

**Severn & Magothy SAV transect sampling results, 2007-2012**  
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**Background and methods:** The VIMS aerial Submerged Aquatic Vegetation (SAV) survey of Chesapeake Bay and the MD and VA coastal bays accurately maps the size and locations of beds, but does not identify or map the species (<http://web.vims.edu/bio/sav/sav11/index.html>). The survey is supplemented by opportunistic “ground truthing” that verifies the presence of SAV and identifies the species, but it does not estimate the relative abundance of each species (<http://thumper-web.vims.edu/bio/sav/wordpress/>).

To provide more quantitative SAV surveys, Maryland DNR started a program in 2007 to enable watershed groups to do quantitative Submerged Aquatic Vegetation (SAV) sampling using modified oyster tongs. DNR provided instructions and equipment, as well as funding to some of the groups. In 2007 I worked with the South, Severn, and Magothy river watershed groups to do this sampling. DNR did not have additional funding for this after 2007 but I still had a set of equipment, so I worked with Severn and Magothy watershed groups to repeat sampling there each summer through 2012. The South River group stopped sampling after 2007 because there were almost no grasses left, and let us use their tongs.

The three main SAV species we found in both rivers were widgeongrass (Rm), redhead grass (Ppf), and sago pondweed (Ppc). There was a tiny amount of slender pondweed (Ppu) in one Magothy transect in 2009, and a small amount of wild celery (Va) in another Magothy transect in 2012, but these were left out of the results below.

The four transect sites in each river were chosen in 2007 to be near the centroids of historical SAV beds, along the range of where SAV is found in the river. Table 1 lists the four transect sites in each river. For maps of the transect sites with the 2007 SAV maps, see Figs. 1 and 3; for the 2011 SAV maps, showing the SAV losses over four years, see Figs. 2 and 4. For depth profiles of the transects in each river, see Figs. A-1 and A-2 in the Appendix.

One transect on the Severn, AC, was moved in 2012 to a dense bed just north of its former location (Fig. 1 & 2), which used to be in a dense bed, but was very sparse when we sampled it in 2011 (only 17 ml of SAV was found; see Table 2). By moving the transect north we sampled close to 7,000 ml of SAV in the AC transect in 2012, which was almost twice as much as the previous high volume we found in our sampling, which was in this transect in 2007 (Table 2).

## **Results**

**Comparing volumes between rivers & among years:** The total volume collected was lower in the Magothy than in the Severn in all six years, but the difference went down as the volumes decreased through 2011 (Tables 2 & 3, Fig. 5). This is consistent with the apparent density of the beds when in the field, since most of the Severn beds

Table 1. Names and description of the four transect sites in each river, arranged from upriver to downriver.

| <b>Severn Transect</b>    | Description   | <b>Magothy Transect</b>     | Description   |
|---------------------------|---|-----------------------------|---|
| <b>Sullivan Cove (SC)</b> | Next to community marina  | <b>Swan Cove (SC)</b>       | In cove behind N. Ferry Pt, next to one residential pier  |
| <b>Brewer Pond (BP)</b>   | Just outside the pond on mainstem   | <b>South Ferry Pt (SFP)</b> | Between residential piers; same area has had small amounts of wild celery since the mid-80's.   |
| <b>Asquith Creek (AC)</b> | On the shoal outside the creek; near where first SAV beds were mapped in 1994. Moved north in 2012 to sample dense bed. | <b>Stonington (STON)</b>    | Next to a community pier. Used to have much more SAV.   |
| <b>Martins Pond (MP)</b>  | Outside mouth of tidal pond on mainstem   | <b>Gibson Island (GI)</b>   | On western shore of the island; near where first SAV beds were mapped in 1993 after years of no SAV mapped. Used to have lots of redhead grass; none now. |

usually looked much denser than the Magothy beds. Comparing between years, the total Severn volume went down slightly in 2008, while the total Magothy volume more than doubled in 2008; the total volumes in both rivers dropped sharply in 2009 and stayed low through 2011 (Tables 2 & 3, Fig. 5). Severn total volume went up in 2012 to the highest volume we had measured there, because we moved the AC transect to a dense bed. If we had not moved it, the total Severn volume in 2012 would have been about 2,200 ml (Table 2), still a large increase over the 2009-2011 volume there (Fig. 5).

Looking at changes over time at the same transects, two Severn transects, Brewer Pond Asquith Creek, had the largest volume declines from 2007 to 2011 (Table 2). In 2007, samples at these transects had to be measured in several batches in the largest graduated cylinders we had (500 ml), while in 2011, we could use a 100 ml cylinder at both sites. A decline in transect volume did not mean the bed was gone; it may have moved or contracted, as the Asquith bed did in 2009, when it contracted northward so that our transect was no longer in the bed (see Fig. 2 for the 2011 map showing the new AC transect location). A less pronounced decline was seen in the Magothy data (Table 3) at Stonington and Gibson Island from 2007-2008 compared to 2009-2010, but both increased in volume in 2011, and decreased again in 2012. The changes in volume at South Ferry Point (high in 2008 & 2010, lower in other years) are probably at least partly a result of the very patchy beds there. In some years the tongs hit more dense beds than others.

Fig. 1. Map of 2007 Severn SAV showing transect locations.

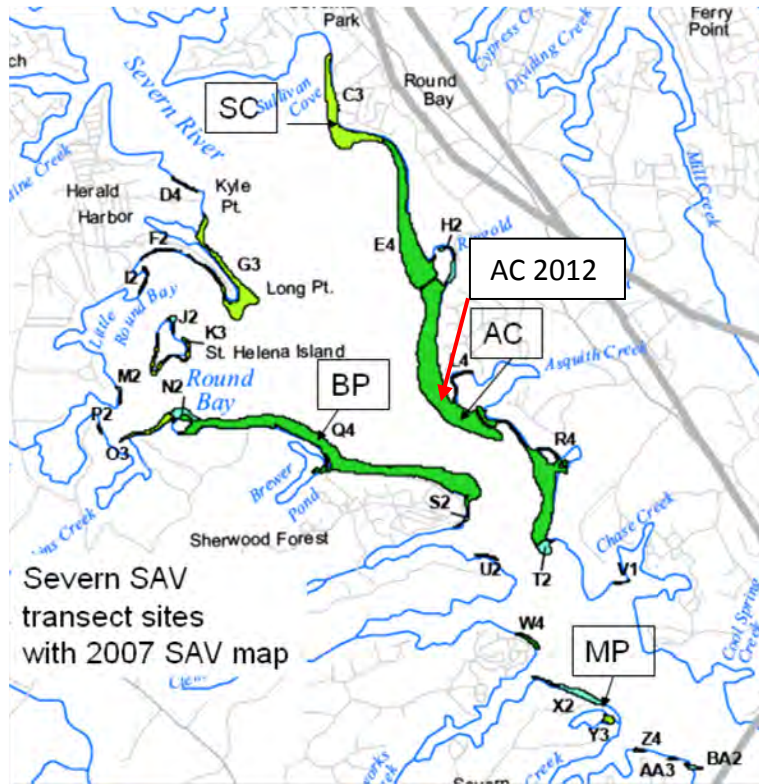


Fig. 2. Map of 2011 Severn SAV showing loss of beds since 2007. The new location of the AC transect is marked, as well as the Ppf beds at Sherwood Forest (not in a transect).

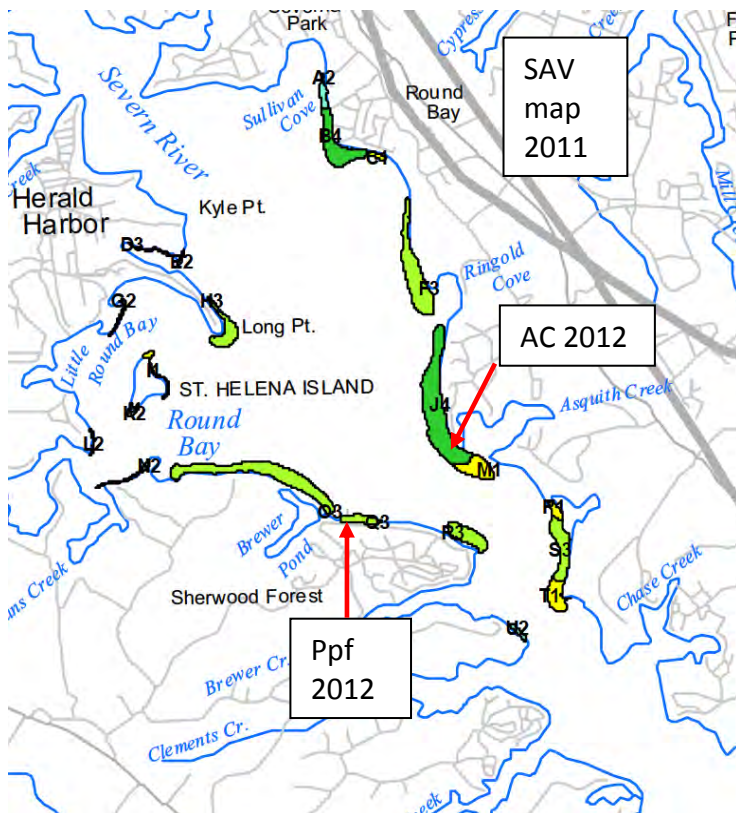


Fig. 3. Map of 2007 Magothy SAV showing transect locations.

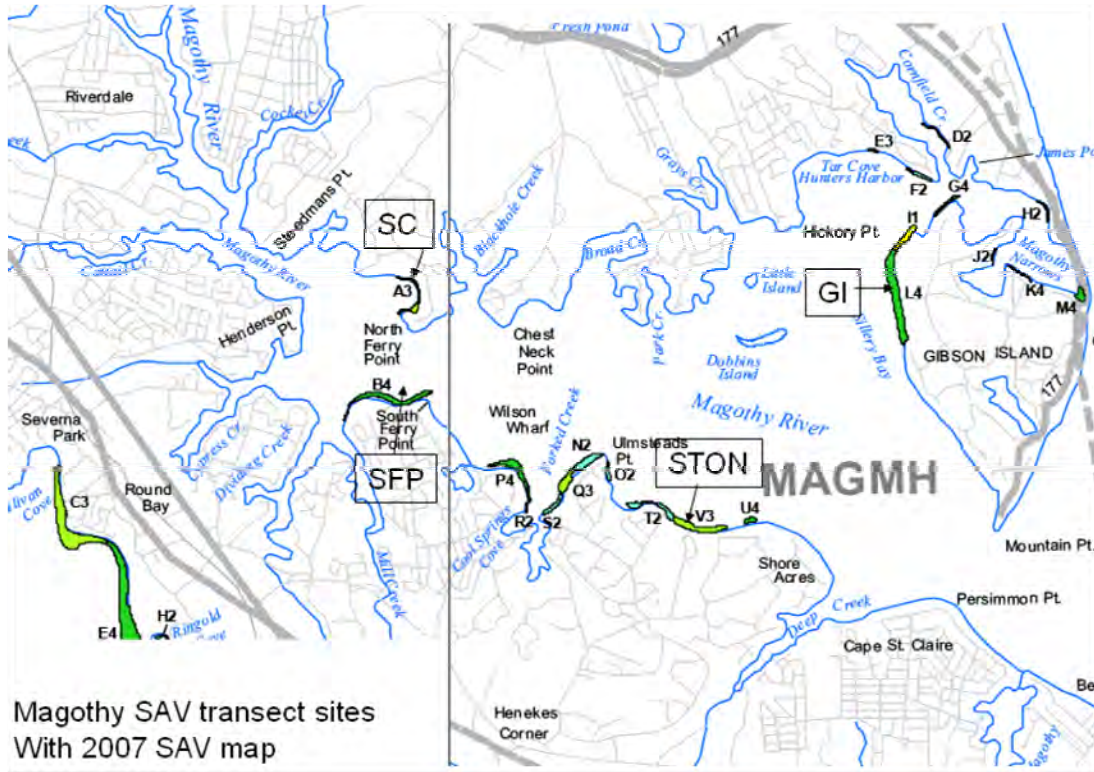
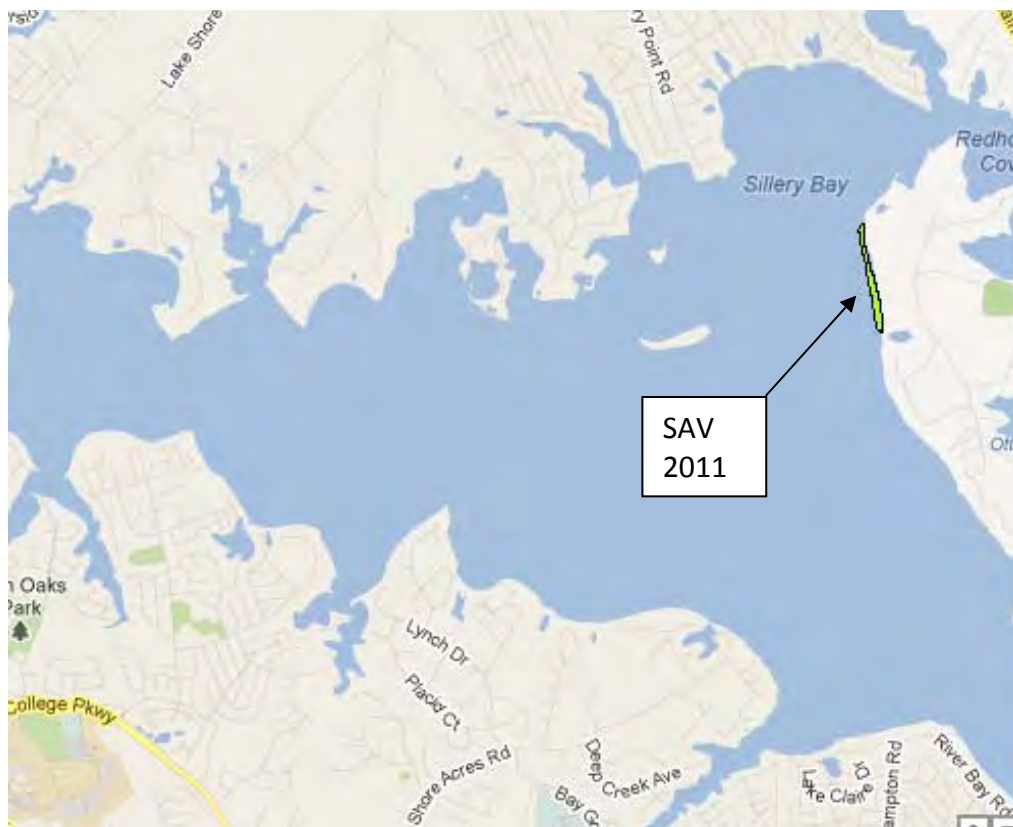


Fig. 4. Map of 2011 Magothy SAV showing loss of beds since 2007. There was only one mapped bed, shown at the arrow, which includes the GI transect.





**Comparing patchiness of beds among years:** The declines in SAV volumes that started in 2009 could mean that the beds were getting thinner overall, or that the SAV was becoming patchier over time (more bare patches), or both. I graphed the percent of grabs that had any SAV (Fig. 6) to see if patchiness was increasing, and it appeared that it did for the first two years of surveys. The percent of grabs that had any SAV dropped in the Severn and in the Magothy in 2009, and then leveled off in both rivers (Fig. 6).

Fig. 5. Total volume collected by river and year, 2007-2012.

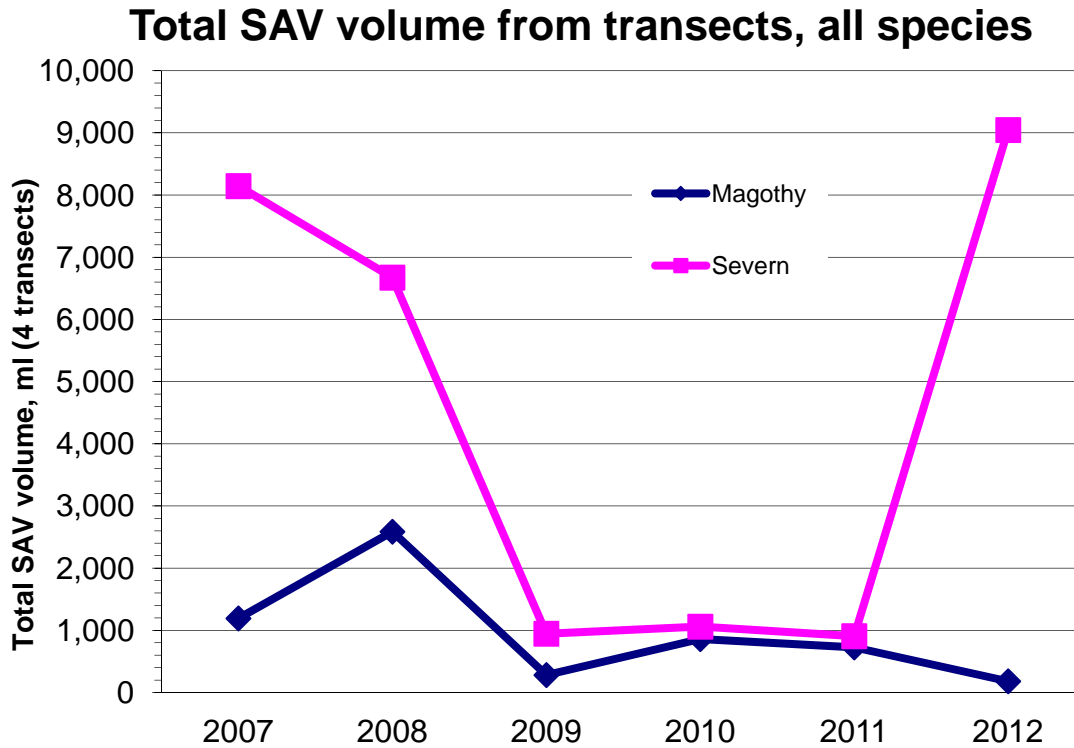


Fig. 6. Percent of grabs that had some SAV by river and year, 2007-2012.

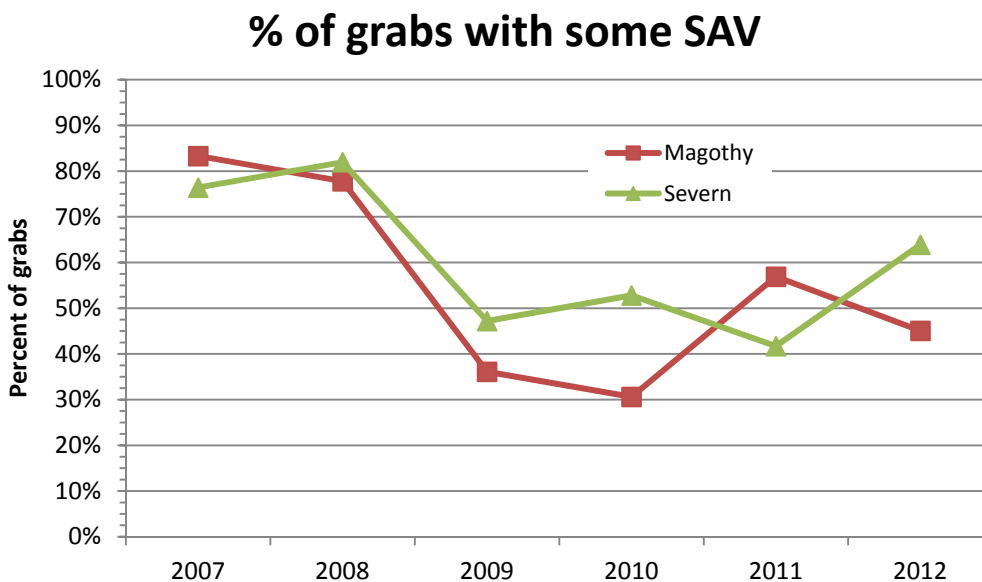


Table 2. Summed volume of all Severn grabs by species (using the sum of the 3 grabs at each site).

| Sampling date    | Transect      | Rm volume (ml) | Ppf volume (ml) | Ppc volume (ml) | Total volume |
|------------------|---------------|----------------|-----------------|-----------------|--------------|
| 9-11-2007        | Sullivan Cove | 895            | 1538            | 0               | 2433         |
| 9-11-2007        | Brewer Pond   | 1032           | 889             | 0               | 1921         |
| 9-11-2007        | Asquith Creek | 19             | 3755            | 0               | 3774         |
| 9-11-2007        | Martins Pond  | 16             | 0               | 0               | 16           |
| <b>9-11-2007</b> | <b>All</b>    | <b>1962</b>    | <b>6182</b>     | <b>0</b>        | <b>8144</b>  |
| 7-15-2008        | Sullivan Cove | 99.5           | 811.5           | 0               | 911          |
| 7-15-2008        | Brewer Pond   | 103.0          | 2402            | 301             | 2806         |
| 7-15-2008        | Asquith Creek | 42             | 2600            | 12              | 2654         |
| 7-15-2008        | Martins Pond  | 204            | 0               | 127             | 331          |
| <b>7-15-2008</b> | <b>All</b>    | <b>448.5</b>   | <b>5813.5</b>   | <b>440</b>      | <b>6702</b>  |
| 7-31-2009        | Sullivan Cove | 54             | 179             | 0               | 233          |
| 7-31-2009        | Brewer Pond   | 38             | 620             | 31              | 689          |
| 7-31-2009        | Asquith Creek | 0              | 2               | 0               | 2            |
| 7-31-2009        | Martins Pond  | 0              | 0               | 22              | 22           |
| <b>7-31-2009</b> | <b>All</b>    | <b>92</b>      | <b>801</b>      | <b>53</b>       | <b>946</b>   |
| 7-20-2010        | Sullivan Cove | 113            | 142             | 0               | 255          |
| 7-20-2010        | Brewer Pond   | 84             | 702             | 0               | 786          |
| 7-20-2010        | Asquith Creek | 17             | 2               | 0               | 19           |
| 7-20-2010        | Martins Pond  | 0              | 0               | 0               | 0            |
| <b>7-20-2010</b> | <b>All</b>    | <b>214</b>     | <b>846</b>      | <b>0</b>        | <b>1060</b>  |
| 7-26-2011        | Sullivan Cove | 773            | 1               | 0               | 774          |
| 7-26-2011        | Brewer Pond   | 69             | 1               | 0               | 70           |
| 7-26-2011        | Asquith Creek | 17             | 0               | 0               | 17           |
| 7-26-2011        | Martins Pond  | 43             | 0               | 0               | 43           |
| <b>7-26-2011</b> | <b>All</b>    | <b>902</b>     | <b>2</b>        | <b>0</b>        | <b>904</b>   |
| 7-30-2012        | Sullivan Cove | 1986           | 34              | 5               | 2025         |
| 7-30-2012        | Brewer Pond   | 213            | 0               | 2               | 215          |
| 7-30-2012        | Asquith Creek | 53             | 53              | 6700            | 6806         |
| 7-30-2012        | Martins Pond  | 0              | 0               | 0               | 0            |
| <b>7-30-2012</b> | <b>All</b>    | <b>2252</b>    | <b>87</b>       | <b>6707</b>     | <b>9046</b>  |

Table 3. Summed volume of all Magothy grabs by species (using the sum of the 3 grabs at each site).

| Sampling date    | Transect       | Rm volume (ml) | Ppf volume (ml) | Ppc volume (ml) | Total volume |
|------------------|----------------|----------------|-----------------|-----------------|--------------|
| 9-8-2007         | Swan Cove      | 40             | 136             | 0               | 176          |
| 9-8-2007         | South Ferry Pt | 8              | 173             | 21              | 202          |
| 9-8-2007         | Stonington     | 33             | 110             | 223             | 366          |
| 9-8-2007         | Gibson Island  | 3              | 353             | 92              | 448          |
| <b>9-8-2007</b>  | <b>All</b>     | <b>84</b>      | <b>772</b>      | <b>336</b>      | <b>1192</b>  |
| 7-22-2008        | Swan Cove      | 5              | 701             | 0               | 706          |
| 7-22-2008        | South Ferry Pt | 0              | 749             | 303             | 1052         |
| 7-22-2008        | Stonington     | 10             | 47              | 142             | 199          |
| 7-22-2008        | Gibson Island  | 1              | 340             | 288             | 629          |
| <b>7-22-2008</b> | <b>All</b>     | <b>16</b>      | <b>1837</b>     | <b>733</b>      | <b>2586</b>  |
| 8-17-2009        | Swan Cove      | 85             | 33              | 0               | 128          |
| 8-17-2009        | South Ferry Pt | 0              | 129             | 1               | 130          |
| 8-17-2009        | Stonington     | 1              | 0               | 0               | 1            |
| 8-17-2009        | Gibson Island  | 0              | 18              | 5               | 23           |
| <b>8-17-2009</b> | <b>All</b>     | <b>86</b>      | <b>180</b>      | <b>6</b>        | <b>282</b>   |
| 8-4-2010         | Swan Cove      | 19             | 0               | 0               | 19           |
| 8-4-2010         | South Ferry Pt | 35             | 803             | 0               | 838          |
| 8-4-2010         | Stonington     | 0              | 0               | 0               | 0            |
| 8-4-2010         | Gibson Island  | 3              | 0               | 0               | 3            |
| <b>8-4-2010</b>  | <b>All</b>     | <b>57</b>      | <b>803</b>      | <b>0</b>        | <b>860</b>   |
| 8-9-2011         | Swan Cove      | 0              | 0               | 128             | 128          |
| 8-9-2011         | South Ferry Pt | 0              | 28              | 20              | 48           |
| 8-9-2011         | Stonington     | 0              | 0               | 221             | 221          |
| 8-9-2011         | Gibson Island  | 0              | 0               | 330             | 330          |
| <b>8-9-2011</b>  | <b>All</b>     | <b>0</b>       | <b>28</b>       | <b>699</b>      | <b>727</b>   |
| 7-27-2012        | Swan Cove      | 0              | 0               | 0               | 0            |
| 7-27-2012        | South Ferry Pt | 1              | 1               | 0               | 22*          |
| 7-27-2012        | Stonington     | 90             | 0               | 39              | 129          |
| 7-27-2012        | Gibson Island  | 0              | 0               | 31              | 31           |
| <b>7-27-2012</b> | <b>All</b>     | <b>91</b>      | <b>1</b>        | <b>70</b>       | <b>182</b>   |

\*Includes 20 ml of Va (wild celery), not shown in table.

**Spatial patterns along each river:** Volumes found for each species by transect and year are shown for the Severn in Table 2 and for the Magothy in Table 3. In the Severn and Magothy, SAV abundance based on the VIMS aerial survey usually appears to be greatest near the middle of the tidal portion, so we expected the most upriver and downriver transects might have less SAV volume than the two midriver transects. In the Severn, water clarity also tends to be better at midriver sampling sites, but this pattern is less apparent in the Magothy.

We found this general spatial pattern in Severn data (more SAV volume at mid-river transects) in all six years (Table 2), with a few exceptions. In 2007, the most upriver Severn transect, Sullivan Cove, had slightly more SAV volume than the next one downriver, Brewer Pond. In 2009, only Brewer Pond had much SAV, although there were denser SAV beds we did not sample downriver from it, and upriver from the Asquith Creek transect. In 2011, only Sullivan Cove, farthest upriver, had much SAV, and in 2012, most of the SAV was at Sullivan Cove and Asquith Creek (Table 2). Since SAV beds often move from year to year, fixed transects may sample the middle of a bed one year and miss it or sample its fringes the next year.

Spatial patterns along the river in Magothy total volume were different from those in the Severn (Table 3). In 2007, total volume went up as one moved downriver, while in 2008, total volume was greatest at one midriver site (South Ferry Point) and least at the other midriver site, Stonington. In 2009, only the two upriver transects had much SAV (Swan Cove and South Ferry Point), and their volumes were much less than in the previous years. In 2010, most of the SAV we found was at South Ferry Point, while in 2011 it was more evenly distributed among transects, and in 2012 the most volume was at Stonington. These results are surprising given the Magothy depth profiles (Fig. A-2). One would expect more SAV in the two downriver transects (Stonington and Gibson Island), as we found in 2007, since they are much shallower than the two upriver transects, and thus should have more light reaching the bottom, and thus more SAV.

**Comparing volumes among species:** Redhead grass (Ppf) had the largest volume in both rivers (Tables 2 and 3 and Figs. 7 and 8) through 2010. Ppf abundance declined in 2011-2012 in both rivers. In the Severn, there was much more widgeongrass (Rm) than Ppf in 2011 and much more sago pondweed (Ppc) than Ppf in 2012 (Table 2 and Fig. 7). In the Magothy, there was much more Ppc than Ppf in 2011, and more Ppc & Rm than Ppf in 2012 (Table 3 and Fig. 8).

As noted above, the main species shift in 2010-2011 was a big decline in Ppf in 2011 in both rivers. This species, with broad leaves that are often horizontal, seems to accumulate more sediment on its leaves than the other two species present with narrow leaves (Rm and Ppc), probably making Ppf more sensitive to worsening water clarity. The total volume did not decline much in either river in 2011 (Fig. 5), since 2011 also had an increase in Rm (Severn) or Ppc (Magothy). In 2012, the decline in total volume continued in the Magothy (Fig. 5), but in the Severn, there was an increase in Rm and a huge increase in Ppc (Fig. 7). Most of the increase in Ppc in the Severn in 2012 resulted from moving the AC transect north to sample a dense bed, which was mostly Ppc.



In 2012 there are still a few Ppf beds in the Severn, but they were outside of our transects. We found two fairly dense beds of Ppf in the Severn on 2012, just south of the BP transect, on both sides of the Sherwood Forest pier (location marked in Fig. 2). We stopped to look there because those areas had dense Ppf in past years. The Ppf here was a bit shorter than it had been at this site in the past, not quite to the surface at low tide, and not as dense as it had been, but the plants downriver of the pier had flowers and seeds. Most SAV tend not to flower when they are stressed, so this shows the plants were fairly healthy. It was mixed with Ppc on both sides of the pier, and also with Rm on the upriver side.

Fig.7. Volume by species by year, Severn River transects.

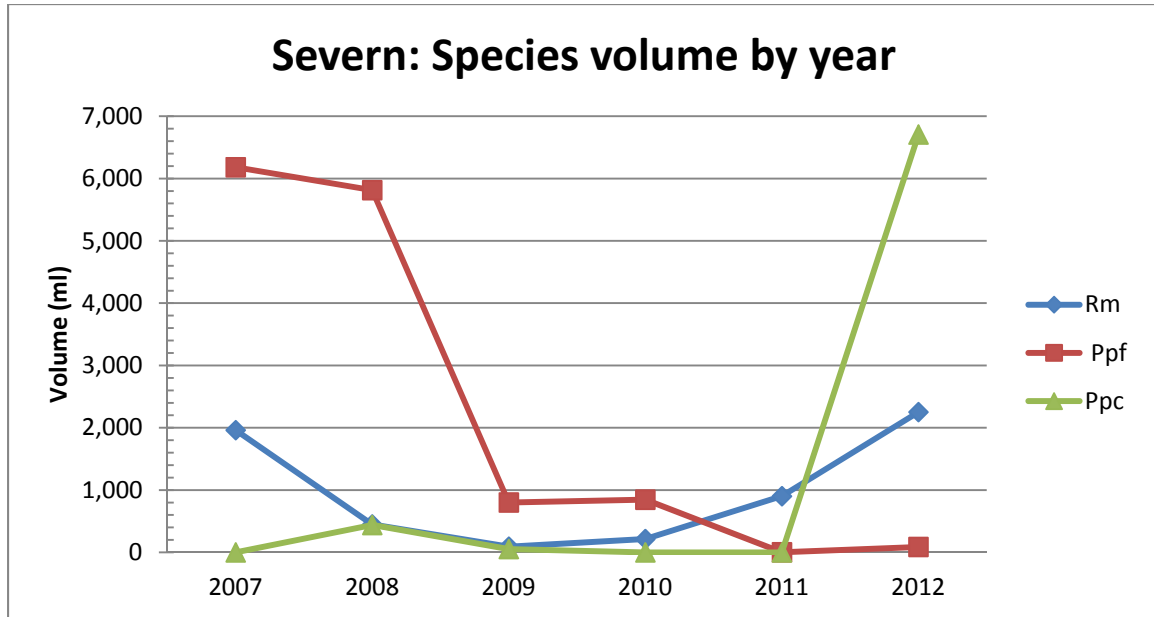
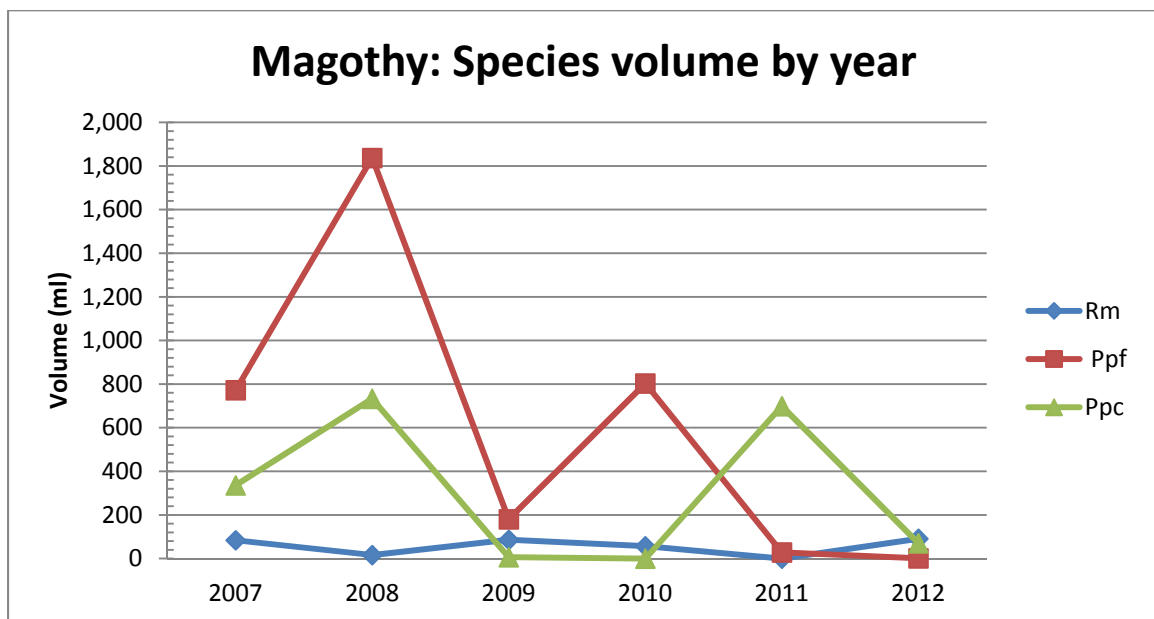


Fig. 8. Volume by species by year, Magothy River transects. Note the different y-axis scale.



## **Conclusions:**

- There was more total SAV volume in the Severn than in the Magothy in all six years, as expected from visual observation of the beds and the VIMS SAV survey, but the differences were small in 2010-2011, when both rivers had fairly low volumes.
- Volume in both rivers declined from 2008 to 2009, and stayed near that low level through 2011 in the Severn, with a small increase in the Magothy in 2010 followed by declines in 2011-2012. Severn volume had a huge increase in 2012 to its highest volume ever, due to moving the Asquith transect, but its 2012 volume would have more than doubled from 2011 even if we had not moved it.
- In both rivers, redhead grass predominated by volume at almost all sites through 2010, and then declined. Widgeongrass (Severn) and sago pondweed (Magothy) dominated in 2011. Sago pondweed predominated in the Severn in 2012 (with 74% of total volume) but that was mainly because we moved the Asquith transect to sample a dense sago pondweed bed. The Magothy had roughly equal amounts of widgeongrass and sago pondweed in 2012, and only one piece of redhead grass found.
- The decline in redhead grass over time may be related to its leaf structure, which makes it more susceptible to sediment accumulation on its leaves, reducing light availability.
- Spatial patterns in total volume along the river (based on previous SAV patterns and depth gradients) generally fit with what we expected in the Severn, with more SAV in the middle transects, but usually not in the Magothy.
- The percent of grabs that had any SAV declined in 2009 in both rivers, and then leveled off, suggesting that patchiness increased over time.

**Acknowledgments:** Thanks to all of the Severn Riverkeeper (SRK), Arlington Echo, and Magothy River Association (MRA) volunteers and agency staff who provided boats and labor that made these surveys possible (see Table A-1). Thanks to the South River Federation for letting us use the oyster tongs they got from MD DNR in 2007.

## APPENDIX: Additional graphs and tables of methods and results

Fig. A-1. Depth profiles for the 4 Severn transects, all sampled near low tide. All transects had similar profiles except AC (Asquith) had little or no gradient, since it is next to a channel, not the shore.

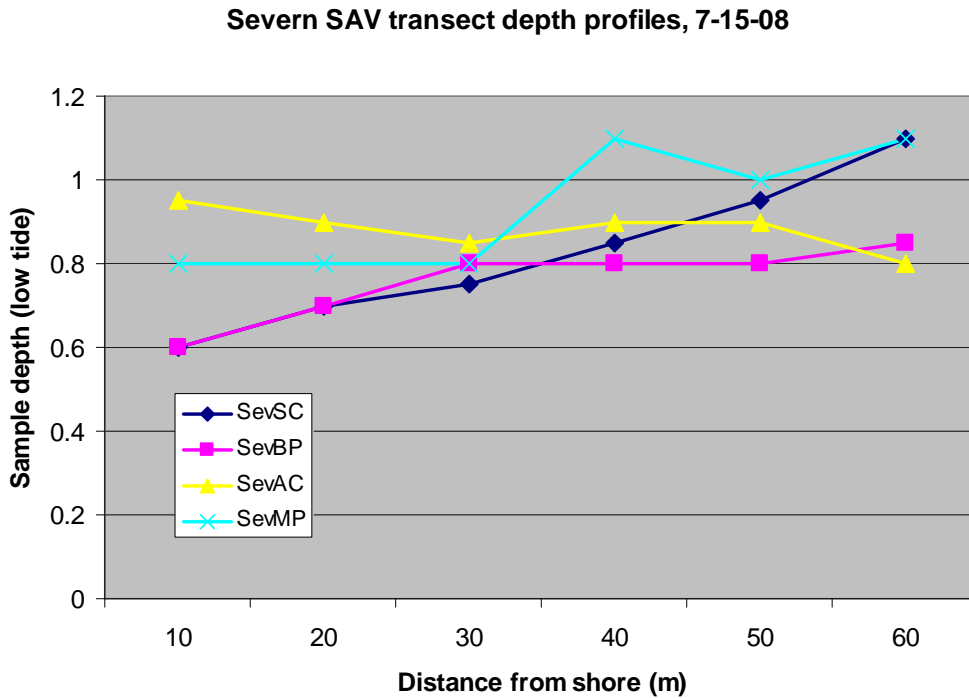


Fig. A-2. Depth profiles for the 4 Magothy transects, adjusted to low tide depth (by subtracting 0.35 m). The two upriver transects (Swan Cove, SC and South Ferry Point, SF) are much deeper than the two downriver ones.

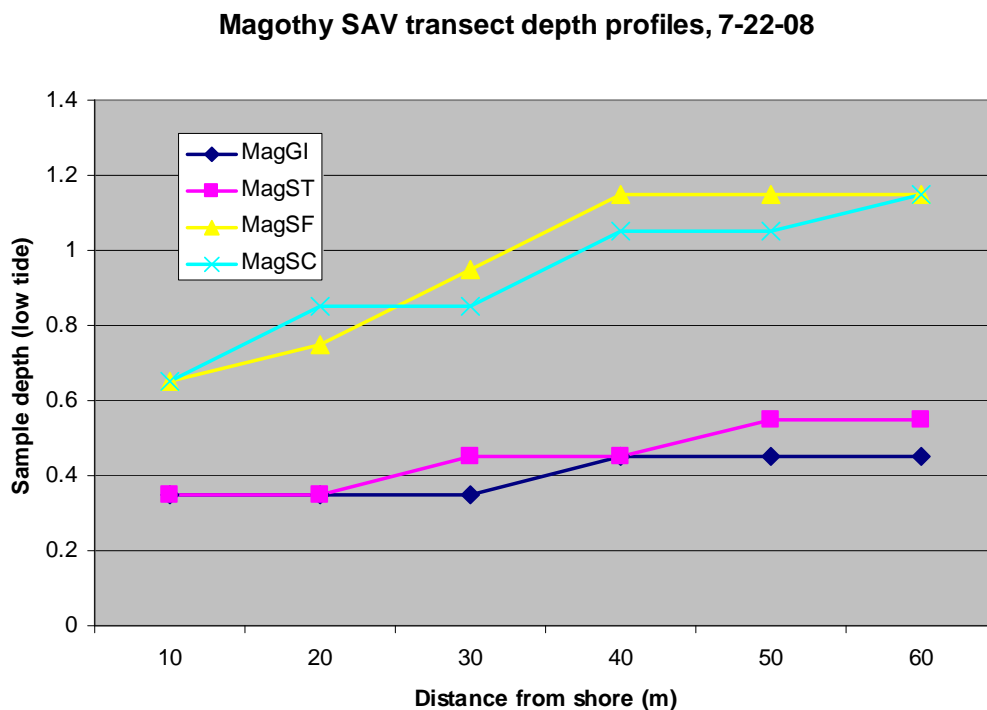


Table A-1. Dates the transects were sampled, and others who helped me sample. The first person listed provided and drove the boat we used.

| Severn date | Other samplers   | Magothy date | Other samplers  |
|-------------|--|--------------|---|
| 9/11/07     | Pierre Henkart, Danalee Henkart, Linda Smith, Mark Lewandowski | 9/8/07       | Dave & Conner Lines   |
| 7/15/08     | Pierre Henkart, PJ Klavon, Christie Sandvik, Brooke Warrington | 7/22/08      | Mark Lewandowski, Carol Auer, Bri Langford, Jay Lazar, Kate Parks |
| 7/31/09     | Pierre Henkart, Wiley Laufman, Aaron Canale, Eric              | 8/17/09      | Carl Treff, Tom Horeff, Al Tober, Pete Penoyar, Michael Wagman    |
| 7/20/10     | Pierre Henkart, Aaron Canale, Nate                             | 8/4/10       | Carl & Alex Treff, Tim Decker, Al Tober                           |
| 7/26/11     | Steve Barry, Dan Somers, Ashley Jarvis, Elena Chiras           | 8/9/11       | Carl & Alex Treff, Sally Hornor, Tim Decker                       |
| 7/30/12     | Deb Albert, Chris Farrow, Dana Judy, Collette Vauthier         | 7/27/12      | Carl & Aidan Treff, Tim Decker, Briana Jones, Vernicia Winford    |