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# Distribution and Abundance of Submerged Aquatic Vegetation in 1984 and 1985

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# STATE OF THE CHESAPEAKE BAY
# SECOND ANNUAL MONITORING REPORT

# COMPENDIUM

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# INTRODUCTION

The second report from the Chesapeake Bay Program Monitoring Subcommittee summarizes data collected from June 1984 through September 1985 at over 165 stations Bay-wide for the new coordinated monitoring program. This initial effort represents the baseline for a large, complex, and rapidly growing store of information.

This Compendium volume is intended to accompany the State of Chesapeake Bay summary report, amplifying the contribution of each group involved in this complex overall monitoring effort. Weaving these discrete and more technically oriented documents together has been the job of the summary report.

Like the summary report, this report is organized so the reader can follow discussion of the Bay's problems and progress in a logical sequence. First, the physical and chemical observations characterize the Bay system and its major tributaries. These physical and chemical characteristics underly the movement and transformation of materials we're concerned about in the water column.

Chapters on sediments and toxics discuss the current understanding of how materials enter and leave the sediments and outline the distribution of toxic materials we have been monitoring in the Bay.

In logical sequence, the chapters on living resources appear next, because we believe the Bay's living resources rely on the habitat quality, which is often limited by what is in the waters and sediments.

We follow the food chain: the phytoplankton, which synthesize nutrients into algal biomass; the zooplankton, which are primary consumers; and the benthic (bottom-dwelling) organisms and submerged aquatic vegetation that are also vital elements of the Bay's food base. Another step up the food chain brings us to fisheries and waterfowl.

Much interest has surrounded the Patuxent River, which served as a catalyst in focusing attention on many of the Bay's problems. As in the summary report, the Patuxent Story is developed as a case history.

This Compendium demands more of the reader than does its summary report, because the constituent chapters cover topics in greater technical detail. Still, these chapters are themselves simplifications, as we approximate an understanding of the Bay's complex systems. We hope this understanding will be broadened and deepened as monitoring progresses over its intended course of 10 to 15 years.

# Distribution and Abundance of Submerged Aquatic Vegetation in 1984 and 1985

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Communities of submerged aquatic vegetation (SAV) are an integral part of the Chesapeake Bay ecosystem. They provide an important habitat for many species, either as a food source or as protection from predators, i.e., as a nursery. By reducing currents and baffling waves, they allow for deposition of suspended material. In addition, they bind sediments with their roots and rhizomes to prevent erosion of the underlying material. They are important in nutrient cycling through both the absorption and release of nitrogen and phosphorus (Thayer et al. 1975; Kemp et al. 1984; Orth and Moore 1984; Ward et al. 1984).

The interest in SAV communities, generated in the 1970s because of their dramatic Bay-wide decline, has continued into the 1980s. A key aspect of the research programs currently being funded by both Maryland and Virginia entails annual monitoring of all SAV beds in the Chesapeake Bay and its tributaries.

The first Bay-wide aerial survey of SAV beds was conducted in 1978 and resulted in two separate reports on the SAV distribution in Virginia and Maryland (Orth et al. 1979; Anderson and Macomber 1980). Between 1979 and 1984, various state agencies conducted a number of field and aerial surveys in sections of the Bay, but there was no Bay-wide effort to monitor SAV distribution.

The first coordinated mapping of all the SAV beds in the Bay was attempted in 1984. In addition to the aerial surveys, 1984 ground survey information was included to provide as much detail as possible on the SAV distribution in that year (Orth et al. 1985). Although some problems were experienced in acquiring the photography (e.g., poor weather, airspace restriction), coverage of almost all areas was obtained. Ground surveys included efforts by the U.S. Geological Survey (USGS) and the Northern Virginia Community College (NVCC) in the Potomac River; Maryland's Department of Natural Resources (MD DNR) SAV station survey of the entire upper Bay; the Virginia Institute of Marine Science (VIMS) surveys in the lower Bay; and several sectional surveys conducted by Harford Community College (HCC) and the University of Maryland's Horn Point Laboratory (HPL).

A coordinated survey for SAV adjacent to the shoreline of the Chesapeake Bay and its tributaries was repeated in 1985. Ground survey information was available from USGS, MD DNR, HPL, HCC, and VIMS. In addition to these scientific surveys, the Chesapeake Bay Foundation (CBF) and the Citizens Program for Chesapeake Bay (CPCB) solicited help from citizen volunteers to help locate SAV beds and provide ground truth for the aerial photography. Maryland's Charter Boats Association also participated in the SAV ground truthing through funding provided by the MD DNR Watermen's Assistance Program.

In 1985 color aerial photography at a scale of 1:12,000 was used to map the Maryland portion of the Bay, while black and white photography at a scale of 1:24,000 was used to map the Virginia portion. Both areas had been photographed with 1:24,000 color photography in 1984. SAV beds detected on the aerial photography were traced onto mylar USGS quadrangles, and areas of each bed were then digitized. Data was reported in square meters for each quadrangle. For ease of reporting, the Bay was divided into 21 sections and three zones (Figure 1), which will be used in further discussions of the data.

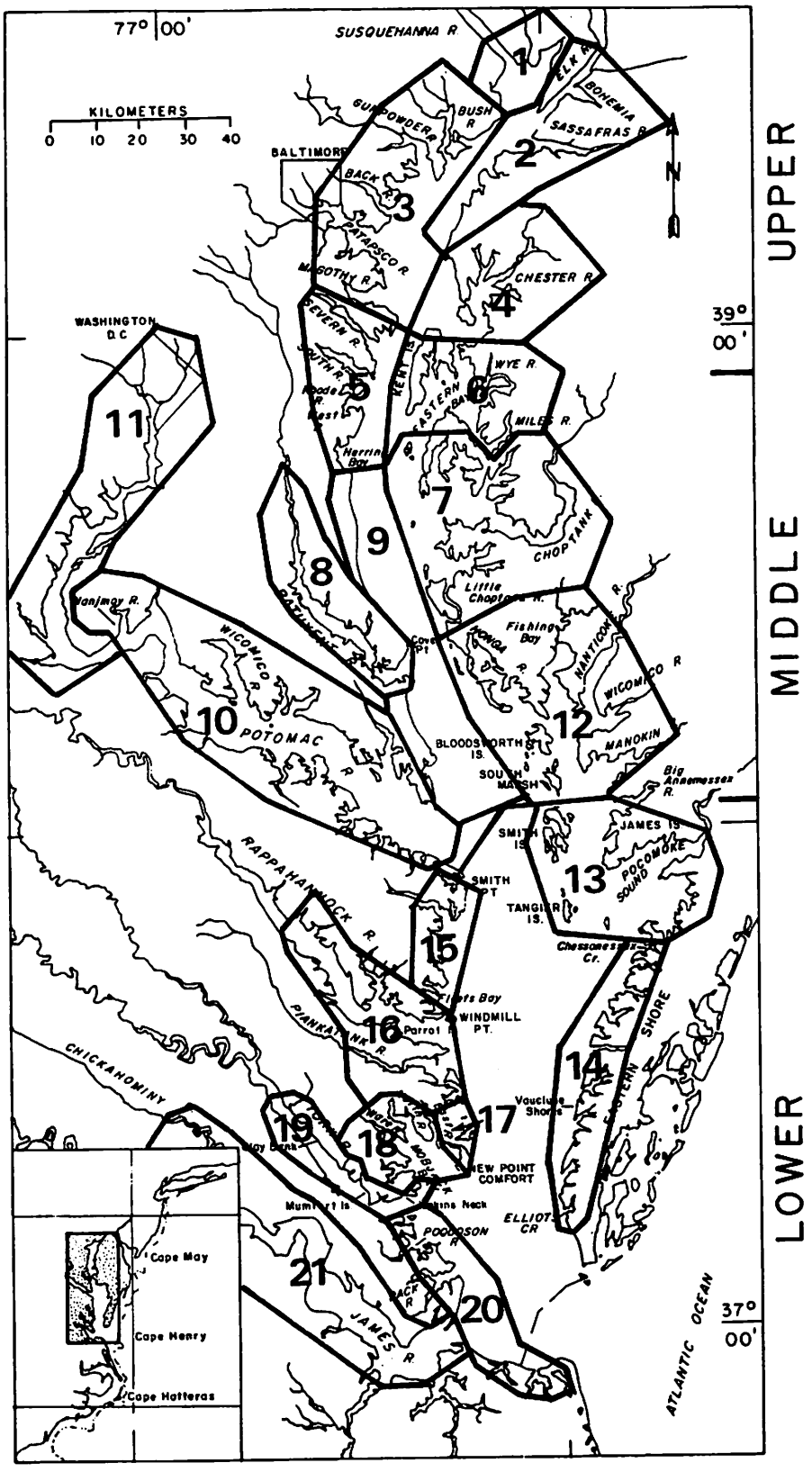


**Figure 1.** Map of the Chesapeake Bay illustrating 21 sections and 3 zones used for reporting distribution and abundance of submerged aquatic vegetation.

## RESULTS

A total of 19,390 hectares (Table 1) of SAV was mapped in the Chesapeake Bay in 1985, a 26% increase over that reported in 1984. The upper zone had 3,025 hectares of SAV in 1985, representing a decrease of 4.5% from that reported in 1984 (3,168 hectares). The middle zone showed an increase of 398%, from 984 hectares in 1984 to 4,912 hectares in 1985. All sections in this zone showed an increase in SAV for 1985. The lower zone increased less than 1%, from 11,248 hectares in 1984 to 11,379 hectares in 1985. The following is a discussion of SAV trends in each of the 21 sections of the Bay (refer to Figure 1 and Table 1).

### Upper zone

Section 1: Susquehanna Flats. The distribution of SAV in this section decreased by 6.5% in 1985, from 2,150 hectares in 1984 to 2,011 hectares in 1985. Seven species of SAV were found in 1985, with *Myriophyllum spicatum* the most abundant.

**Table 1.** Number of hectares of bottom covered with submerged aquatic vegetation (SAV) in 1978, 1984, and 1985 for different sections within the three zones in the Chesapeake Bay (data for 1978 from Orth et al. 1979, and Anderson and Macomber 1980; data for 1984 from Orth et al. 1985).

| | No. of hectares | | |
|---|---|---|---|
| Section | 1978 | 1984 | 1985 |
| Upper Bay zone | | | |
| (1) Susquehanna Flats | 804* | 2150 | 2011 |
| (2) Upper Eastern Shore | 29 | 43 | 105 |
| (3) Upper western shore | 484 | 244 | 238 |
| (4) Chester River | 1475 | 731 | 671 |
| Total | 2792 | 3168 | 3025 |
| Middle Bay zone | | | |
| (5) Central western shore | 241 | 0 | 26 |
| (6) Eastern Bay | 1800 | 66 | 356 |
| (7) Choptank River | 1740 | 82 | 1528 |
| (8) Patuxent River | 34 | 9 | 44 |
| (9) Middle western shore | 11 | 0 | 23 |
| (10) Lower Potomac River | 410 | 194 | 381 |
| (11) Upper Potomac River | --+ | 600 | 1440 |
| (12) Middle Eastern Shore | 210 | 33 | 1188 |
| Total | 4446 | 984 | 4986 |
| Lower Bay zone | | | |
| (13) Tangier Island complex | 3759 | 5447 | 5504 |
| (14) Lower Eastern Shore | 1991 | 2232 | 2227 |
| (15) Reedville | 364 | 264 | 172 |
| (16) Rappahannock River complex | 93 | 23 | 20 |
| (17) New Point Comfort region | 271 | 299 | 332 |
| (18) Mobjack Bay complex | 1785 | 1550 | 1505 |
| (19) York River | 157 | 238 | 258 |
| (20) Lower western shore | 925 | 1149 | 1315 |
| (21) James River | 54 | 46 | 46 |
| Total | 9399 | 11,248 | 11,379 |
| Total for all zones | 16,637 | 15,400 | 19,390 |

*1978 data for Susquehanna Flats remapped and digitized to allow for greater compatability with 1984 data.

+No aerial photography was taken of this area in 1978; the absence of SAV is based on ground survey observations by the USGS.

Other species of importance were *Heteranthera dubia, Vallisneria americana,* and *Hydrilla verticillata,* which appeared to be increasing in abundance along the Susquehanna River and in the Havre de Grace area.

The MD DNR survey found SAV at one of the 37 stations sampled annually in the Susquehanna Flats.

Section 2: Upper Eastern Shore. This section showed a 142% increase in SAV from 1984 (43 hectares) to 1985 (105 hectares). Most of the increase in SAV in 1985 occurred along the Elk, Bohemia, and Sassafras Rivers. Fifteen stations were sampled by MD DNR in the Elk and Bohemia Rivers, with no vegetation recorded at any of those stations. Similarly, no vegetation was found at the 10 stations sampled by the MD DNR survey on the Sassafras River or the five stations on Stillpond Creek. Other field surveys conducted by citizens and charter boat captains, along with observations of drifting SAV by MD DNR field crews, revealed that *M. spicatum* was the most prevalent species in this section. Seven stations sampled by MD DNR in the southern portion of the section, from Howell Point to Swan Point, also had no SAV.

Section 3: Upper western shore. The 1985 aerial survey indicated 238 hectares of SAV in this section, a decrease of 2.4% from that mapped in 1984 (244 hectares). Aerial photos indicated that SAV was present in all river systems (Gunpowder, Bush, Back, Middle, and Magothy) in the section. Generally most of the SAV was present in the lower section of each river. Four of 27 MD DNR stations on the Gunpowder, Bush, Back, and Middle Rivers found rooted SAV in 1985, one more than in 1984. Species present in these samples were *M. spicatum, Chara, V. americana, Potamogeton perfoliatus,* and *Najas guadalupensis.* No rooted SAV was found by MD DNR at the 12 Magothy River stations.

Section 4: Chester River. In 1985, 671 hectares of SAV were mapped in the Chester River section, a decrease of 8.2% from the 731 hectares mapped in 1984. As in 1984, most of the SAV mapped (87%) occurred on the Langford Creek quadrangle. Five species of SAV were reported by citizen and MD DNR field surveys: *Ruppia maritima, Zannichelia palustris, P. perfoliatus, Potamogeton pectinatus,* and *M. spicatum. P. perfoliatus* and *Ruppia maritima* were the most prevalent.

The MD DNR survey found eight (22.2%) of their 35 stations in the Chester River vegetated in 1985, as compared with seven (19.4%) in 1984.

**Middle zone**

Section 5: Central western shore. A total of 26 hectares of SAV was mapped in this section in 1985, where none was seen in 1984. Seventy-two percent of the SAV reported was located in Herring Bay on the North Beach quadrangle. No SAV was mapped in any river system in this section except for a small bed near the mouth of the West River.

The MD DNR survey found no rooted SAV in either the Severn section or the South, West, and Rhode River section.

Section 6: Eastern Bay. In 1985 a total of 356 hectares of SAV were noted on the aerial photography, an increase of 441% over the 66 hectares reported in 1984. *Ruppia maritima* was the most abundant species reported in field surveys by citizens and MD DNR personnel. *Potamogeton pectinatus* and *P. perfoliatus* were also reported, but other species reported in 1978, such as *M. spicatum, Elodea canadensis,* and *Z. palustris,* were not seen.

The MD DNR survey, as in 1984, found no SAV at the stations from Love Point to Kent Point. Of 46 stations in the Eastern Bay section the number vegetated increased from three (6.5%) to eight (17.4%). *Ruppia maritima* was the only species found in the MD DNR survey.

Section 7: Choptank River. In 1985, a total of 1,528 hectares of SAV was noted on the aerial photography, as compared with only 82 hectares in 1984 (a 1,760% increase). Six species were reported in this section, with *R. maritima* the most abundant species reported in field surveys. Other species found were *P. perfoliatus, P. pectinatus, Z. palustris, N.guadalupensis,* and *V. americana.*

The MD DNR survey found rooted SAV at seven of 60 stations on the Choptank River in 1985; none of the 19 stations on the Little Choptank River had SAV. All SAV found was *R. maritima.* Information provided by HPL showed SAV at five of their six monitored areas, as compared with two in 1984. Horn Point was the only station not vegetated, and dramatic increases were seen at all the other stations. Species present were *Z. palustris* in June followed by *R. maritima* in July (Stevenson et al. 1986).

Section 8: Patuxent River. In 1985, 44 hectares of SAV were noted on the aerial photography, as compared with nine in 1984. SAV was noted on four of the five quadrangles in this section.

The MD DNR survey found no SAV at the 43 stations surveyed.

Section 9: Middle western shore. A total of 23 hectares of SAV was noted on the aerial photography in this section in 1985. None had been noted in 1984. Most of the mapped SAV in this section was found in small marsh ponds that drain into the Bay. The MD DNR survey found no SAV at eight sampled stations from Curtis Point to Cove Point. This section is a very exposed region, with little habitat suitable for SAV; thus it would not be expected to support significant stands of SAV.

Section 10: Lower Potomac River. In 1985 there were 381 hectares of SAV in the lower Potomac River, as compared with 194 mapped in 1984. This change represents a 69% increase, of which 9% comprises quadrangles that were not mapped in 1984 because of a lack of photographic coverage.

The MD DNR survey sampled 88 stations in the lower section, and found vegetation at four stations, all at the northern end of the section near Upper Cedar Point and the Nanjemoy River. Species located at these stations were *P. perfoliatus, V. americana, Z. palustris, M. spicatum,* and *N. guadalupensis.*

Section 11: Upper Potomac River. In 1985, 1,440 hectares of SAV were noted on the aerial photography of this section as compared with 600 in 1984, a 140% increase. The vegetation was largely confined to the upper reaches of the section between Alexandria, Virginia and Marshall Hall, Maryland. Since 1984 the vegetation has spread almost 2 km farther downriver. The most abundant and most widely distributed species were *H. verticillata, M. spicatum, Heteranthera dubia, Ceratophyllum demersum, V. americana* and *N. guadalupensis.* Results of the USGS shoreline survey showed that *Hydrilla verticillata* was more abundant than all other species in 25% of the vegetated areas, accounting for 62% of the total dry weight from the fall sampling (Rybicki et al. 1986).

The MD DNR survey sampled 52 stations in this section, of which three yielded SAV. Rooted SAV species found at these stations were *M. spicatum, H. verticillata,* and *C. demersum.*

Section 12: Middle Eastern Shore. In 1985, there were 1,188 hectares of SAV in this section as compared with only 33 hectares in 1984. This 3,504% increase was the largest in any section of the Bay. One of the most significant increases was the 265 hectares, mostly in one large bed, in the Barren Island Gap region, where no SAV was seen in 1984.

The MD DNR survey sampled 169 stations in this section. SAV was found at one station each in the James/Barren Island section, Honga section, and the Bloodsworth Island/South Marsh Island section; at two stations in the Manokin River section; and at three stations in the Big/Little Annemessex River sections. No SAV was found in the Fishing Bay or Nanticoke/Wicomico River sections. *Ruppia maritima* was found at seven of the eight sample points with SAV, and *Z. palustris* was located at the other site.

**Lower zone**

Section 13: Tangier Island complex. This section contained the greatest amount of SAV in the lower Bay zone, with 5,504 hectares, or 49% of the total for this zone; this amount is similar to that reported for 1984.

SAV beds were concentrated in distinct areas in the section: adjacent to Big Marsh between Chesconessex Creek and Deep Creek; on the west side of Webb and Halfmoon Island; the east side of Great Fox Island; and in the areas between Tangier Island and Smith Island. Dominant species in this section were *Zostera marina* and *R. maritima.* Although this section had significant stands of SAV, and data in Table 1 indicate that the abundance of SAV has increased, a MD DNR survey found SAV in only eight of 57 stations. Contrary to the findings of the aerial survey, the DNR survey indicated that SAV abundance decreased to 23.5% of the surveyed stations in the Smith Island portion and has been continually declining from 47.1% of the stations in 1980.

Section 14: Lower Eastern Shore. This section contained 2,227 hectares of SAV in 1985, in dense to scattered patchy beds from Chesconessex Creek to Elliots Creek. Large beds of *Z. marina* and *R. maritima* were present around Cape Charles, and at the mouths of Cherrystone Inlet and Hungars, Mattawoman, Occahannock, Craddock, Pungoteague, and Onancock Creeks.

SAV in the Vaucluse Shore "historical" areas was reduced slightly (6%) from 1984. This is one of six sites where historical aerial photography from various years since 1937 was used to map SAV distribution (see Orth et al. 1979 for more detail). The SAV at the site has been declining gradually in the last 50 years, principally because of the migrating nature of the sand bars and spits that cover existing SAV and prevent potential SAV growth.

Section 15: Reedville. The Reedville section contained 172 hectares in 1985, a decrease of 35% from 1984 (264 hectares). This reduction was evident in the Fleets Bay historical area, which declined in spatial coverage by 15%. Most of the SAV beds in this section are small and sparse, are susceptible to disturbance, and can undergo rapid changes.

Section 16: Rappahannock River complex. Only 20 hectares of SAV were found in this section in 1986, an area similar to that found in 1984 (23 hectares). The dense SAV stands found in the Milford Haven area consisted predominantly of *Z. marina.* There were no SAV beds in the Parrott Island historical area.

Section 17: New Point Comfort. SAV beds in this section were concentrated in the area between New Point Comfort Lighthouse and Horn Harbor. This section contained 332 hectares of SAV in 1985, consisting of *Z. marina* and *R. maritima.* This figure represents an 11% increase in spatial coverage from 1984.

Section 18: Mobjack Bay complex. This section contained the greatest amount of SAV along the entire western shore, with 1,505 hectares in 1985, a 3%

decrease from 1984. SAV beds consisting of Z. *marina* and *R. maritima* were present along the shoreline of the entire Mobjack Bay and three of four tributaries: the Severn, Ware, and North Rivers. Little SAV appeared in the East River; SAV in the East River historical area decreased 32% from 1984.

Section 19: York River. This section contained 258 hectares of SAV in 1985, an increase of 8% over that found in 1984. SAV beds (*Z. marina* and *R. maritima*) were found from Gloucester Point to the mouth of the river, principally along the north shore. Transplanted SAV beds (*Z. marina* only) at Gloucester Point were thriving, and individual planted units were rapidly expanding. Transplanted *Zostera* at Mumfort Island has been much less successful than at Gloucester Point. *Zostera* transplanted to Clay Bank, the upriver limits of the species in the past, has never survived through the summer.

SAV in the Jenkins Neck historical area increased 17% from 1984, but was still 150 hectares below levels found during the years when SAV was very abundant. SAV continued to be absent from the Mumfort Island historical area.

Section 20: Lower western shore. There were 1,315 hectares of SAV in this section in 1985, an increase of 14% from 1984. These beds, consisting of both *Z. marina* and *R. maritima*, were still concentrated in Broad Bay, Back River, Drum Island Flats adjacent to Plumtree Island, and on the south side of Goodwin Island. The beds found on Drum Island Flats represented one of the more extensive and densely vegetated areas along the western shore.

Section 21: James River. No SAV beds were identified in the James River from the aerial photography or ground surveys. The concentration of SAV in the Chickahominy River still persisted (46 hectares); these were the only beds found in the entire section. The species found in these upriver and marsh creek areas were fresh-to-brackish water species such as *C. demersum*, *E. canadensis*, and *Najas* spp.

## SUMMARY

The distribution and abundance of SAV was mapped for the entire Chesapeake Bay in 1985. The entire Chesapeake Bay exhibited 19,390 hectares of SAV in 1985, compared with 15,400 hectares in 1984, a 26% increase.

The upper Bay zone had 3,025 hectares of SAV in 1985 (15.6% of the total SAV in the Bay), which was a decrease of 4.5% from that reported in 1984. The Susquehanna Flats section contained 66% of the SAV in this zone. Three of the four sections in this zone showed a slight decrease in SAV abundance, whereas a 142% increase was seen in the sparsely vegetated upper Eastern Shore section, principally along the Elk, Bohemia, and Sassafras Rivers. SAV beds in the upper Bay zone consisted of 13 species. Dominant species in Susquehanna Flats were *M. spicatum*, *H. verticillata*, and *V. americana*, whereas the Chester River was dominated by *P. perfoliatus* and *R. maritima*.

The middle Bay zone had 4,986 hectares of SAV in 1985 (25.7% of the total SAV in the bay), which represents a 389% increase from 1984. All sections in the zone showed an increase in SAV, with most (3,072 hectares) of the SAV and the greatest percentage changes occurring in the Eastern Bay (441%), Choptank River (1,760%), and middle Eastern Shore (3,504%) sections on the Eastern Shore of the mainstem of the Bay. The Patuxent River, although sparsely vegetated, showed a 401% increase in SAV, from 9 hectares in 1984 to 44 in 1985. Both Potomac River sections increased in SAV in 1985, with the largest increase (104%) in the upper Potomac River section.

SAV beds in the mainstem of the Middle Bay Zone consisted principally of *R. maritima*. The Potomac River SAV beds consisted of 14 different species, with the most prevalent being *M. spicatum* and *H. verticillata*.

The return of SAV to the upper Potomac River continues to be significant because of its rapidity. In less than five years, the vegetated area has increased from almost nothing to 1,440 hectares. Although *Hydrilla* is one of the dominant species, 13 other species coexist and, in some areas, share the dominant role with *Hydrilla*.

The lower Bay zone had 11,379 hectares of SAV in 1985 (58.7% of the total SAV in the bay). This amount was similar to that reported for 1984. Most (68%) of the SAV in this zone was found along the eastern shore, with the major beds being located on the broad, shallow flats on and near Tangier and Smith Islands. SAV beds were concentrated at the mouths of the major bayside creeks, principally Cherrystone Inlet, and Hungars, Mattawoman, Occahannock, Craddock, Pungoteague, and Onancock Creeks. Along the western shore of the zone, SAV beds were found in Back River, at Drum Island Flats adjacent to Plumtree Island, at the mouth of the York River adjacent to the Guinea Marshes, along the shoreline of the Mobjack Bay, and in a small band from New Point Comfort to Horn Harbor. There were no major changes in SAV distribution in the nine sections in this zone. The largest change was in the Reedville section, where SAV distribution decreased 34% from 1984.

SAV beds in the lower zone consisted principally of two species, *Z. marina* and *R. maritima*.

*Zannichelia palustris* has also been found in small isolated patches, but is not considered a dominant species here.

SAV was still absent in two of the six historical areas from the lower Bay zone (Mumfort Island and Parrott Island). SAV increased in the Jenkins Neck area (17%) but decreased in the East River (33%), Fleets Bay (150%), and Vaucluse Shore (6%) areas from 1984. Changes in the Vaucluse Shore area were related to the dynamic nature of the sand bars and sand spits that continually alter the area available for SAV growth. Changes in the East River and Fleets Bay distribution occurred in very patchy beds. These beds are more susceptible to physical damage from storms and can easily change in less than a year.

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