Submerged Aquatic Vegetation Outcome

Management Strategy

Introduction

Submerged aquatic vegetation (SAV) or underwater grasses provide significant benefits to aquatic life and serve critical functions in the Chesapeake Bay ecosystem. Underwater grasses add oxygen to the water; improve water clarity by helping suspended sediment settle to the bottom; provide shelter for young striped bass, blue crabs and other species; and reduce shoreline erosion. Increasing the abundance of grasses in the Bay and its rivers will dramatically improve the entire Bay ecosystem.

I. Goal, Outcome and Baseline

This management strategy identifies approaches for achieving the following goal and outcome:

Vital Habitats Goal: Restore, enhance and protect a network of land and water habitats to support fish and wildlife, and to afford other public benefits, including water quality, recreational uses and scenic value across the watershed.

Submerged Aquatic Vegetation (SAV) Outcome: Sustain and increase the habitat benefits of SAV (underwater grasses) in the Chesapeake Bay. Achieve and sustain the ultimate outcome of 185,000 acres of SAV Bay-wide necessary for a restored Bay. Progress toward this ultimate outcome will be measured against a target of 90,000 acres by 2017 and 130,000 acres by 2025.

This outcome was derived from the Chesapeake Bay Program's SAV Workgroup and is based on the acreage recorded in certain regions during certain high-growth years.

Baseline and Current Condition: The Bay Program's SAV workgroup has reviewed the historic record and photographic evidence from the 1930s to present and determined that the Bay has historically supported approximately 185,000 acres of SAV. The most critical component for restoring SAV is to achieve the Water Quality Goal (reduce pollutants to achieve the water quality necessary to support the aquatic living resources of the Bay and its tributaries and to protect human health). In most cases, as water clarity improves, SAV will reestablish without the need for planting. However, as the Water Quality Outcomes are met there will be places where the water clarity is sufficient, but there is no longer a seed source for SAV to promote natural recolonization. Therefore, the workgroup aims to plant or seed 20 acres of SAV each year in order to provide seed sources and improve physical conditions for further SAV recruitment. In addition, continued seeding and planting will encourage retaining and promoting SAV propagule production facilities and increasing expertise among restoration practitioners, as well as provide opportunities for citizen and student engagement. This restoration target is intended to stimulate the natural bed growth to aid in reaching the bay-wide abundance goal of 185,000 acres. Please refer to SAV maps for the historic distribution used to set the Bay-wide abundance goal and current status of bay grass abundance.

SAV constitutes one of the most important biological communities in an estuary. SAV has historically contributed to the high primary and secondary productivity of the Bay, but increased nutrient and sediment inputs from anthropogenic sources such as development and agriculture in the watershed from World War II onward caused Bay-wide declines in the 1960s and 1970s. Hurricane Agnes in 1972 further stressed the resource. SAV has recovered somewhat since that time in accompaniment with improved watershed nutrient management, but not to historic levels.

Since 1976, the workgroup has served the larger Bay community by providing technical expertise and applied research findings to resource managers in an effort to inform the restoration and protection agenda.

II. Participating Partners

Team Lead: Vital Habitats Goal Team
Workgroup Lead: Submerged Aquatic Vegetation Workgroup

Opportunities for Cross-Goal Team Collaboration:

Fisheries Goal Team
Water Quality Goal Team
Black Duck Action Team

Participating agencies **(Signatories in bold)**

Level of Participation: High:

Chair: Vacant

- **Maryland Department of Natural Resources**
  Direct involvement with SAV surveys, collaborates with VIMS/UMCES/EPA
- **D.C.'s District Department of the Environment**
- **Virginia Institute of Marine Sciences**
  Conducts research
  Conducts Bay-wide holistic SAV surveys
  Matches EPA funding
- University of Maryland Center for Environmental Science (UMCES)
  Conducts research
- **U.S Environmental Protection Agency**
  Provides the majority of funding for SAV projects (about 80 percent)
- U.S. Army Corps of Engineers
  Utilizes SAV data for permits required for mitigation if a project impacts existing SAV beds or historic SAV presence.
  Additionally uses SAV data for project planning and to evaluate the value and function of shallow water habitats.

Level of Participation: Medium:

- U.S. Fish and Wildlife Service
- U.S. Geological Survey
  Conducts surveys
- National Oceanic and Atmospheric Administration
- Baltimore County (past participant in surveys)

Likely Participating Jurisdictions:

Maryland
Virginia
Washington, D.C.

Likely Participating Federal Partners:

Fish and Wildlife Service
National Oceanic and Atmospheric Administration
U.S. Geological Survey
U.S. Army Corps of Engineers

- SAV Workgroup chair (TBD)
  Prepare biennial workplan
- SAV Workgroup
  Implement ***Strategy to Accelerate the Protection and Restoration of Submerged Aquatic Vegetation in the Chesapeake Bay***
  Produce and publish ***Submerged Aquatic Vegetation Habitat Requirements and Restoration: A Third Technical Synthesis***

Local Engagement
Non-profit groups, such as the Chesapeake Bay Foundation, historically have been involved in implementing local community SAV plantings in partnership with schools. However, funding cutbacks and difficulty in achieving long-term success in direct restoration have resulted in a decreased focus on implementation, and an increase in research efforts instead.

III. Factors Influencing

Many factors, with wide-ranging levels of importance and management potential, influence the attainment of SAV goals. A thorough understanding of these factors is essential to restoration success.

Habitat Conditions

High-quality habitat conditions are vital to the success of SAV restoration and abundance goals. Good quality habitat conditions for SAV are defined by shallow water (2 meters or less) with sufficient water quality and salinity for the species being targeted for restoration. For example, eel grass grows in the high-salinity waters of the lower Bay, while sago pondweed prefers the fresh and brackish waters of the upper Bay. Most important, water clarity is necessary for productive SAV habitat. Water clarity varies as a function of precipitation. Additionally, bottom disturbance by rays and herbivory by waterfowl serve to limit success of active restoration efforts. While these factors are difficult to control directly, the workgroup is able to target restoration projects to areas in the Bay with suitable habitat conditions. The SAV maps provide information on Bay salinity, depth, and sediment input, which plays an important role in water clarity.

The Bay is considered at high-risk for sea level rise and increased Bay water temperatures from climate change, which will influence SAV habitat conditions. Climate change and sea level have little management potential; however, the workgroup is able to advocate management approaches to alleviate some of the climate stressors (i.e. minimize shoreline hardening/modification to allow inland migration of SAV as water levels increase). Also, heat-tolerant SAV species can be used in planting and transplanting efforts if they anticipate that climate change and sea level rise will be an important factor for a restoration project.

Human Impacts

Physical interruption of SAV through anthropogenic activities (e.g., dredging, propeller scarring, aquaculture facilities, and introduction of invasive species) as well as the indirect effect of localized water quality degradation (e.g., physical habitat changes due to shoreline alteration or sedimentation from changes in land use or in water activities like clam dredging) also influence the health of SAV beds. Human activities can be managed through education, outreach, and regulation.

Restoration Science

Success of SAV planting and seeding activities in the Bay has been poor to date because of the over-riding water quality and physical habitat stressors that active SAV restoration efforts cannot correct. In addition, degraded water clarity -- which varies by the amount of polluted runoff and other inputs that locations receive over time -- bottom disturbance and herbivory can also limit success of active planting and seeding efforts. However, continued SAV propagule management investigations will contribute to the knowledge base and serve to maintain expert staff in agencies and institutions as well as provide opportunities for public involvement and education. Even in ideal habitat conditions with limited human impacts, the availability of source seeds, plants and propagules (laboratories, nurseries, wild collection) as well as survival rate of the SAV species influence the success of restoration projects. The table below describes the current understanding of planting and transplanting capabilities of several species of SAV found in the Bay and its tributaries.

Species	**Growth from Seed**	**Seed Collection**	**Growth from Cuttings/Micro-Propagation**	**Planting Success**
Zostera marina, **Eelgrass**	Moderate	Moderate	No	From seed and adult plants: five- to 20-year survival from adult plants, 15+ years from seed
Ruppia maritima**, Widgeon grass**	Unknown	Easy	Yes	Unknown
Stuckenia pectinata**, Sago pondweed**	Unknown	Difficult	Yes	Low success rate
Potamogeton perfolaitus**, Redhead grass**	Difficult	Difficult	Yes	Variable success rate; up to nine years from adult plants grown in lab
Vallisneria americana**, Wild celery**	Easy	Easy	No	Variable success rate; up to 12 years from adult plants grown from seed
Heteranthra dubia**, Water stargrass**	Unknown	Difficult	Yes	Few attempts, some survival

IV. Current Efforts and Gaps

Successful restoration of SAV in the Bay is dependent upon improved water clarity conditions. Water clarity improvements are being made by meeting pollutant allocations set by the Chesapeake Bay TMDL, and through the work of the Water Quality and Maintain Healthy Watersheds Goal Implementation Teams. The SAV workgroup focuses its efforts on planting SAV, where possible, in areas with high potential to benefit other living resources.

In 2011, an estimated 63,074 acres of SAV were present in the Bay based on preliminary data. Areas of the Middle, Upper and Western Branch of the Patuxent River; Middle and Upper Potomac River; Piscataway Creek; and Anacostia River could not be mapped due to excess turbidity following Hurricane Irene and Tropical Storm Lee. Based upon acreages mapped in 2010, it is estimated that an additional 5,119 acres could have been present in these areas during 2011. In 2013, there were an estimated 59,927 acres of SAV in the Chesapeake Bay achieving 32 percent of the 185,000-acre goal.

It is critical that consistent funding be available to ensure that monitoring occurs every year. Annual monitoring provides data utilized in determining the health and recovery of the Bay and also in nutrient management decisions that are vital to improving Bay water clarity, and thus the SAV resource.

Funding and capacity for SAV planting will need to be increased dramatically to meet the SAV restoration goal. To date, the NOAA Chesapeake Bay Office (NCBO), the U.S. Army Corps of Engineers Research and Development Center (ERDC), Maryland, Virginia, and private foundations have funded almost all of the large-scale plantings in the Bay. No agency has been able to increase funding enough to meet the annual need. NCBO and ERDC have zeroed out funding for large-scale SAV restoration.

Additionally, significant investments in research should be made to improve the body of knowledge surrounding restoration techniques. Specific objectives for restoration and protection research should include:

- *Watershed Impacts on SAV.* Determine the extent to which processes and impacts on adjacent watersheds influence SAV survival and growth. Assess impact of watershed improvements on SAV.
- *Succession*. Determine whether success rate increases if a primary colonizing SAV species is planted first, followed by a climax species (e.g., *Ruppia* followed by *Zostera*).
- *Species diversity.* Determine the conditions under which planting multiple species in the same location are likely to increase the chances of population survival.
- Identify and select species with characteristics that maximize ecological function.
- *Genetic Diversity.* Determine the condition under which planting multiple genotype and locally adapted genotypes are likely to increase chances of population survival.
    - Artificial selection. Select individual plants with desirable geno/phenotypes to increase the chances of population survival.
- *Propagule choice.* For species that grow well from two or more types of propagules, such as seeds and whole shoots, determine which propagule choice is the most cost-effective under different conditions, comparing total planting cost to the survival rate.
- *Propagule transport modeling.* Determine connectivity among source beds that act as source of seed material over varying spatial scales.

- *Size.* Define the ideal size of restoration plots to maximize success.
    - Further understanding of the role of smaller sub-populations
- *Density and Pattern.* Determine at what density and spatial arrangement SAV should be planted to maximize growth and survival.
- *Exclosures.* Determine whether the physical protection of plantings and of sporadic populations resulting from natural recruitment results in significantly improved survivorship and the spread of individuals in a population.

Information is needed on the basic ecology of SAV, the factors influencing its growth and reproduction and the best methods of restoration. Research into these subjects should be carried out with an ultimate objective of applying what is learned to the Bay SAV restoration goals. Extensive research on restoration methods and habitat requirements needs to be undertaken for most of the Bay's native SAV species. Topics other than those outlined in the habitat requirements should be investigated as possible limiting factors to SAV restoration. Researchers must identify and prioritize research needs by species, because each species may have different habitat requirements. Results of these research projects should be shared with the CBP community.

V. Management Approaches

The Partnership will work together to carry out the following actions and strategies to achieve the SAV outcome. These approaches seek to address the factors affecting our ability to meet the goal and the gaps identified above.

The following four strategies have been identified as critical to the success of SAV restoration goals.

Restore Water Clarity in the Chesapeake Bay

In order to meet current and future SAV restoration goals, it is essential to meet water clarity standards in areas and at depths that are designated by Maryland, Virginia, and the District of Columbia for the application of those criteria (*i.e.,* SAV use). The water clarity standards reflect the light requirements that are necessary for the growth and maintenance of SAV populations throughout the shallow waters of the Chesapeake Bay and its tidal tributaries. This strategy is being implemented by meeting pollutant allocations set by the Chesapeake Bay TMDL and through the work of multiple Chesapeake Bay Program groups, including the Water Quality Goal Implementation Team and the Healthy Watersheds Goal Implementation Team.

Protect Existing Submerged Aquatic Vegetation

Protect existing SAV by characterizing threats and developing protection measures, establishing protection area criteria, minimizing the effects of invasive species, and increasing understanding of the potential effects of sea-level rise on SAV populations.

The workgroup is focusing on the following two of the four strategies. With additional resources, the workgroup will be able to implement all strategies.

Restore Submerged Aquatic Vegetation

Restore SAV where possible, targeting sites with suitable water quality and high potential to benefit living resources.

Enhance Research, Citizen Involvement, and Education

VI. Monitoring Progress

Monitoring programs are critical to understanding year to year fluctuations in living resource distribution and abundance. SAV distribution is assessed using annual aerial surveys, and abundance acreage is derived from photographs taken during the aerial survey. Continued annual Bay-wide monitoring is the top funding priority for SAV resource management as it provides information vital to managing water quality. The most recent SAV distribution data are displayed below. For additional information, please visit the Virginia Institute of Marine Science website.

VII. Assessing Progress

In 2010, 12 acres of SAV were planted, 60 percent of the SAV workgroup's annual restoration target, and there were 79,675 acres of SAV Bay-wide, 43 percent of the 185,000 acre goal.

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In 2013, there were an estimated 59,927 acres of SAV in the Chesapeake Bay achieving 32 percent of the 185,000-acre goal.

Increased resources and capacity for bay grass and water clarity restoration are required to hasten progress toward this goal. Please refer to the map below for the current status of bay grass abundance by segment, and areas where the most progress needs to be made.

VIII. Adaptively Manage

Information needed.

IX. Biennial Workplan

Biennial workplans for each management strategy will be developed by December 2015. It will include the following information:

- Each key action
- Timeline for the action
- Expected outcome
- Partners responsible for each action
- Estimated resources