This document is Chapter 18 of the Volunteer Estuary Monitoring Manual, A Methods Manual, Second Edition, EPA-842-B-06-003. The full document can be downloaded from: http://www.epa.gov/owow/estuaries/monitor/

Voluntary Estuary Monitoring Manual

Chapter 18: Submerged Aquatic Vegetation

March 2006

Chapter 18

Submerged Aquatic Vegetation

In the shallows of many healthy estuaries, where sunlight penetrates the water to the estuary bottom, dense stands of aquatic plants sway in unison with the incoming waves. The aquatic plants are known collectively as submerged aquatic vegetation. Unfortunately, over the past several decades these plants have fared poorly in many of our nation's estuaries. Areas once covered by thick beds of these plants may have little or no vegetation remaining. In areas that can support them, the plants often serve as a barometer of estuarine ecosystem health. By monitoring the status of these plant populations over time, we can better determine the estuary's vitality.

Photos (l to r): K. Register, R. Ohrel, The Ocean Conservancy, E. Ely.

Overview

In the shallows of many healthy estuaries, where sunlight penetrates the water to the estuary bottom, dense stands of aquatic plants sway in unison with the incoming waves. The aquatic plants are known collectively as **submerged (or submersed) aquatic vegetation. SAV**—or sometimes called **seagrasses** in marine environments—generally include rooted vascular plants that grow up to the water surface but not above it (although a few species have flowers or tufts that may stick a few centimeters above the surface). The definition of SAV usually excludes algae, floating plants, and plants that grow above the water surface.

The plants are important components of estuarine systems, providing shelter, habitat, and a food source for many organisms. They also benefit estuarine species indirectly by helping to maintain the viability of the ecosystem. Their photosynthesis adds dissolved oxygen to the water, and their leaves and roots help stabilize the shoreline against erosion. The plants also absorb nutrients, which can be major estuarine pollutants.

Unfortunately, over the past several decades these plants have fared poorly in many of our nation's estuaries. Areas once covered by thick beds of these plants may have little or no vegetation remaining.

Not all healthy estuarine and near coastal areas have the physical and chemical properties necessary to support SAV. For example, areas with very high tidal ranges (e.g., more than two meters) or soft sediments may not provide a suitable habitat for the plants. In areas that can support them, the plants often serve as a barometer of estuarine ecosystem health. By monitoring the status of these plant populations over time, we can better determine the estuary's vitality.

This chapter describes the role of SAV in the estuarine ecosystem, describes some common SAV species, and provides basic steps for monitoring SAV.

Why Monitor SAV?

SAV forms a critical link between the physical habitat and the biological community. The plants require specific physical and chemical conditions to remain vigorous. In turn, they stabilize sediments and provide habitat, nourishment, and oxygen to other species in the estuary.

A viable and self-sustaining SAV population is the hallmark of a healthy estuary (in estuaries that naturally support SAV). By monitoring the occurrence of SAV beds and the changes in their distribution, density, and species composition, trained volunteers can help determine the health and status of SAV in an estuary. Scientists can then compare this information to historical data of SAV beds.

Volunteers and SAV Monitoring

SAV is extremely sensitive to disturbance. Therefore, it is essential that volunteers receive proper training and supervision from qualified scientists or resource managers. Volunteer leaders should check with the appropriate government agency to determine which monitoring or sampling activities may be suitable for volunteers.

The Role of SAV in the Estuarine Ecosystem

As critical to the shallow waters of an estuary as trees are to a forest, SAV beds play several roles in maintaining an estuary's health. Although only a few truly aquatic species consume the living plants (e.g., manatees, sea turtles, and some species of fish), several types of waterfowl and small mammals rely on them as a major portion of their diet. Even in death, the plants are a major estuary component. SAV forms huge quantities of decomposed matter as leaves die; several aquatic species use this detritus as a primary food source.

During the growing seasons of spring and summer, SAV supplies oxygen to the water through the process of photosynthesis, thereby helping to support aquatic organisms' survival. The plants also take up large quantities of nutrients, which remain locked in the plant biomass throughout the warm weather seasons. As the plants die and decay in autumn, they slowly release the nutrients back to the ecosystem at a time when phytoplankton blooms pose less of a problem (see Chapters 10 and 19).

Additionally, the plant communities provide shelter for various species of organisms. Juvenile and larval fish and crustaceans use SAV beds as protective nurseries and to hide from predators. Shedding crabs conceal themselves in the vegetation until their new shells have hardened. A variety of organisms [e.g., barnacles, bryozoans (a group of colonial invertebrates)] and eggs of many species attach directly to the leaves.

The sheer bulk of the plants often buffers the shoreline and minimizes erosion by dampening the energy of incoming waves. Plant roots bind the sediments on the estuary bottom and retard water currents. By minimizing water movement, SAV allows suspended sediments to settle and water clarity is improved.

SAV Habitat Requirements

Once established and under optimal conditions, these plants can spread quickly into large, thick stands. SAV habitat requirements are as follows (adapted from Bergstrom, 1999):

Adequate Light Penetration

SAV can grow only in those portions of the estuary shallow enough and clear enough to receive sufficient sunlight for photosynthesis. The plants tend to grow in shallow water, but may grow in deeper areas where the water is particularly clear.

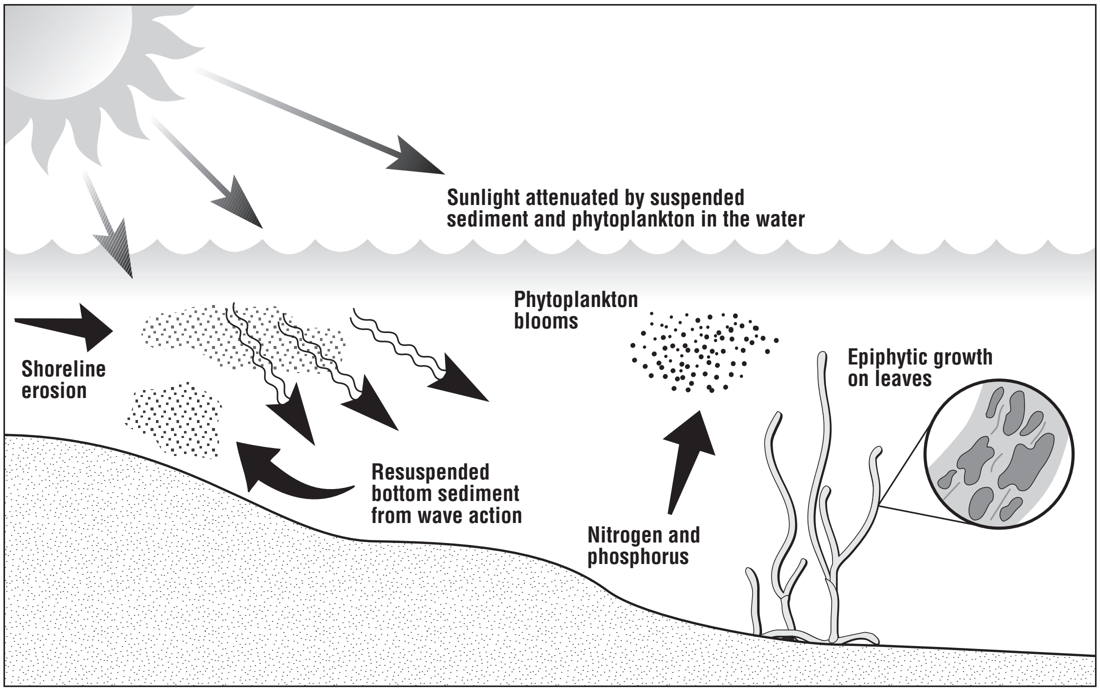


Figure 18-1. Impacts on SAV. Sediments, nutrients (and accompanying algal blooms), and epiphytic growth can ultimately affect the amount of sunlight reaching the plants *(adapted from Barth et al., 1989).*

Water Inundation

SAV species primarily live in areas where the plants will remain submerged; however, some species can withstand exposure during low-water periods (e.g., low tide). A large tidal range may limit SAV growth (i.e., prolonged exposure during low tide and inundation by deep water during high tide, especially when the water is cloudy, can make for undesirable habitat conditions).

Suitable Salinity, Temperature, and Sediments

The salinity, temperature, and sediments of a particular estuarine location determine, to a large extent, which species can survive. While some species tolerate a fairly wide range of salinity, others are restricted to very specific levels.

Low to Moderate Wave Action

Heavy waves impede SAV roots from getting established. Some water circulation is desirable, however, to prevent SAV from becoming choked with algae.

The Demise of SAV

In a balanced and healthy estuarine ecosystem, SAV species blanket the shallows with the composition of each bed attuned to controlling variables such as light availability, sediment, salinity, temperature, and depth. When an estuary is tipped out of balance, however, SAV beds usually suffer. The degradation or loss of these beds can set up a chain reaction of ill effects that ripples through the entire estuarine ecosystem.

As SAV beds decline, the need to protect them becomes ever more critical (photo by R. Ohrel).

This chain of events often starts with an overload of nutrients (Figure 18-1). Excessive quantities of nitrogen and phosphorus cause an overgrowth of phytoplankton (see Chapter 19). These **algal blooms** cloud the water and severely diminish sunlight penetration. The nutrients may also trigger a thick growth of **epiphytes**—plants that grow on the surface of SAV leaves. The epiphytes block sunlight from reaching the leaf surfaces of their hosts.

As the water clarity problem worsens, the area of the estuary that is able to support SAV becomes even smaller. For example, estuary water once capable of supporting plants to a depth of ten feet may now only transmit enough light for plant survival to a depth of six feet.

When plant beds thin or die back, water that may already be low in dissolved oxygen due to algal blooms (see Chapters 9 and 19) becomes even more depleted as the amount of oxygen generated by SAV photosynthesis declines. Nutrients once tied up in the plant leaves, roots, and bottom sediments may be released to the water where phytoplankton snap them up, thereby increasing the possibility of more blooms.

A bare substrate, where SAV once flourished, poses a whole set of new problems. Without plant roots to stabilize the sediment, waves easily kick up silt which remains suspended in the water until calmer conditions return. Like algal blooms, suspended silt cuts down on light transmission through the water. The silt may also settle onto the leaves of any remaining plants, further blocking the light needed for photosynthesis.

As some species lose a foothold in the estuary, non-indigenous (or invasive) and opportunistic species may move in and displace them. Non-indigenous SAV species (e.g., Eurasian watermilfoil, parrotfeather milfoil, and hydrilla) may overwhelm native SAV species and assume their habitat. While the growth of these new species often alleviates the problems associated with a bare substrate, other problems may arise (see Chapter 19).

While nutrients are one of the major causes of SAV disappearance or decline in many bays and estuaries (particularly on the Atlantic coast), other factors may also play a role. Runoff from different land uses and dredging activities can cloud waters over acres of SAV beds with sediment. Agricultural and lawn herbicides may cause a loss of some species, while industrial pollutants and foraging animals may selectively kill off local beds. Areas frequently subject to improper shellfish harvesting, boat-generated waves, and boat propeller scarring may also lose their SAV beds. ■

Sampling Considerations

What to Sample

There are numerous SAV species with different ranges throughout the United States. The type of SAV monitored by volunteers, then, will depend on geographic location. A few common and widely distributed SAV species are described below:

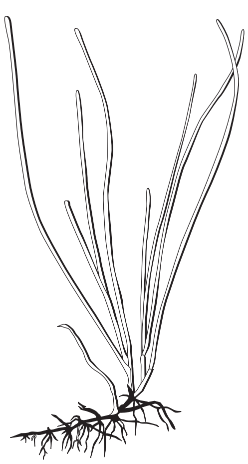


Figure 18-2. Eelgrass *(Zostera marina).*

Eelgrass *(Zostera marina)*

Eelgrass (Figure 18-2) is the dominant seagrass in the cooler temperate zones of the Atlantic and Pacific coasts. Beds of this luxuriant plant survive in a wide range of salinities throughout these regions, but occur mainly in high salinity waters (18-30 parts per thousand-ppt) (Chesapeake Bay Program Web site). Flowing and elongate like an eel, the slender leaf blades grow up to several feet in length.

Eelgrass spreads by sending out runners that creep along the bottom and repeatedly send up shoots that grow into new plants. The species produces tiny, rather inconspicuous flowers and seeds that appear on large and easily distinguished branching stalks. New plants take several years to reach maturation. Once a bed becomes established, however, this species of seagrass is highly productive.

Because of its predominance and widespread coverage, eelgrass is an important ecological element of many estuaries and nearshore areas. It may cover acres of the bottom, providing food and/or cover for fish, invertebrates, and waterfowl.

Eelgrass is subject to infection by a blight presumably caused by a slime moldlike organism called *Labyrinthula zosterae*. The disease causes dark lesions on the eelgrass leaves and can ultimately result in mass mortality of the plant beds. A major epidemic occurred in the 1930s, but by the 1960s most beds had recovered. Along with the dieback of eelgrass, animals dependent on this plant, such as the brant (a small goose) and bay scallops (an important economic resource), also declined precipitously.

In the past 15 years, scientists and volunteers have noted the characteristic lesions of the disease on some eelgrass plants once again. The blight, also known as eelgrass wasting disease, is not fully responsible for eelgrass bed demise. While some areas never fully recovered from the 1930s epidemic, other factors have contributed to the plant's decline. Nutrient-rich waters, herbicides, and abundant algal growth have also harmed eelgrass and other SAV species.

Volunteers in New England have worked with a technique to assess the degree of infestation on individual eelgrass leaves (Figure 18-3). This information provides an estimate of disease progression.

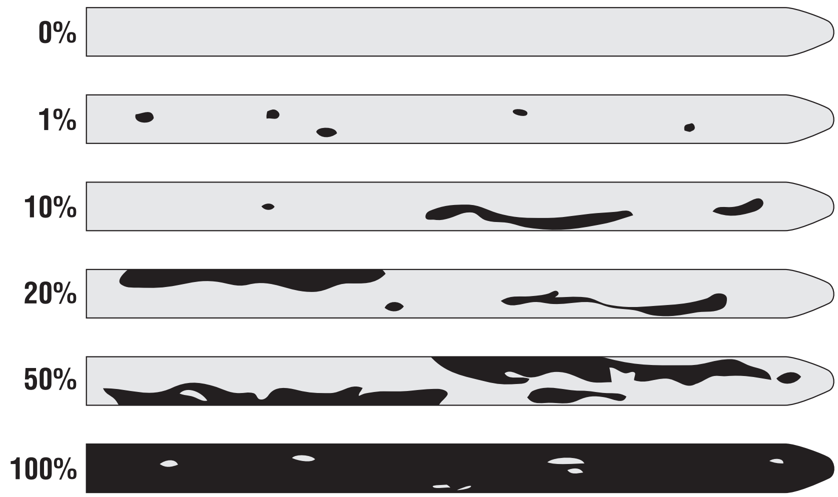


Figure 18-3. Eelgrass wasting disease index key. The disease causes black patches to appear on eelgrass leaves. Volunteer monitors can use the index to estimate the disease's presence on the leaves *(Burdick et al, 1993).*

Widgeon Grass *(Ruppia maritima)*

Widgeon or ditch grass (Figure 18-4) inhabits the entire Atlantic and Gulf Coasts, and part of the Pacific Coast of the United States. This plant is remarkably resilient and can withstand a wide range of salinities. Specimens have occasionally been found in fresh water, yet the species can also tolerate full ocean salinity. Its primary habitat, however, is in brackish bays and estuaries.

The leaves of widgeon grass are needlelike, short, and usually about two inches in length. They branch off of slender, elastic stems. Like eelgrass, this grass produces tiny, rather inconspicuous flowers and seeds found on stalks. The plants may also reproduce asexually by means of rhizomes which extend along the estuary bottom and send out shoots.

Widgeon grass is an extremely important SAV species for waterfowl. The American widgeon, a brown duck for which the plant is named, relies heavily upon widgeon grass as a major component of its diet. The plant is nutritious, making it a favored food item for many other waterfowl species as well.

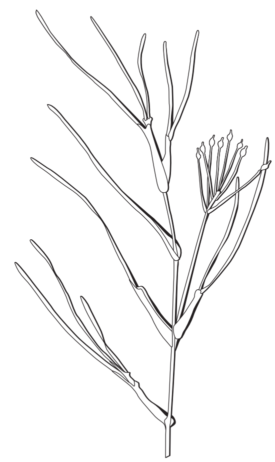


Figure 18-4. Widgeon grass *(Ruppia maritima).*

Wild Celery *(Vallisneria americana)*

Wild celery, also known as tapegrass or freshwater eelgrass (Figure 18-5), is found along the Atlantic Coast. It is widely distributed in fresh water, tidal freshwater rivers, and tidal tributaries to estuaries.

Wild celery has long, flattened, ribbonlike leaves that emerge from clusters at the base of the plant. The leaves, which can grow up to several feet in length, have a bluntly rounded tip and a light green stripe that runs down their centers.

Wild celery can reproduce by seed, rhizome, and tuber. It is an important food source for waterfowl, particularly the canvasback duck.

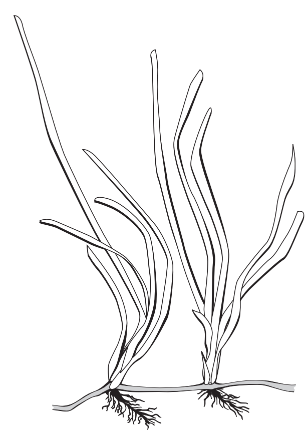


Figure 18-5. Wild celery *(Vallisneria americana).*

Turtle Grass *(Thalassia testudinum)*

Along the Florida and Gulf Coasts, turtle grass (Figure 18-6) replaces eelgrass as the dominant seagrass species. Turtle grass

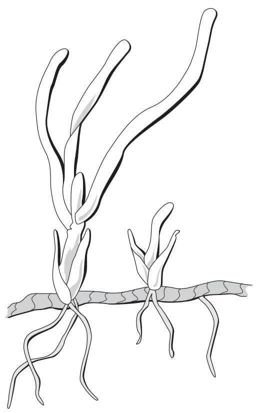


Figure 18-6. Turtle grass *(Thalassia testudinum).*

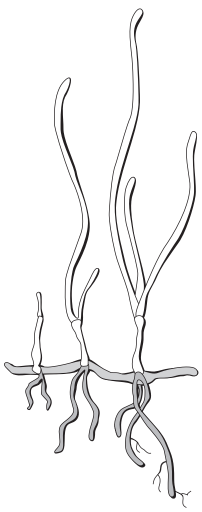


Figure 18-7. Manatee grass *(Syringodium filiforme).*

Figure 18-8. Shoal grass *(Halodule wrightii).*

meadows are highly productive and, therefore, play an important role in estuarine and near coastal ecosystems.

Turtle grass plants have broad, straplike blades, which are wider and shorter than those of eelgrass. This grass reproduces asexually by creeping rhizomes or sexually by water-borne flower pollen and forms dense meadows which often cover vast swaths of the shallow marine or estuarine substrate.

Manatee Grass *(Syringodium filiforme)* and Shoal Grass *(Halodule wrightii)*

Both of these seagrass species are common along southern Florida and the Caribbean islands.

Long and thin, the blades of manatee grass (Figure 18-7) are light green and up to three feet in length. Like other seagrasses, this grass has inconspicuous flowers. Manatee grass also propagates by rhizome extension. Manatee grass often mixes with turtle grass in seagrass meadows.

Shoal grass (Figure 18-8) has elongate stalks that often branch into flat, wide leaves with a maximum width of 1/8 inch. These stalks may grow to 15-16 inches in length. They have a naturally ragged, somewhat three-pointed tip on the leaf. This plant is aptly named since it inhabits very shallow areas, generally in water less than 20 inches deep. While shoal grass beds can grow on both the landward and ocean sides of turtle grass beds, they are usually found on turtle grass beds' landward sides.

When to Sample

As with all water quality variables, repetitive measures over a period of years give a more representative picture of SAV status than a single sampling approach. Unlike many of the other variables, however, volunteers usually need to measure SAV density and distribution and identify species only one to three times during the peak growing season.

The best time of year to sample is when the SAV species of interest is at its peak biomass (maximum growth). This varies by species and location.

Optimal sampling times are close to low tide on a sunny day when the water is fairly clear (Bergstrom, 1998). A notable exception may apply to SAV beds growing in very shallow water, which may be accessible only during high tide. In either case, monitors should try to avoid times when boat traffic is heavy (e.g., weekends) and the water tends to be cloudier.

Choosing a Sampling Method

There are several means of monitoring SAV. Choosing the most appropriate method will depend on the number and location of sites already being monitored by volunteers or others for water quality, the extent of SAV coverage, the location of problem areas, the availability of qualified scientists and resource managers to supervise the activity, and the planned uses for the collected data.

> **Helpful Hint**
>
> *Collecting plant samples is not generally recommended. Only properly trained and authorized personnel should take minimal samples, if necessary, for positive identification.*
>
> *Before collecting, transporting, or planting any SAV species, check with the appropriate government agency about obtaining necessary permits.*

Observations at Established Water Quality Monitoring Sites

Volunteer monitoring programs may choose to analyze SAV concurrently with several other water quality variables. In this case, the simplest option is to estimate the shoot density of each SAV species in a pre-determined radius around the established monitoring sites (Figure 18-9). No plants should be removed from the site.

An SAV index (Table 18-1) or other density scale is a simple means of ranking the density

Table 18-1. Sample SAV index values. The index may be modified or expanded to include more categories (e.g., SAV coverage of 0-10%, 10-40%, 40-70%, and 70-100%).

SAV Index Value	Category	Description
0	None	No vegetation present
1	Patchy	Small colonies or clumps; sparse bottom coverage
2	Dense	Extensive grass beds; lush meadows

of plants at specific sites. Volunteers estimate SAV density and classify the bed as falling within one of three or more density classes.

The data collected from this approach is not scientifically rigorous and therefore may be considered only for general education purposes. The method is, however, a quick and easy means of obtaining relative information on the status of an estuary's SAV beds.

Transect Sampling

In transect sampling, a straight line is established across an area containing SAV. Records are made of each plant that touches the line at predetermined increments (Figure 18-10). If the vegetation is extremely dense, the data collector can place a rod into the vegetation at the designated point and record the different species that touch the rod. The method provides a rough estimate of the percent of vegetative cover and the frequency of each species.

In a modified version, discrete monitoring sites can be established along the transect (see case study, page 18-8).

Groundtruthing

Groundtruthing is done to verify maps of SAV beds that some government agencies or universities create from aerial surveys. The exercise involves on-the-ground observations to verify the presence of beds, identify species, and locate smaller beds that might not be captured by aerial photography. By groundtruthing, volunteer groups help scientists and resource managers get a more complete picture of year-to-year SAV distribution. Knowing SAV bed locations and species composition helps ensure their protection from activities that might have a negative impact on them (see case study, page 18-9).

Groundtruthing requires a great deal of on-the-ground effort, and resource agency personnel and other professional staff usually cannot cover the entire aerial survey area. Volunteers, then, can provide valuable assistance in verifying the SAV maps. ■

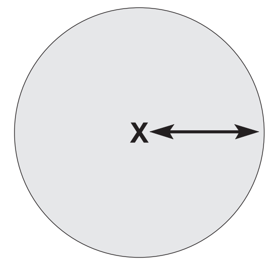


Figure 18-9. SAV shoot density can be estimated in a circle around a water quality monitoring site (marked with an X).

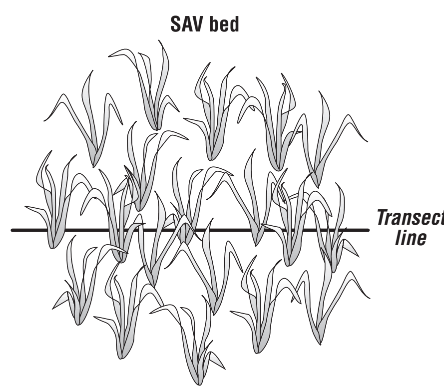


Figure 18-10. Transect sampling through a bed of SAV.

Case Study: Intertidal SAV Monitoring in Oregon

In 1998, the Tillamook Bay National Estuary Project initiated a four-year study to investigate the interactions of eelgrass with other estuarine species and its response to human disturbance. Under the leadership of estuarine researchers, volunteers collect percent cover and density data on three different weeklong occasions between May and September. Intertidal eelgrass is examined, making volunteers' time in the field limited to the duration of the low tide. This limitation requires several volunteers to help collect data.

Volunteers measuring percent cover and eelgrass shoot density in Oregon (photo by Tillamook Bay National Estuary Project and Battelle Marine Sciences Lab).

At three different intertidal sites, monitors establish five 30-meter transects and record data at five-meter intervals along each transect (e.g., at one meter, six meters, and so on). Using a one-meter square quadrat made from 1/2-inch PVC pipe, volunteers measure percent cover and eelgrass shoot density.

To measure percent cover, there are several ways to proceed: visual estimation, photo digitizing, grid overlay, and others. A "point intercept" method, which utilizes a clear piece of Plexiglas that has 50 randomly placed dots on it (marked with a permanent ink marker), is used in this program. The Plexiglas is placed over the experimental plot, and volunteers observe the item [e.g., sand, eelgrass (including shoots and blades), ulva (a green algae), etc.] covered by the majority of each dot. Then, a percent cover value is calculated by dividing the number of each component found by the total number of dots on the Plexiglas. For example:

Component	# Dots	Formula	Percent Cover
Eelgrass	31	31÷50 =	62%
Sand	6	6÷50 =	12%
Ulva	13	13÷50 =	26%

Determining eelgrass shoot density is somewhat less complex. Volunteers simply count the number of shoots (not blades) of eelgrass in each quadrat. A researcher familiar with eelgrass can teach volunteers how to distinguish between eelgrass shoots, blades, and rhizomes.

For More Information:

Tillamook Bay National Estuary Project
P.O. Box 493
Garibaldi, OR 97118
Phone: 503-322-2222
Fax: 503-322-2261
http://www.co.tillamook.or.us/gov/estuary/tbnep/nephome.html

Case Study: Chesapeake Bay SAV Hunt

Volunteers throughout the Chesapeake Bay region participate in the SAV Hunt, an annual effort coordinated by the U.S. Fish and Wildlife Service to locate, identify, and map SAV.

The SAV Hunt is used to groundtruth the results of an annual aerial survey. While the survey provides invaluable information about the location and extent of SAV beds, aerial photographs have some limitations:

- they miss small beds;
- they don't identify which species are growing;
- sometimes what looks like a bed of SAV in the photo turns out to be something else entirely, such as algae growing on underwater rocks or large rocks placed in the water usually as an erosion control measure; and
- photos are usually taken once a year (or even less frequently), and the SAV species in the beds change over the growing season.

The SAV Hunters' on-the-ground observations fill in the missing information; their data are vital supplements to the aerial survey (see Appendix A for a sample data sheet).

Volunteers select the area they want to survey. They receive a map of that location, showing where SAV has been found in aerial surveys and previous SAV Hunts. Volunteers also receive a field guide with line drawings, color photographs, and descriptive text to help them identify the species.

A new Maryland law bans clam dredging in SAV beds, and the information provided by citizens helps identify those areas that are now off-limits to clam dredging. Natural resource agencies use the information to help target SAV protection and restoration, and local planning agencies use it when considering approval for construction projects that may affect aquatic resources.

For More Information:

SAV Monitoring Coordinator
U.S. Fish and Wildlife Service
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401
Phone: 410-573-4500
http://www.fws.gov/r5cbfo/

(Excerpted and adapted from Reshetiloff, 1998.)

How to Groundtruth

Monitoring SAV beds may pose more logistical problems than the measurement of other water quality variables. Whereas volunteers measure other variables at set stations, SAV groundtruthing requires volunteers to go to areas where the SAV is growing—the plant beds may not be in exactly the same location from year to year.

Although land access to the beds may lie on private property, landowners are often willing to provide right-of-way to volunteer monitors. Water access may be limited by depths too shallow to accommodate some vessels—necessitating use of a shallower draft boat (e.g., canoe, kayak, johnboat, or skiff with outboard motor). The program manager should assist each volunteer in solving possible logistical problems before the volunteer heads for the field.

General procedures for monitoring SAV using the groundtruthing method are presented in this section for guidance only (they are adapted from the Chesapeake Bay SAV Hunt—see case study, page 18-9). **Monitors should consult with qualified scientists or resource managers overseeing the effort on proper equipment and techniques. Monitors should also make sure that necessary permits are obtained before collecting any samples.**

Before proceeding to the monitoring site, volunteers should review the topics addressed in Chapter 7. It is critical to confirm the monitoring site, date, and time; have the necessary monitoring equipment and personal gear; and understand all safety considerations. Once at the monitoring site, volunteers should record general site observations, as discussed in Chapter 7. Groundtruthers should be especially careful to note the tidal stage, weather conditions, water clarity, and the time of day, as these variables can substantially affect the visibility of SAV beds.

SAV Site Logistics

Reaching SAV beds marked on maps may require walking, motoring, rowing, paddling, wading, or swimming.

Volunteers can reach some SAV beds by walking along the shoreline. Attempt to reach the beds during low tide when they are in shallower water, but first ensure that the sediments support safe walking.

When using a boat, keep it in sufficiently deep water so that the propeller does not tear up the plants. If the beds are consistently located in shallow areas, consider using a rowboat, canoe, or even an inflated inner tube as an alternate vessel. In areas such as the Everglades in southern Florida, volunteers should consider using an airboat.

Keeping track of map position is extremely important. In areas of vast seagrass beds and few distinct landscape features, it is particularly easy to get lost. A Global Positioning System (GPS) or compass, used in conjunction with the map, may be a helpful orientation tool. The volunteer should:

- Travel to the SAV beds marked on the provided map. To find the beds, look for dark patches on the bottom or calmer surface water surrounded by ripples. The calm water may overlie SAV beds (Bergstrom, 1998).
- Compare the bed to its noted map position by examining its general location, notable landscape features (natural or manmade), position relative to the shoreline, and the overall extent of the bed. These distinctions may change from year to year, but collectively should provide sufficient information to confirm the identity of the bed.

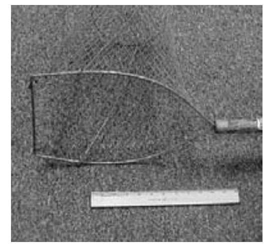
If you are not sure that you are in the exact spot, if the bed seems to be in a different position than indicated on the map, or if other aspects of the bed are dramatically different, make sure to note this or record the changes on the survey sheet and map. Have a companion corroborate your observations if possible.

STEP 1: *Check equipment.*

In addition to the standard sampling equipment and apparel listed in Chapter 7, the volunteer should bring the following items to the site:

- map showing SAV beds covering the study site, as determined from aerial survey;
- global positioning system (GPS) receiver, if available;
- weighted and calibrated line to measure depth, or Secchi disk;
- SAV field identification guide;
- shoes for wading;
- plastic sealable bags (sandwich size);
- labels to go inside plastic bags, or waterproof marker;
- mask and snorkel or SCUBA, if necessary;
- instructions for monitoring SAV;
- rake to gather specimen for identification (see box below for details);
- view tube or hand lens, if available;
- polarized sunglasses; and
- waterproof copy of any required collection permits.

a



b

c

d

Several rakes for collecting SAV samples: (a) bamboo shrub rake; (b) crab landing net; (c) bow rake; and (d) lawn thatch rake, or "throw rake," adapted with a short handle and rope (photos by P. Bergstrom, U.S. Fish and Wildlife Service).

Raking It In

Unless you get into the water to identify SAV, some kind of tool may be needed to take a minimum number of samples. From a boat or pier, a properly trained person using the right rake is critical to groundtruthing success. At all times, care should be taken to avoid digging the rake into the sediment, since this can damage underground roots and rhizomes.

There are several rakes available (see Appendix C for suppliers); however, no one rake will find all SAV species at all times, and some species simply cannot be collected by raking.

Some recommended rakes are described below, with accompanying photographs on this page.

- A bamboo shrub rake is good for shallow water and SAV with short stems. It works much better from a canoe or kayak than the more common shrub rake with plastic tines. For deeper water, an extension pole can be attached. Most shrub rakes have 5-10 tines (although the bamboo ones have more) and are about 8" across, with a 4' handle.
- The crab landing net—consisting of a wire basket and long (6') handle—can be hard to find, but works well on very short, sparse SAV stems. As the net sweeps through the SAV, samples are collected in the net junctions. This quality may, however, make it difficult at times to remove one sample from the net in order to collect another. This net is not recommended for very dense SAV.
- A metal garden bow rake with stiff tines is used by some hunters, but it is probably the least effective of the four kinds. However, it is the one that most people already have on-hand.
- Though it may be difficult to find, a modified lawn thatch rake can work in water deeper than the length of a typical rake handle. Adapted with a short handle and rope and called a "throw rake," it can be tossed from a boat or pier. As a volunteer pulls it back by its rope, the rake picks up fairly tall, branched plants, leaving short, unbranched plants behind.

  The throw rake can be a useful tool, but extreme caution should be exercised.

As new and more effective designs are found, information will be made available at the U.S. Fish and Wildlife Service Chesapeake Bay Field Office Web site: http://www.fws.gov/r5cbfo/ under "Submerged Aquatic Vegetation (SAV)."

(Source: Bergstrom, 2000.)

Trained volunteer collecting SAV samples with a lawn thatch rake (photo by P. Bergstrom, U.S. Fish and Wildlife Service).

STEP 2: *Collect initial data and map bed area.*

If the map already shows the outline of the bed, use the map's name or code for the bed as its identifier on the data sheet. If the map contains no record of the bed, name it according to the format established by the program manager. Volunteers will need to roughly map unidentified beds to add them to the permanent record. Those areas marked as SAV beds on the map but having no plants should be designated on the survey form by writing "no plants."

Indicate the means by which the volunteer reached the beds (motor boat, canoe, by foot, pier, etc.).

Use the weighted, calibrated line to measure depth. A Secchi disk attached to a marked line can also be used to measure depth. Record the depth on the survey form.

STEP 3: *Monitor SAV.*

A bed may contain only one type of SAV or a variety of species. Move around within the bed and closely examine several areas to get a representative assessment of the species composition. Snorkeling or a view tube may be needed.

Assessing SAV bed condition

- To identify the plants, carefully use a rake or another implement to obtain a small sample of the stems and leaves. Try not to dig the tool into the sediment as it may damage underground roots and rhizomes. It may be necessary to snorkel or SCUBA for some species that rakes may not be able to pick up easily (e.g., eelgrass in summer when it is short).
- Using the identification guide or a key, match the specimen to the appropriate plant. **Do not record floating samples, as they may have come from a different location**. Record the common name of the plant on the survey form. If the match is tenuous or the plant does not seem to resemble any diagram, place the specimen in a plastic bag and bring it back to shore for a program leader to identify. Make sure to label the plastic bag with the site name, date, and collector using an indelible marker. Place one label inside the specimen bag and another on the outside of the bag as a precaution against lost labels or illegible writing. Record the identity of the collected plant as "unknown" on the survey form. Any collected sample should be refrigerated if not examined right away.
- Examine several different areas of the bed, estimating density and inspecting several plants. The program manager should train volunteers to recognize symptoms of common diseases or infestations.
- If this site has been visited previously, any noticeable differences, such as changes in the species composition, density, bed size, and general plant health, should be recorded.

"Mapping" SAV beds

When the SAV bed is unmarked on the map or has shifted in location, the volunteer should hand-draw the new location on the map. Shoreline features, manmade objects, buoys, shoals, and other landmarks may all be helpful in marking location. If possible, the volunteer should use a Global Positioning System (GPS) unit to roughly establish the position of the bed (see Chapter 7).

After completing all steps at the first SAV bed, navigate to the next designated bed on the map. Complete the same steps for each bed and record all information on a new survey form for each bed. Treat unmapped beds the same way; after establishing the bed position on the map, evaluate them like any other bed.

STEP 4: *Clean up and send off data.*

Volunteers should clean all equipment and deliver any unknown specimens to the program manager for plant identification assistance. The samples should be refrigerated if they will not be examined immediately.

Ensure that the data survey forms are complete and legible. Send the forms to the appropriate person or agency, preferably after identifying any unknown specimens. Identified specimens do not need to be sent with the forms; the program manager should provide guidance on dealing with the remaining unidentified plants. As with all data sheets, the volunteer should make a copy in case the original becomes lost. ■

SAV Bed Restoration and Monitoring

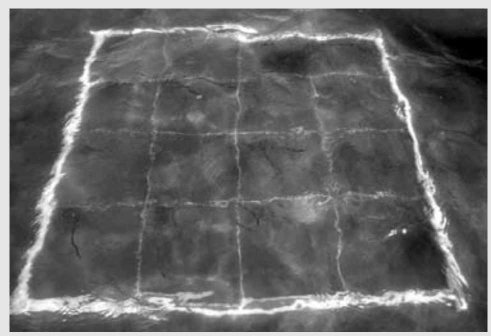
In an effort to restore SAV populations, many volunteer and professional groups are experimenting with planting SAV (Bergstrom, 1999).

Even with the right permits and supervision, however, simply planting grasses does not guarantee success. As photosynthetic plants, they depend on sunlight to survive. A comprehensive monitoring program can provide detailed information about water clarity and other water quality parameters important to SAV survival. Some programs use water quality data that volunteers are already collecting to help identify top candidates for SAV restoration projects.

While plants may show growth initially, they may disappear a few years later. Many volunteer restoration projects do not include follow-up monitoring to determine their long-term effectiveness. Without water quality and plant survival monitoring, volunteers are unable to understand what works and what fails.

Post-restoration monitoring can be a strain on organizational resources. It requires staff and volunteer time, which may be difficult to spare. SAV planting projects are usually one-time events, making it easier to oversee volunteers. Doing the necessary follow-up monitoring, however, often requires volunteers to work on their own with less oversight by the program leader (after all, the leader can't be everywhere at once!). Because follow-up monitoring may require the use of snorkel or SCUBA equipment, program leaders might be reluctant to support unsupervised volunteer SAV restoration monitoring; liability becomes an issue.

The Alliance for the Chesapeake Bay is working with other Bay-area organizations to standardize SAV monitoring and reporting methods throughout the region. This effort should improve the groups' knowledge of restoration sites and monitoring activities. It is hoped that this coordination will allow the groups to improve their tracking of SAV restoration projects.



Alliance for the Chesapeake Bay volunteers use a 1.0 x 1.0 m frame, constructed with nylon rope and 2.5 cm diameter PVC piping, to guide SAV replanting efforts. The frame is divided into 1/4-meter intervals. At each grid intersection, two mature plants (called "planting units"), held together with a biodegradable staple so that their rhizomes are aligned parallel, are anchored on the bottom with a bamboo skewer. Twenty-five planting units equaling 50 plants per square meter are placed in each 1m^2 grid. The use of the planting grid allows for the number of plants, and therefore planting density, to be easily quantified (photo by B. Murphy).

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Chesapeake Bay Program: http://www.chesapeakebay.net/baygras.htm

Maryland Department of Natural Resources: http://www.dnr.state.md.us/bay/sav/index.html

University of Hawaii Seagrass: http://www.botany.hawaii.edu/seagrass/

U.S. Fish and Wildlife Service Chesapeake Bay Field Office: http://www.fws.gov/r5cbfo/

Virginia Institute of Marine Science: http://www.vims.edu/bio/sav/index.html