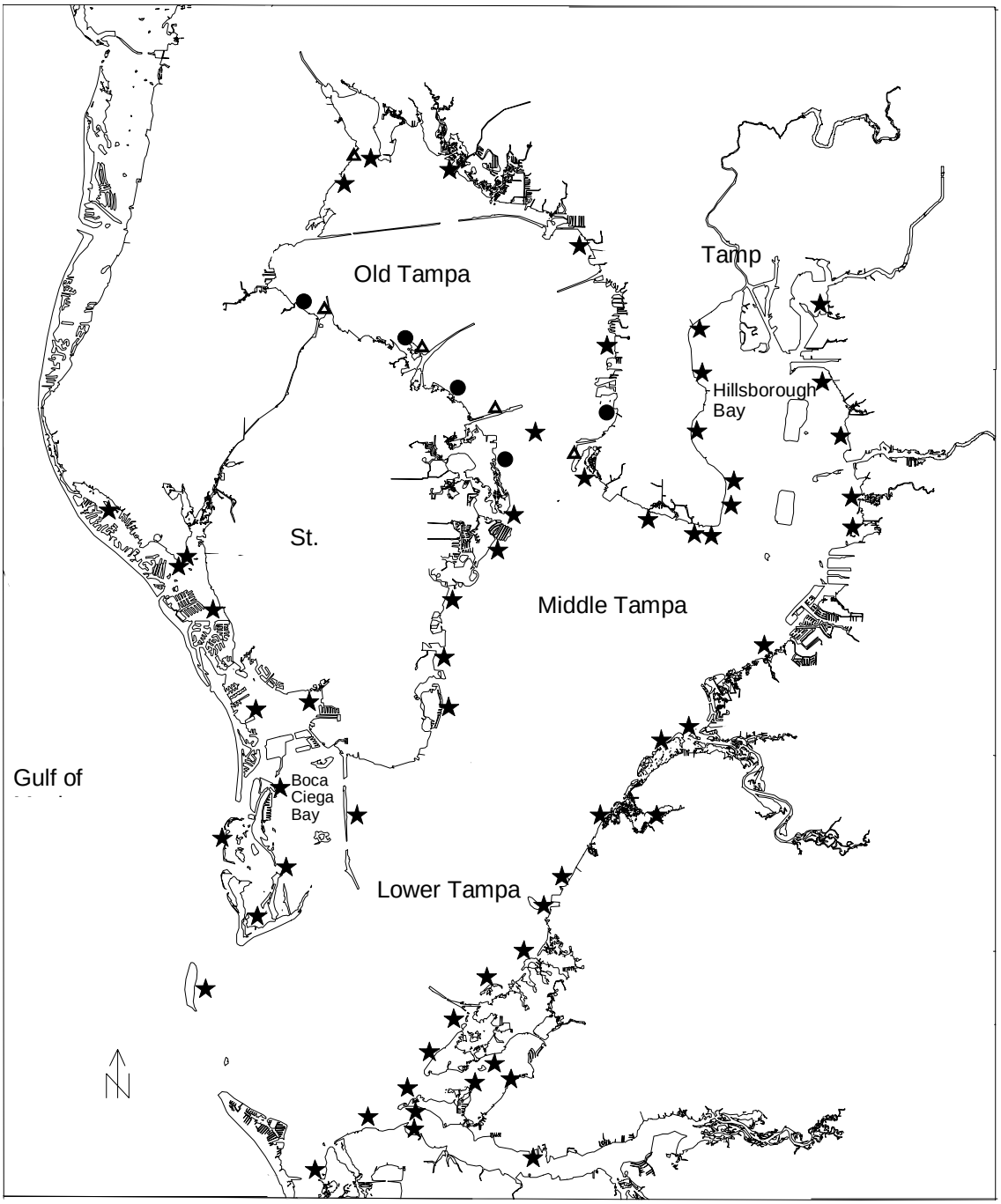

Figure 1. Location of the 62 seagrass monitoring transects in Tampa Bay. Filled circles (●) are new Old Tampa Bay transects. Triangles (△) are discontinued Old Tampa Bay transects.

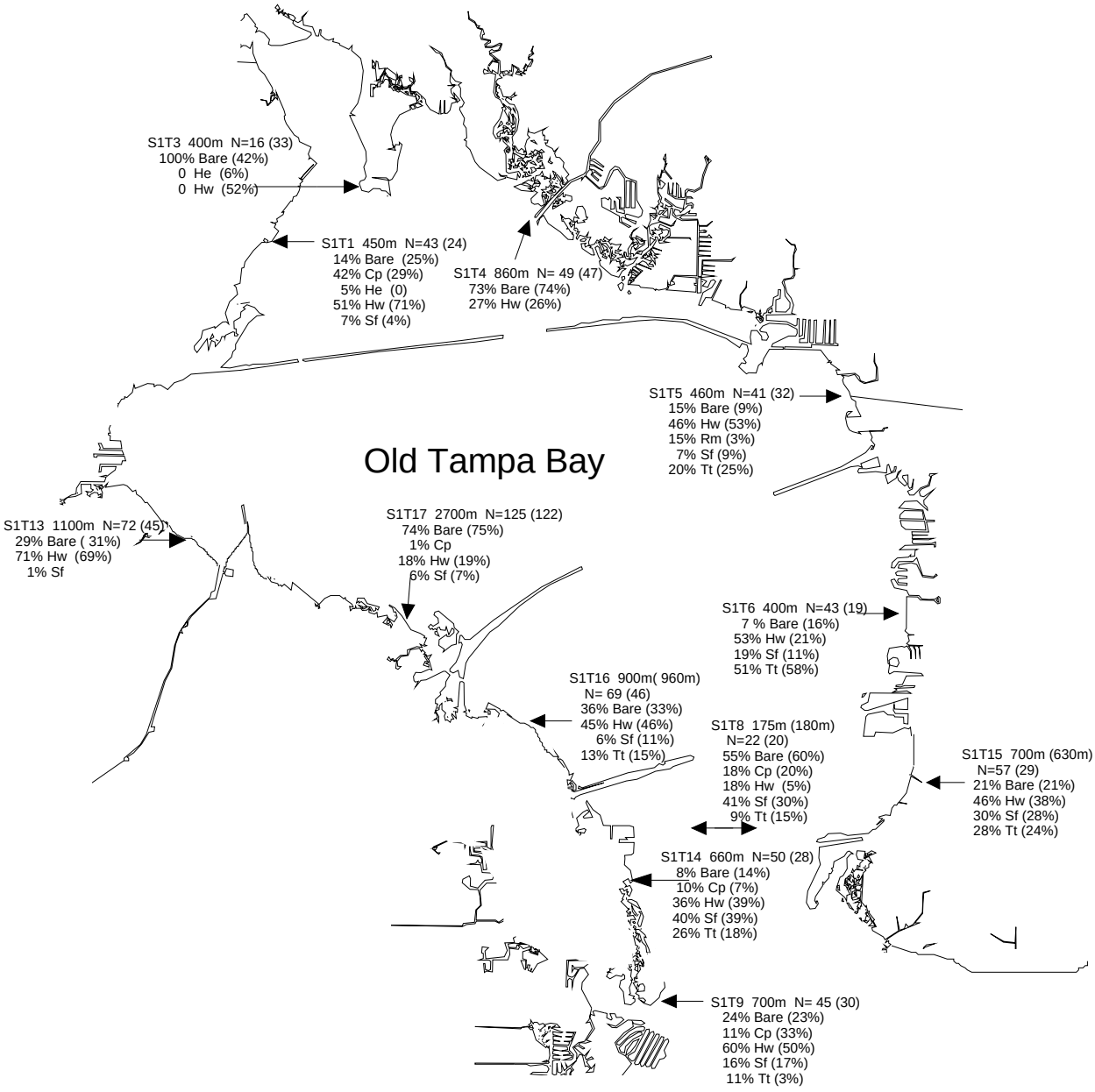

Figure 2. Name, location, length and percent of meter square placements containing each seagrass species along the 12 Old Tampa Bay seagrass monitoring transects in 2002. Results from 2001 in parentheses. N=number of meter square placements; He=*Halophila engelmanni*; Hw=*Halodule wrightii*; Rm=*Ruppia maritima*; Sf=*Syringodium filiforme*; Tt=*Thalassia testudinum*.

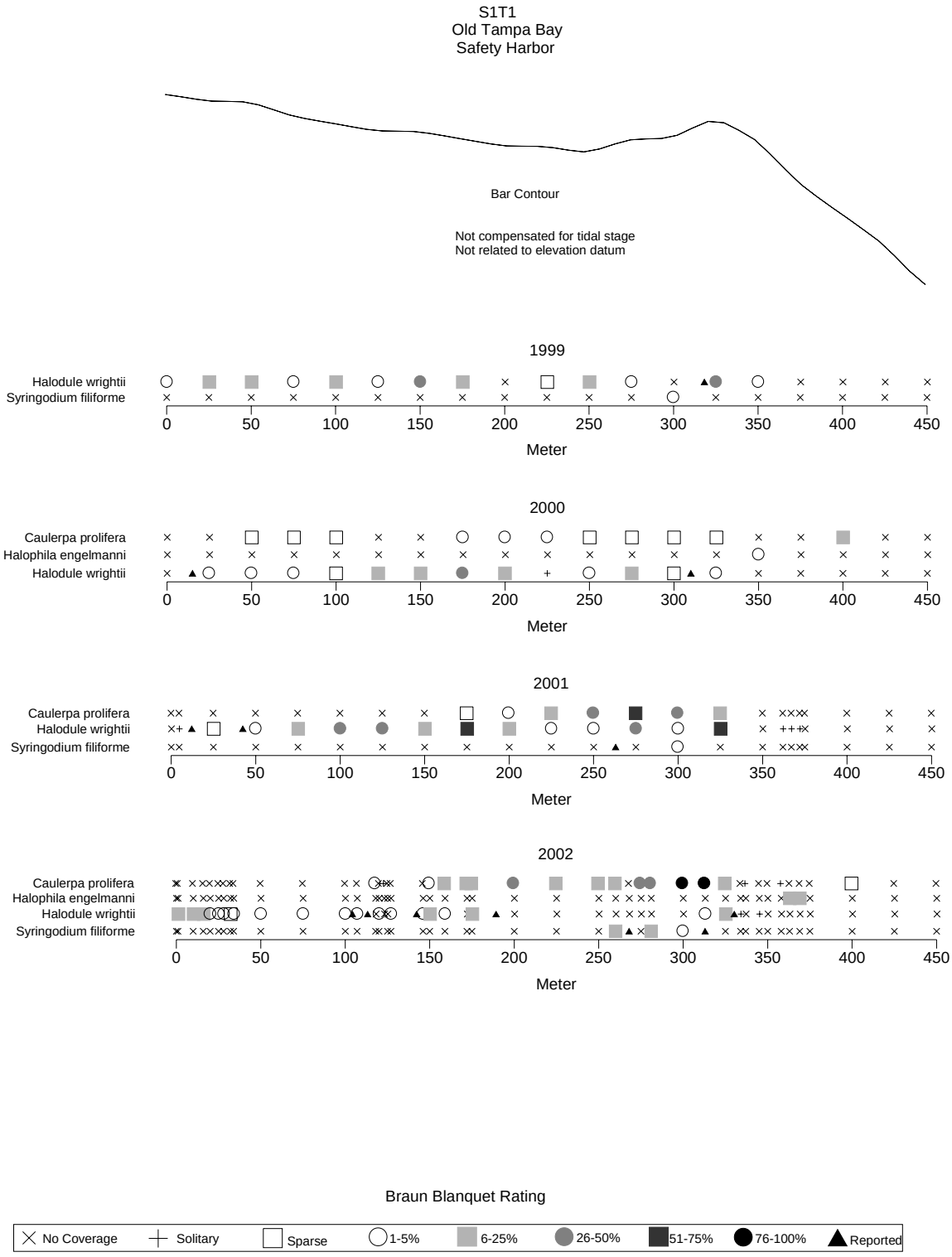

Figure 3. Seagrass species, abundance, and zonation at S1T1 from 1999-2002.

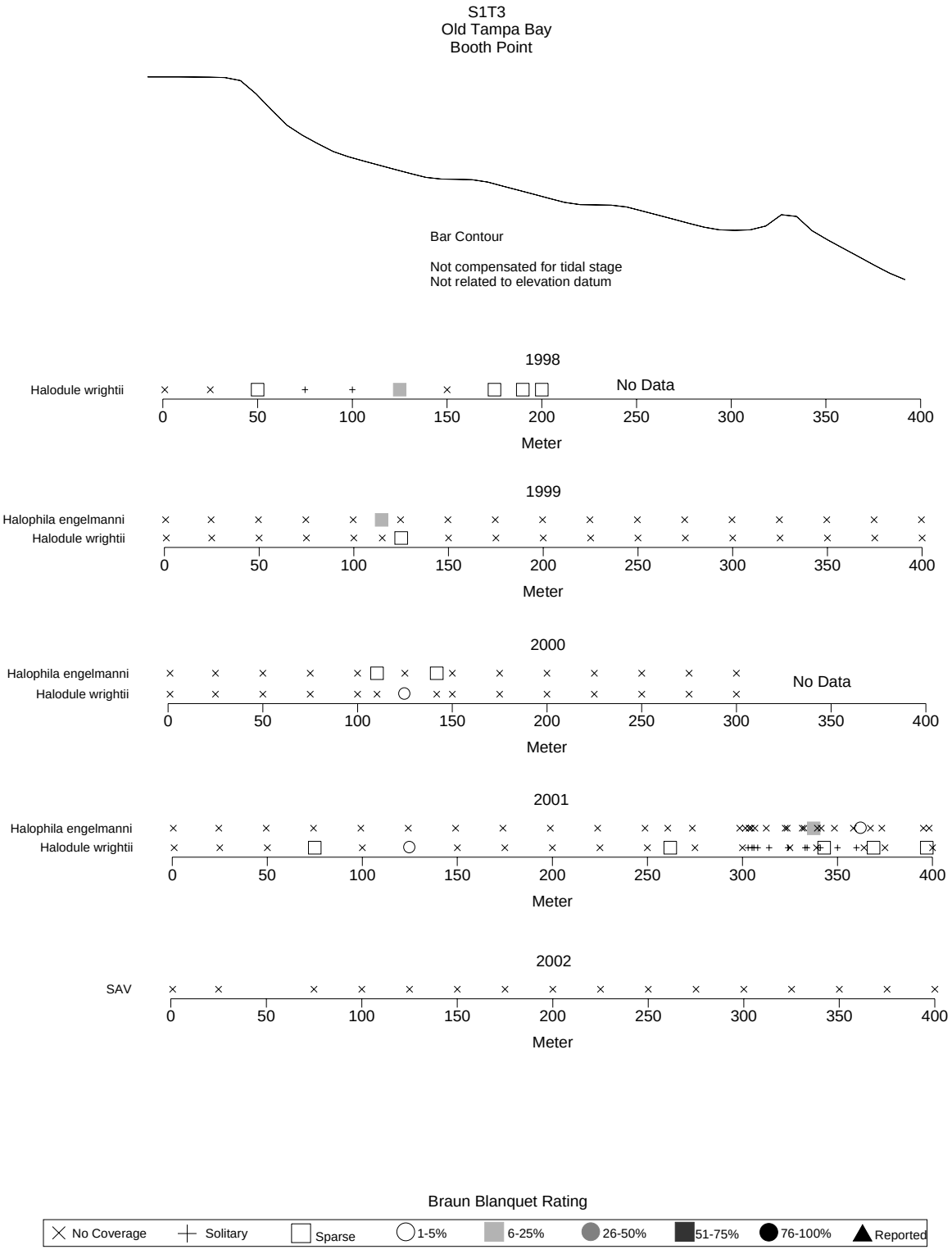

Figure 4. Seagrass species, abundance, and zonation at S1T3 from 1998-2002.

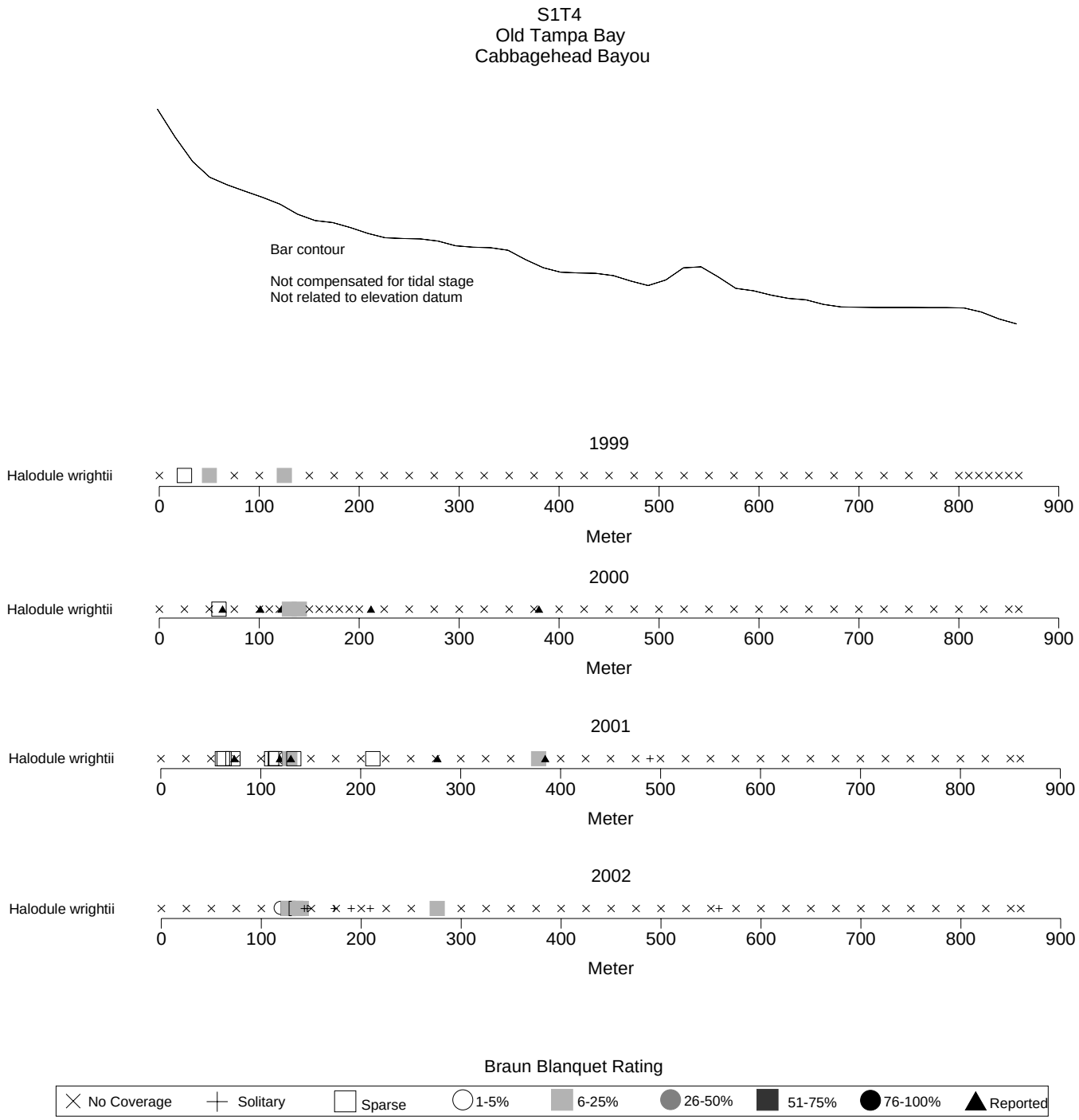

Figure 5. Seagrass species, abundance, and zonation at S1T4 from 1999-2002.

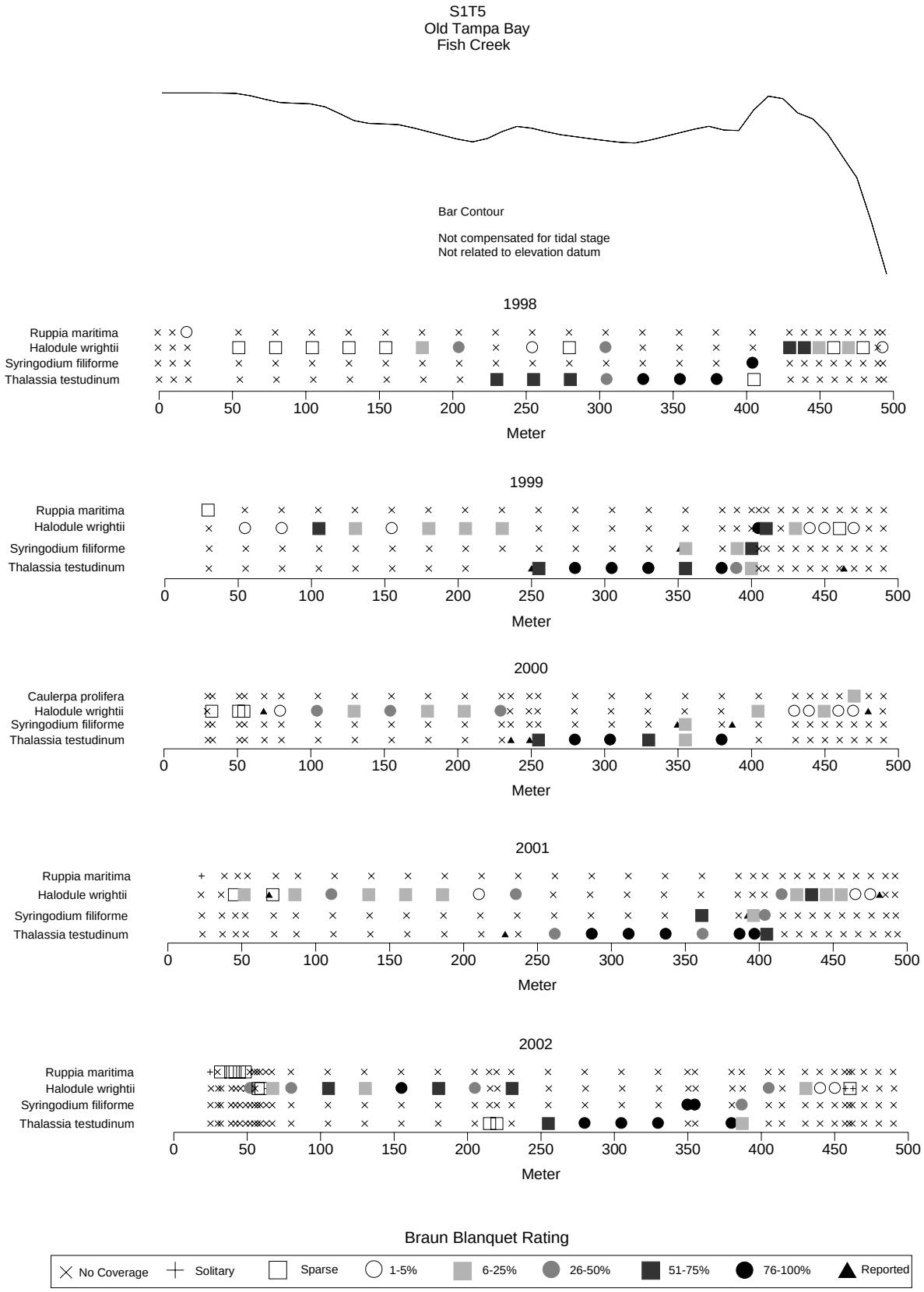

Figure 6. Seagrass species, abundance, and zonation at S1T5 from 1998-2002.

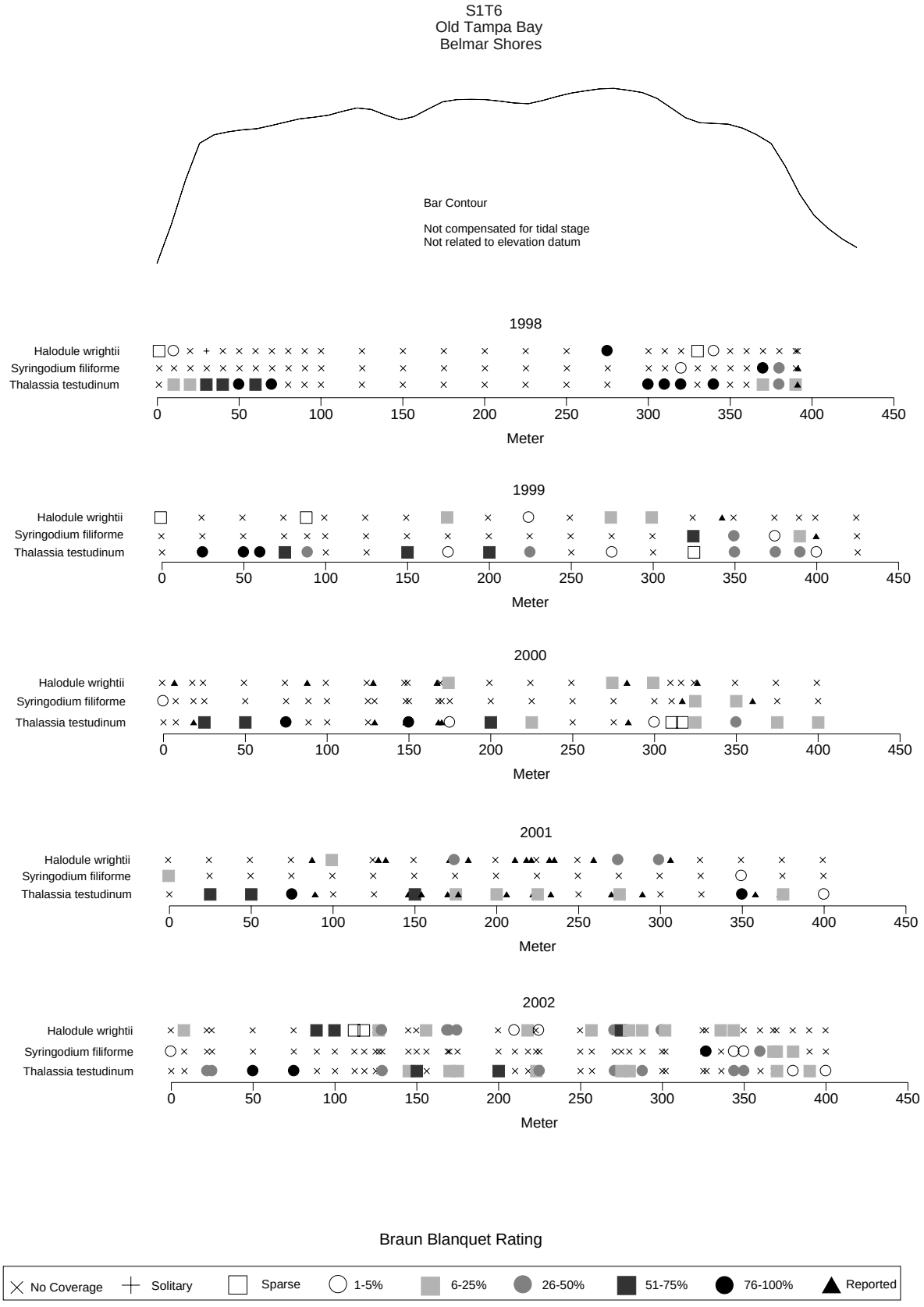

Figure 7. Seagrass species, abundance, and zonation at S1T6 from 1998-2002.

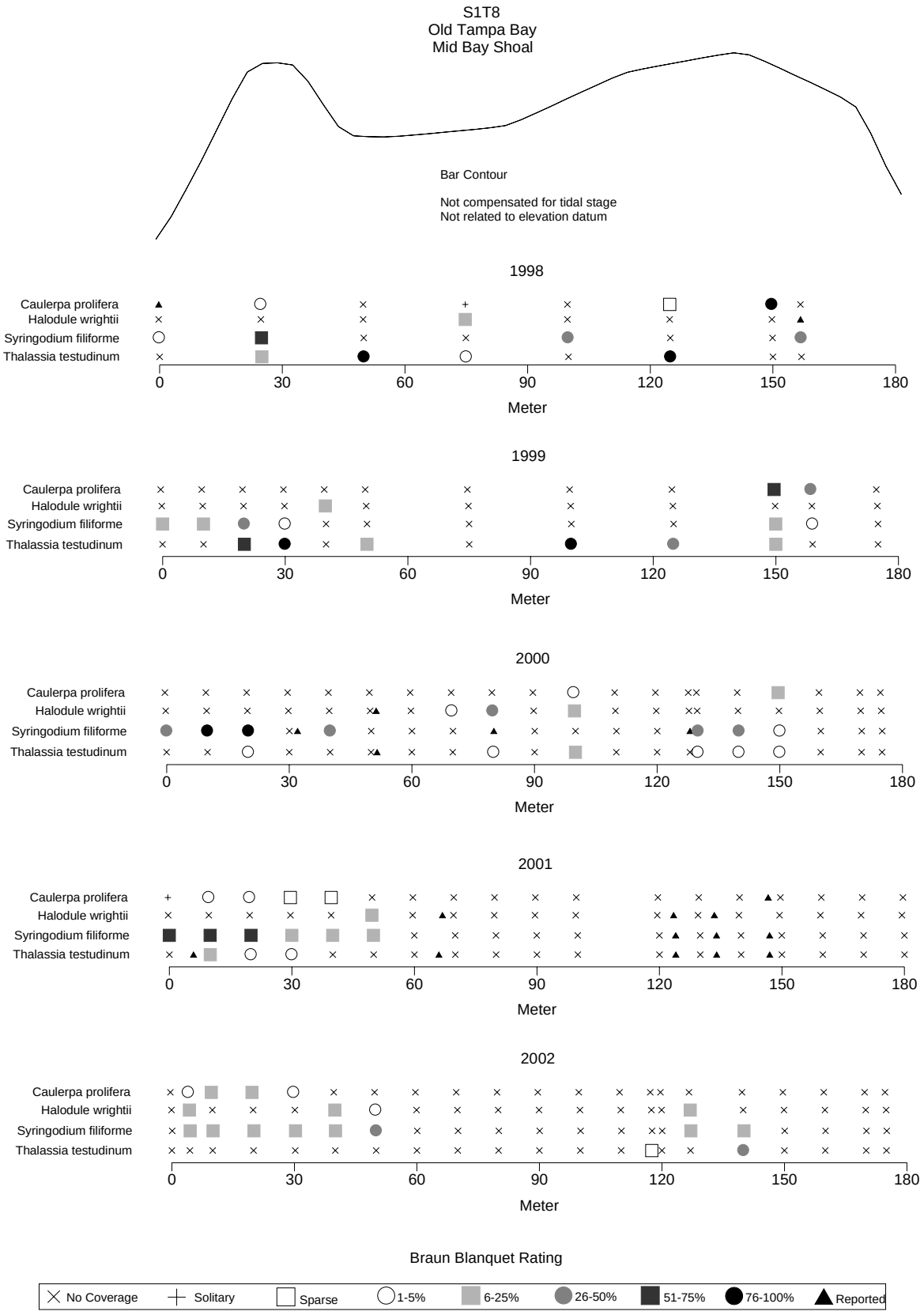

Figure 8. Seagrass species, abundance, and zonation at S1T8 from 1998-2002.

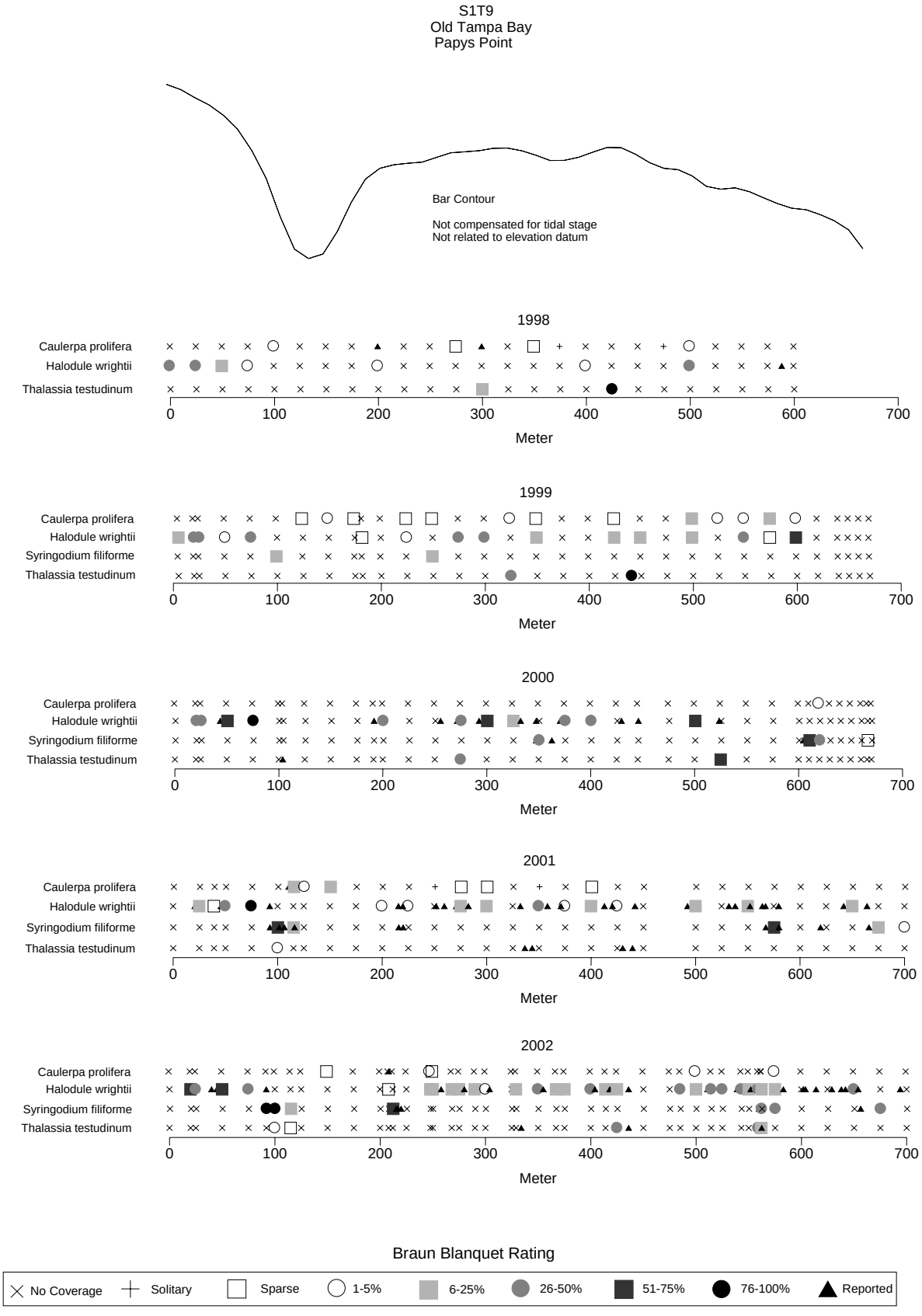

Figure 9. Seagrass species, abundance, and zonation at S1T9 from 1998-2002.

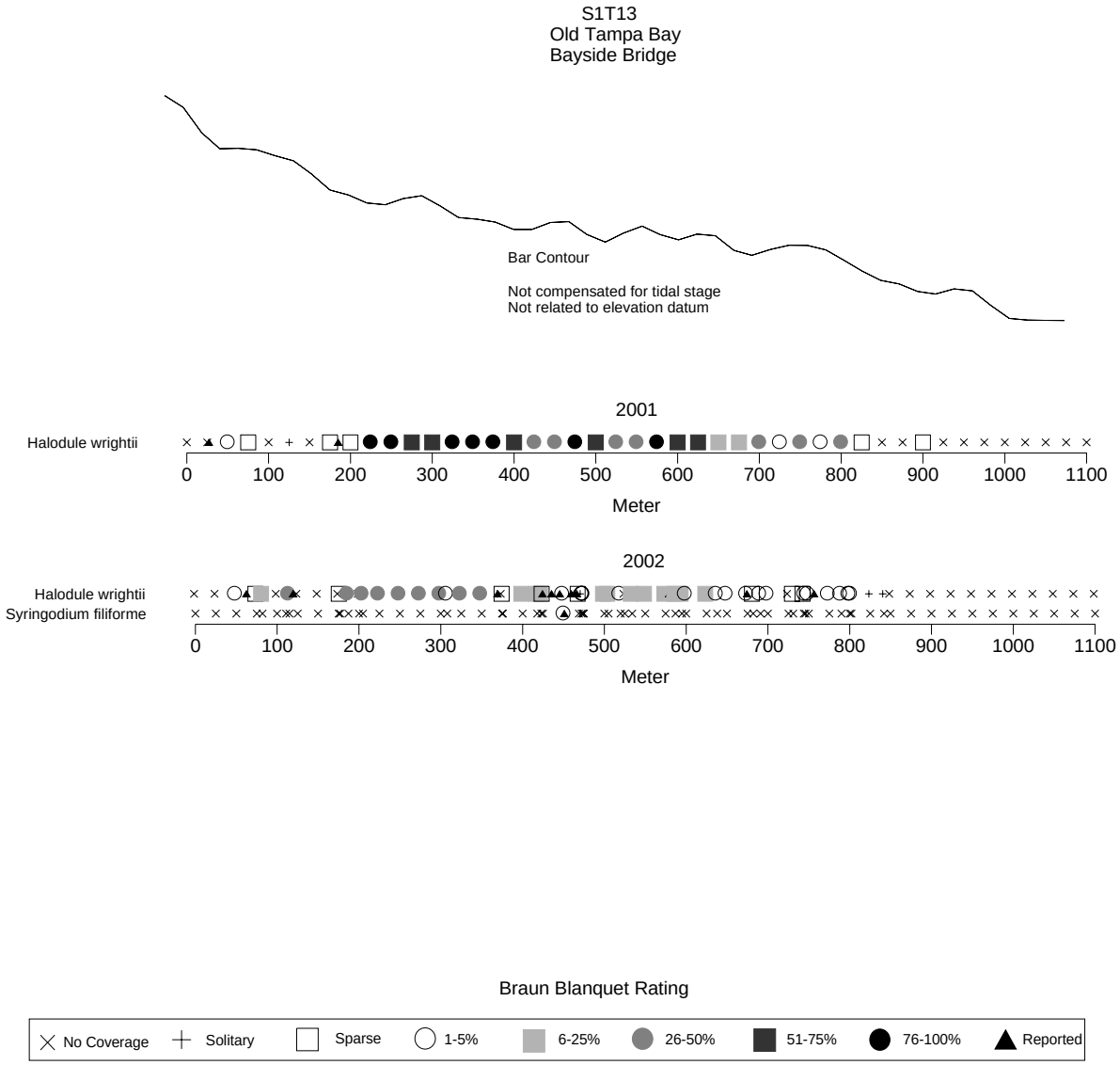

Figure 10. Seagrass species, abundance, and zonation at S1T13 from 2001-2002.

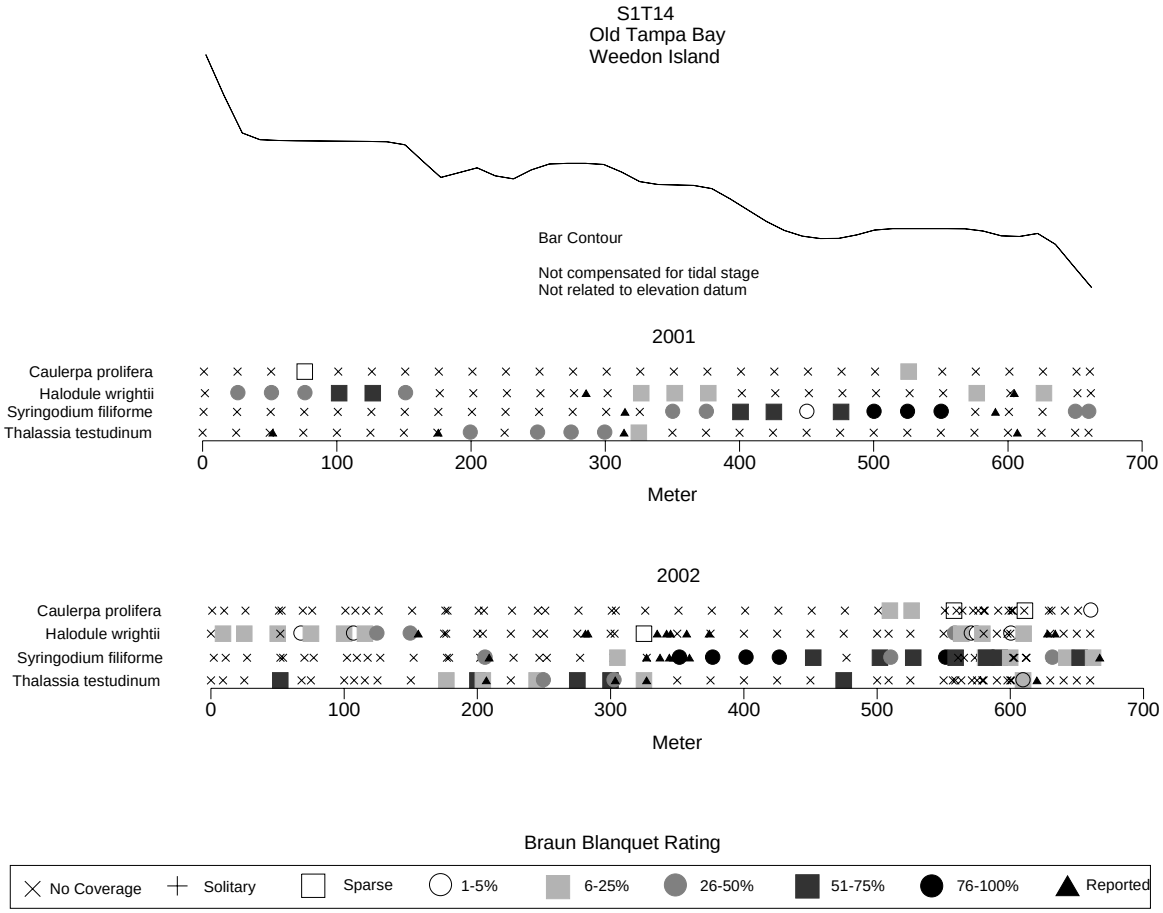

Figure 11. Seagrass species, abundance, and zonation at S1T14 from 2001-2002.

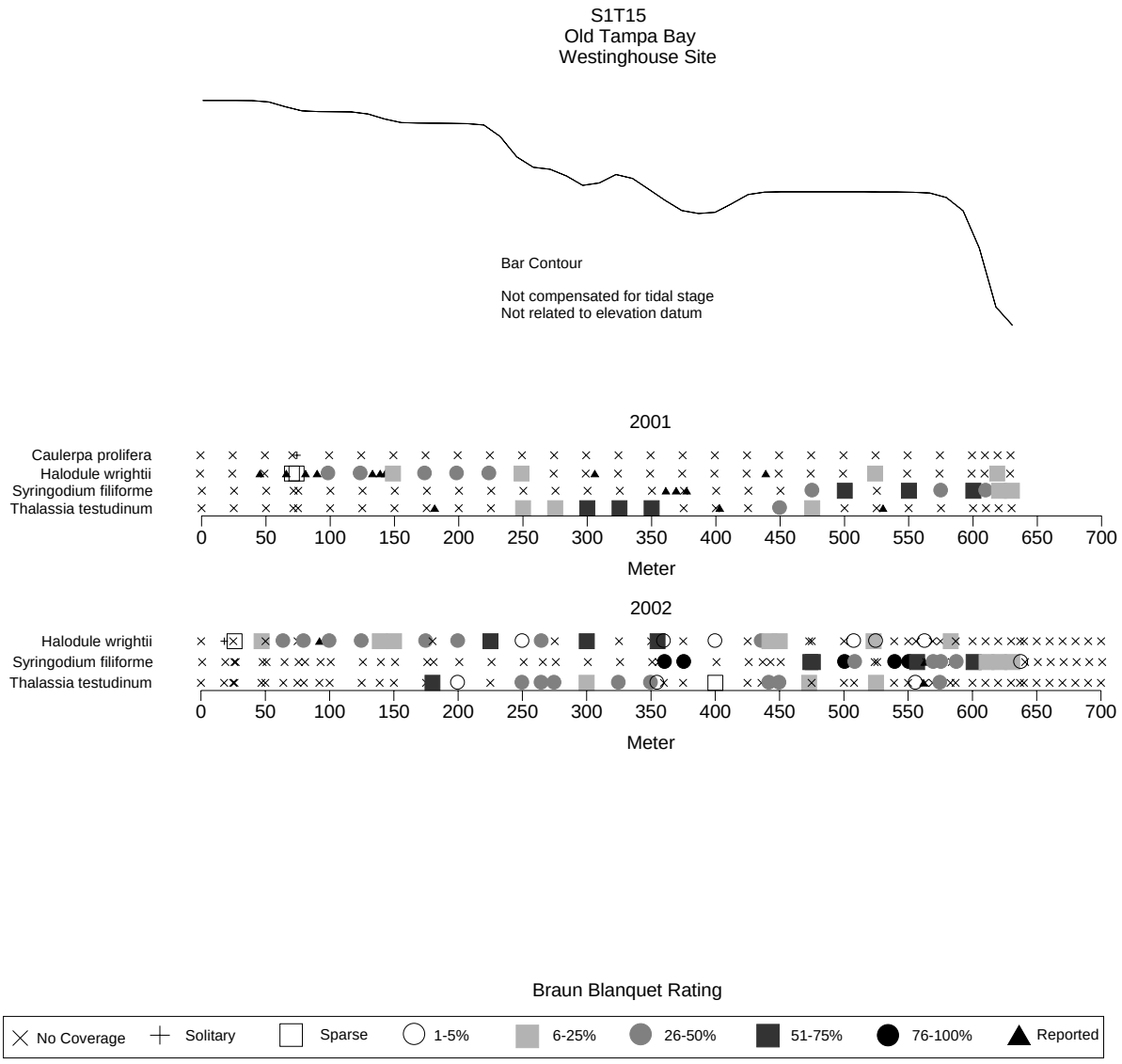

Figure 12. Seagrass species, abundance, and zonation at S1T15 from 2001-2002.

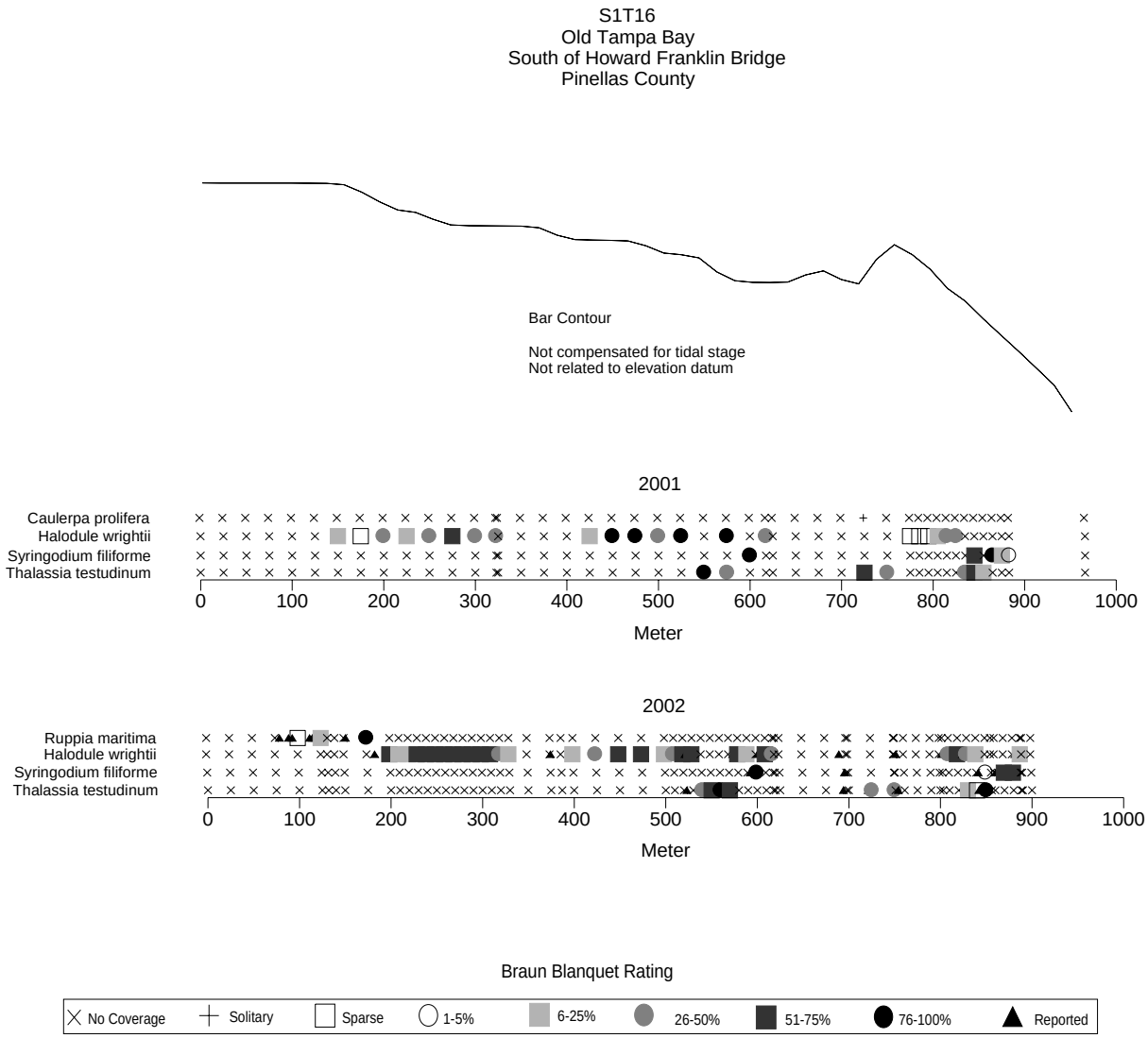

Figure 13. Seagrass species, abundance, and zonation at S1T16 from 2001-2002.

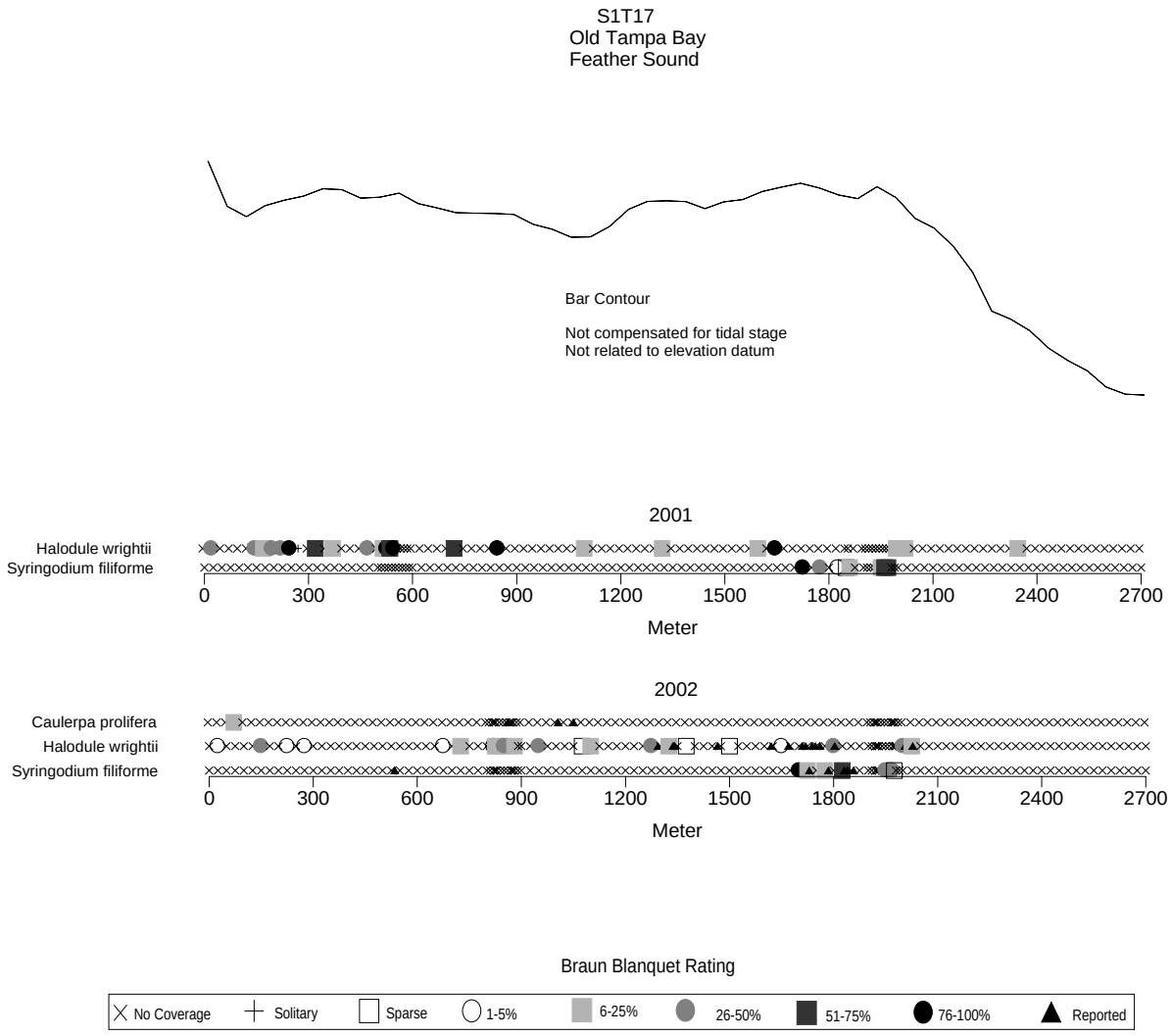

Figure 14. Seagrass species, abundance, and zonation at S1T17 from 2001-2002.

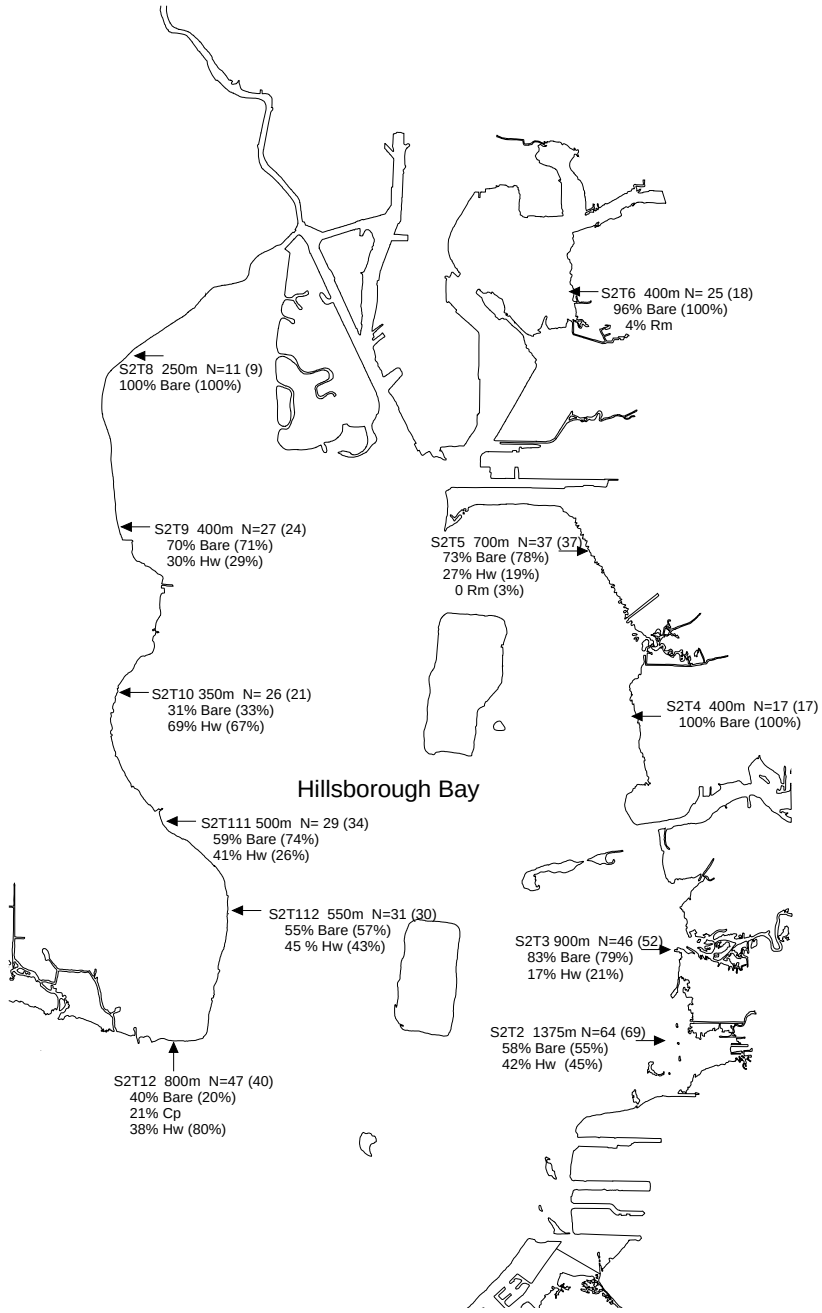

Figure 15. Name, location, length and percent of meter square placements containing each seagrass species along the 11 Hillsborough Bay seagrass monitoring transects in 2002. Results from 2001 in parentheses. N=number of meter square placements; He=*Halophila engelmanni*; Hw=*Halodule wrightii*; Rm=*Ruppia maritima*; Sf=*Syringodium filiforme*; Tt=*Thalassia testudinum*.

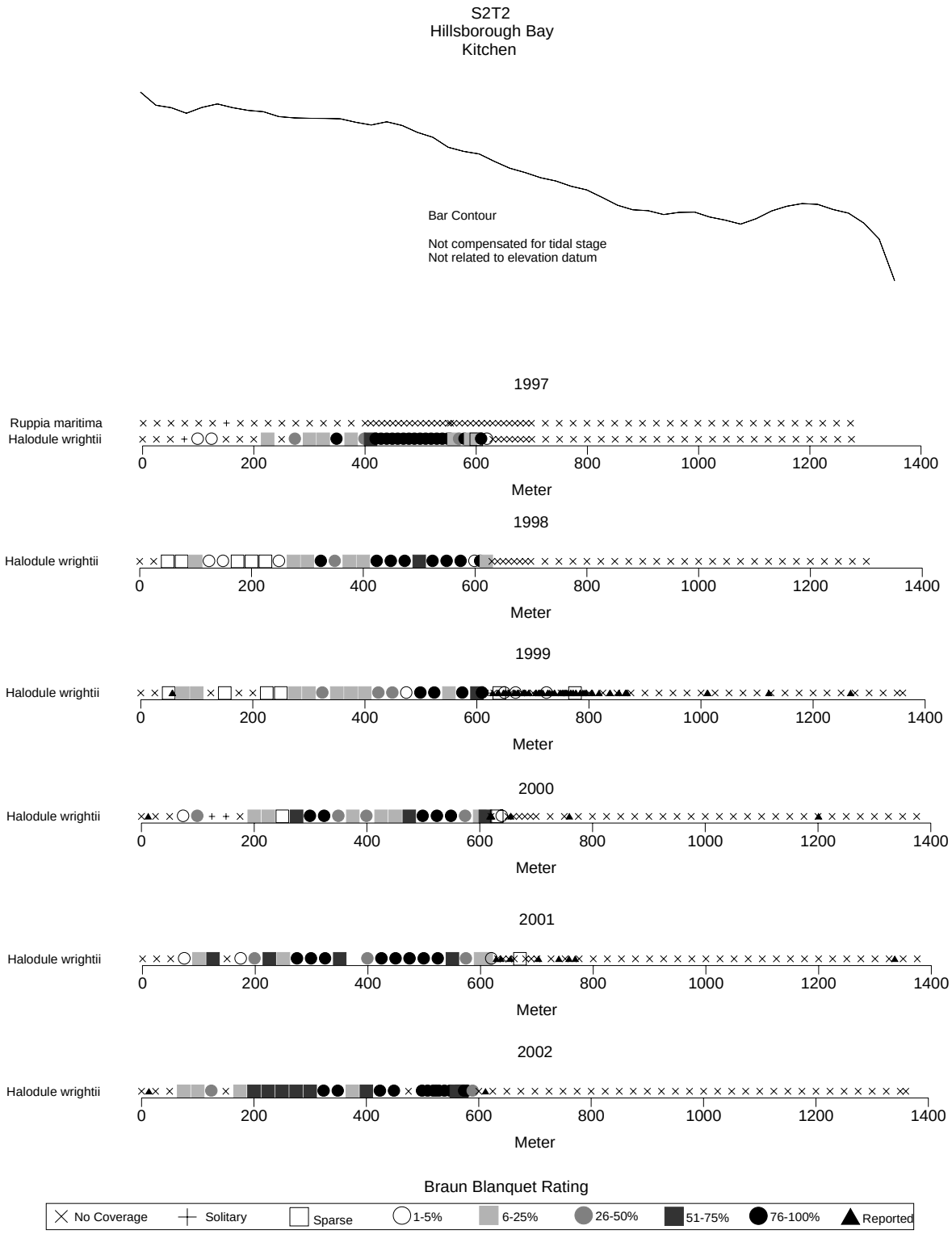

Figure 16. Seagrass species, abundance, and zonation at S2T2 from 1997-2002.

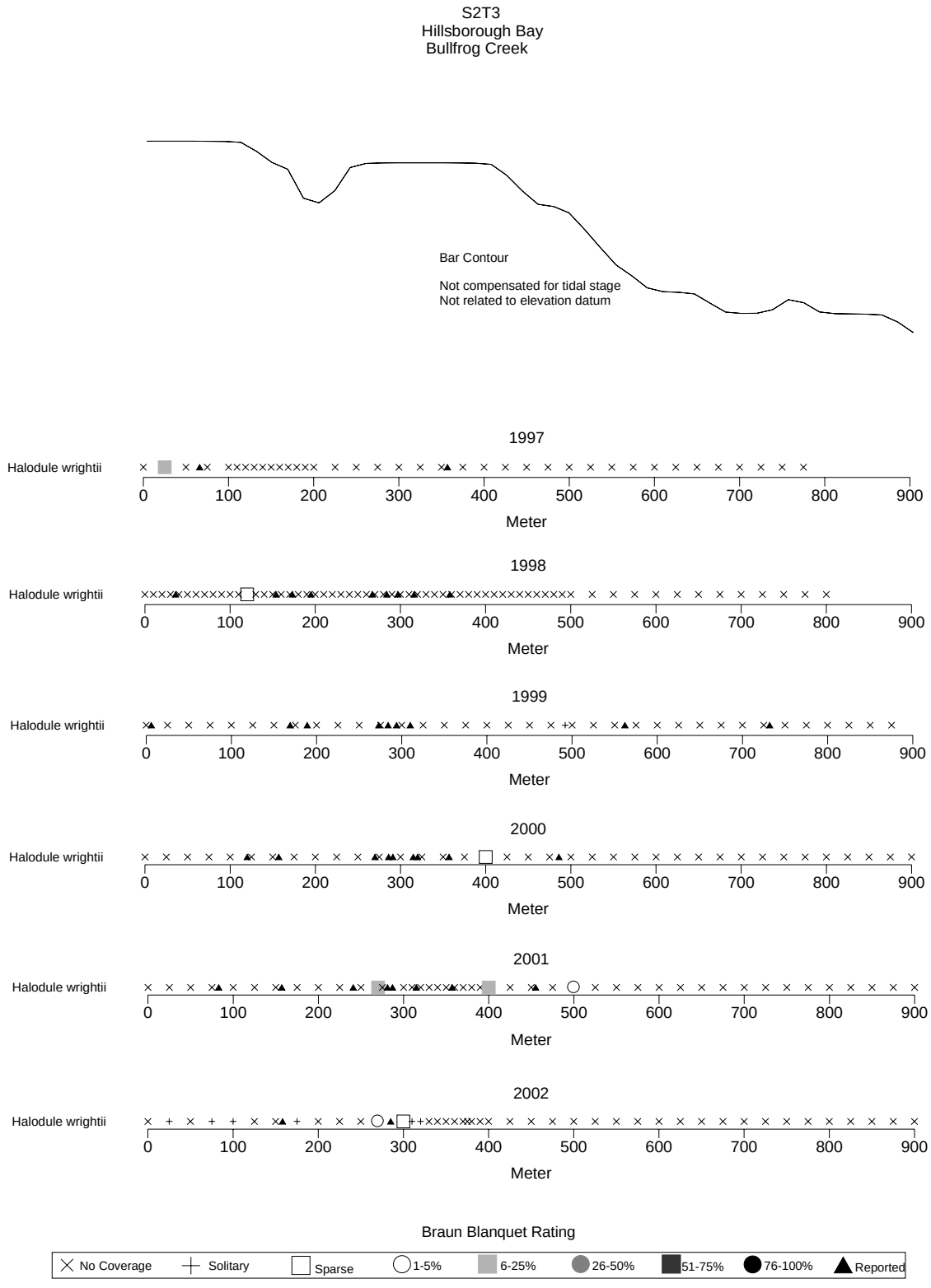

Figure 17. Seagrass species, abundance, and zonation at S2T3 from 1997-2002.

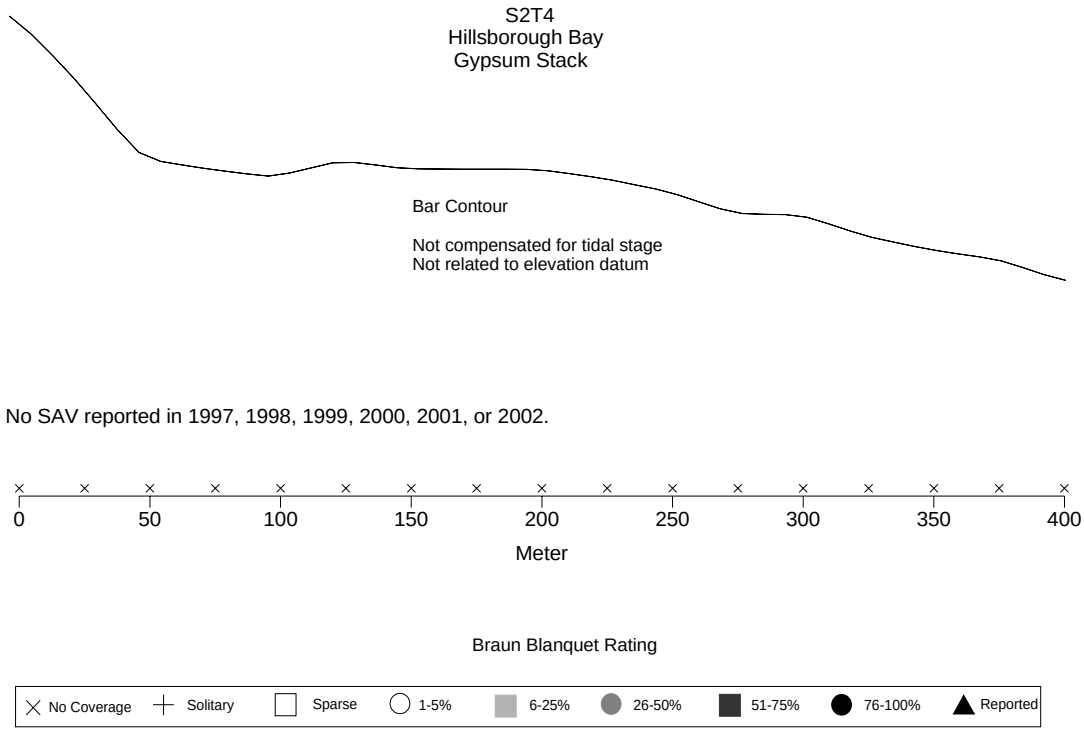

Figure 18. Seagrass species, abundance, and zonation at S2T4 from 1997-2002.

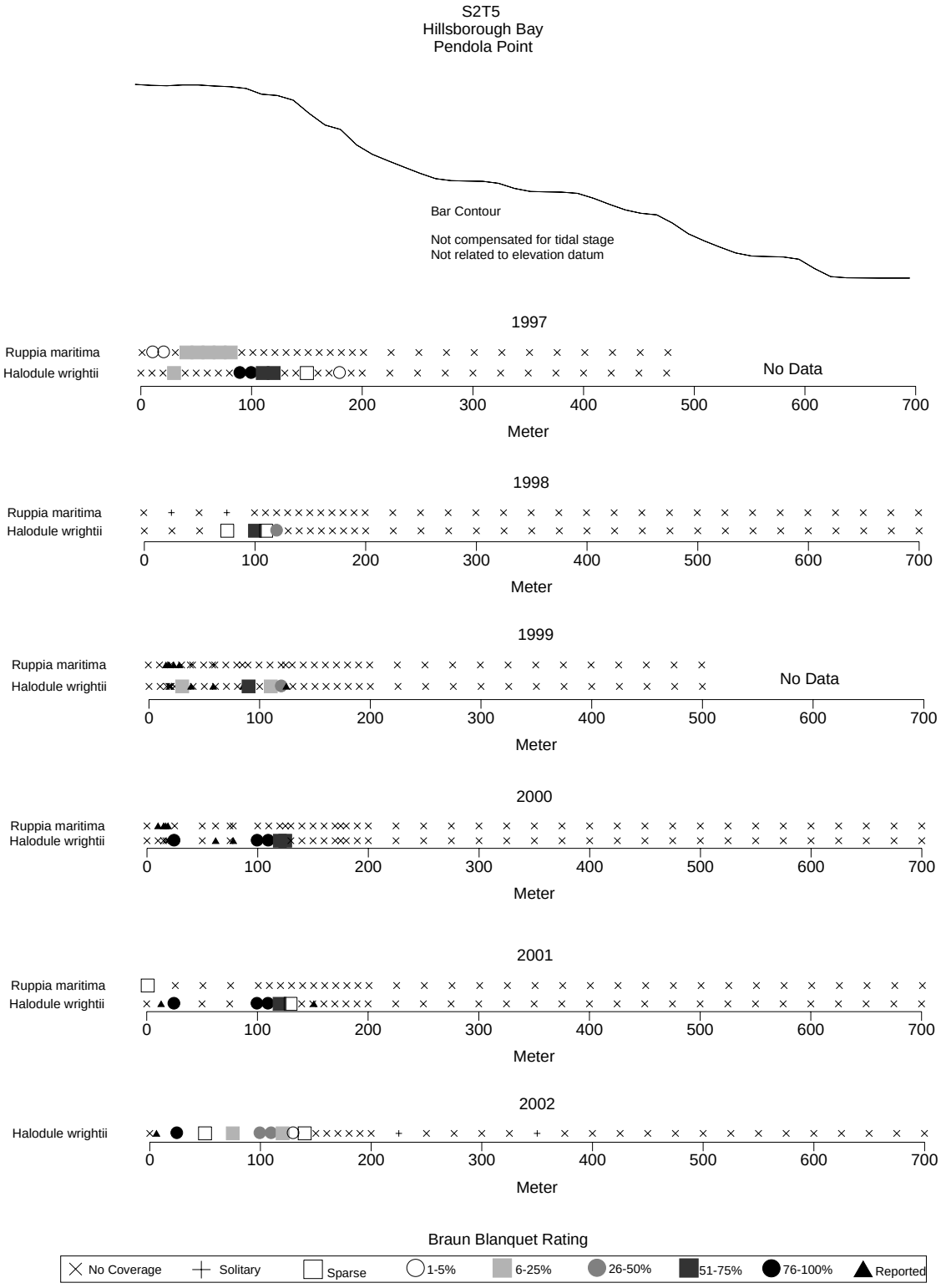

Figure 19. Seagrass species, abundance, and zonation at S2T5 from 1997-2002.

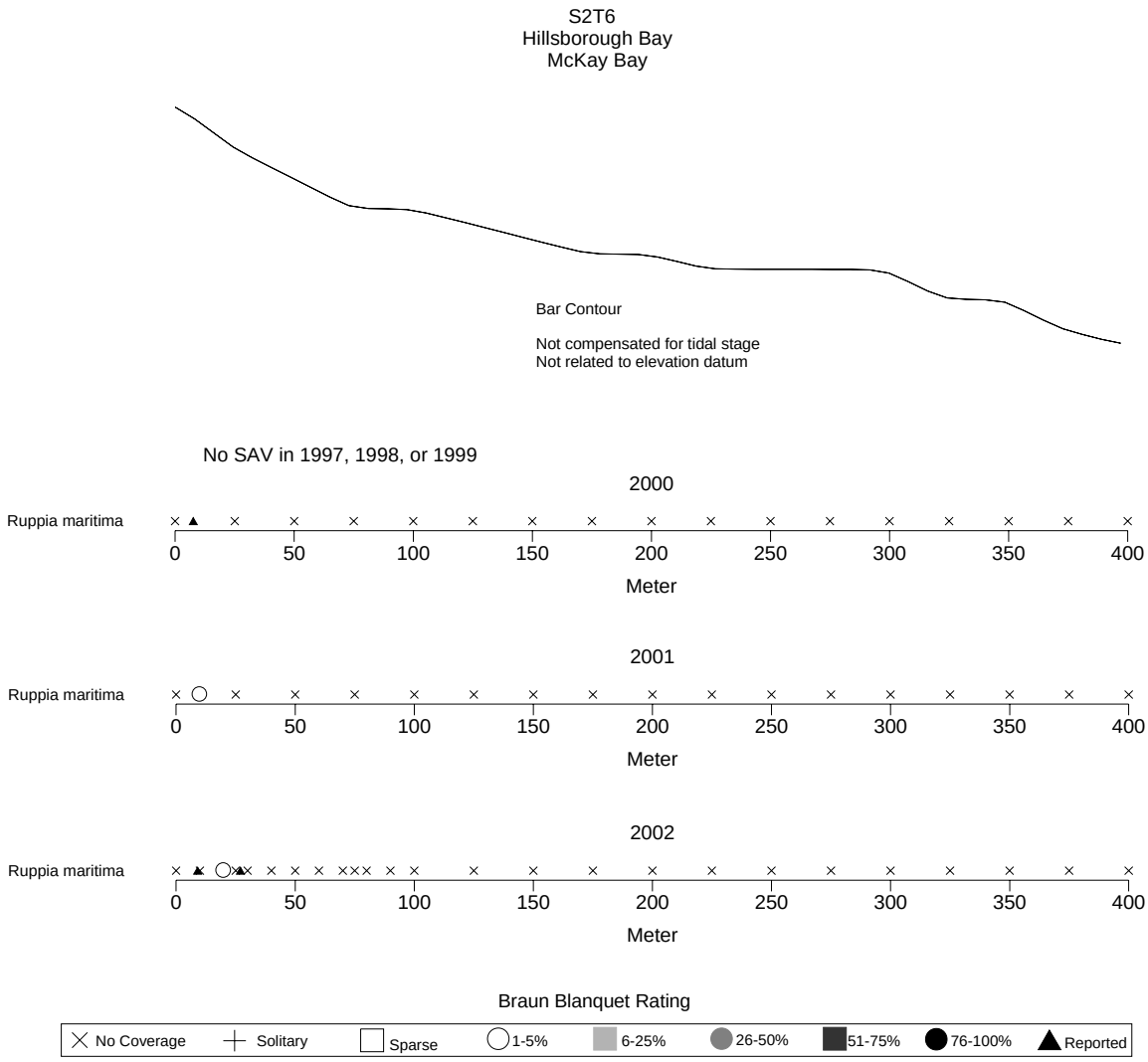

Figure 20. Seagrass species, abundance, and zonation at S2T6 from 1997-2002.

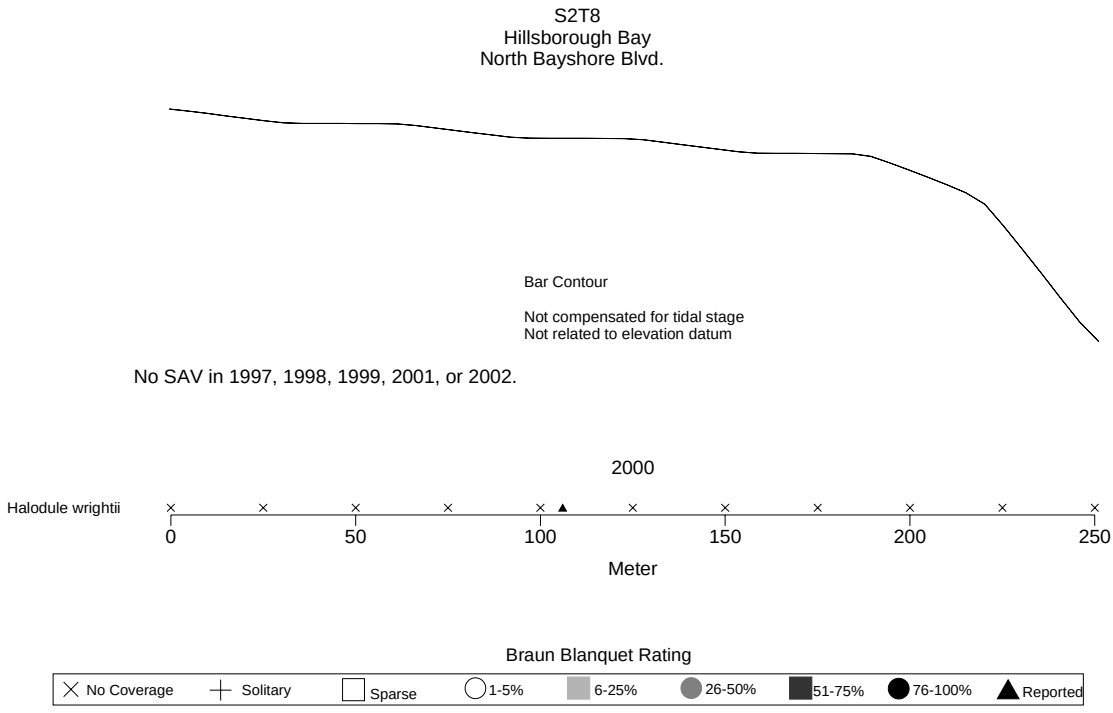

Figure 21. Seagrass species, abundance, and zonation at S2T8 from 1997-2002.

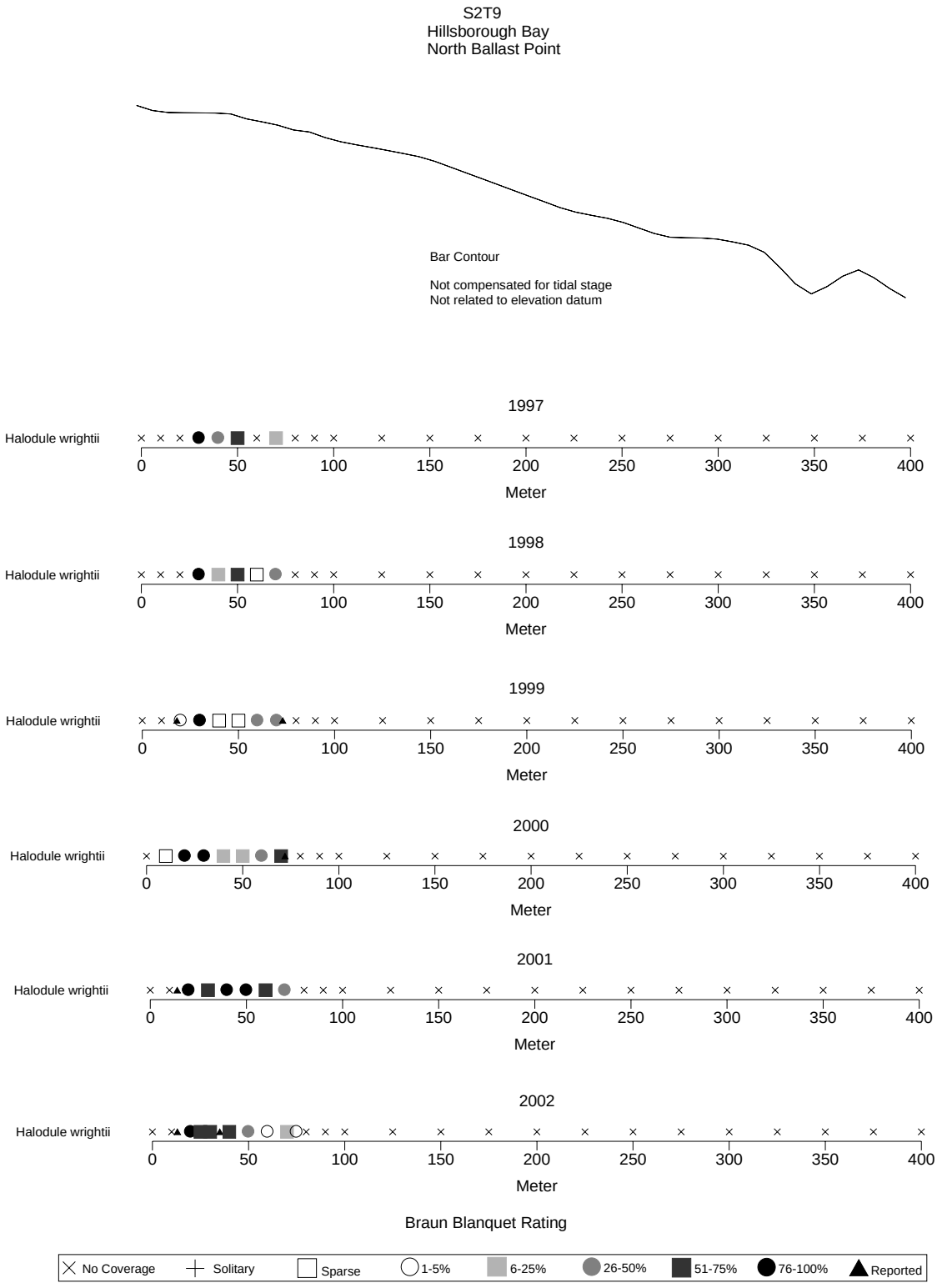

Figure 22. Seagrass species, abundance, and zonation at S2T9 from 1997-2002.

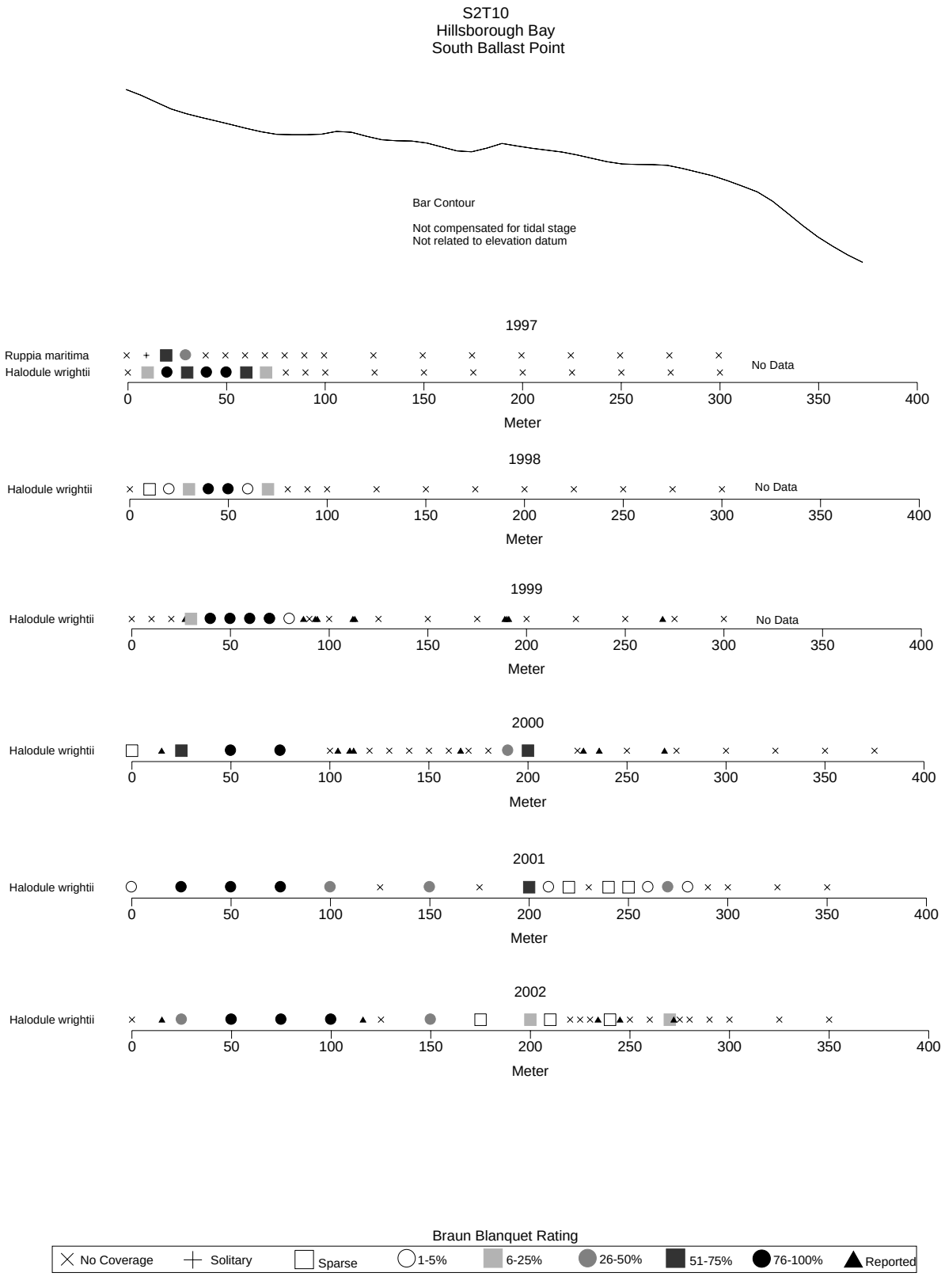

Figure 23. Seagrass species, abundance, and zonation at S2T10 from 1997-2002.

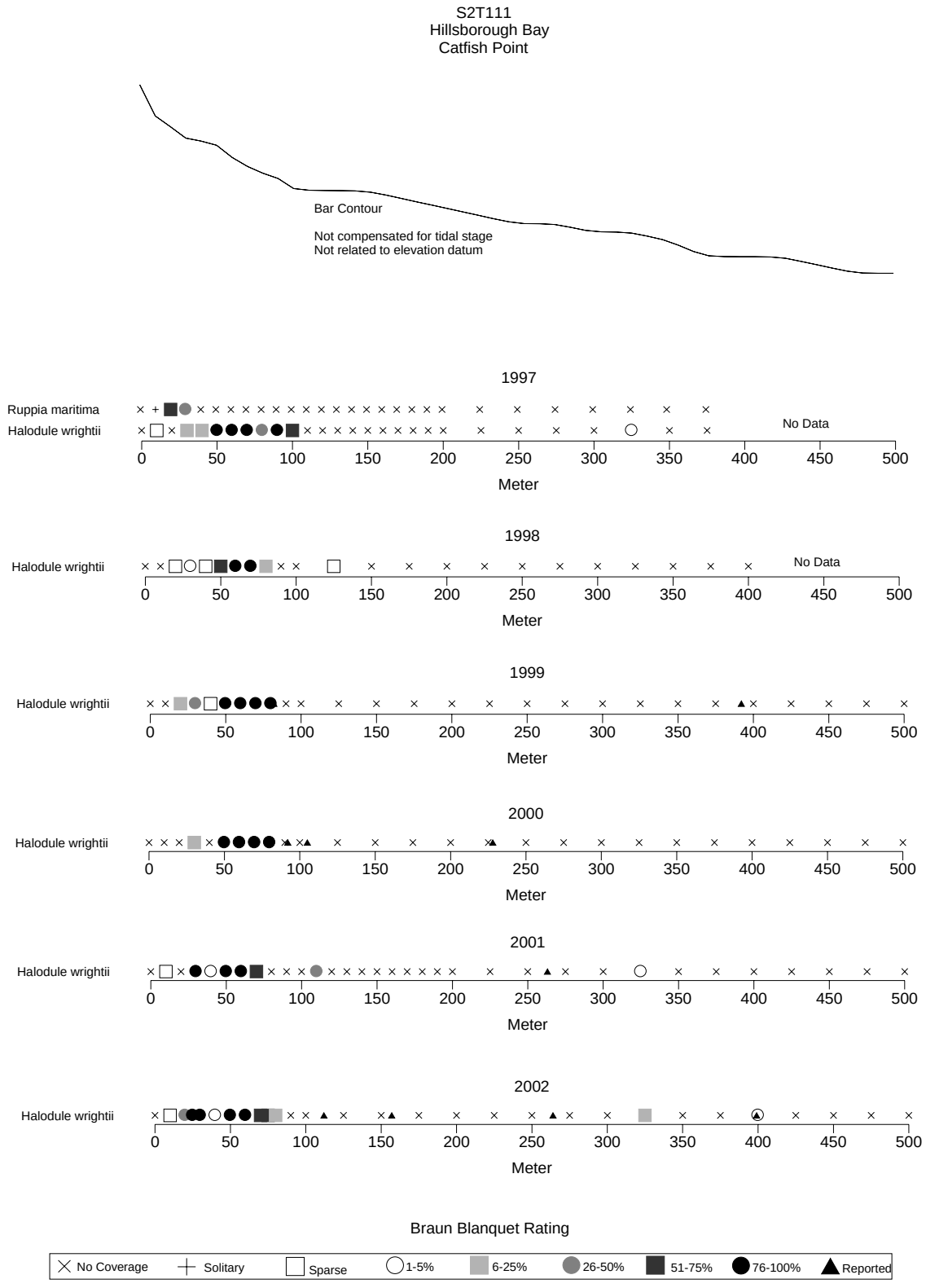

Figure 24. Seagrass species, abundance, and zonation at S2T111 from 1997-2002.

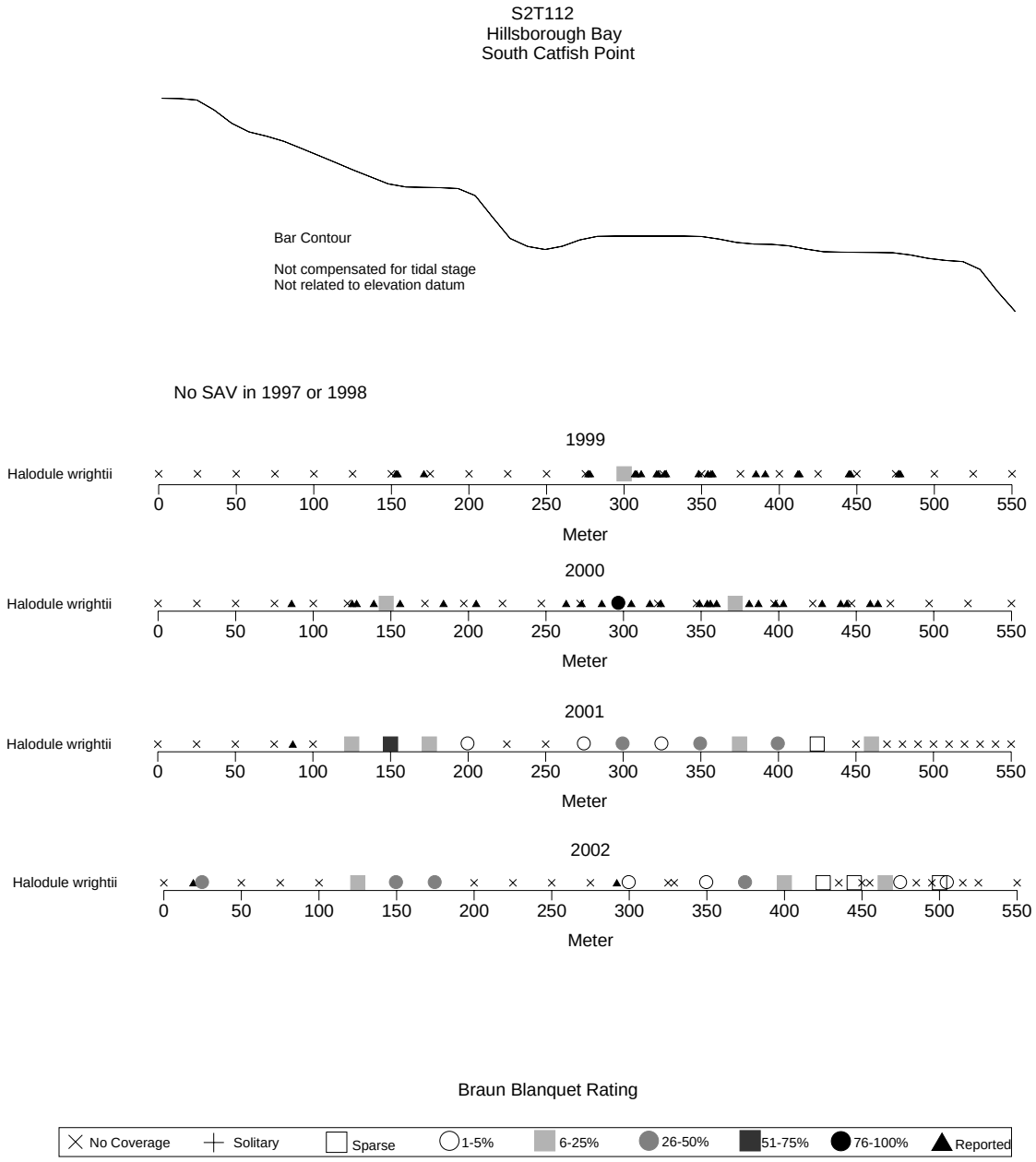

Figure 25. Seagrass species, abundance, and zonation at S2T112 from 1997-2002.

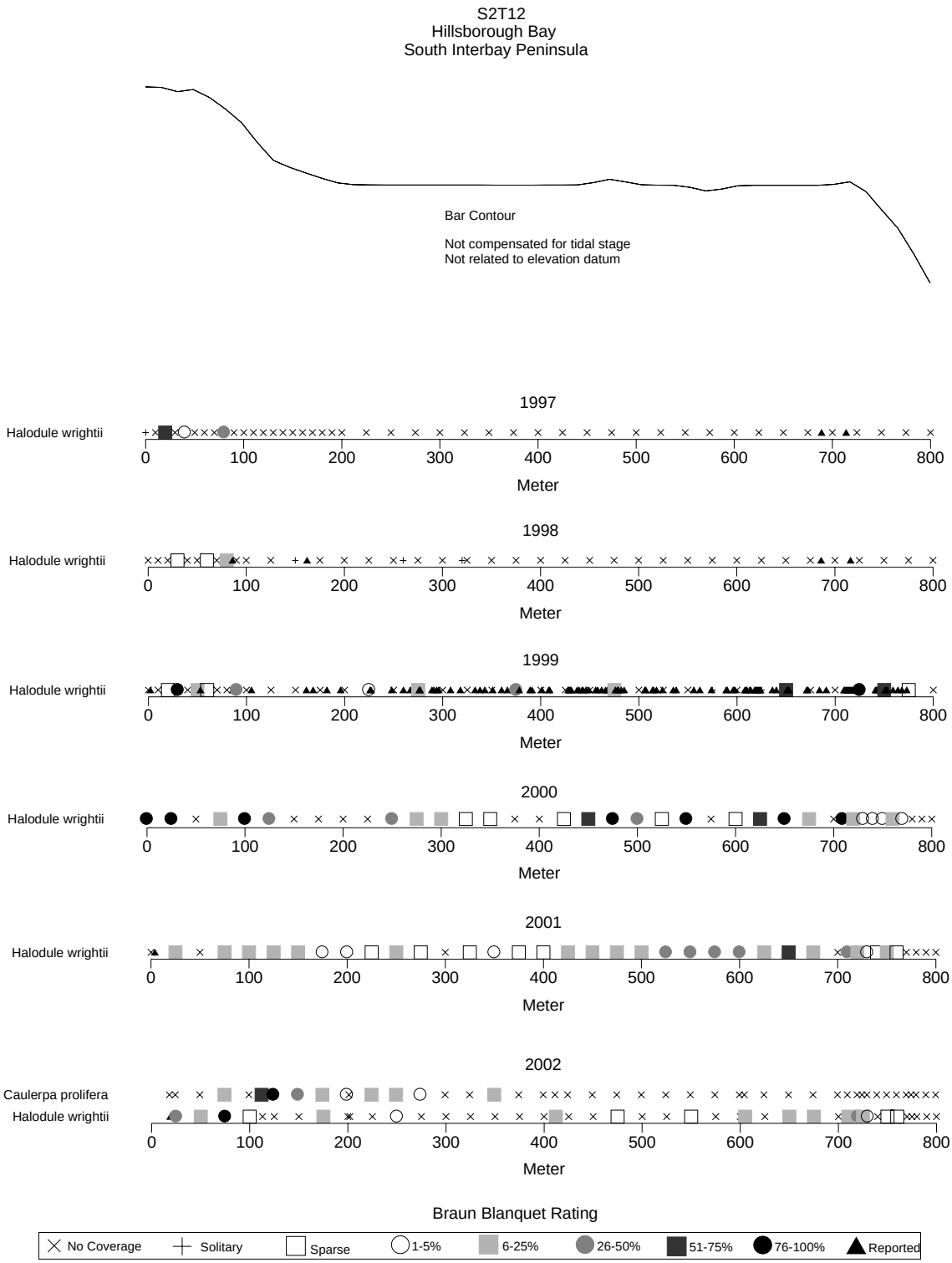

Figure 26. Seagrass species, abundance, and zonation at S2T12 from 1997-2002.

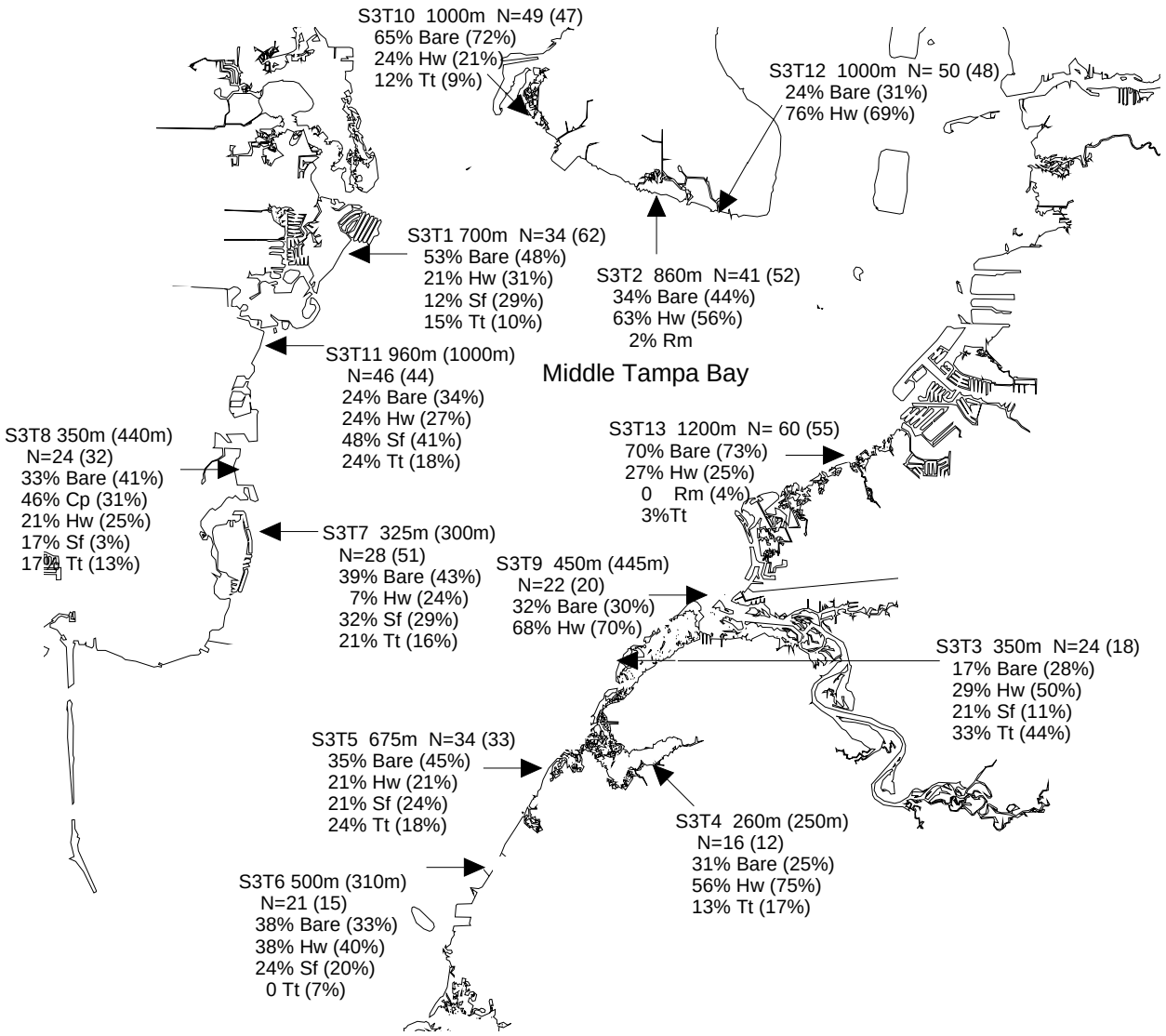

Figure 27. Name, location, length and percent of meter square placements containing each seagrass species along the 13 Middle Tampa Bay seagrass monitoring transects in 2002. Results from 2001 in parentheses. N=number of meter square placements; Hw=*Halodule wrightii*; Rm=*Ruppia maritima*; Sf=*Syringodium filiforme*; Tt=*Thalassia testudinum*.

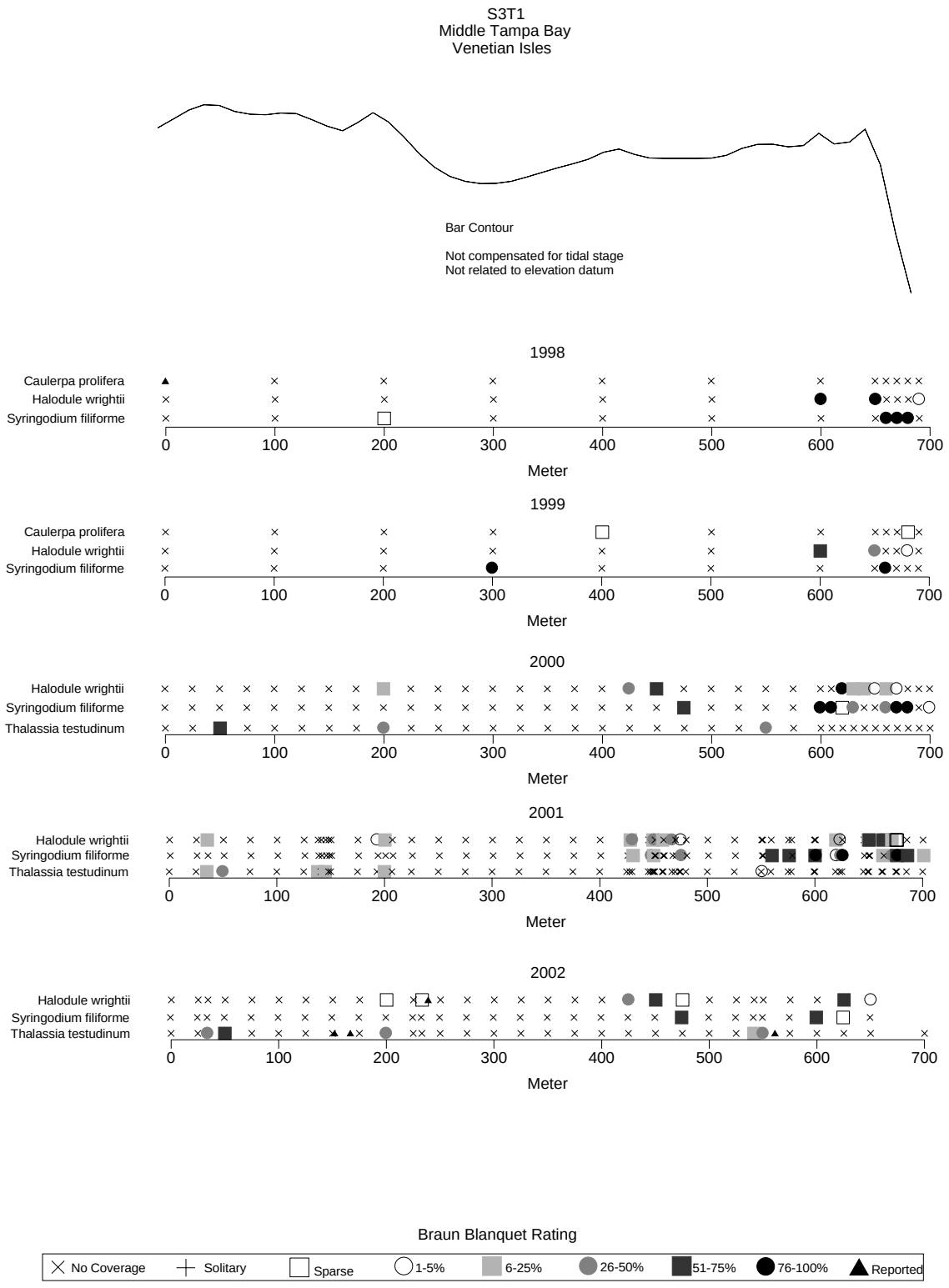

Figure 28. Seagrass species, abundance, and zonation at S3T1 from 1998-2002.

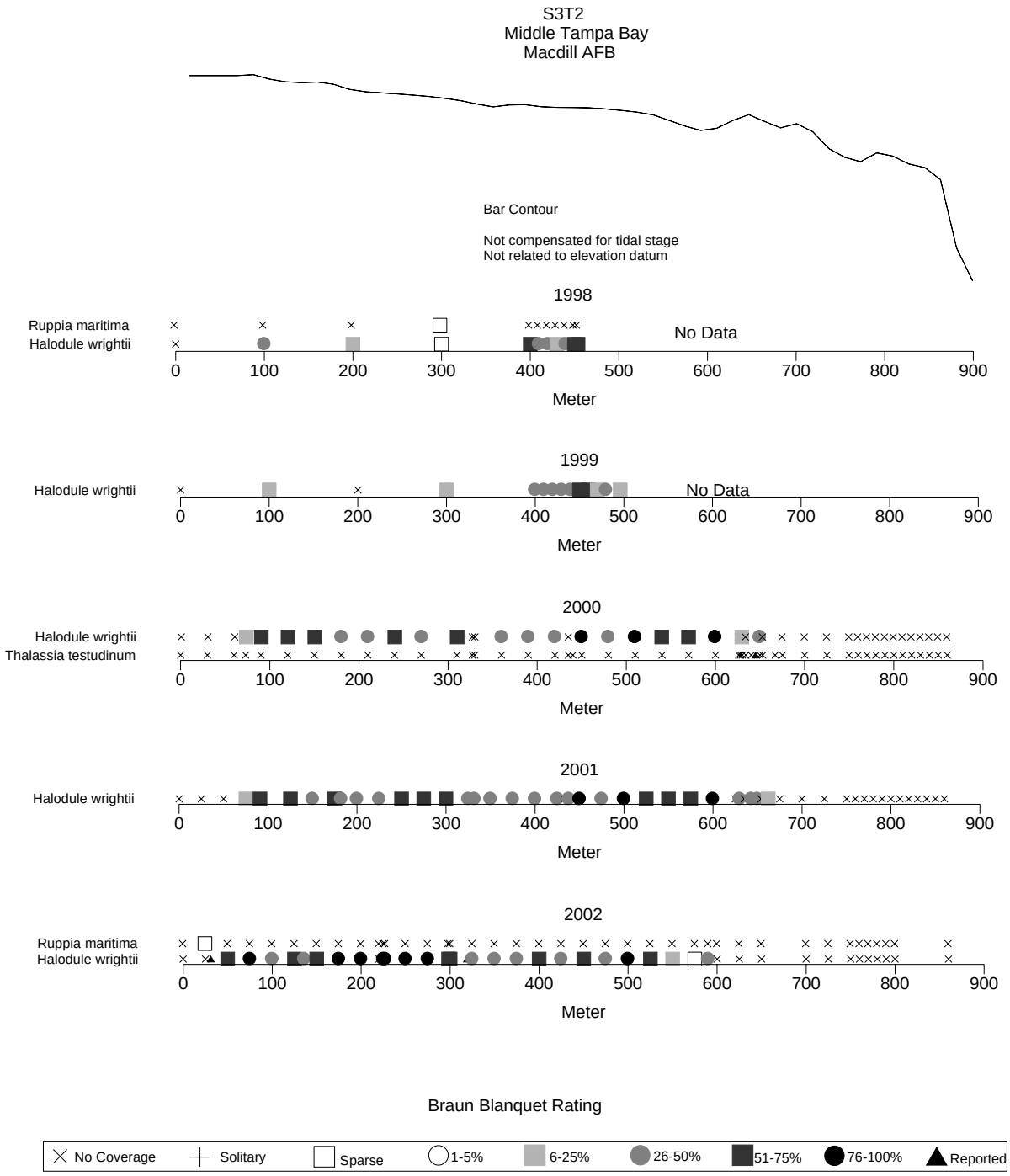

Figure 29. Seagrass species, abundance, and zonation at S3T2 from 1998-2002.

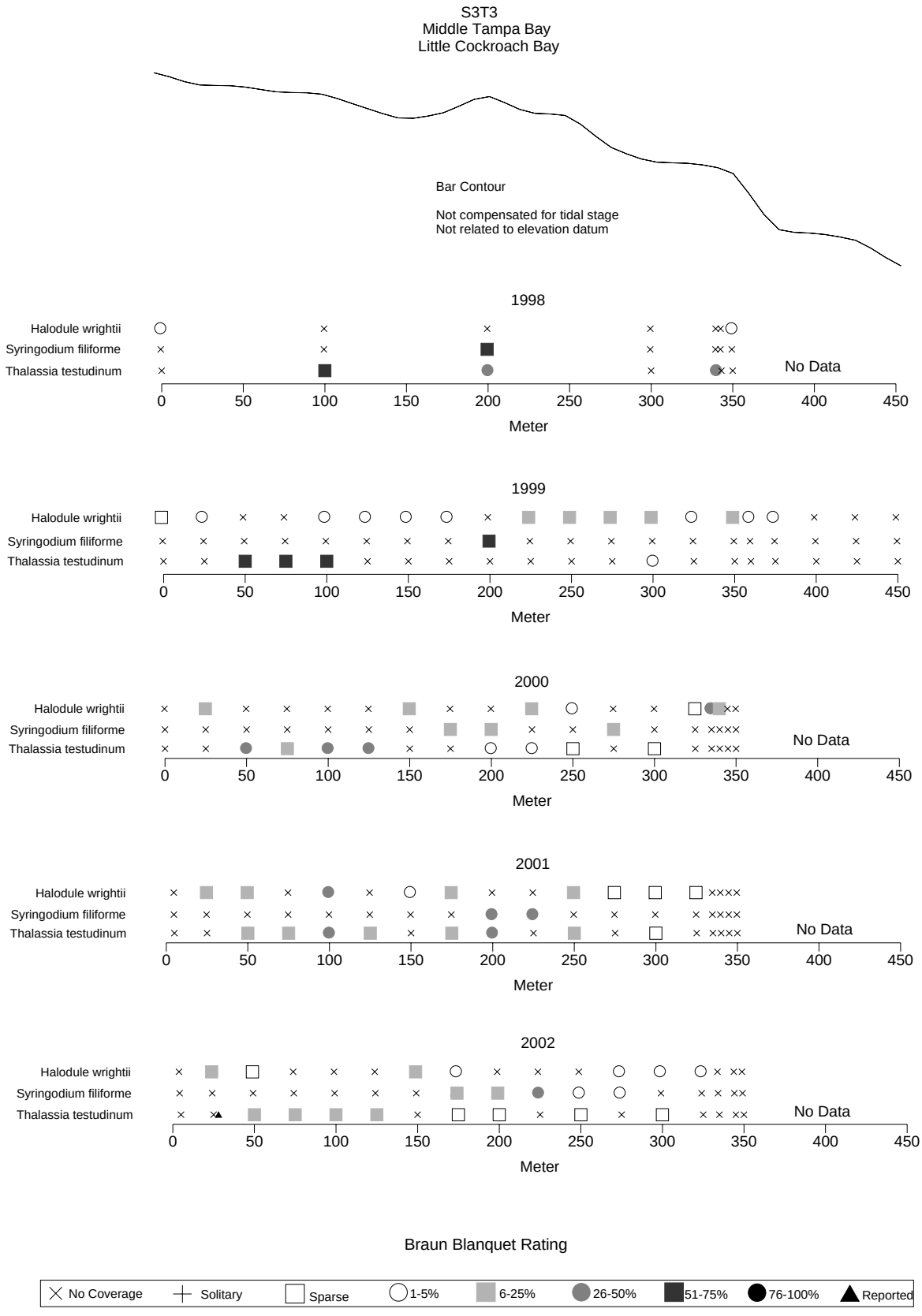

Figure 30. Seagrass species, abundance, and zonation at S3T3 from 1998-2002.

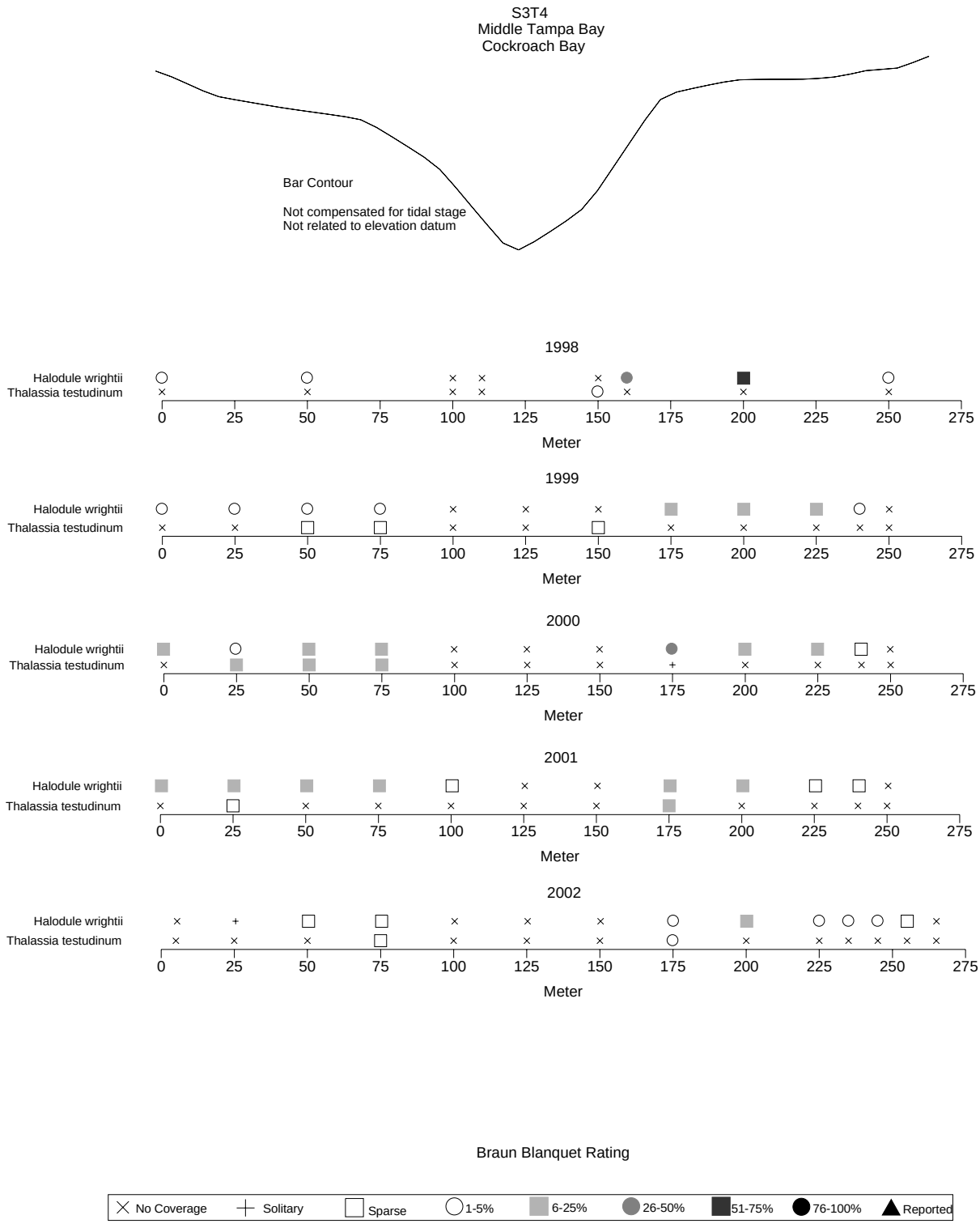

Figure 31. Seagrass species, abundance, and zonation at S3T4 from 1998-2002.

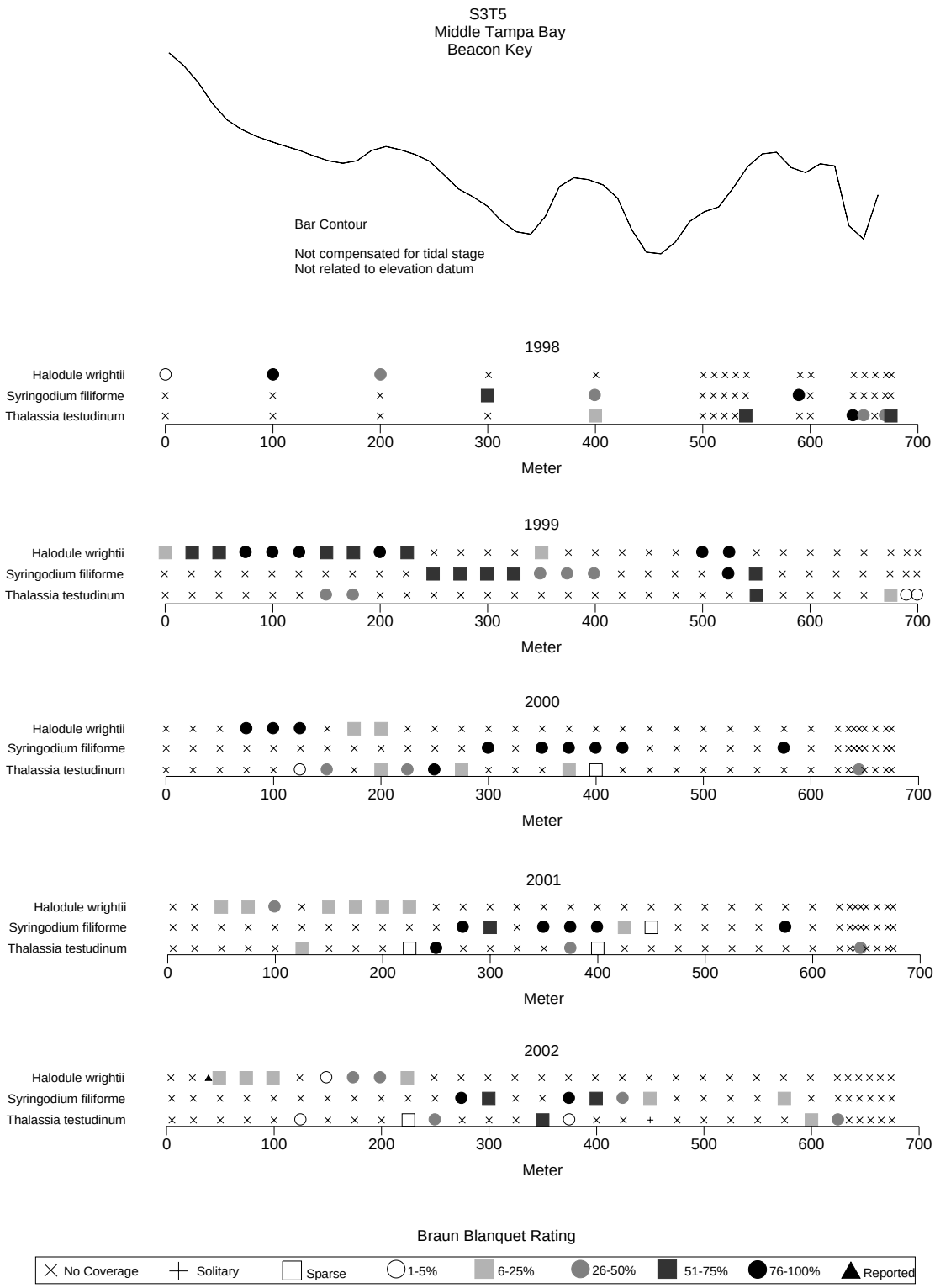

Figure 32. Seagrass species, abundance, and zonation at S3T5 from 1998-2002.

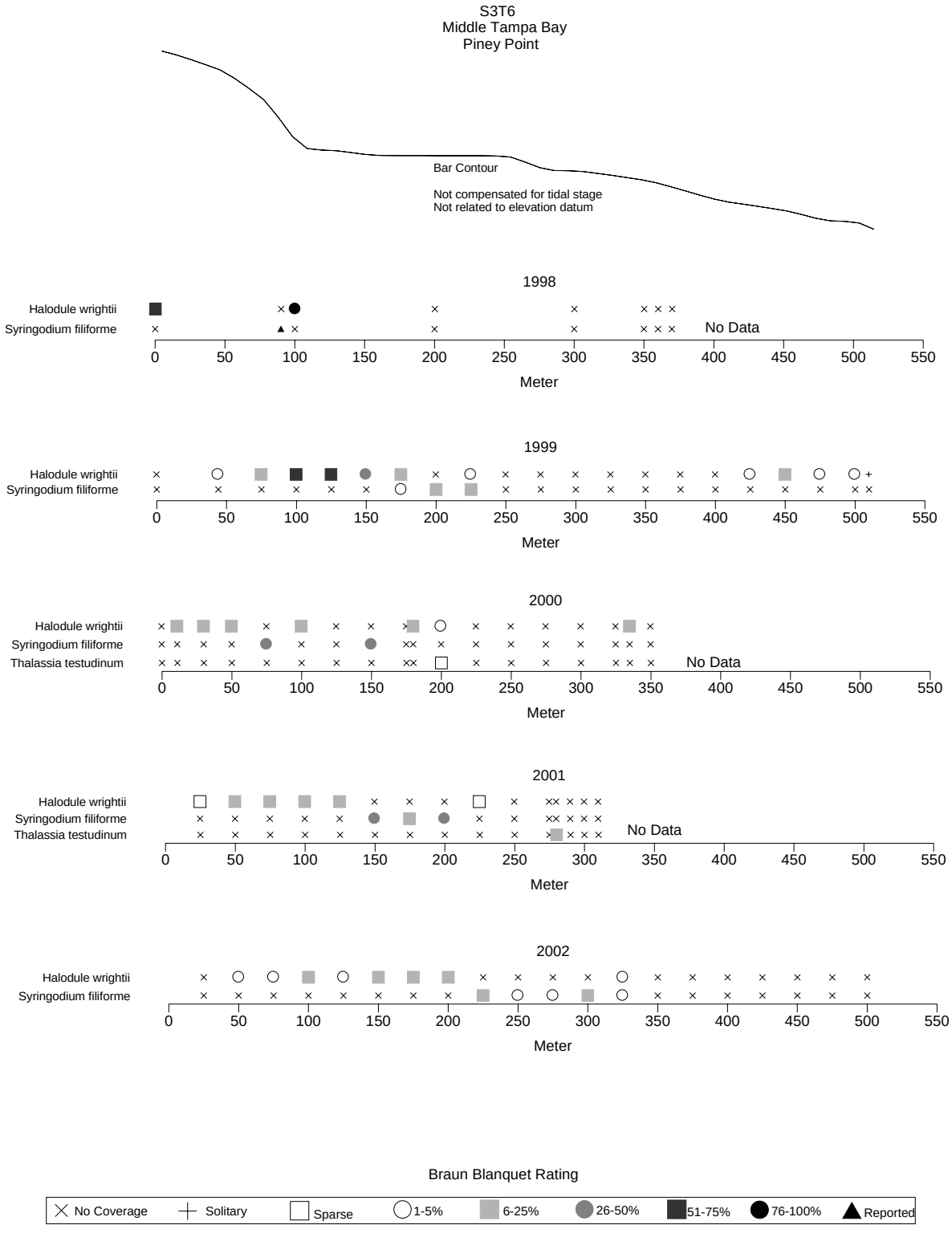

Figure 33. Seagrass species, abundance, and zonation at S3T6 from 1998-2002.

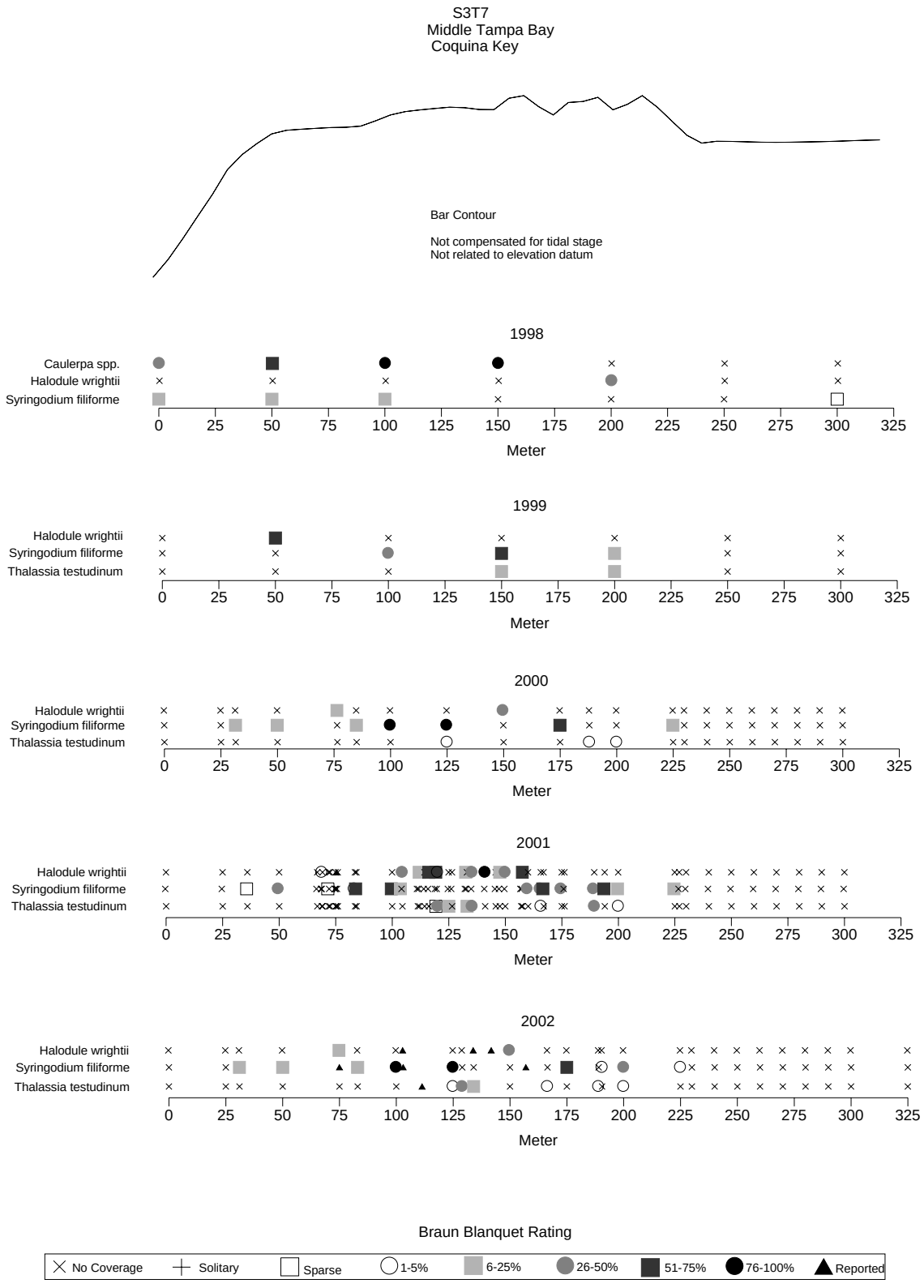

Figure 34. Seagrass species, abundance, and zonation at S3T7 from 1998-2002.

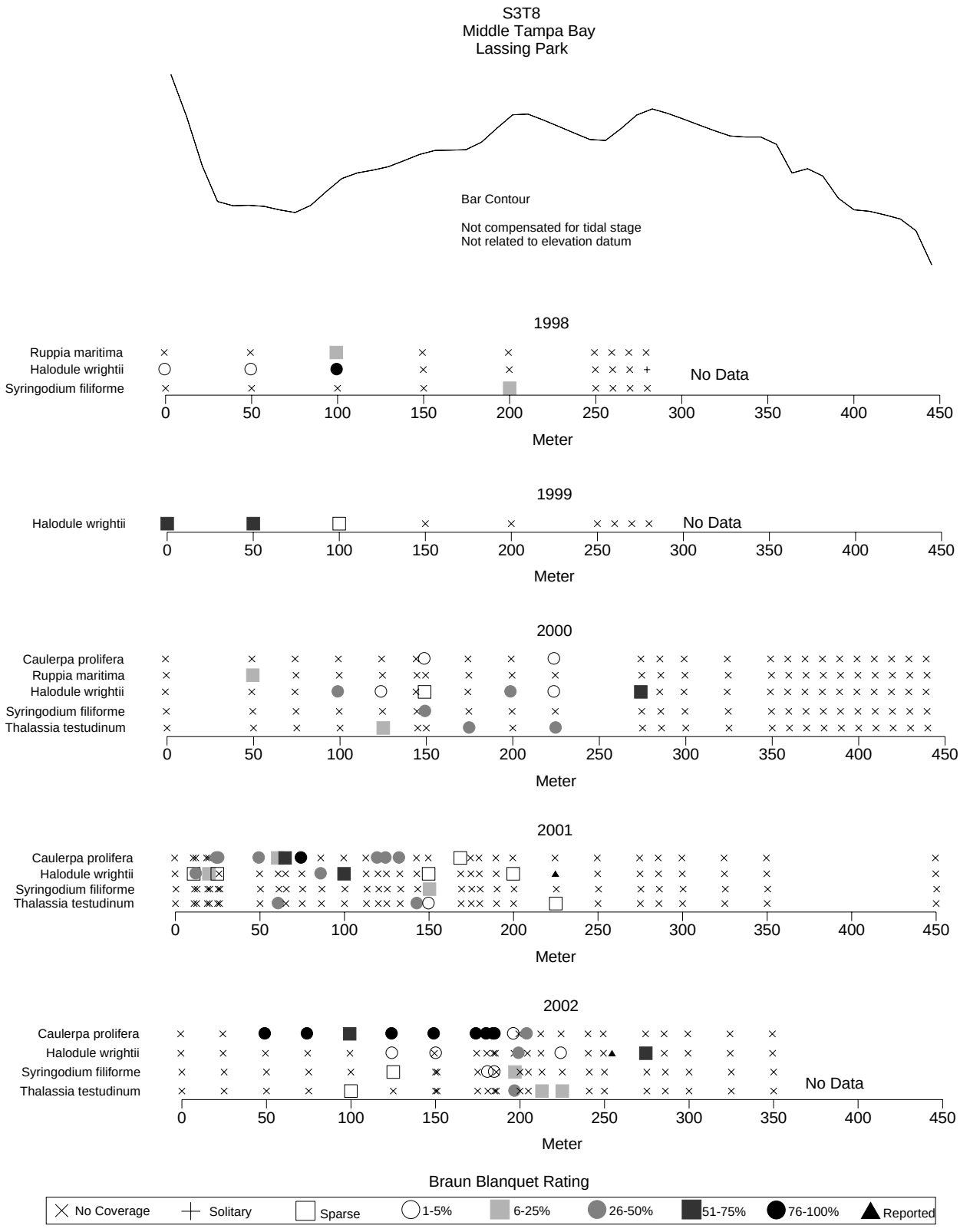

Figure 35. Seagrass species, abundance, and zonation at S3T8 from 1998-2002.

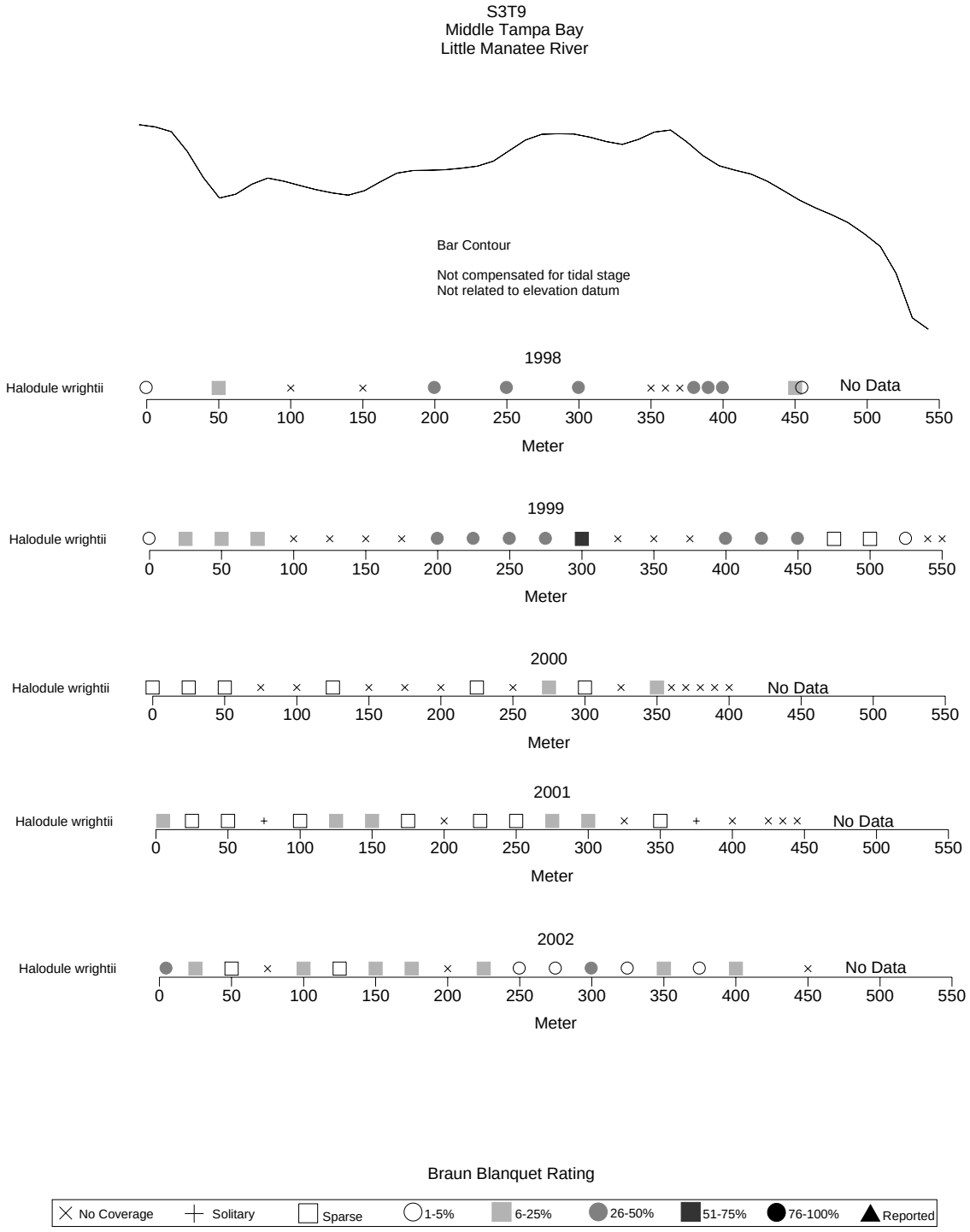

Figure 36. Seagrass species, abundance, and zonation at S3T9 from 1998-2002.

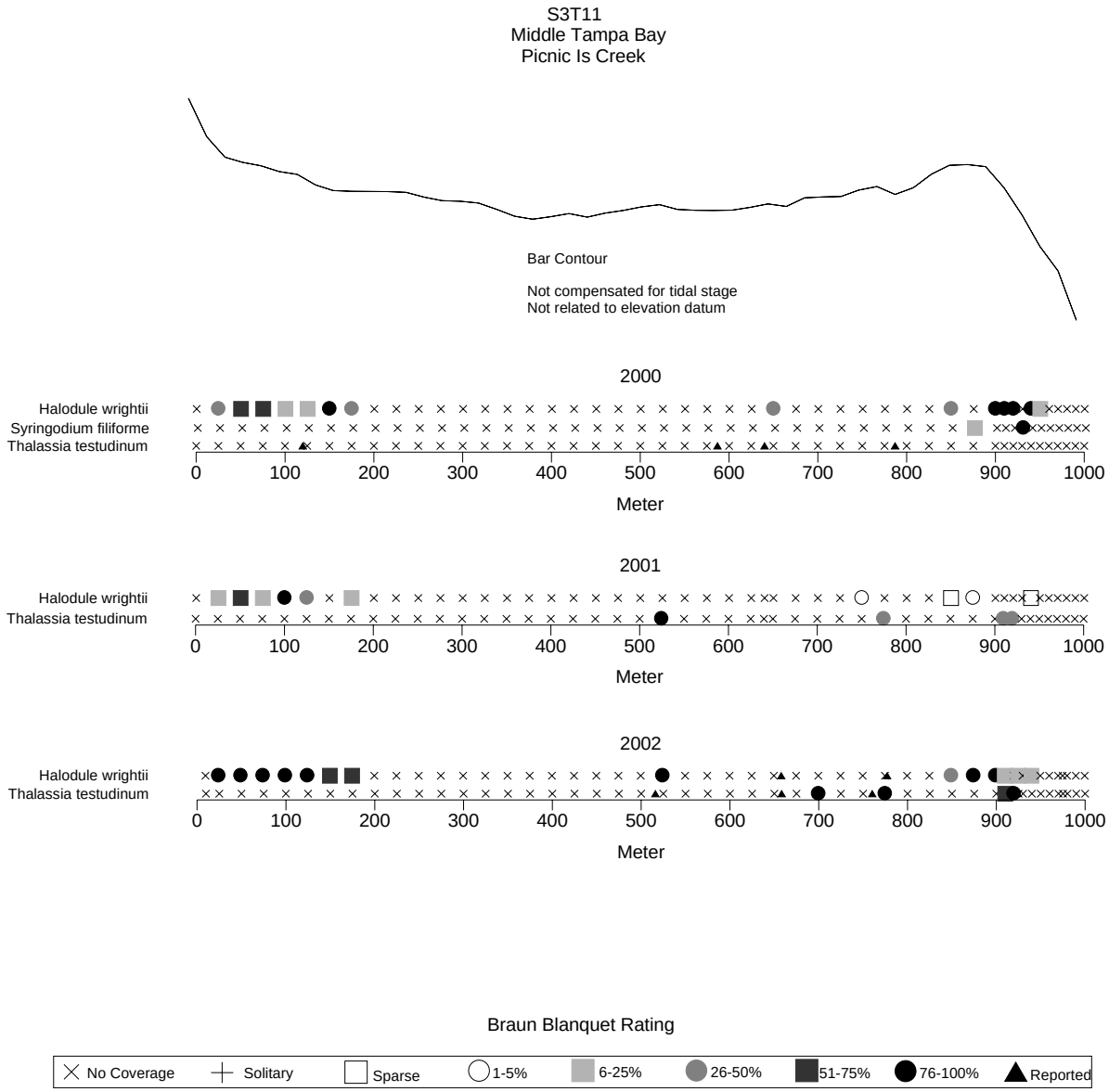

Figure 37. Seagrass species, abundance, and zonation at S3T10 from 2000-2002.

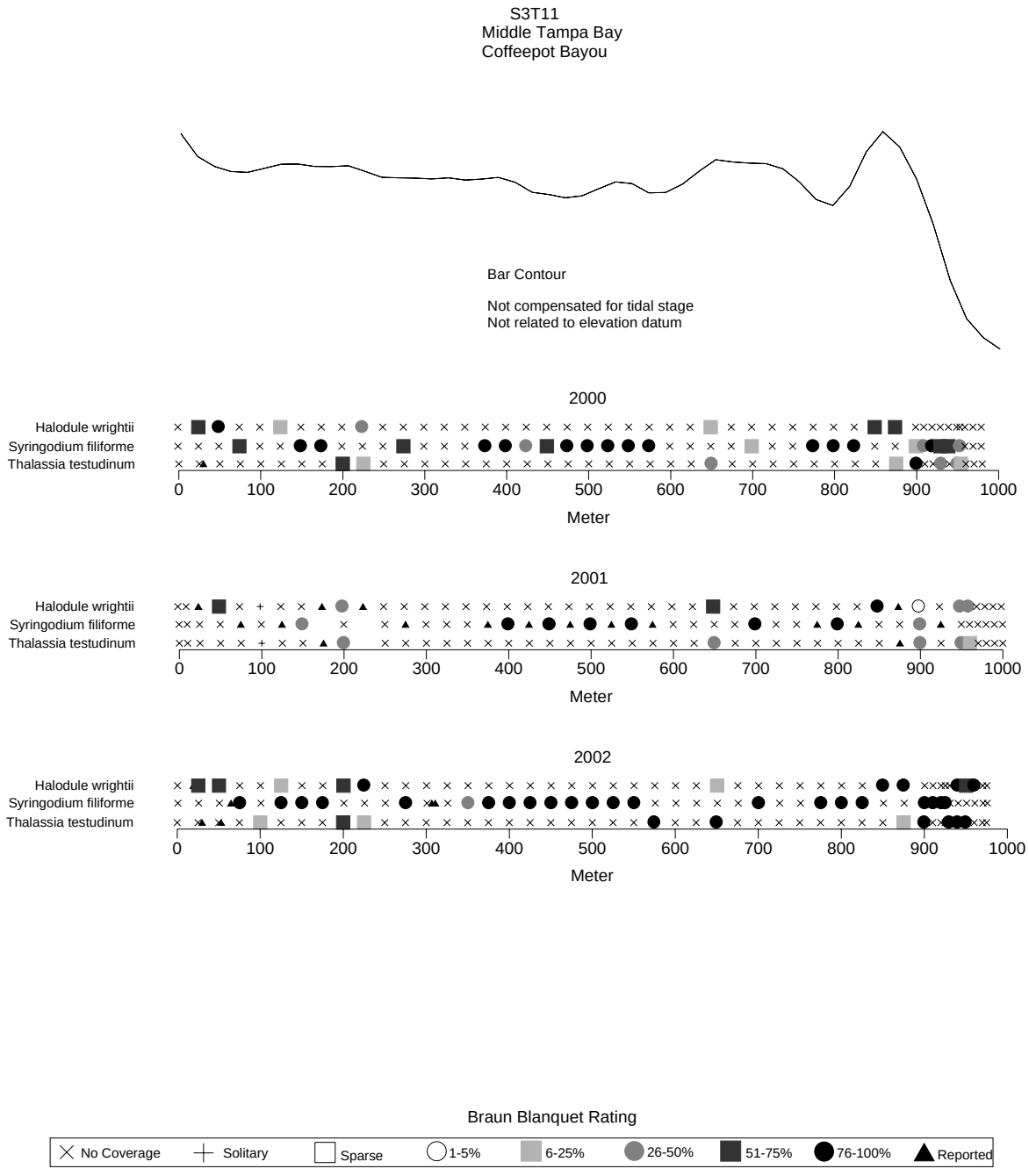

Figure 38. Seagrass species, abundance, and zonation at S3T11 from 2000-2002.

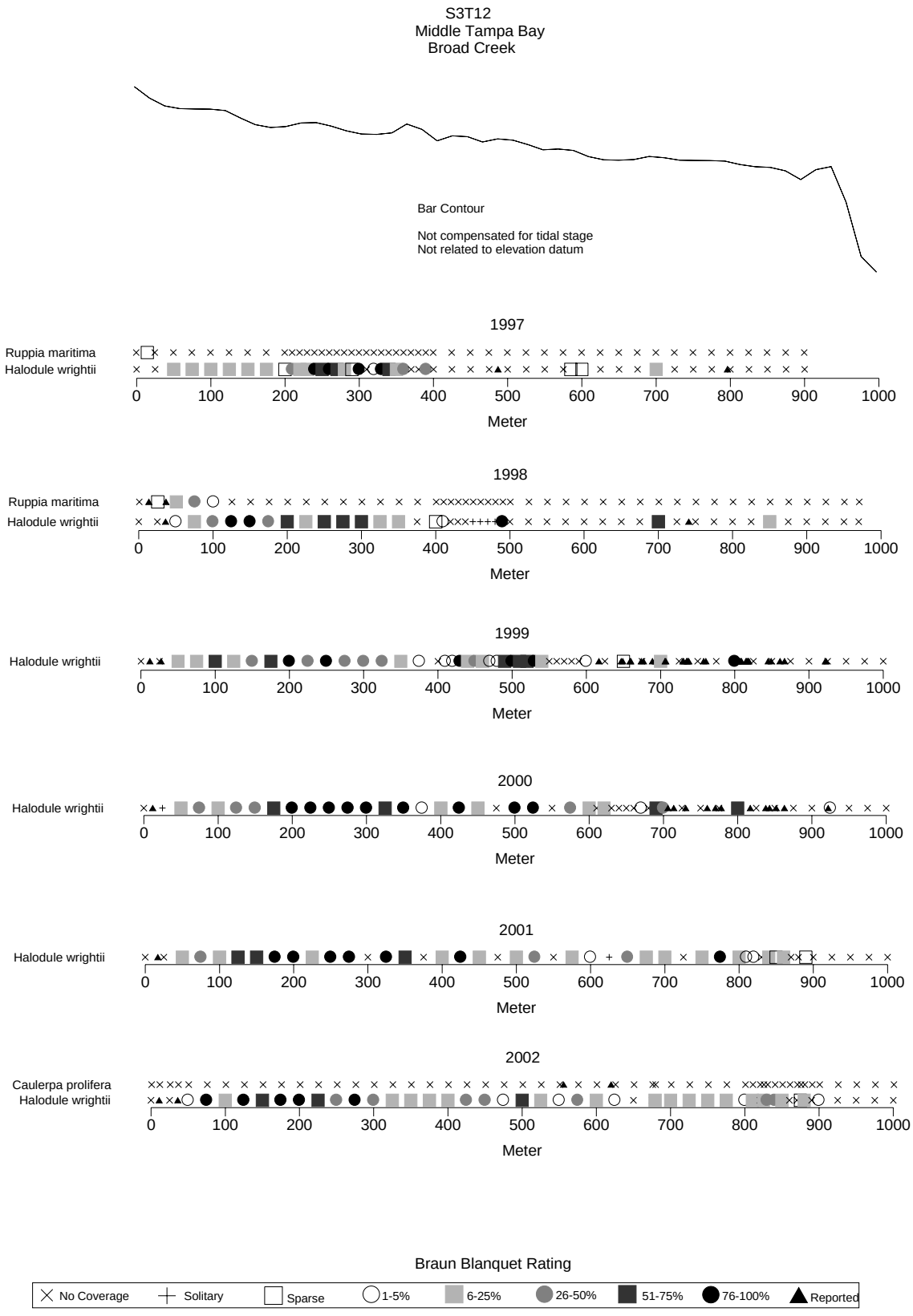

Figure 39. Seagrass species, abundance, and zonation at S3T12 from 1997-2002.

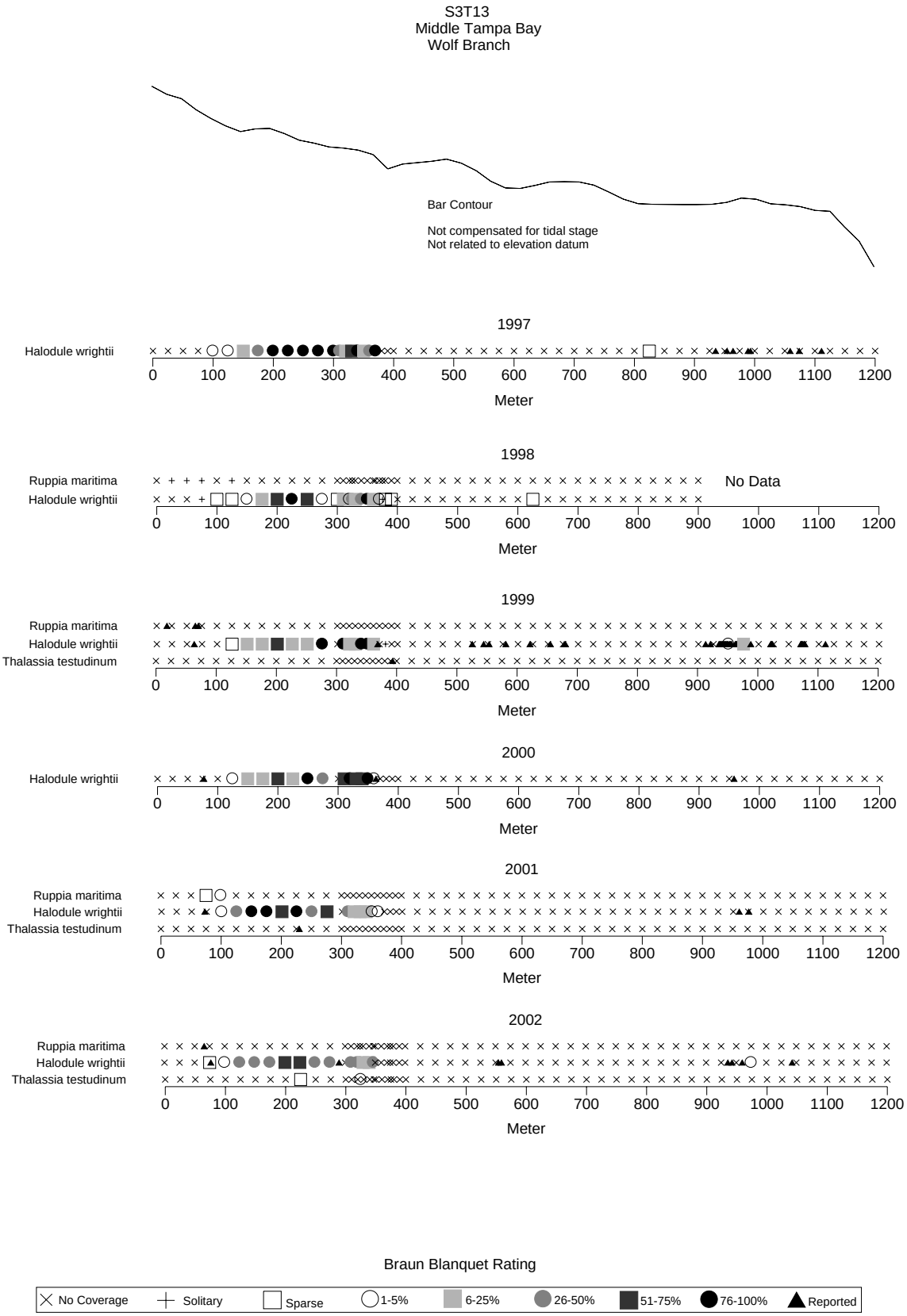

Figure 40. Seagrass species, abundance, and zonation at S3T13 from 1997-2002.

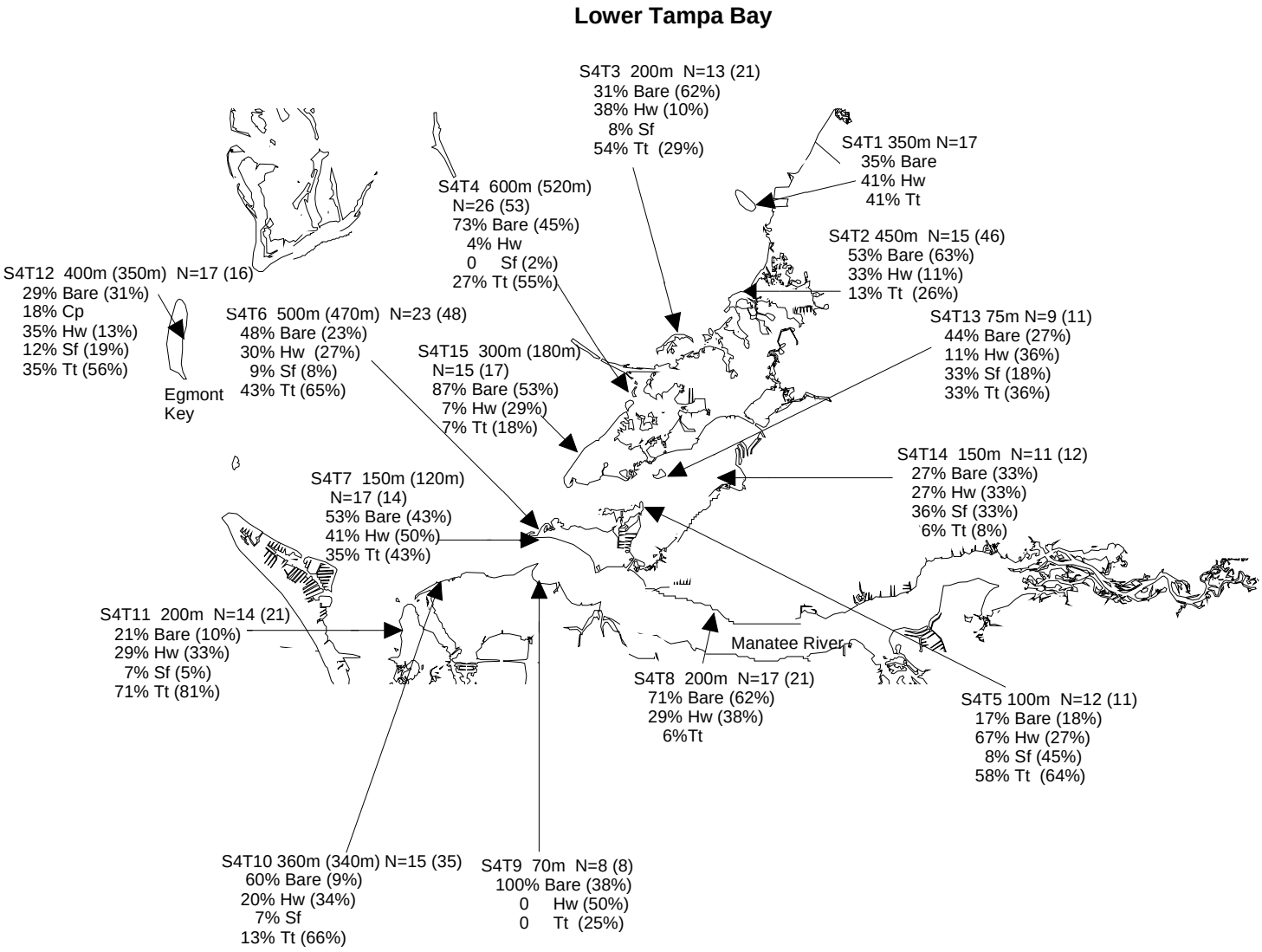

Figure 41. Name, location, length and percent of meter square placements containing each seagrass species along the 14 Lower Tampa Bay seagrass monitoring transects in 2002. Results from 2001 in parentheses. N=number of meter square placements; Hw=*Halodule wrightii*; Rm=*Ruppia maritima*; Sf=*Syringodium filiforme*; Tt=*Thalassia testudinum*.

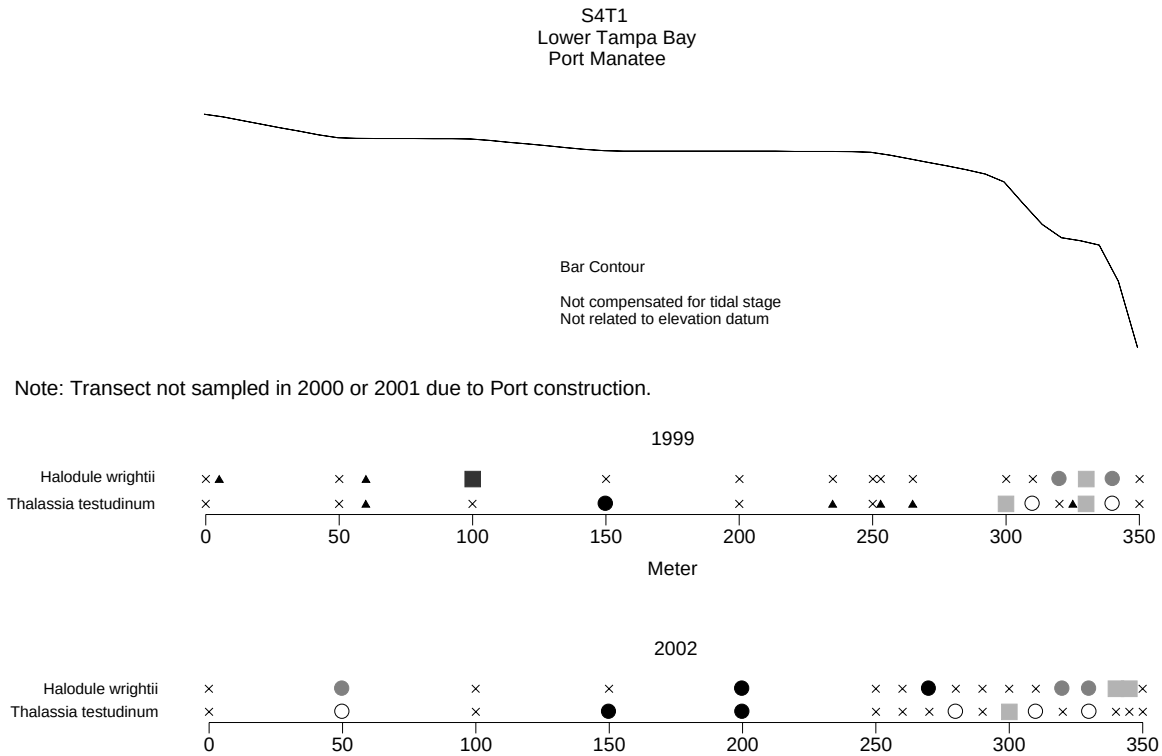

Figure 42. Seagrass species, abundance, and zonation at S4T1 for 1999 and 2002.

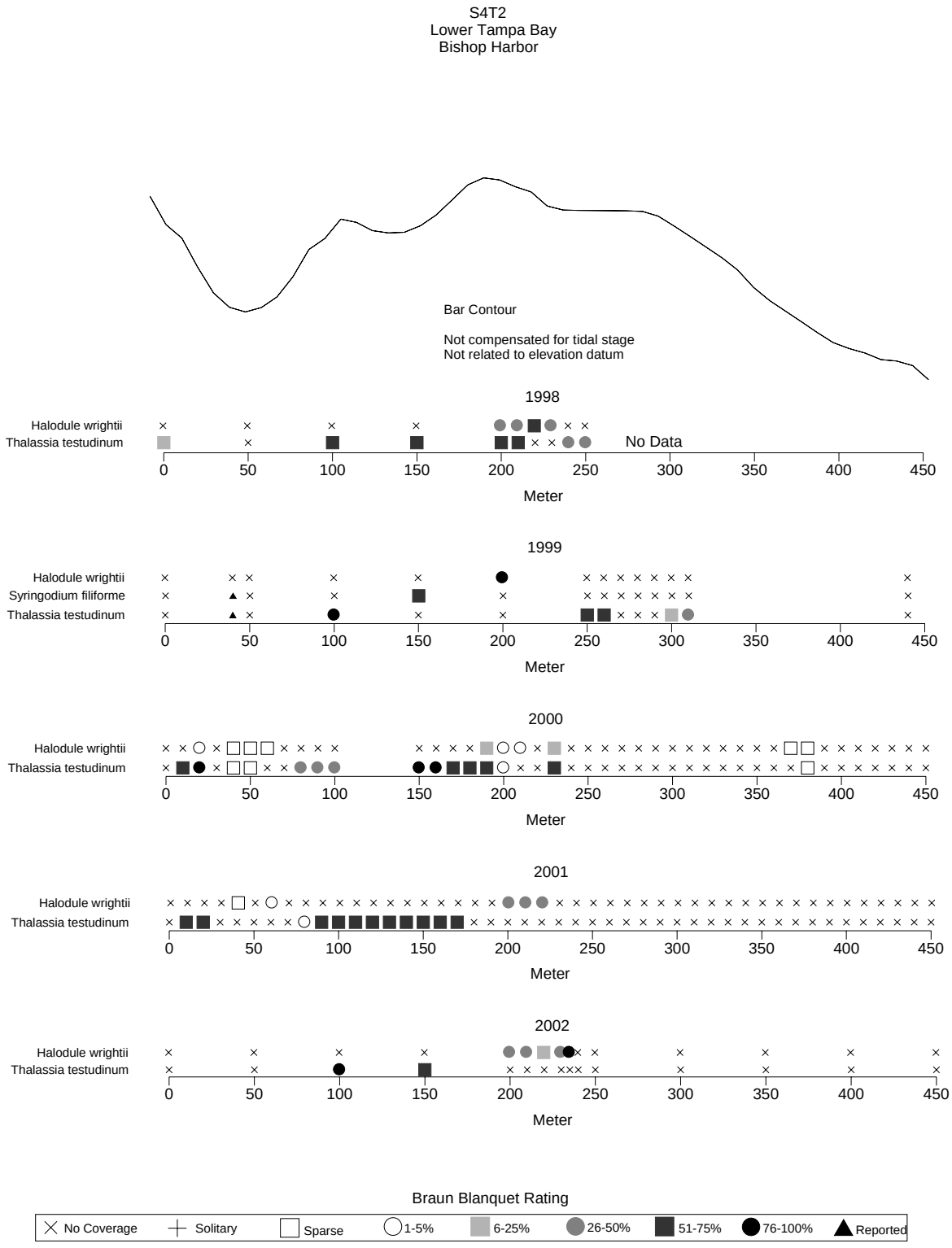

Figure 43. Seagrass species, abundance, and zonation at S4T2 from 1998-2002.

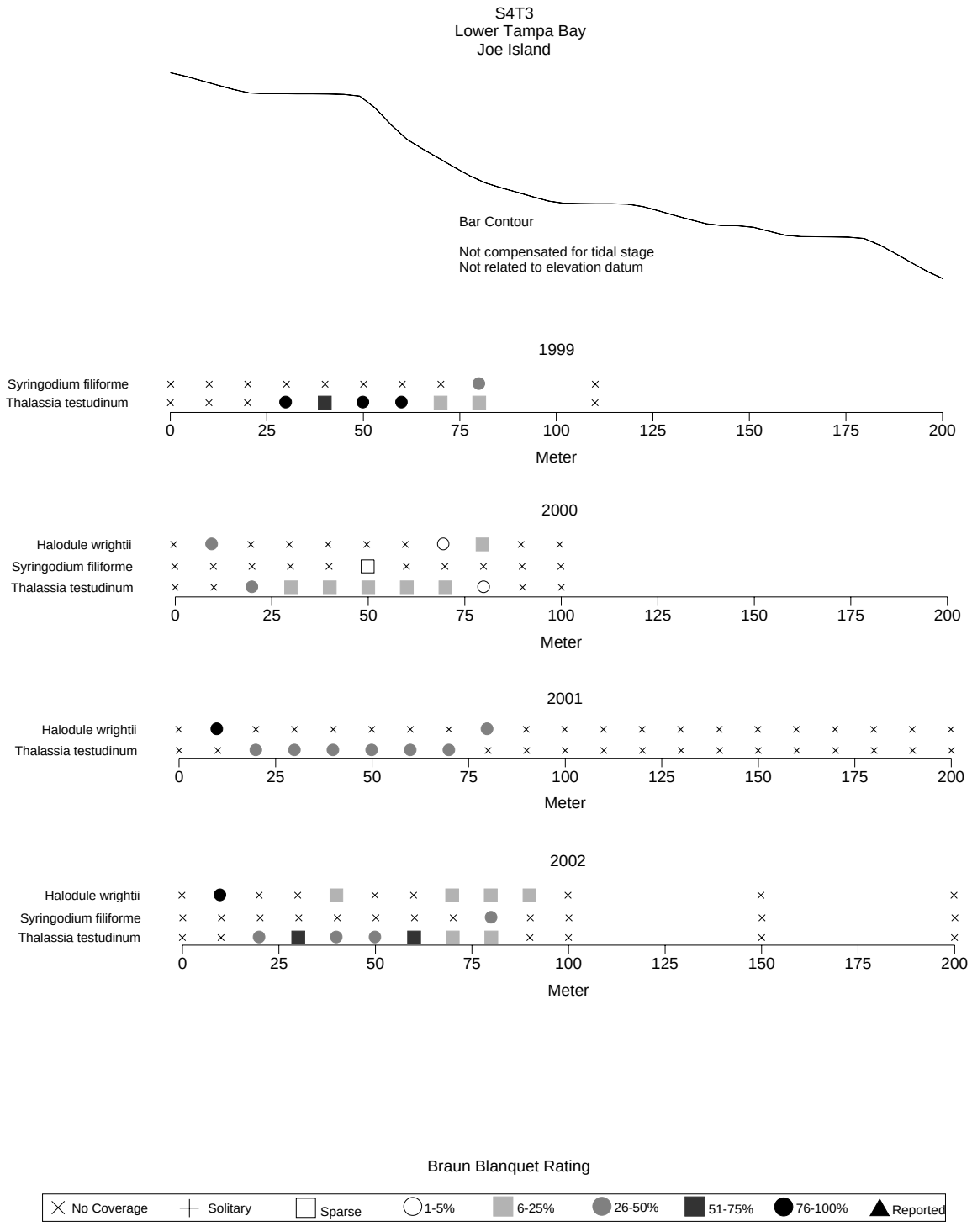

Figure 44. Seagrass species, abundance, and zonation at S4T3 from 1999-2002.

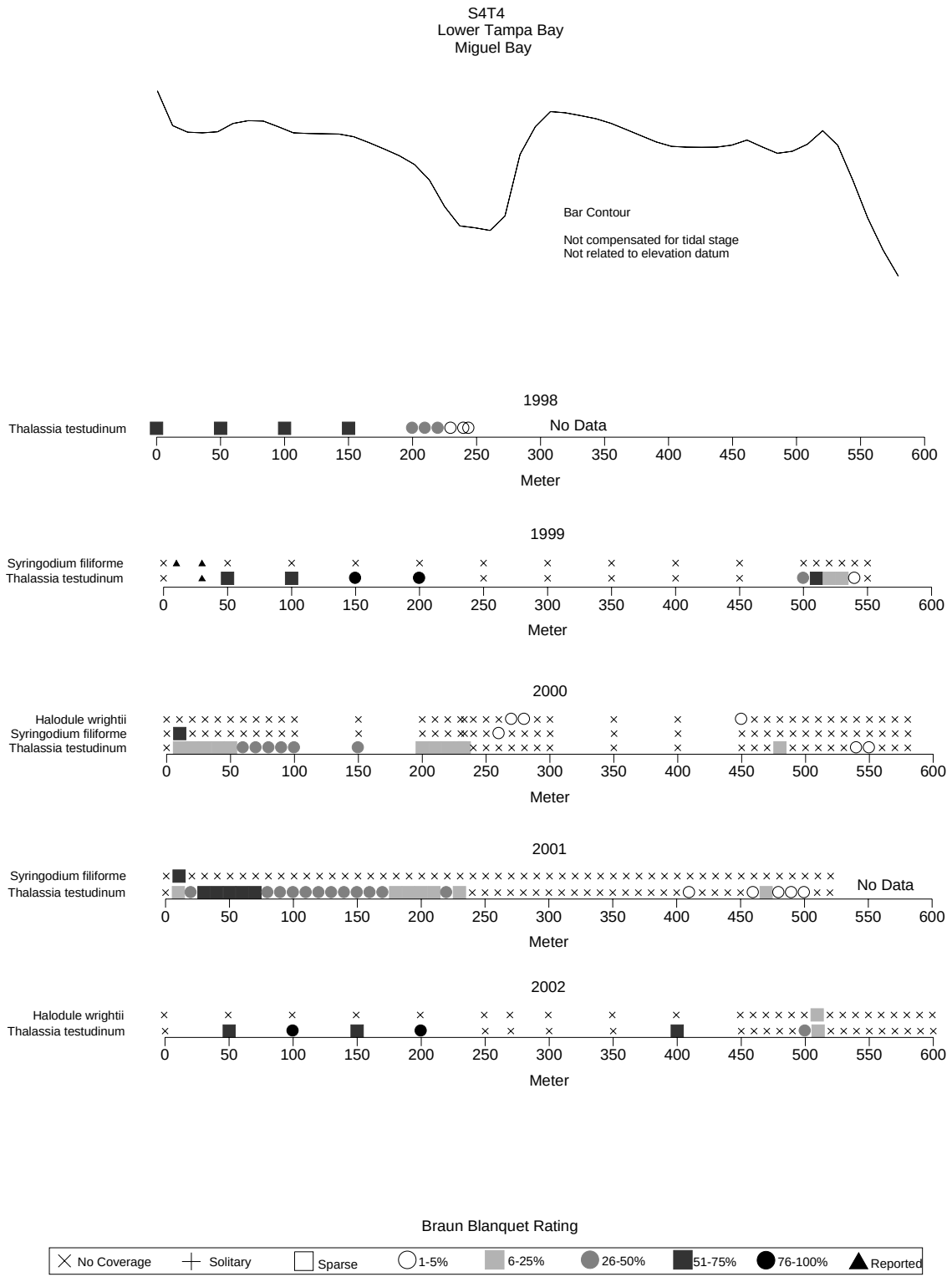

Figure 45. Seagrass species, abundance, and zonation at S4T4 from 1998-2002.

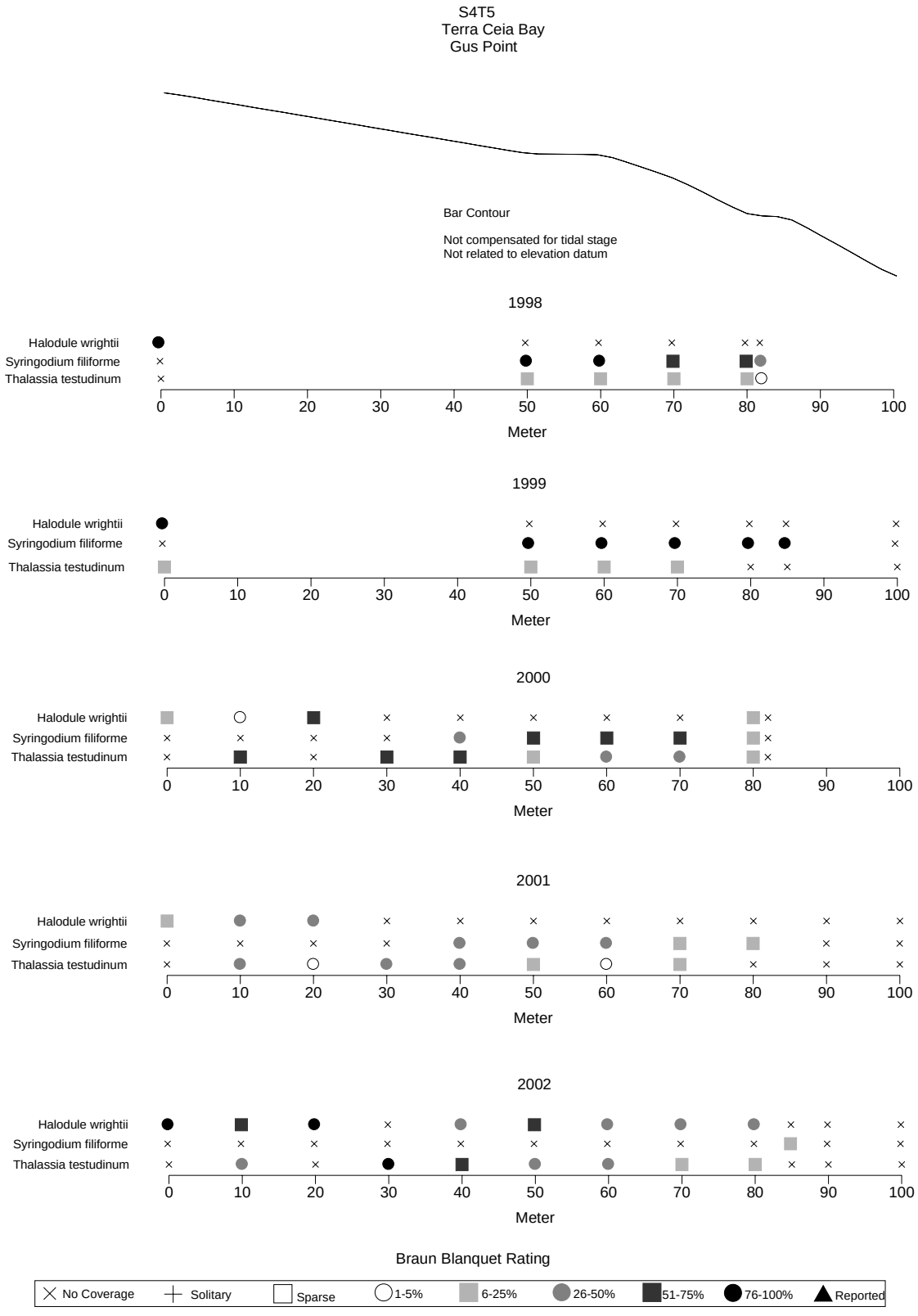

Figure 46. Seagrass species, abundance, and zonation at S4T5 from 1998-2002.

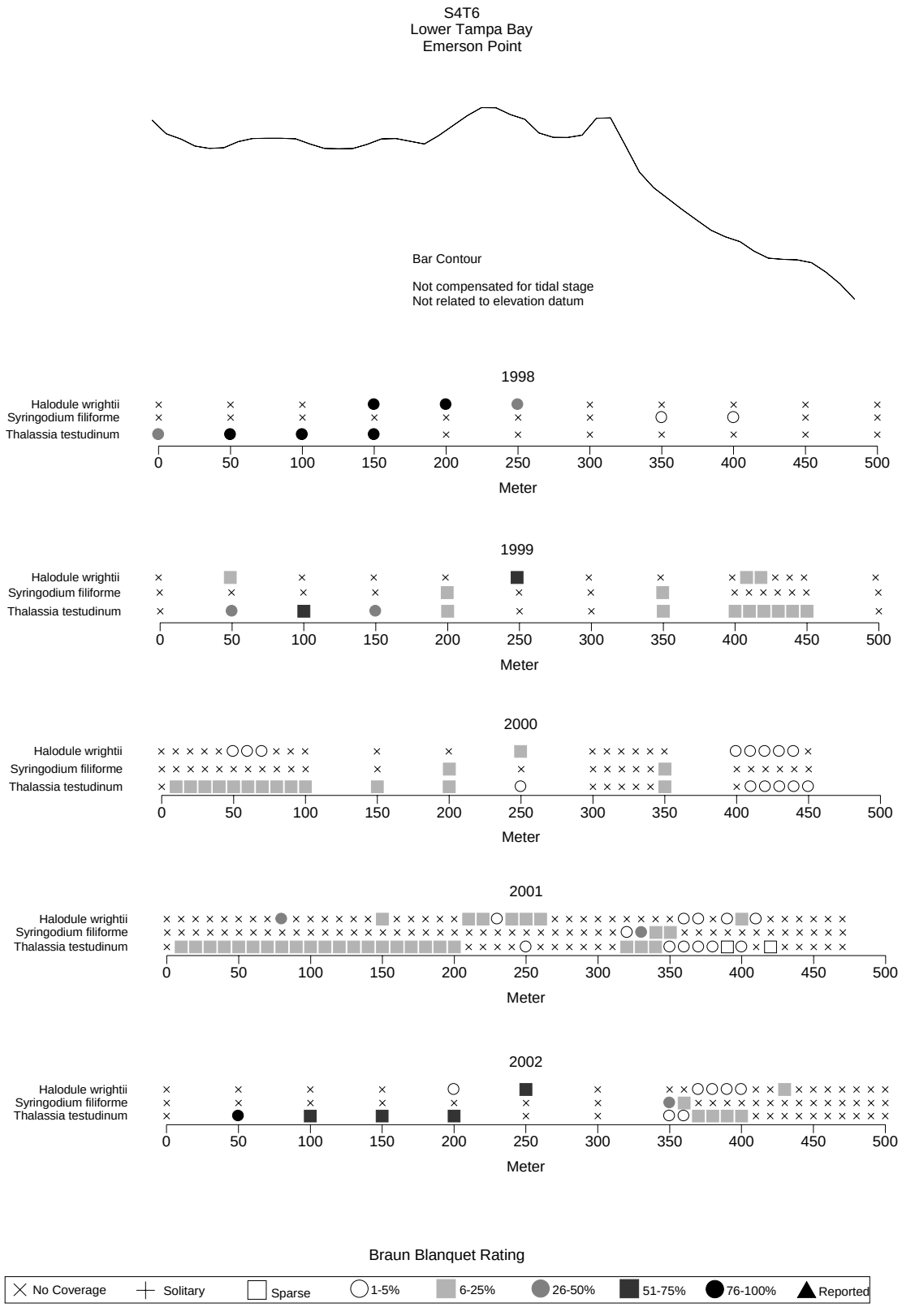

Figure 47. Seagrass species, abundance, and zonation at S4T6 from 1998-2002.

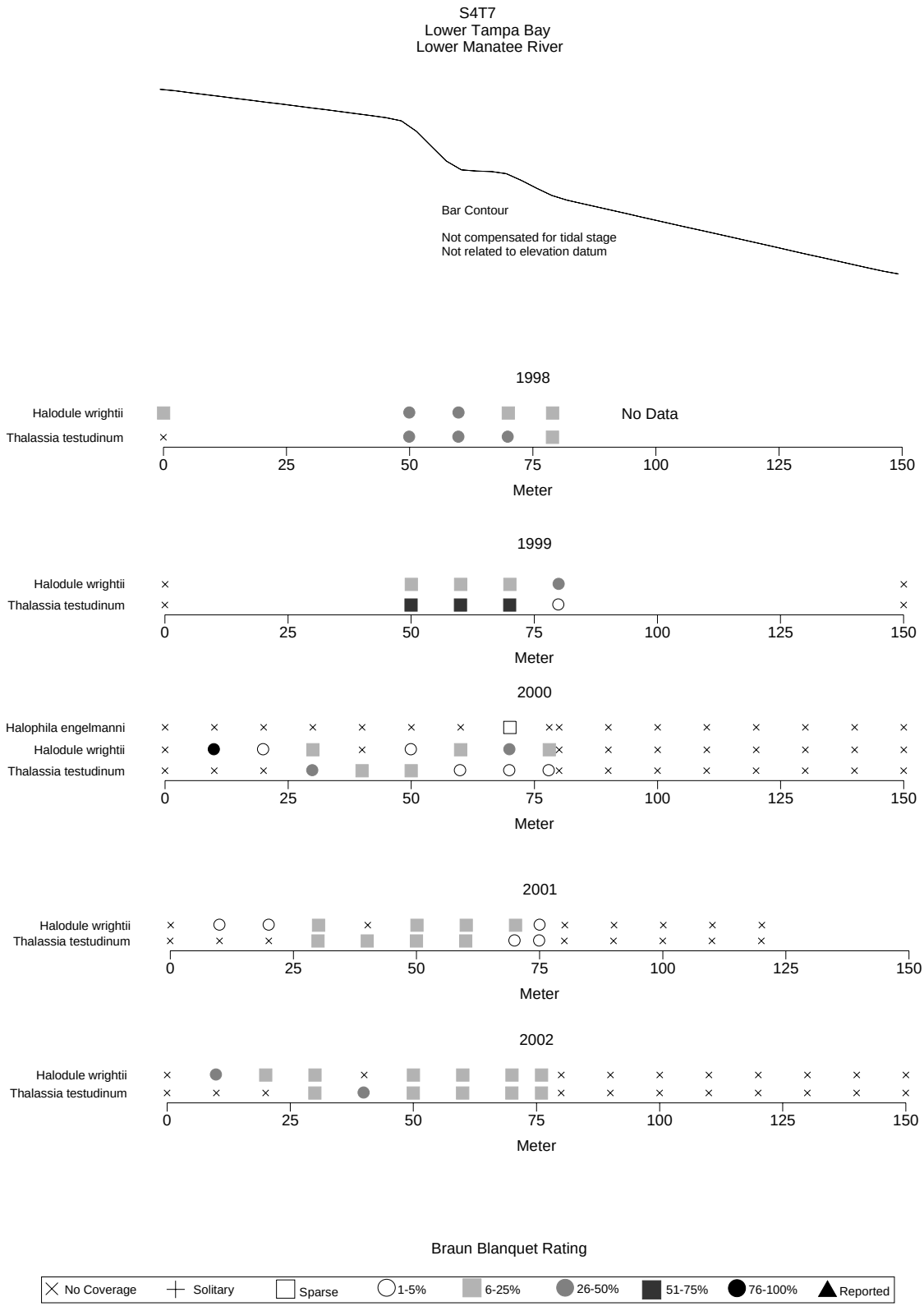

Figure 48. Seagrass species, abundance, and zonation at S4T7 from 1998-2002.

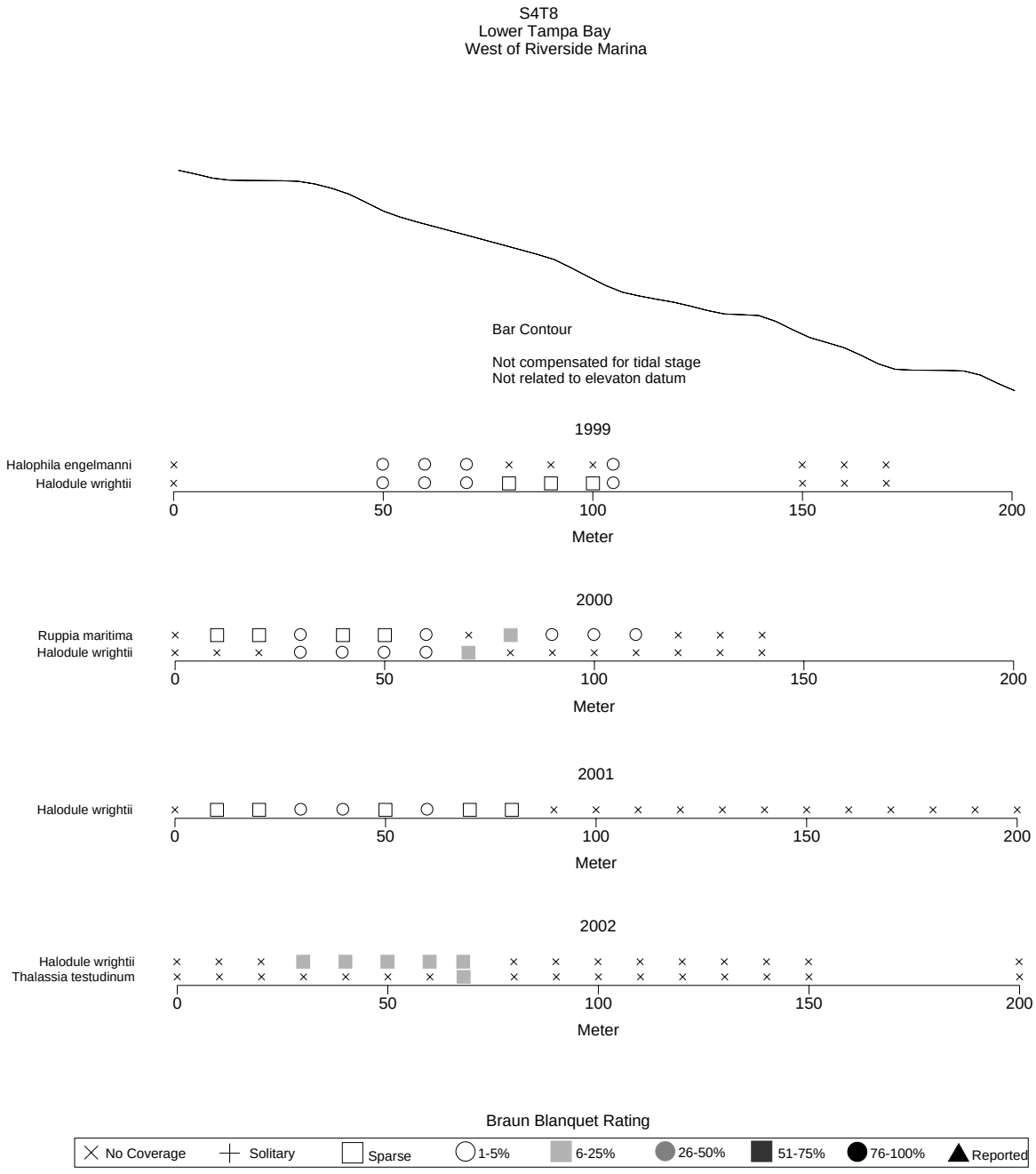

Figure 49. Seagrass species, abundance, and zonation at S4T8 from 1999-2002.

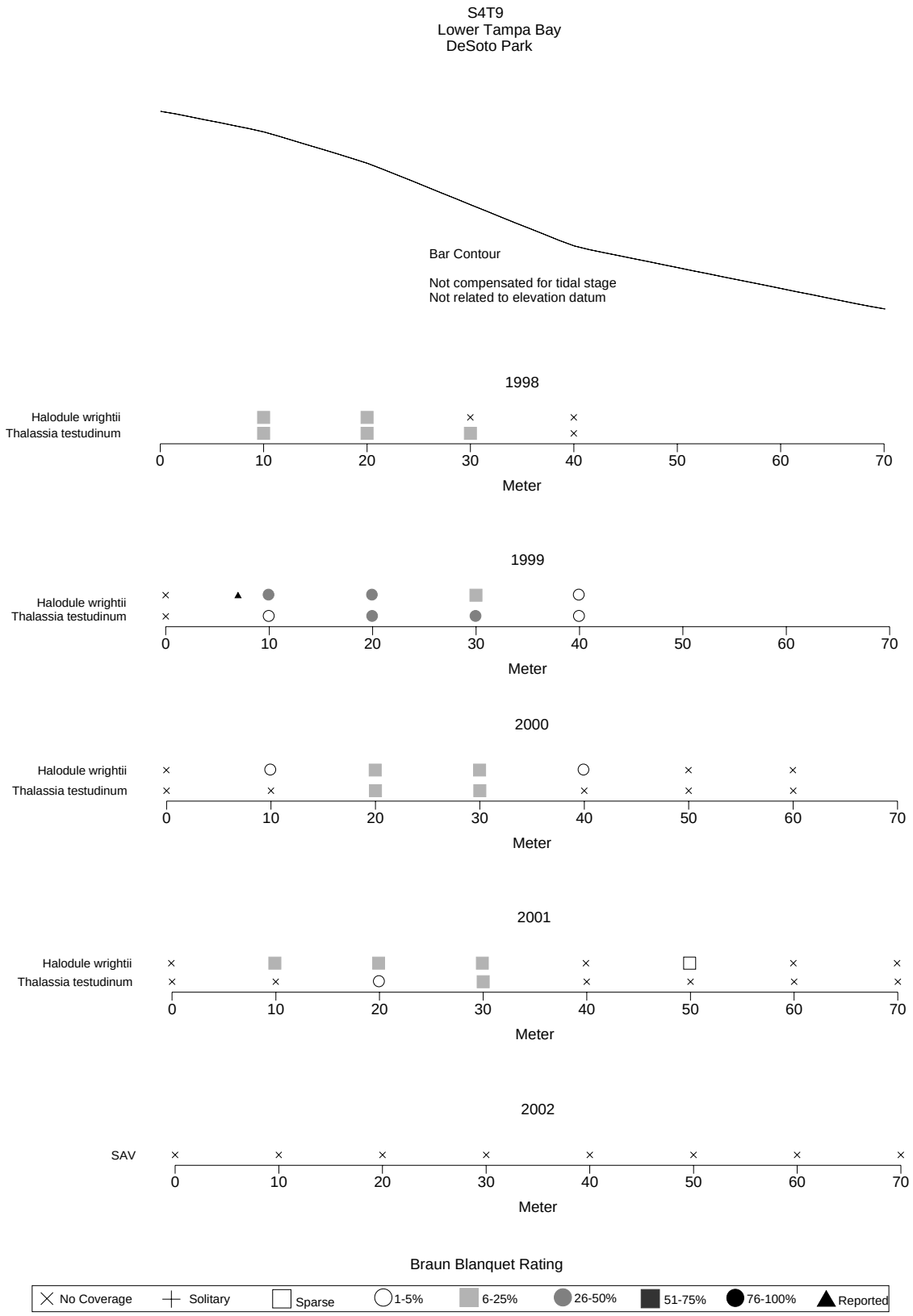

Figure 50. Seagrass species, abundance, and zonation at S4T9 from 1998-2002.

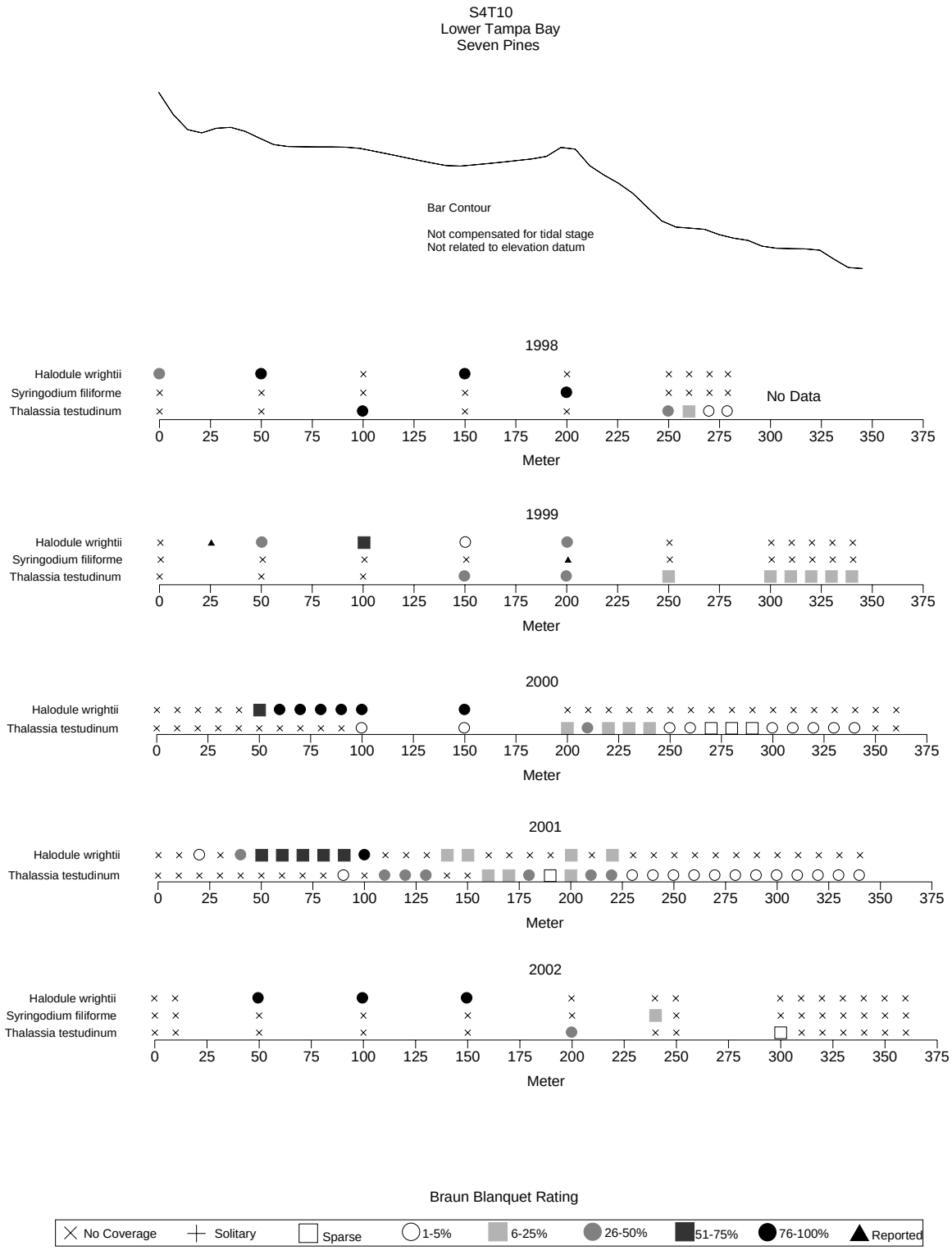

Figure 51. Seagrass species, abundance, and zonation at S4T10 from 1998-2002.

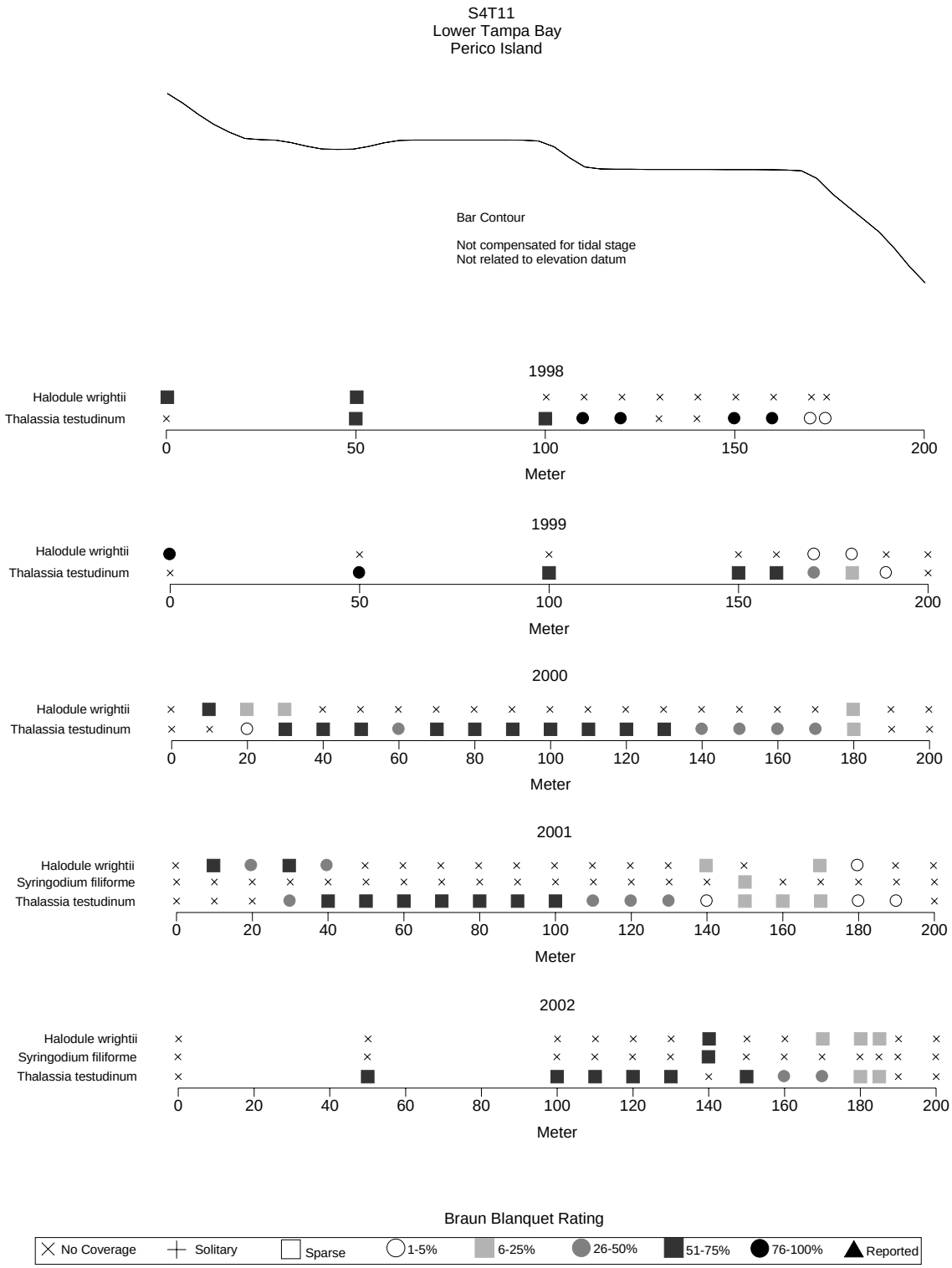

Figure 52. Seagrass species, abundance, and zonation at S4T11 from 1998-2002.

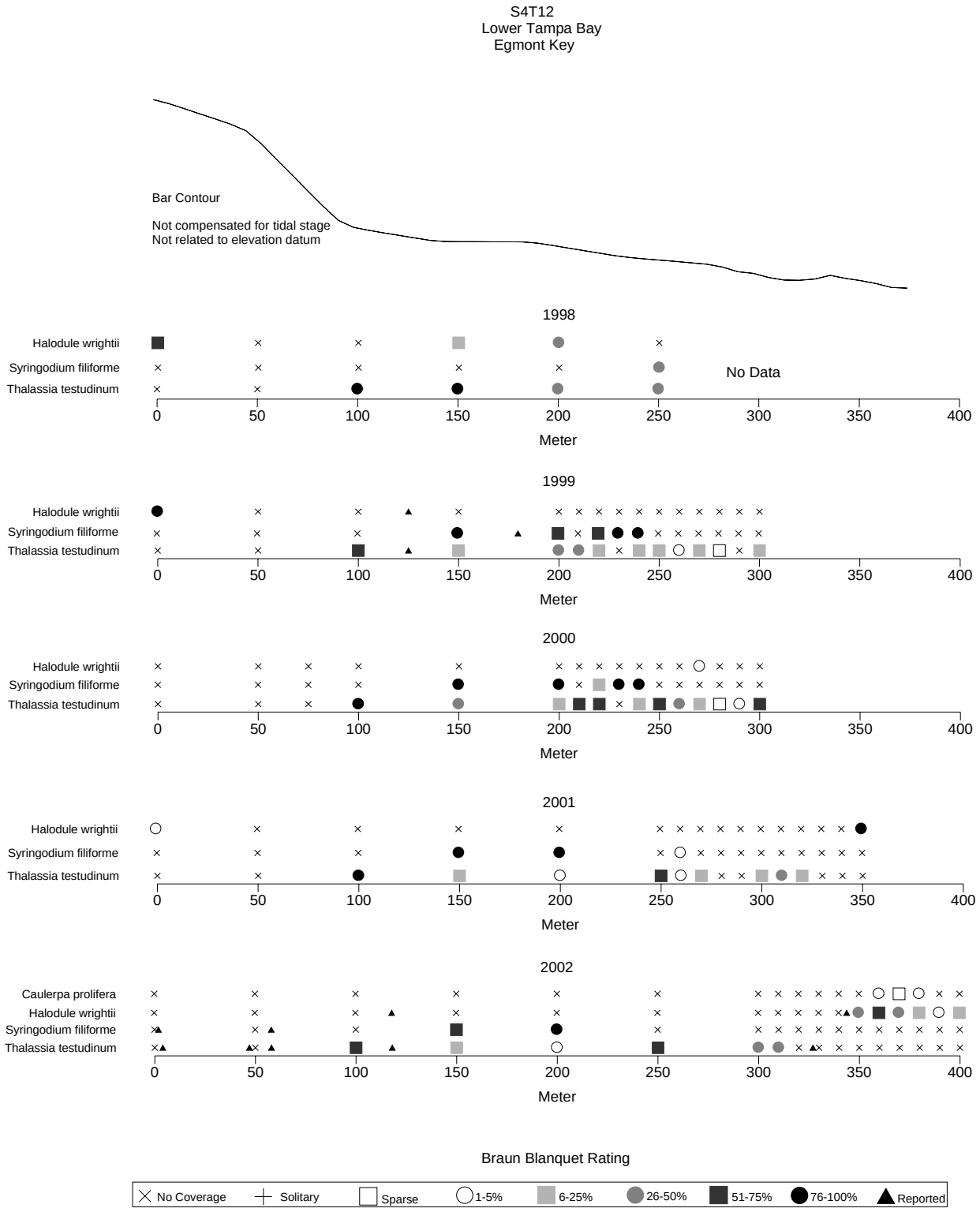

Figure 53. Seagrass species, abundance, and zonation at S4T12 from 1998-2002.

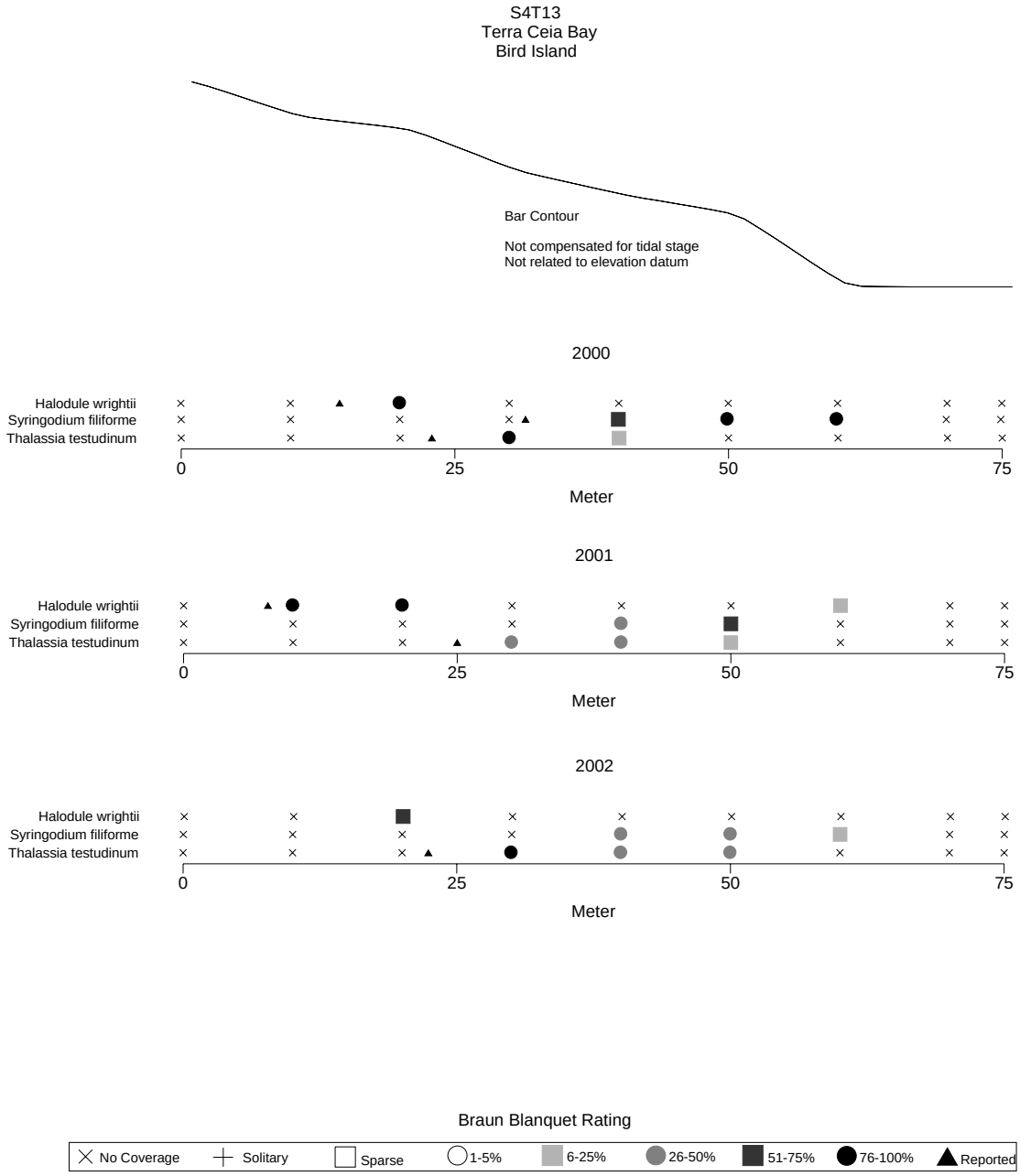

Figure 54. Seagrass species, abundance and zonation at S4T13 from 2000 - 2002.

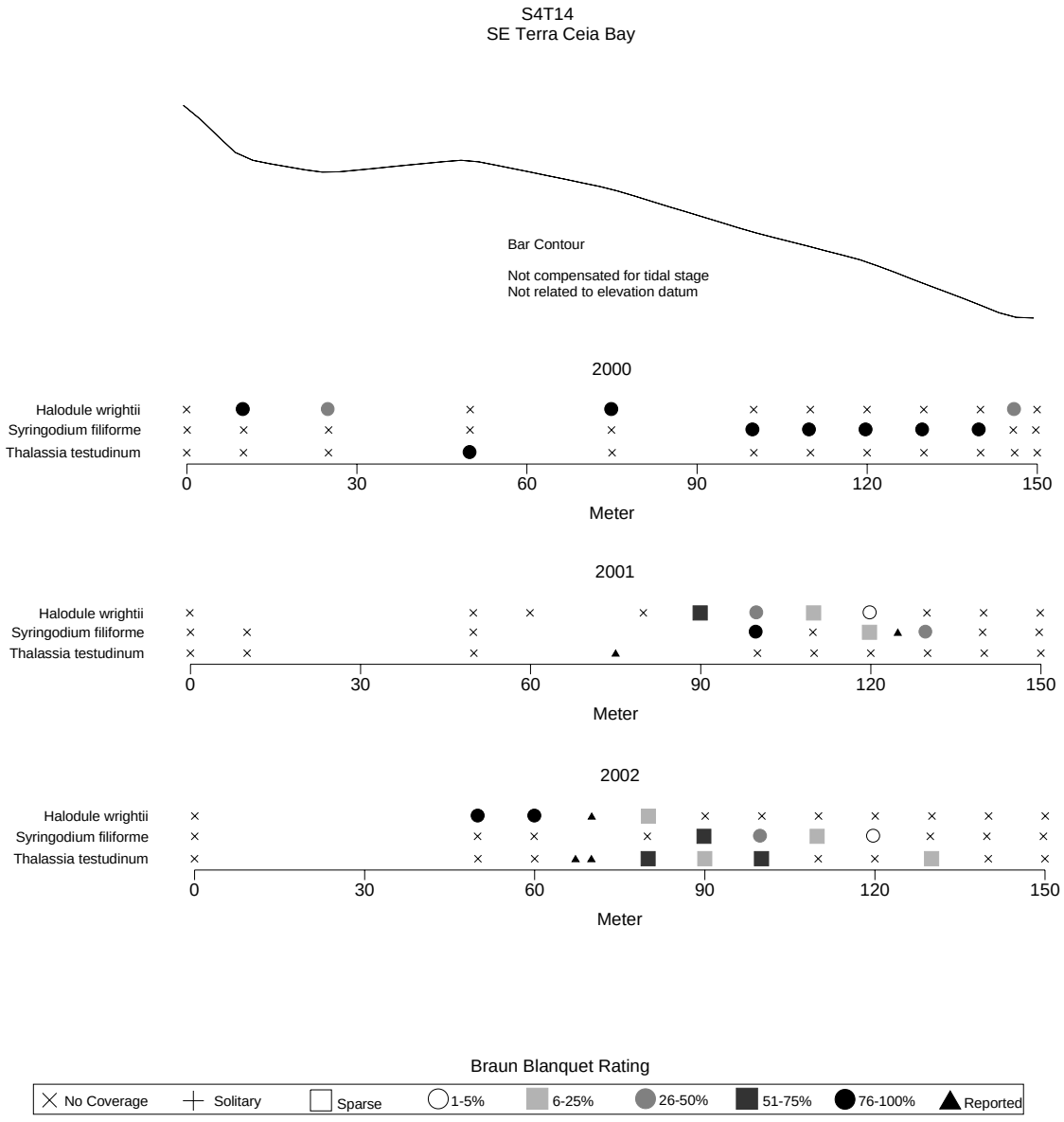

Figure 55. Seagrass species, abundance, and zonation at S4T14 from 2000-2002.

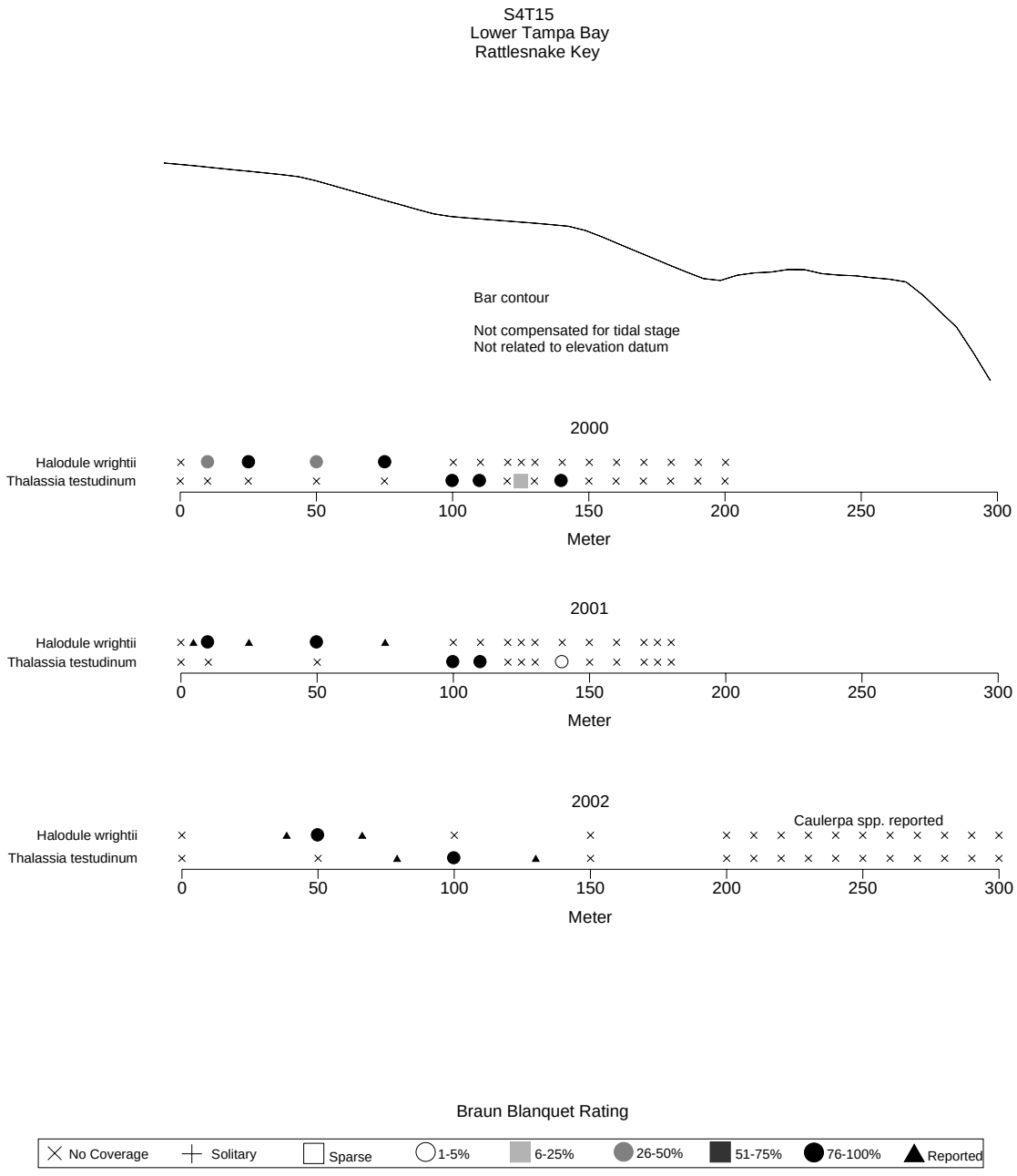

Figure 56. Seagrass species, abundance, and zonation at S4T15 from 2000-2002.

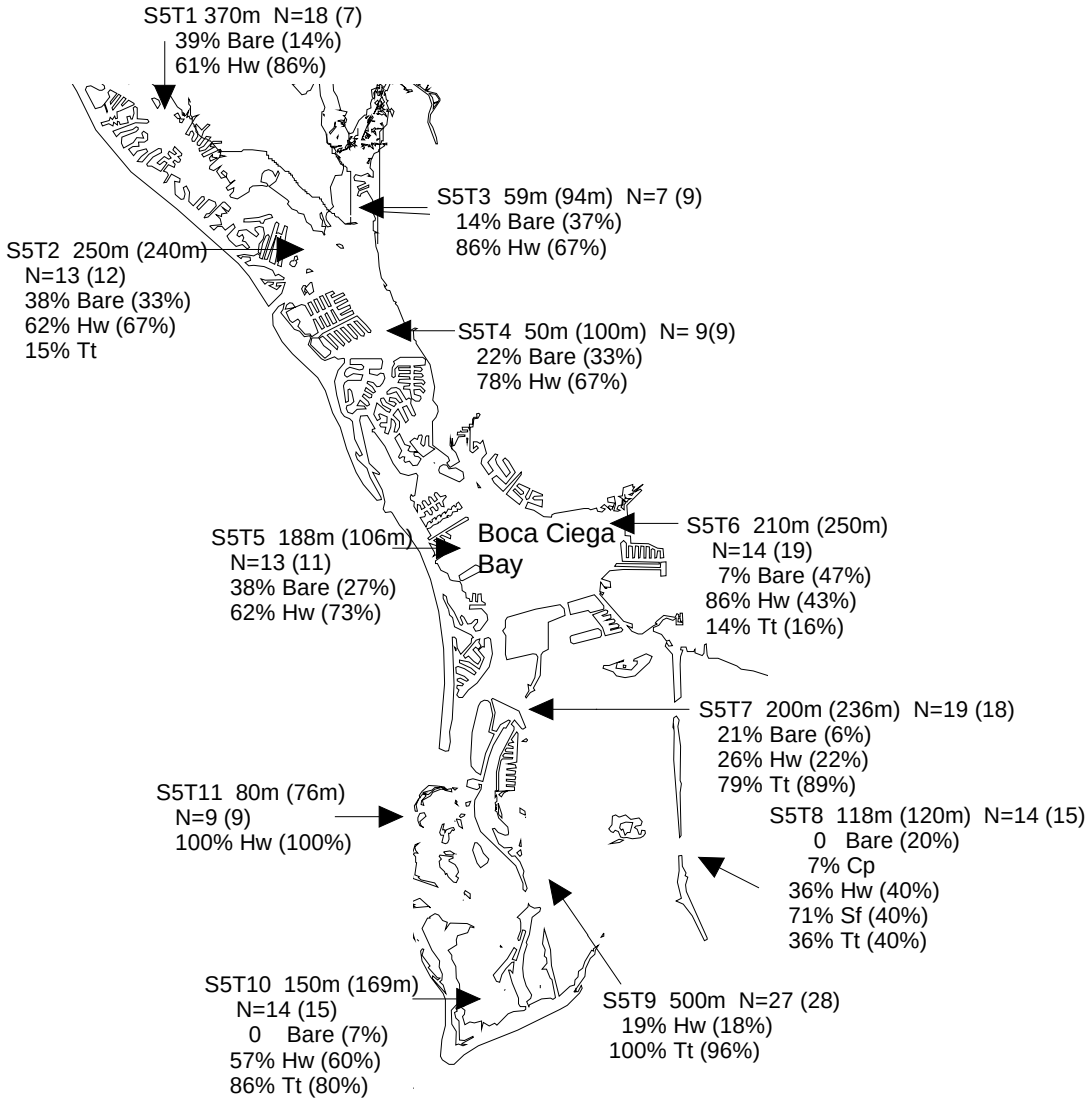

Figure 57. Name, location, length and percent of meter square placements containing each seagrass species along the 11 Boca Ciega Bay seagrass monitoring transects in 2002. Results from 2001 in parentheses. N=number of meter square placements; Hw=*Halodule wrightii*; Rm=*Ruppia maritima*; Sf=*Syringodium filiforme*; Tt=*Thalassia testudinum*.

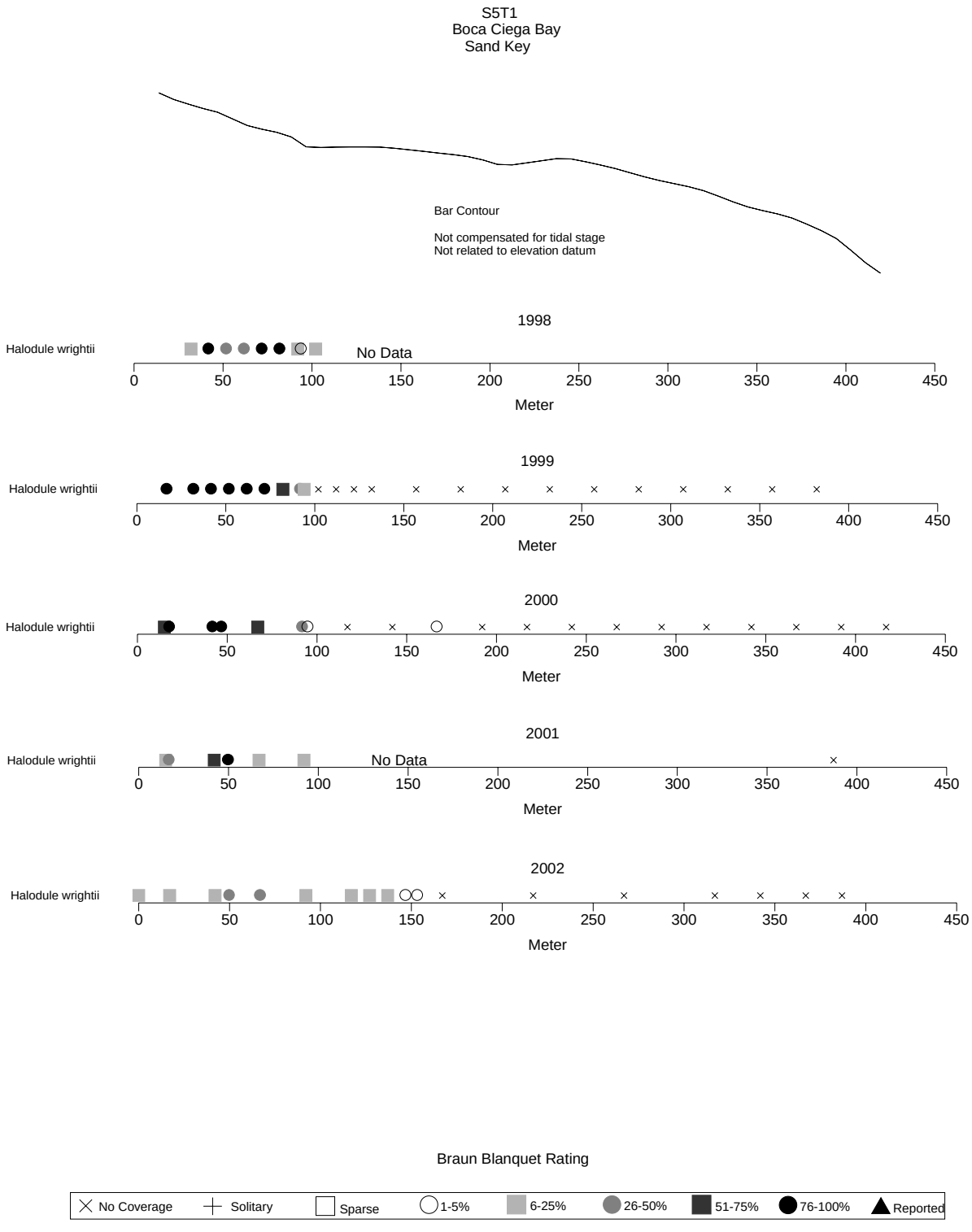

Figure 58. Seagrass species, abundance, and zonation at S5T1 from 1998-2002.

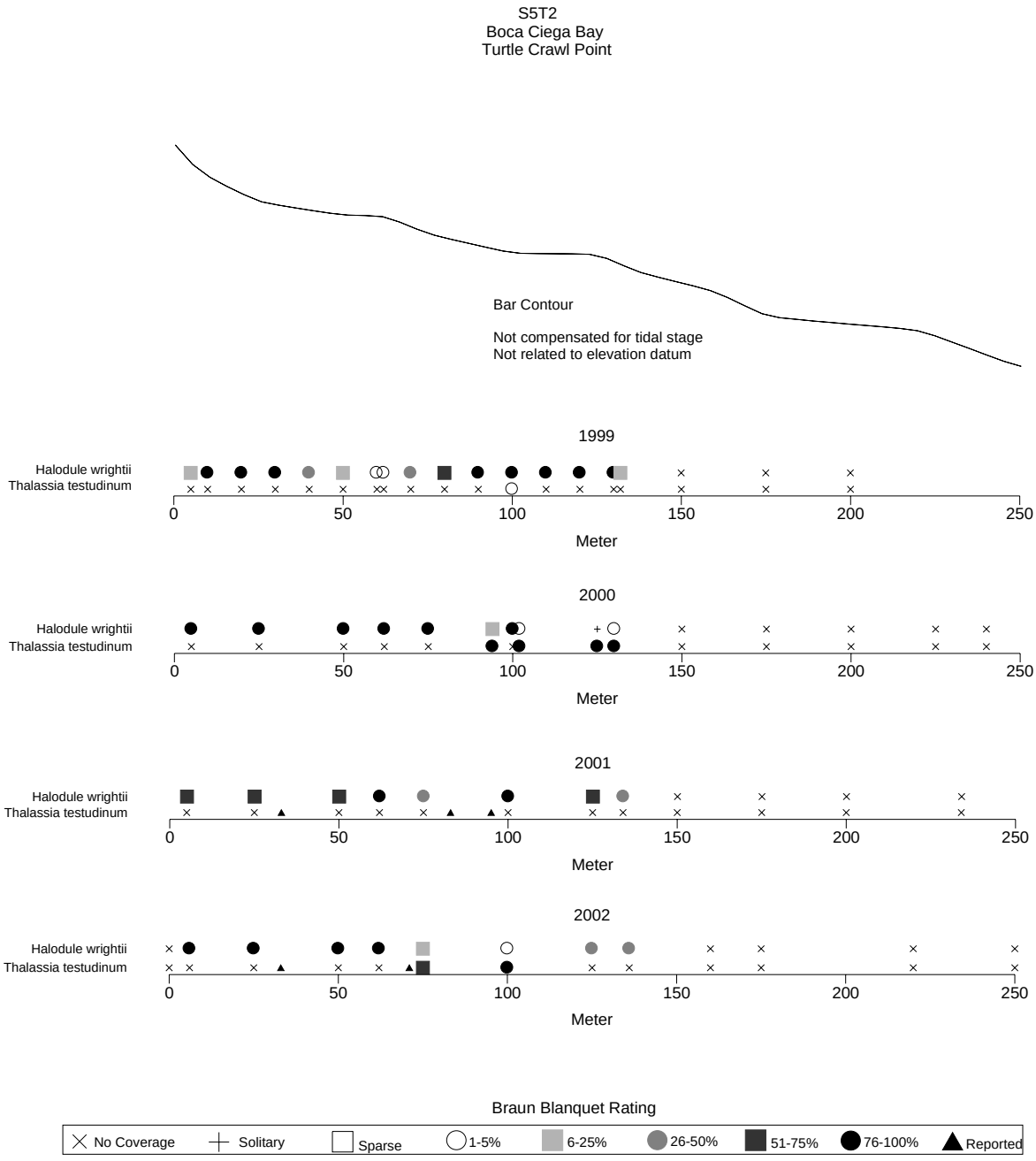

Figure 59. Seagrass species, abundance, and zonation at S5T2 from 1999-2002.

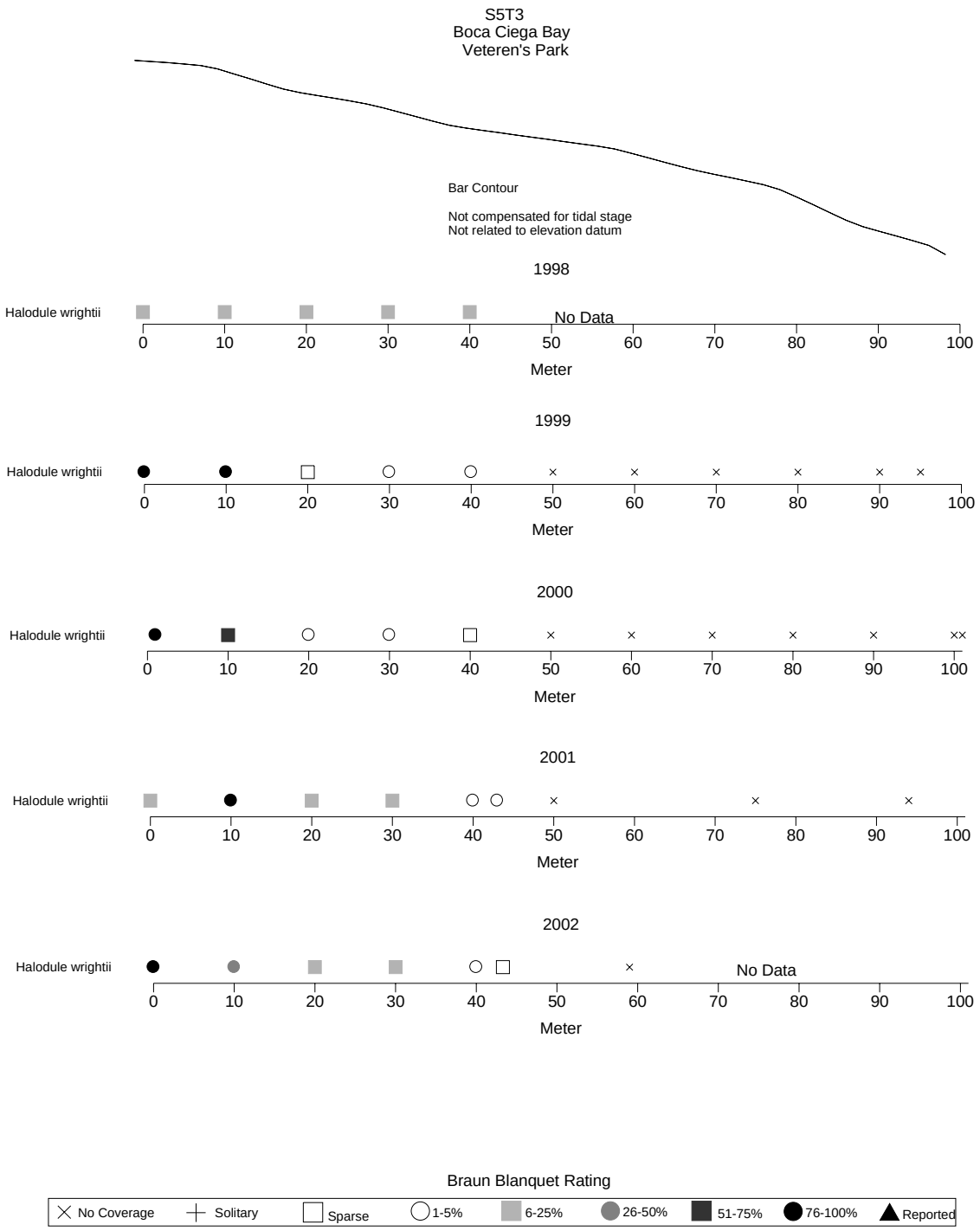

Figure 60. Seagrass species, abundance, and zonation at S5T3 from 1998-2002.

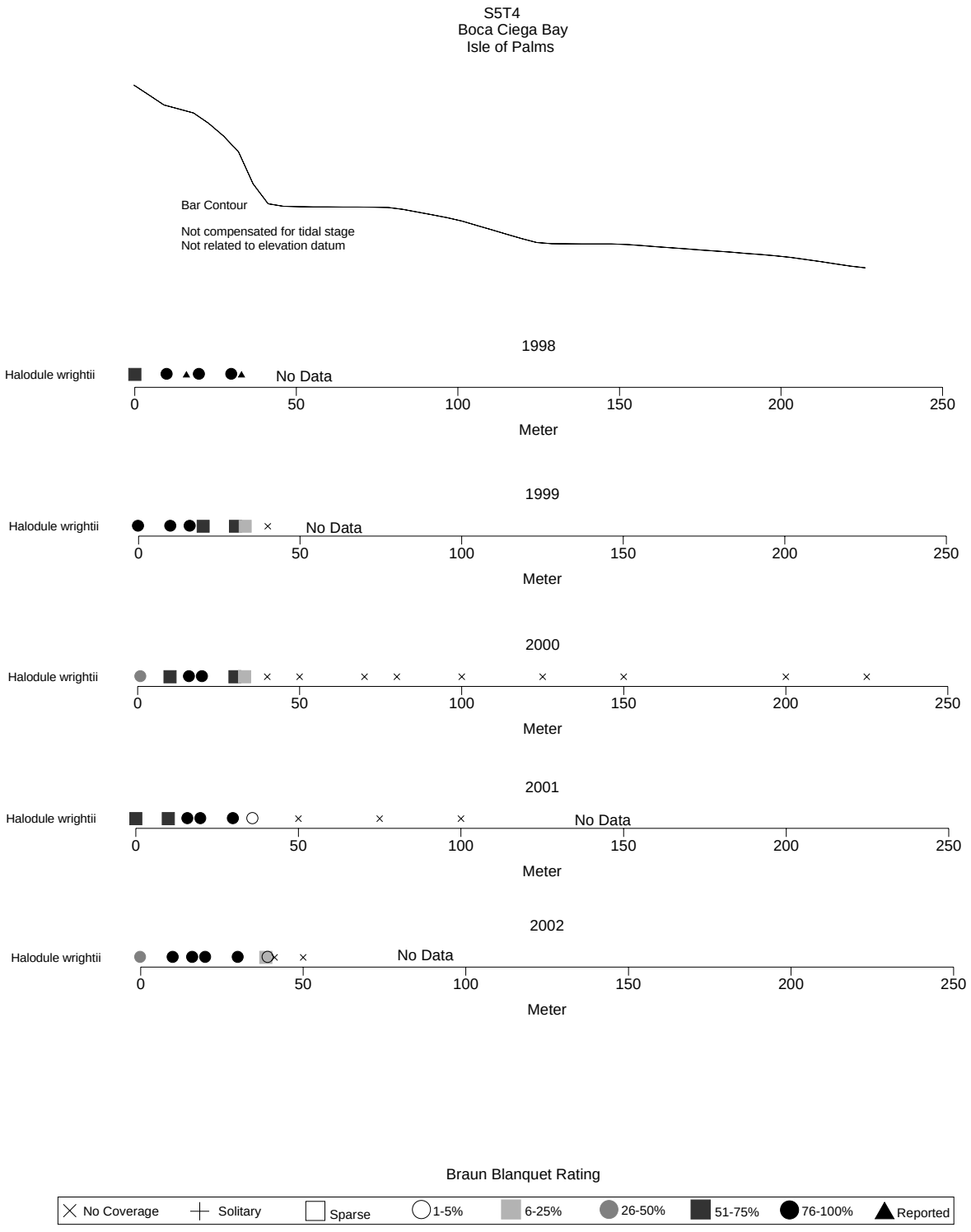

Figure 61. Seagrass species, abundance, and zonation at S5T4 from 1998-2002.

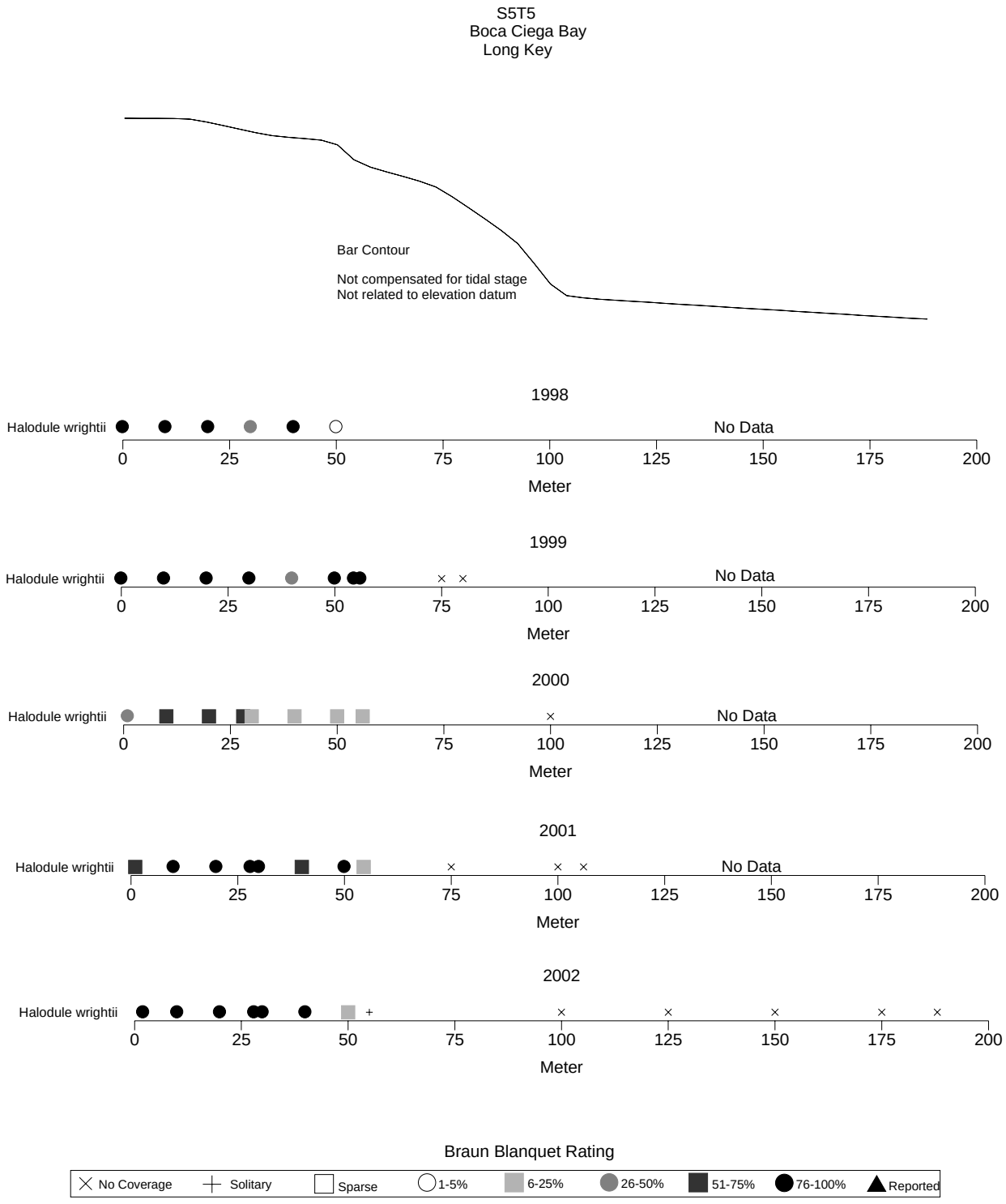

Figure 62. Seagrass species, abundance, and zonation at S5T5 from 1998-2002.

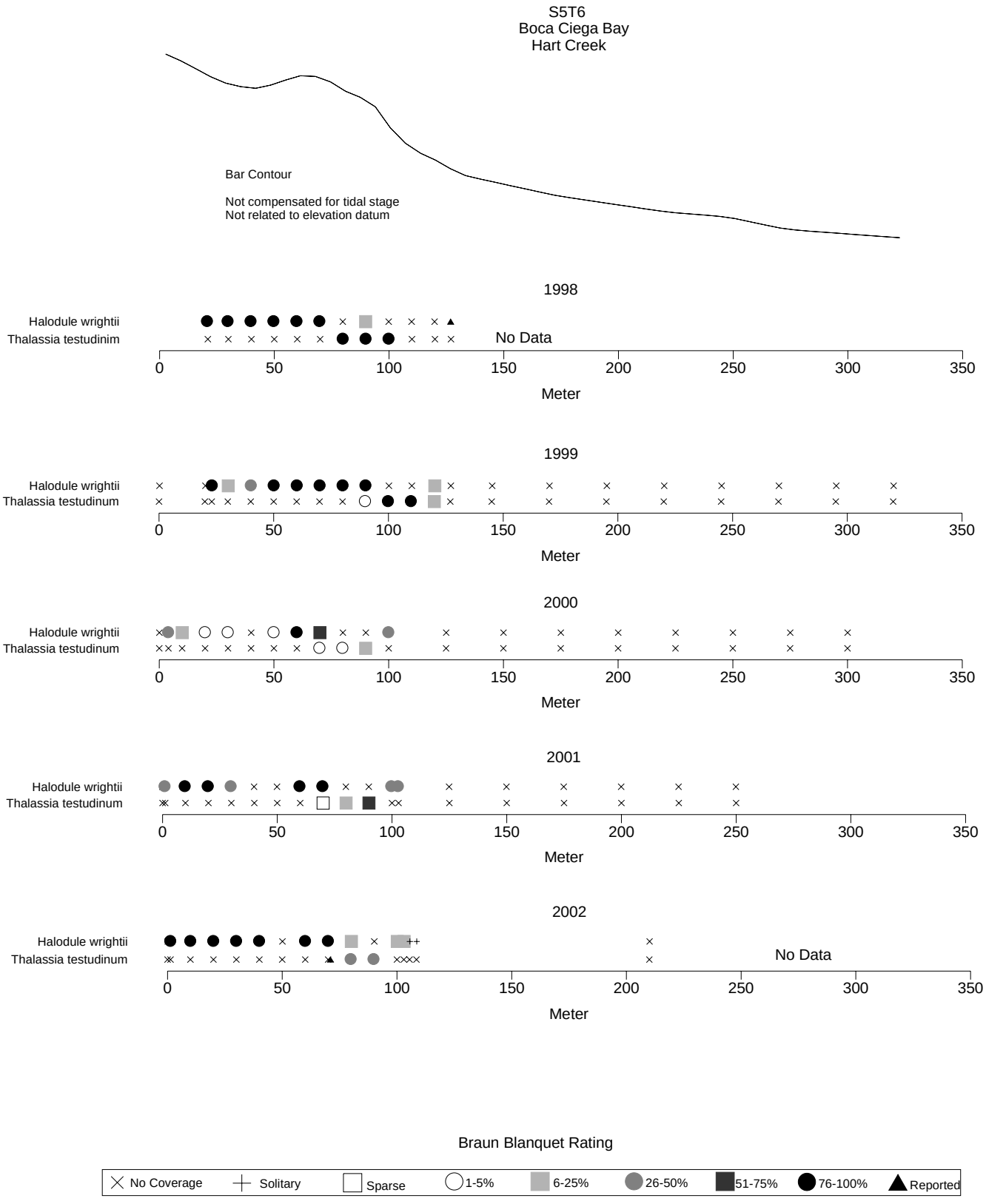

Figure 63. Seagrass species, abundance, and zonation at S5T6 from 1998-2002.

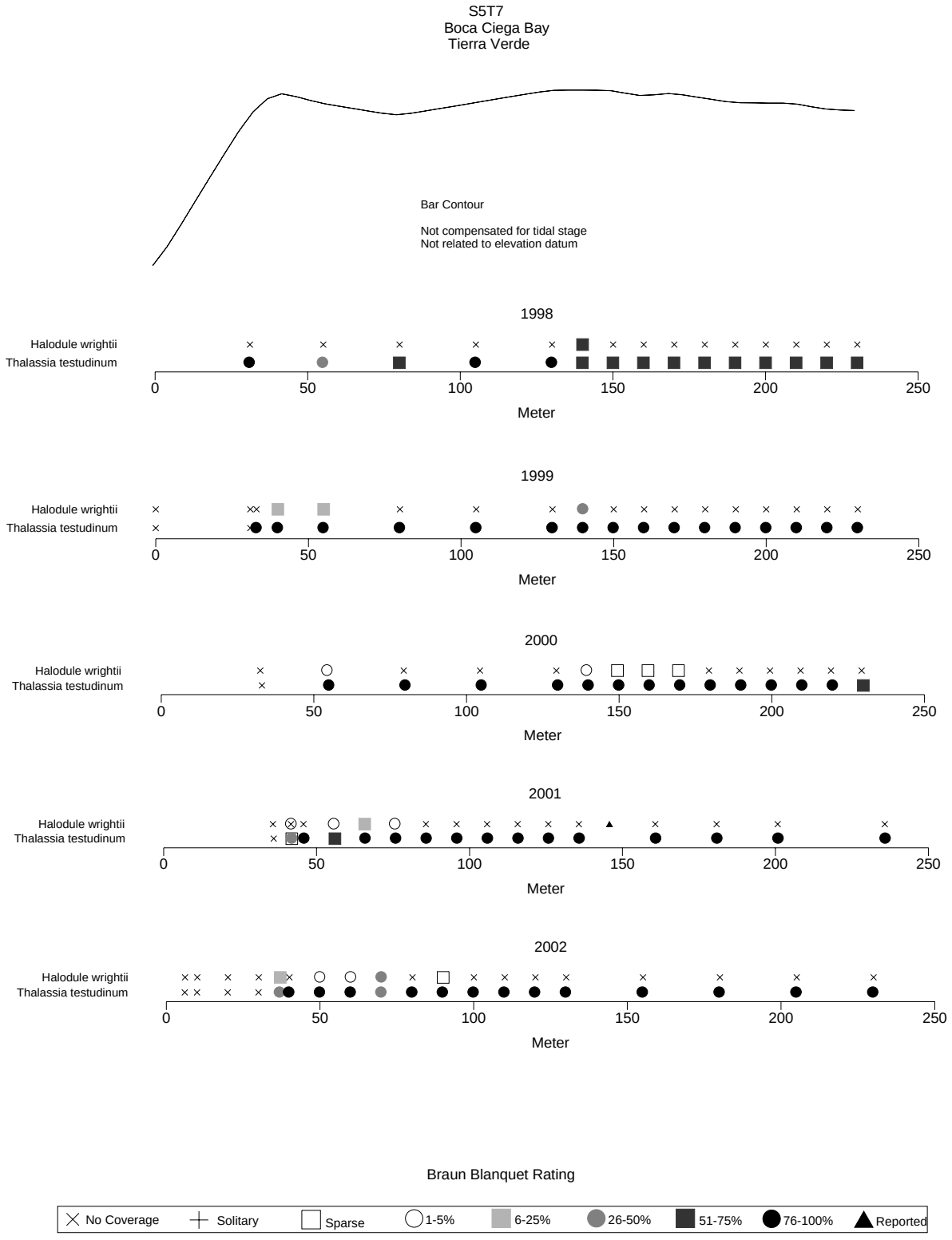

Figure 64. Seagrass species, abundance, and zonation at S5T7 from 1998-2002.

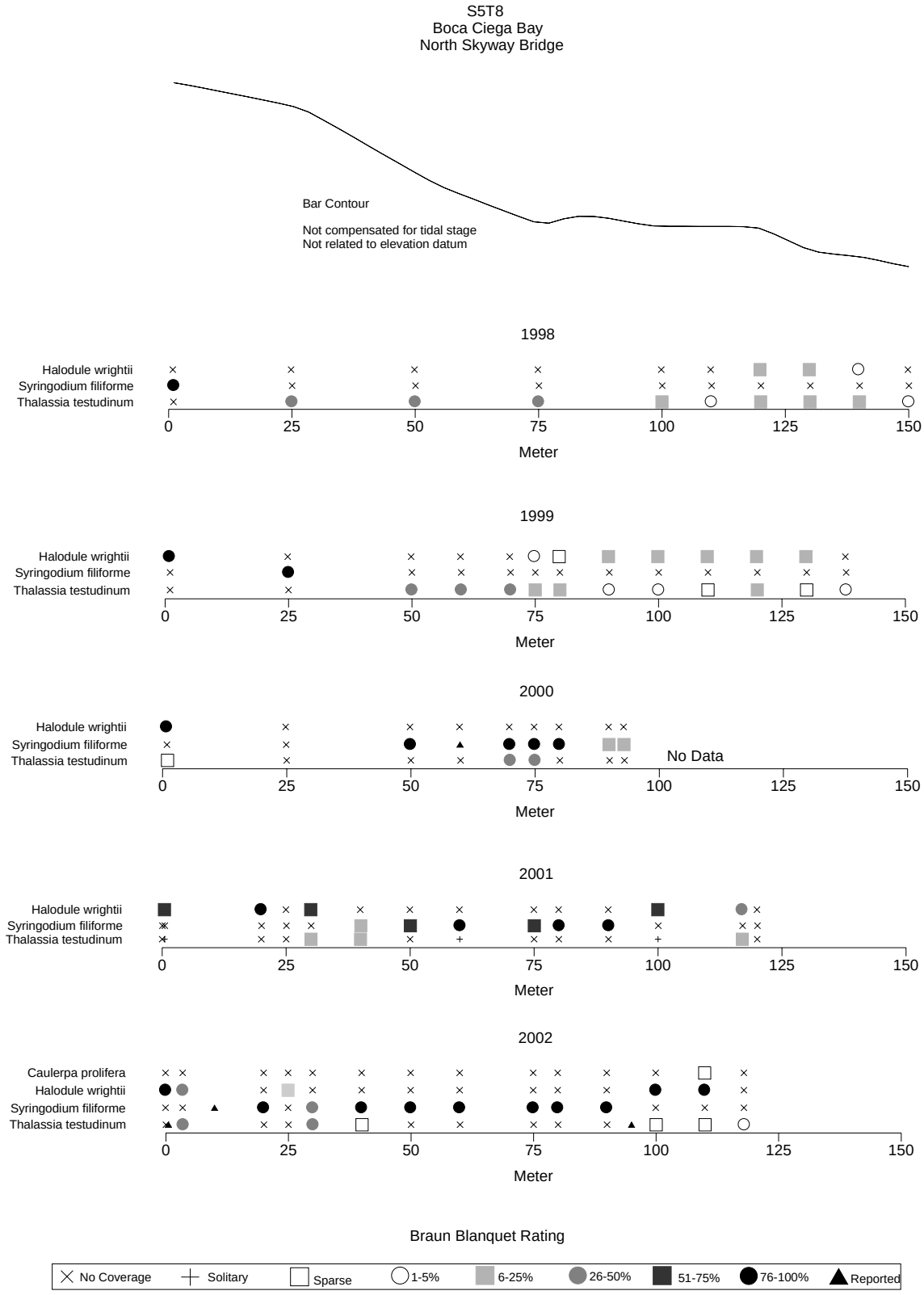

Figure 65. Seagrass species, abundance, and zonation at S5T8 from 1998-2002.

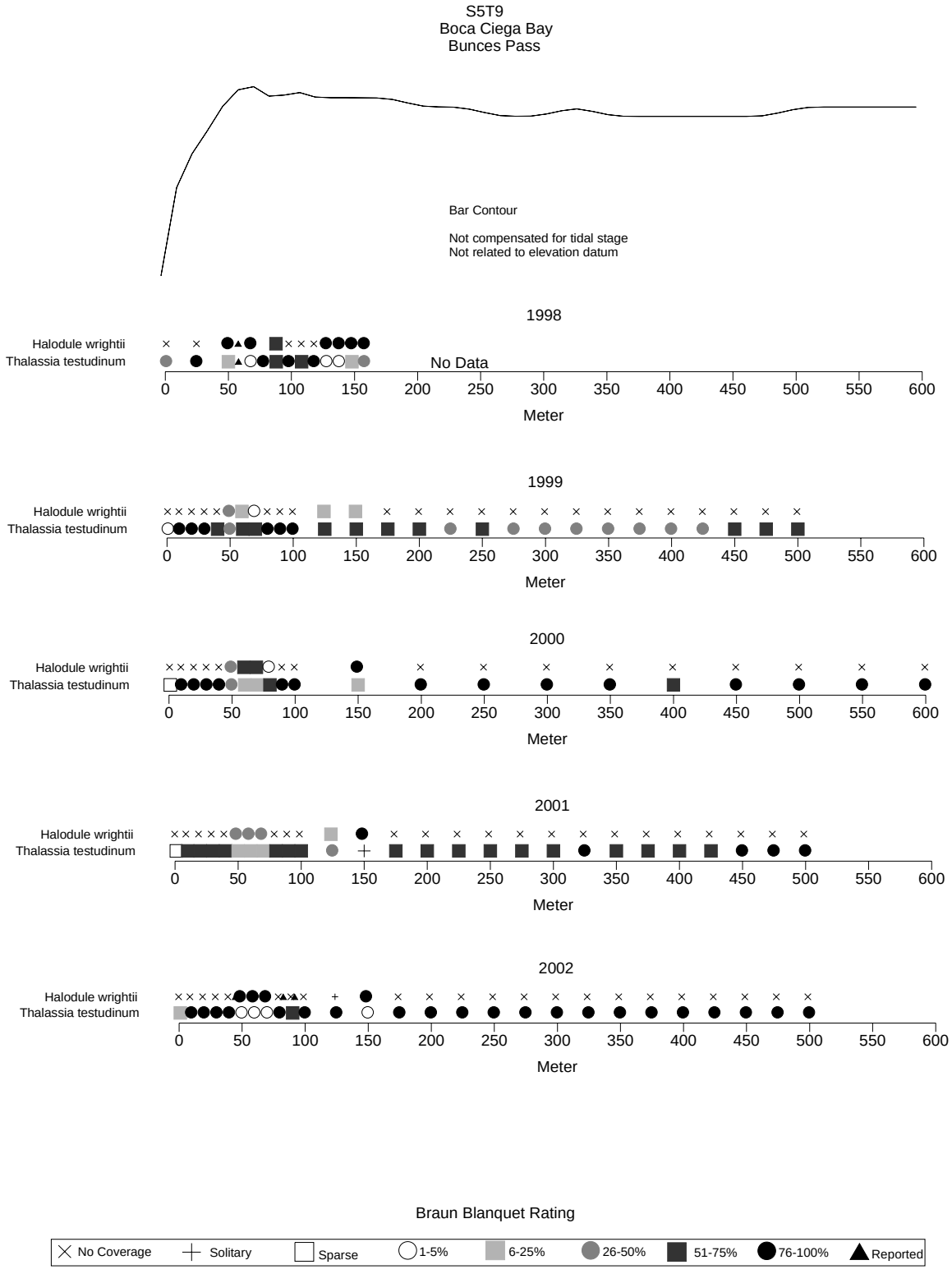

Figure 66. Seagrass species, abundance, and zonation at S5T9 from 1998-2002.

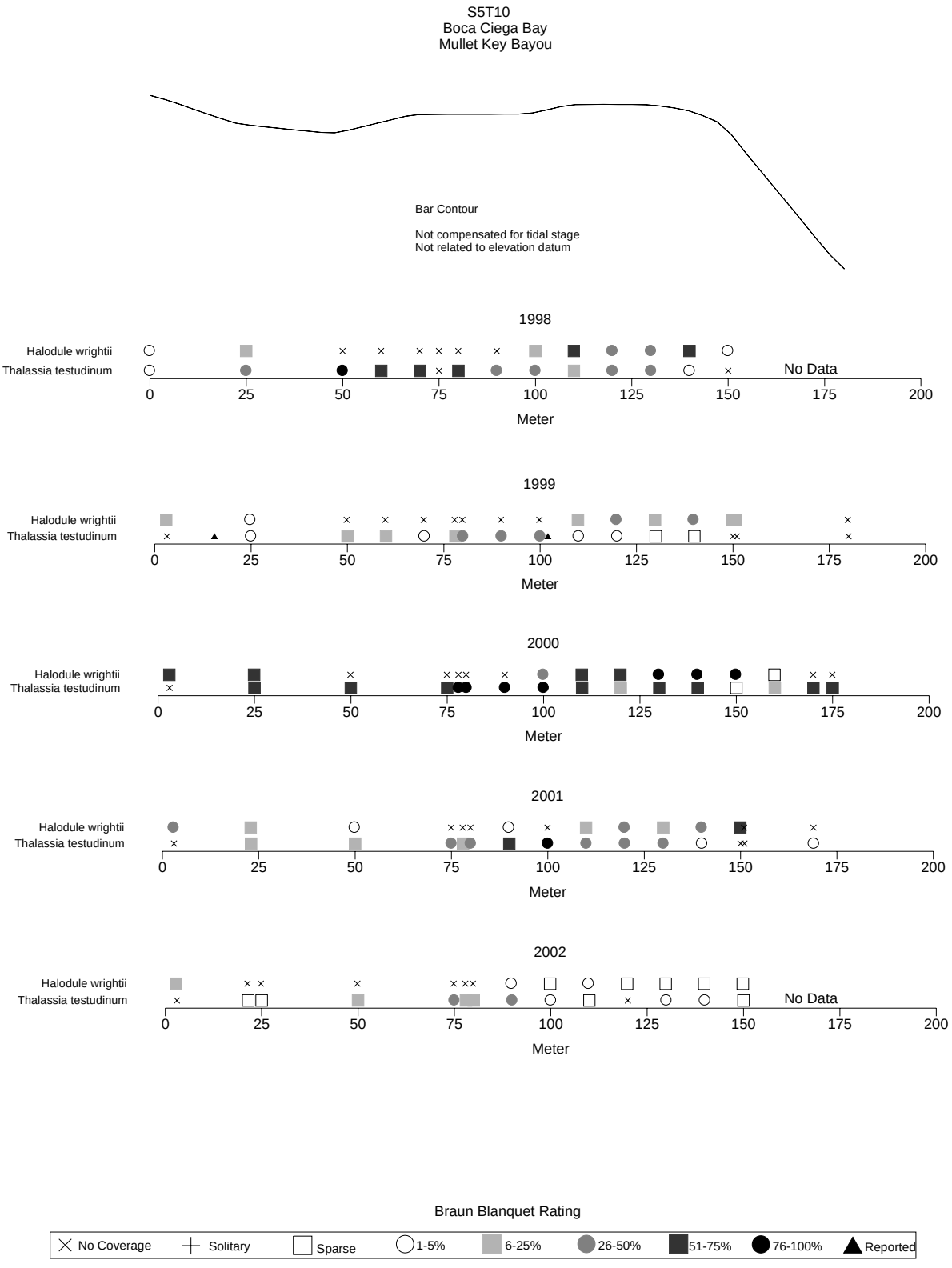

Figure 67. Seagrass species, abundance, and zonation at S5T10 from 1998-2002.

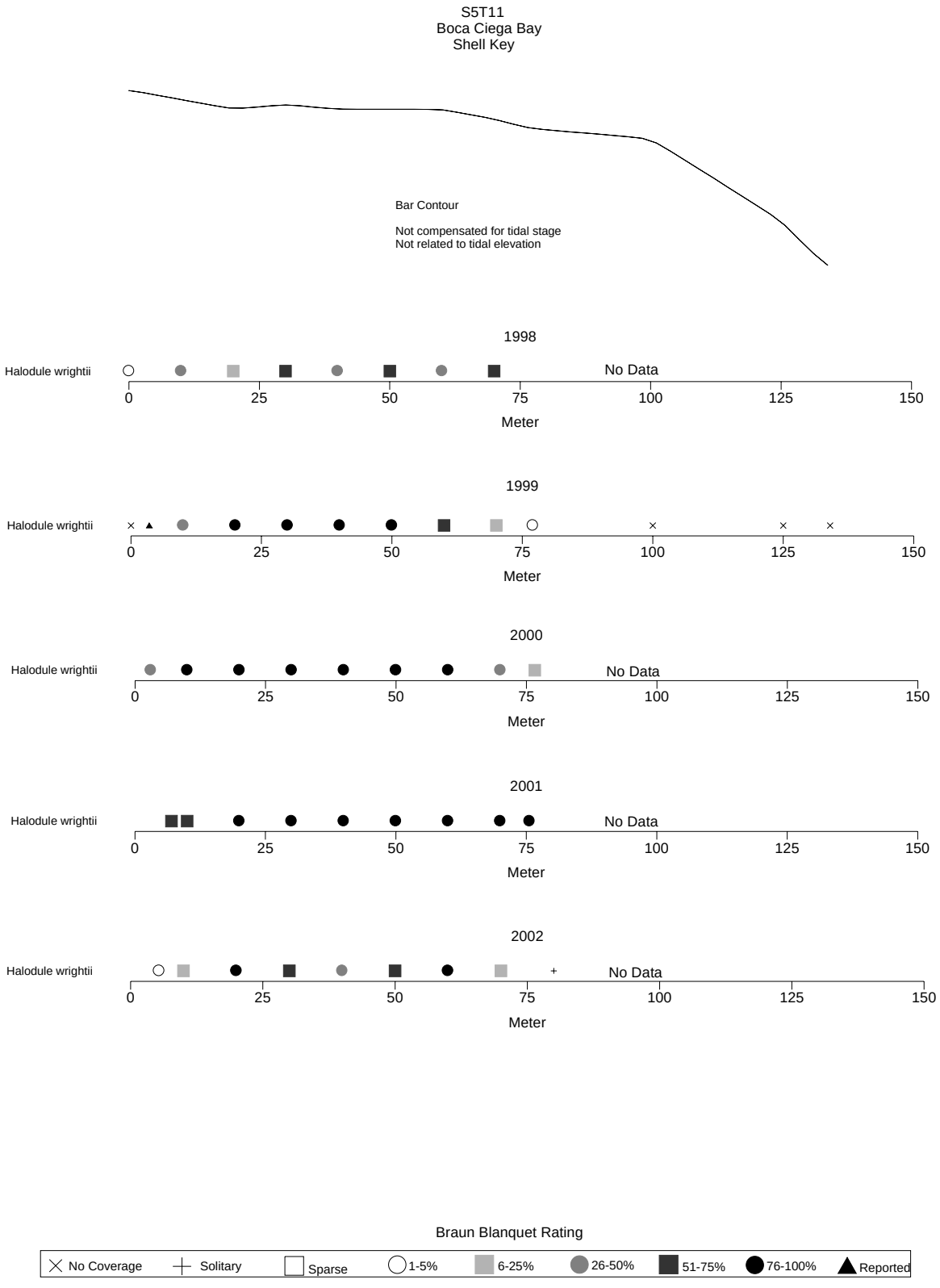

Figure 68. Seagrass species, abundance, and zonation at S5T11 from 1998-2002.