QUARTERLY MEETING – March 14th, 2022

Chesapeake Bay Program

Submerged Aquatic Vegetation

Brooke Landry
Maryland DNR and Chair, SAV Workgroup

Through the Chesapeake Bay Watershed Agreement, *the Chesapeake Bay Program has committed to…*

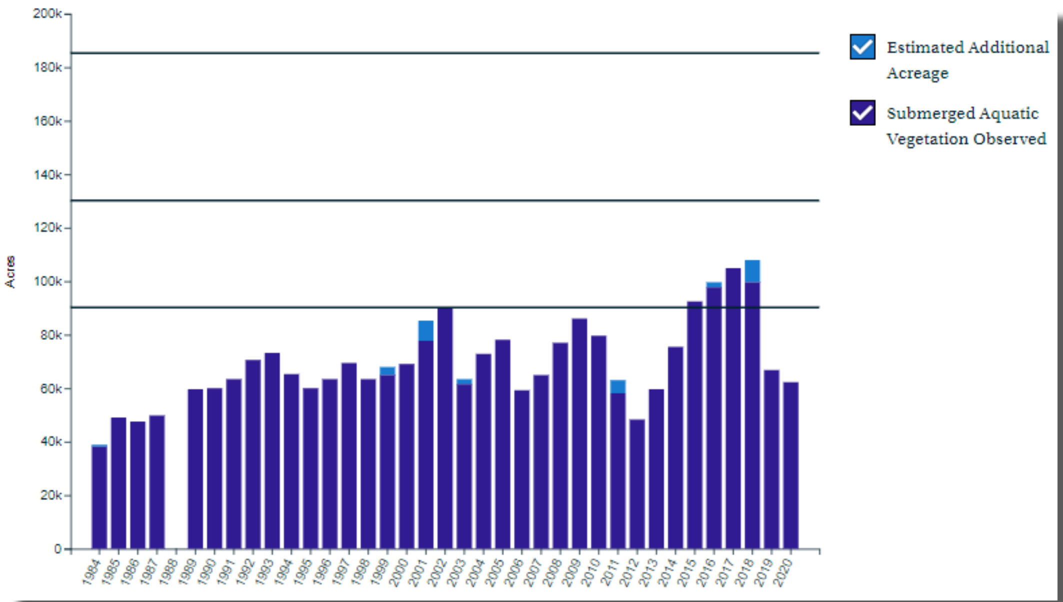
Goal: ***Vital Habitats***

Outcome:

Sustain and increase the habitat benefits of SAV 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.

What is our Progress?

Chesapeake Bay SAV Abundance 1984-2020



<u>62,169 acres of SAV in 2020</u>

- 48% of the 2025 target of 130,000 acres
- 34% of the ultimate 185,000-acre goal

****

The SAV Outcome is off course to achieving the target of 130,000 acres by 2025. Although the 62,169 acres mapped in 2020 is a 60% increase from the 38,958 acres observed during the first survey in 1984, it is a 20% decrease from the current 10-year average of 78,168 acres and a 7% decrease from 2019 when 66,684 acres of underwater grasses were mapped. https://www.chesapeakeprogress.com/abundant-life/sav

CBP Strategy Review System

SAV Management Strategy and Logic and Action Table/2-Year Workplan

Chesapeake Bay Program
Science. Restoration. Partnership.

Submerged Aquatic Vegetation Outcome

Management Strategy
2015–2025, v.4

Water stargrass (Heteranthera dubia) in the clear waters of the upper Potomac River, Maryland on July 28th, 2019. (Photo by Brooke Landry/Maryland Department of Natural Resources)

I. 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 provide food, habitat and nursery grounds for a number of commercially and ecologically important finfish and shellfish, such as striped bass and blue crabs, and migratory waterfowl. They reduce erosion by slowing currents and softening waves, anchor bottom sediments and help keep the water clear by absorbing nutrients and trapping sediments. Through photosynthesis, underwater grasses act as a carbon sink by taking in carbon dioxide. This contributes to the reduction of greenhouse gas emissions and reduces the potential for climate change impacts. Likewise, underwater grasses also produce oxygen, which helps sustain other aquatic life. Increasing the abundance of underwater grasses in the Bay and its rivers will dramatically improve the entire Bay ecosystem.

1

BIENNIAL STRATEGY REVIEW SYSTEM
Chesapeake Bay Program

Logic and Action Plan: Post-Quarterly Progress Meeting

Submerged Aquatic Vegetation – 2022-2023

Long-term Target: Achieve and sustain the ultimate outcome of 185,000 acres of SAV Bay-wide; 130,000 acres by 2025
Two-year Target: To reach our 2025 goal of 130,000 acres, baywide SAV should increase by 16,000 acres per year. By 2023, we hope to achieve 98,000 acres of SAV, but a short-term target is not officially defined.

Factor	Current Efforts	Gap	Actions	Metrics	Expected Response and Application	Learn/Adapt
What is impacting our ability to achieve our outcome?	*What current efforts are addressing this factor?*	*What further efforts or information are needed to fully address this factor?*	*What actions are essential (to help fill this gap) to achieve our outcome?*	*What will we measure or observe to determine progress in filling identified gap?*	*How and when do we expect these actions to address the identified gap? How might that affect our work going forward?*	*What did we learn from taking this action? How will this lesson impact our work?*
Factor 1. Habitat Condition and Availability: SAV requires suitable water quality and clarity to recover and thrive as well as suitable shallow-water habitat in which to expand.	**Effort 1.1** The Bay TMDL was established to limit the amount of N, P and TSS entering the Chesapeake Bay. Reductions in N, P and TSS improve water clarity, which allows SAV to recover.	**Gap 1.1** Although SAV throughout the Bay has been shown to respond to improvements in water quality, it is also susceptible to degradation of water quality, particularly when impacted by multiple stressors, which we observed	**Action 1.1a** [Support WQ GIT in their efforts to improve water quality through the Bay TMDL and achieve water clarity/SAV standards in areas designated for SAV use.]	**Metric 1.1a** Acres of SAV mapped (Bay-wide aerial survey)	**Response 1.1a** Further improvements in water clarity will greatly affect the ability of SAV populations in the Bay to gain or maintain resilience against climate stressors; benefits of improved water	

Updated March 9, 2022

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Science and Research Needs

https://star.chesapeakebay.net/#

STAR

Chesapeake Bay Program Science Needs Database

Home Download About Log In

Goals: Vital Habitats ×

Primary Outcomes: Submerged Aquatic Vegetation (SAV) ×

Categories: Category Filter

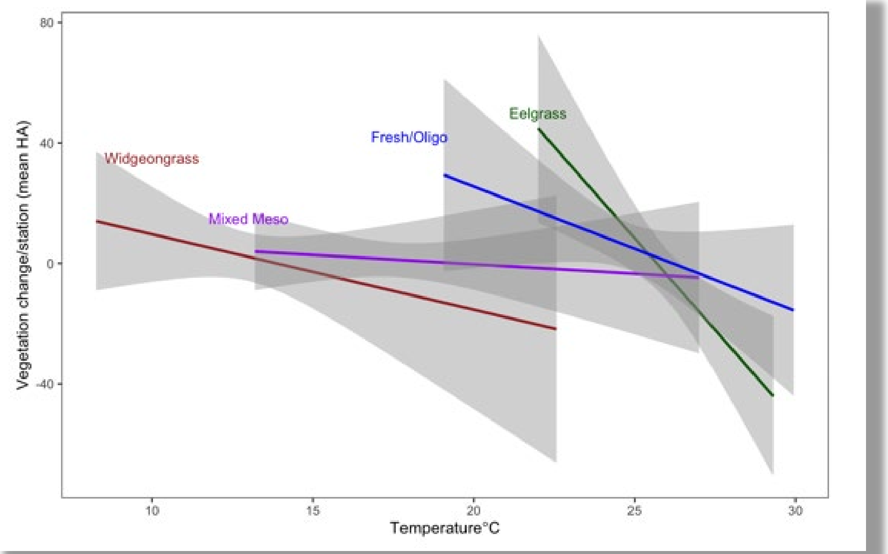
Need: Need Filter

Search

Clear Filters

Goal	Primary Outcome	Category	Need	
Vital Habitats	Submerged Aquatic Vegetation (SAV)	Literature Review, Research	Compare the ecosystem services of Ruppia maritima and Zostera marina and determine if a shift from Zm to Rm dominance in the polyhaline will impact fisheries such as blue crabs.	Detail
Vital Habitats	Submerged Aquatic Vegetation (SAV)		Investigate impacts of climate change on freshwater SAV species	Detail
Vital Habitats	Submerged Aquatic Vegetation (SAV)	Analysis, Modeling, Research, GIS	Determine the impact of the expanding aquaculture industry on our ability to reach segment-specific and Bay-wide SAV restoration targets.	Detail
Vital Habitats	Submerged Aquatic Vegetation (SAV)	Analysis, GIS	Assess integrated impacts of shallow water uses (e.g. living shorelines, aquaculture, clamming, shoreline structures) on SAV habitat	Detail
Vital Habitats	Submerged Aquatic Vegetation (SAV)	Analysis, Data Gathering, Modeling, Synthesis, GIS	Determine the habitat requirements for recovering SAV as opposed to established SAV beds.	Detail
Vital Habitats	Submerged Aquatic Vegetation (SAV)	Analysis, Data Gathering	Assessment of future SAV habitat availability in relation to climate change, sea level rise, shoreline alteration, and nearshore development to determine if segment-specific and Bay-wide SAV restoration goals are feasible.	Detail

Modeling Climate Impacts on SAV in CB



2021 GIT-Funded Project

- STAR/SAV Workgroup Collaboration
- Contracted to VIMS (Chris Patrick's team is lead) with sub-contract to Jon Lefcheck at SERC.
- Standby for Marc Hensel's presentation later for details.

This project will address the role of climate stressors on Chesapeake Bay SAV, including warming temperatures, rising sea levels, chronic low oxygen concentrations, and increased runoff driven by greater precipitation and more frequent, intense storm activity.

SAV Restoration Guide

2020 GIT-Funded Project

- Completed December 2021
- Contracted to Green Fin Studio (Dave Jasinski is lead) with SAV consultation by Cassie Gurbisz, SMCM.
- Standby for Dave's presentation later for details.

The goal of this project is to develop a technical guidance manual and outreach materials for small-scale (less than one acre) SAV restoration projects. The intended audience for Small-scale SAV Restoration in Chesapeake Bay: A Protocol and Technical Guidance Manual will be federal and state agencies, local jurisdictions, and non-government organizations, such as Riverkeeper and other watershed organizations. The goal of this Scope is to get closer to meeting the Chesapeake Bay Program SAV restoration goal attainment by directly restoring SAV in appropriate areas of their tributaries and waterways while simultaneously providing outreach and educational opportunities for their constituents and volunteers.

Chesapeake Bay Native SAV Nursery/Nursery Network

Overall objective of creating a Chesapeake Bay SAV Nursery:

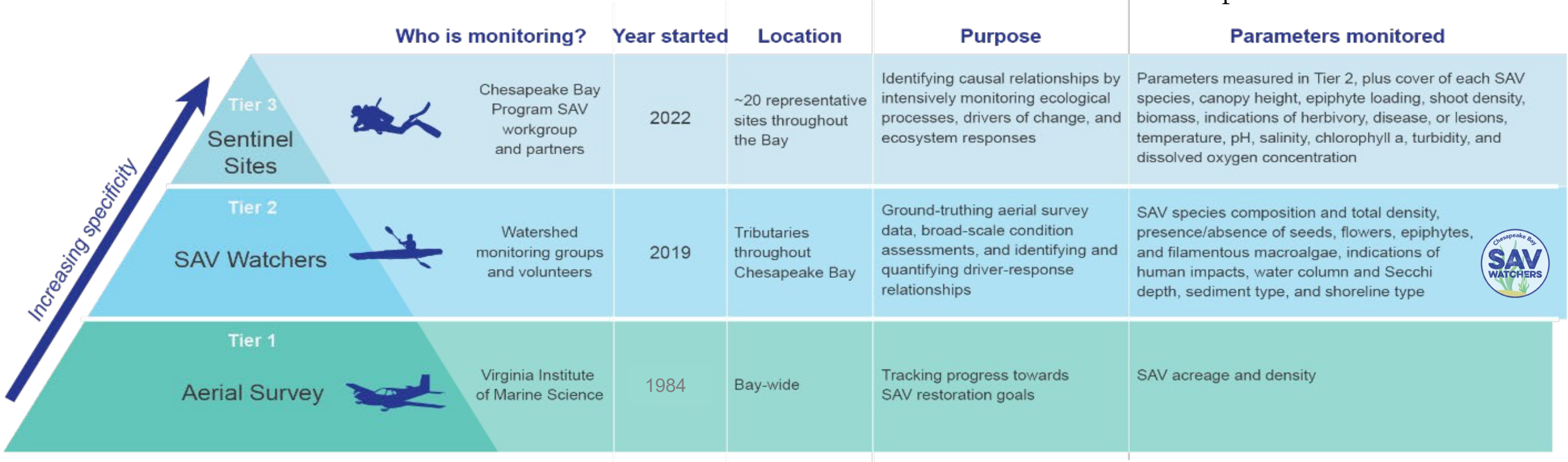
- Create a commercial seed supply for SAV restoration and mitigation projects
- Reduce the burden on donor beds
- Provide research infrastructure to further develop seed and plant handling protocols and SAV mariculture technology
- Finance SAV Restoration

Regional, National, and Global interest in the topic of SAV/Seagrass nursery development

- VA SeaGrant
- Florida Seagrass Nursery already being constructed
- Global Seagrass Nursery Network/ISBW Workshop

Chesapeake Bay SAV Monitoring effort

- **VIMS Aerial Survey:** About to start next contract
- **SAV Watchers Program:** 15 watershed groups or school systems in Maryland with certified trainers and active or to-be active programs. 27 certified trainers.
- **SAV Sentinel Sites:** Pilot implementation in 2022



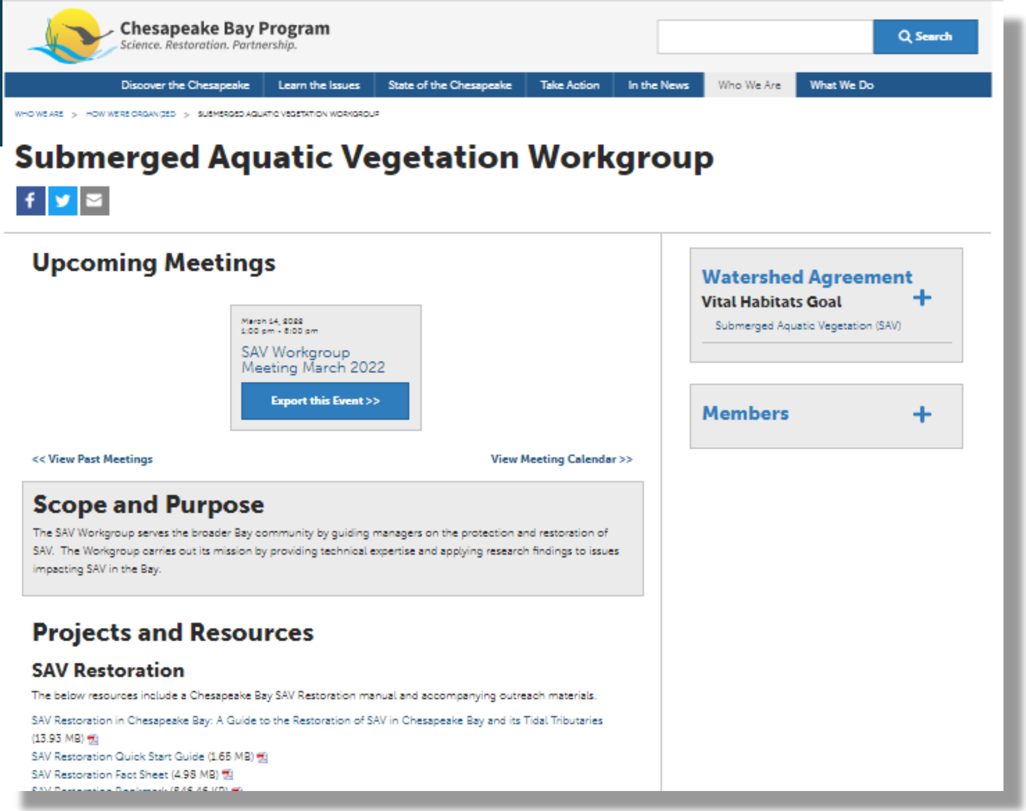
	Who is monitoring?	Year started	Location	Purpose	Parameters monitored
Tier 3 Sentinel Sites	Chesapeake Bay Program SAV workgroup and partners	2022	~20 representative sites throughout the Bay	Identifying causal relationships by intensively monitoring ecological processes, drivers of change, and ecosystem responses	Parameters measured in Tier 2, plus cover of each SAV species, canopy height, epiphyte loading, shoot density, biomass, indications of herbivory, disease, or lesions, temperature, pH, salinity, chlorophyll a, turbidity, and dissolved oxygen concentration
Tier 2 SAV Watchers	Watershed monitoring groups and volunteers	2019	Tributaries throughout Chesapeake Bay	Ground-truthing aerial survey data, broad-scale condition assessments, and identifying and quantifying driver-response relationships	SAV species composition and total density, presence/absence of seeds, flowers, epiphytes, and filamentous macroalgae, indications of human impacts, water column and Secchi depth, sediment type, and shoreline type
Tier 1 Aerial Survey	Virginia Institute of Marine Science	1984	Bay-wide	Tracking progress towards SAV restoration goals	SAV acreage and density

Figure 1. Webster et al. 2021's illustration of the Chesapeake Bay SAV Tiered Monitoring Effort

- **Paige Hobaugh, Tetra Tech, will be presenting a bit more later about this effort and the SAV Monitoring Webpages that have been built for chesapeakebay.net.**

SAV Workgroup Webpage on chesapeakebay.net

- Management Strategy and Workplan
- GIT Project Reports and Products
- Technical Syntheses
- SAV Workgroup STAC Reports
- Restoration Goal Documents
- Links to whatever we're not allowed to share directly (i.e. probably STAC reports)



https://www.chesapeakebay.net/who/group/submerged_aquatic_vegetation_workgroup

Chesapeake Bay SAV: A Third Technical Synthesis

CHAPTER ONE

SHIFTING PATTERNS IN SAV SPECIES DIVERSITY AND COMMUNITY STRUCTURE

Nancy B. Rybicki[1], Christopher E. Tanner[2], Erin C. Shields[3], Kenneth A. Moore[3], Stanley Kollar[4], David J. Wilcox[3], and Katharina A. M. Engelhardt[5]

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[2]St. Mary's College of Maryland, St. Mary's City, MD 20686
[3]Virginia Institute of Marine Science, School of Marine Science, College of William and Mary, 1375 Greate Road, Gloucester Point, VA 23062
[4]Kollar Environmental Associates
[5]University of Maryland Center for Environmental Science, Appalachian Laboratory, 301 Braddock Road, Frostburg, Maryland 21532

ABSTRACT

This chapter examines the shifting patterns in Chesapeake SAV community structure and the potential environmental variables that explain variation in species composition patterns at both long and short time periods. Bay-wide species occurrence data sets are summarized. These data show that twenty-seven or more species of SAV are found within the tidal Chesapeake Bay. Seventeen of these are common, and four of those are non-native. The distributions of these SAV species are largely controlled by salinity, resulting in species associations along salinity gradients. There is higher species richness in low salinity SAV communities compared to medium and high salinity areas, but some of the species have wide salinity tolerances and are found in more than one community type. Most low salinity SAV species have expanded their distributions within the Bay, whereas the distributions of medium and high salinity species have either not changed or decreased. Two non-native species (*Hydrilla verticillata, Najas minor*) have increased their distributions, while the distributions of two non-native species (*Myriophyllum spicatum, Potamogeton crispus*) have not been observed to spread. Factors other than salinity that affect SAV community structure include water quality conditions, water movement, sediment quality, temperature, disease, water fowl herbivory, competitive interactions, propagule availability and shading from the invasive floating aquatic vegetation, *Trapa natans*. Historic declines in SAV abundances and diversity have largely been linked to anthropogenic impacts, although disease and storms have also contributed to episodic alterations to SAV communities.

INTRODUCTION

Twenty-seven or more species of submerged aquatic vegetation are found within the tidal Chesapeake Bay. Seventeen of these are common (Orth et al. 2014), and four of those are non-native (Table 1). Several species are similar in appearance making it difficult to identify the exact number of species and misidentifications occur (Rybicki et al. 2013).The distributions of these SAV species are largely controlled by salinity (Stevenson and Confer 1978, Moore et al. 2000, Orth et al. 2010), resulting in species associations along salinity gradients. Moore et al. (2000) recognized four species associations based on the presence and absence of dominant species, while Orth et al. (2010) divided SAV species into three community types based largely on salinity (Table 2). Their low-salinity community is generally found in tidal fresh and oligohaline regions (salinities of 0 to < 5), the medium-salinity community is generally found in mesohaline regions (salinities of 5 to < 18) and the high-salinity community is found in both mesohaline and in polyhaline regions (salinities of 18 < 30). Some of the species have wide salinity tolerances and are found in more than one community type (i.e., *P. perfoliatus, S. pectinata, Z. palustris, R. maritima, Z. marina*). The area of available habitat for the high-salinity community within the Bay is approximately double that of the other two community types (Orth et al. 2010).

Bay SAV communities have fluctuated in diversity and abundances over time. Factors other than salinity that affect SAV community structure include water quality conditions (turbidity, nutrient enrichment, hypoxia), water movement (currents, waves, storm events), sediment quality, temperature, disease, water fowl herbivory (Mjelde et al. 2012), competitive interactions (Borgnis and Boyer 2015), propagule availability and shading from the invasive floating aquatic vegetation, *Trapa natans* (Gwathmey 1945).

Historic declines in SAV abundances and diversity have largely been linked to anthropogenic impacts, although disease and storms have also contributed to episodic alterations to SAV communities (Bayley et al. 1978, Kemp et al. 1983, Orth and Moore 1984, Carter et al. 1985, Brush and Hilgartner 2000, Moore et al. 2000, Kemp et al. 2005, Orth et al. 2010, Ruhl and Rybicki 2010). This chapter examines the shifting patterns in Chesapeake SAV community structure and the potential environmental variables that explain variation in species composition pattern at both long and short time periods. Species occurrence data sets that were collected by volun-

Fig. 1 Map of the Chesapeake Bay showing salinity zones and locations of highlighted studies (boxes). Red boxes are location of four case studies.

14-14-1853 CBG 14201

Agreement Number

Chesapeake Bay Submerged Aquatic Vegetation (SAV): A Third Technical Synthesis

A multi-institutional effort to synthesize the state of the science regarding submerged aquatic vegetation in Chesapeake Bay

December, 2016

Editor and Project Lead: J. Brooke Landry

Authors: Thomas M. Arnold, Katharina A. M. Engelhardt, Rebecca R. Golden, Cassie Gurbisz, W. Michael Kemp, Chris J. Kennedy, Stanley Kollar, J. Brooke Landry, Kenneth A. Moore, Maile C. Neel, Cindy Palinkas, Christopher J. Patrick, Nancy B. Rybicki, Erin C. Shields, J. Court Stevenson, Christopher E. Tanner, Lisa A. Wainger, Donald E. Weller, David J. Wilcox, and Richard C. Zimmerman

Project Abstract:

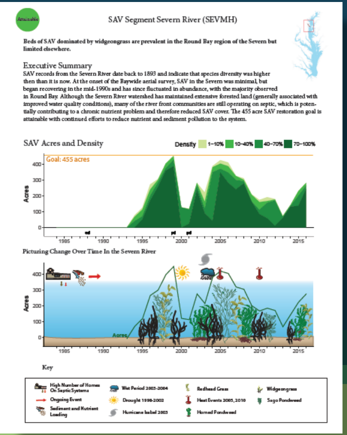
Chesapeake Bay is one of the most widely studied estuaries in the world, with extensive research focused on one of the Bay's most important habitats: submerged aquatic vegetation (SAV). SAV provides a myriad of ecosystem services, from nursery grounds and habitat for ecologically and economically important fish and invertebrates, to sediment stabilization and shoreline erosion control, to carbon sequestration. While the first two SAV Technical Syntheses (published in 1992 and 2000) focused primarily on the identification, development, and refinement of five specific and measurable habitat requirements that limit SAV growth, including light attenuation, chlorophyll a, total suspended solids, dissolved inorganic nitrogen and dissolved inorganic phosphorus, this third SAV Technical Synthesis reviews advancements in our knowledge and understanding of SAV ecosystem dynamics as they relate to SAV habitat requirements, but also genetics, the effects of land-use and shoreline alterations on SAV, climate change impacts, and ecosystem services and their potential monetary value. New information and analyses are reviewed in the context of restoration and management implications and suggest that managers and policy makers must maintain or strengthen protection to SAV and must continue to improve water quality and clarity in the Chesapeake Bay in hopes of counterbalancing the impacts of climate change and increased pressures from a growing watershed population.

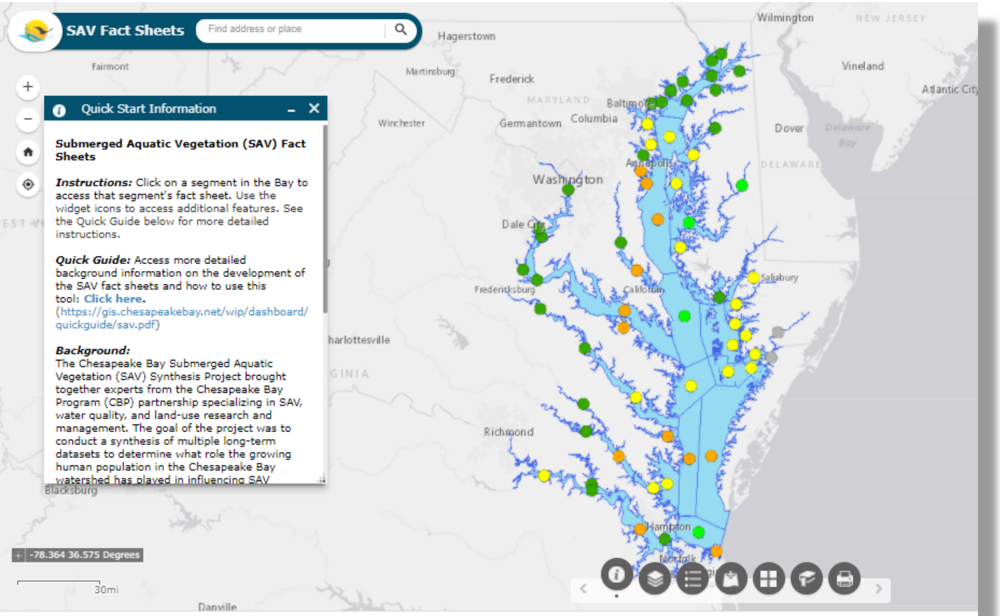
Below, find summary points for each chapter submitted to this third SAV Technical Synthesis.

Authors: Thomas M. Arnold, Katharina A. M. Engelhardt, Rebecca R. Golden, Cassie Gurbisz, W. Michael Kemp, Chris J. Kennedy, Stanley Kollar, J. Brooke Landry, Kenneth A. Moore, Maile C. Neel, Cindy Palinkas, Christopher J. Patrick, Nancy B. Rybicki, Erin C. Shields, J. Court Stevenson, Christopher E. Tanner, Lisa A. Wainger, Donald E. Weller, David J. Wilcox, and Richard C. Zimmerman

https://www.chesapeakebay.net/documents/SAV_TS_III_Final_Report_12.31.16.pdf

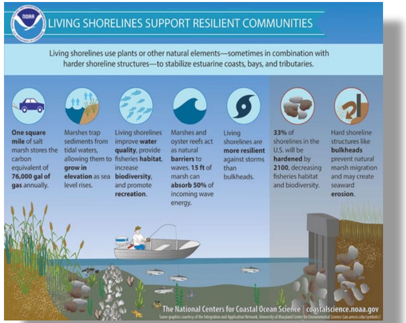
SAV Syn Segment Descriptions





- [Data Dashboard: https://gis.chesapeakebay.net/sav/](https://gis.chesapeakebay.net/sav/)
- [VIMS maps: https://www.vims.edu/research/units/programs/sav/access/maps/index.php](https://www.vims.edu/research/units/programs/sav/access/maps/index.php)
- [CAST: https://cast.chesapeakebay.net/Home/TMDLTracking#SAVReportsSection](https://cast.chesapeakebay.net/Home/TMDLTracking#SAVReportsSection)

Shallow Water Use Conflicts and Habitat Trade-offs



- First came up during the 2019 SRS Process – when SAV was still abundant and multiple shallow water use conflicts were arising (i.e., aquaculture, shellfish harvesting, SAV removal for navigation, living shorelines)
- Discussed during 2021 SAV Workgroup meeting – lots of interest
- Sidelined internally but picked up externally (several CBP meetings on topic, focus morphed to co-benefits)
- Discussed during 2021 HGIT steering committee meeting and included in HGIT management strategy
- **Topic re-focused and will be discussed in depth at the May 4-5 HGIT Spring Meeting**

STAC Workshops

1. Rising Watershed and Bay Water Temperatures—Ecological Implications and Management Responses

Water temperatures are rising in the Bay and will have significant ecological implications for Bay and watershed natural resources, and could undermine progress toward CBP goals for fisheries management, habitat restoration, water quality improvements, and protecting healthy watersheds. There is a critical need for insights into what the CBP might do now–within the scope of its current goals, policies and programs–to actively prevent, mitigate or adapt to some of the adverse consequences. This STAC workshop is proposed to meet these needs through these primary objectives:

• Summarize major findings on the ecological impacts of rising water temperatures, including science-based linkages between causes and effects; and

• Develop recommendations on how to mitigate these impacts through existing management instruments, ranging from developing indicators, identifying best management practices, and adapting policies.

Day 1: January 12th, 2022 – Review of Science
Day 2: March 15th, 2022 - Management Implications

STAC Workshops

2. Advancing Monitoring Approaches to Enhance Tidal Chesapeake Bay Habitat Assessment including Water Quality Standards for Chesapeake Bay Dissolved Oxygen, Water Clarity/SAV and Chlorophyll *a* Criteria

The workshop objective is to develop actionable recommendations on adaptive monitoring and assessment for the next generation Chesapeake Bay Program tidal monitoring program. Adaption will need to occur with methods that

1) improve temporal resolution
2) improve spatial resolution
3) improve efficiency and cost-effectiveness
4) advance water quality assessment efficiency and effectiveness
5) update Bay habitat assessment tools

Day 1: December 9th - SAV
Day 2: April 13th or 20th – Chlorophyll *a*
Day 3: May 11th or 13th – Dissolved oxygen

STAC Workshops

3. Evaluating a Systems Approach to Wetland Crediting

- This workshop will explore opportunities to advance wetland project implementation via incentivizing habitat and other ecosystem benefits beyond water quality BMP credits toward the Bay TMDL.
- This workshop will explore a more holistic "systems approach" to project accounting, specifically how wetlands are considered by multiple workgroups and GITS and how wetlands as BMPs are influenced by other BMP types in the connected landscape.
- Participants will discuss how to approach restoration projects at a systems level in order to maximize synergies for multiple ecological outcomes and accurately calculate pollutant reductions along with habitat value to restoration projects that include multiple habitats.

Date: March 22nd-23rd at the Chesapeake Bay Foundation

World Seagrass Conference 2022
&
International Seagrass Biology Workshop 14

The Graduate Annapolis
Annapolis, MD
August 7th – 12th, 2022

isbw14.org

Infrastructure Bill Funding: 238 Million

Annual CBP Budget: 87.5 Million

Geographic Programs - Chesapeake Bay Program

Federal Agency: Environmental Protection Agency
Bureau or Account: Geographic Programs

Total Funding: $238,000,000; Available until expended

Funding Recipient: Broad Eligibilities

Funding Mechanism: Grant

Description: The Environmental Protection Agency's Chesapeake Bay Program awards competitive grants and cooperative agreements to states, Tribal and local governments, non-governmental organizations, interstate agencies and academic institutions to reduce and prevent pollution and to improve the living resources in the Chesapeake Bay. Grants are awarded for implementation projects, as well as for technical assistance, monitoring, environmental education, and other related activities. The Environmental Protection Agency's funding priority is to achieve the goals and objectives established in the 2014 Chesapeake Bay Watershed Agreement through the implementation of the management strategies.

Eligible Uses: Ecosystem and wetland restoration, stormwater treatment and control, nature-based infrastructure, community resilience, resilient shorelines, and environmental education.

Funding Opportunity Availability (Estimated): TBD

Questions?