

SAV Science and Research Needs:
Presented to STAR December 16th, 2021

An underwater photograph showing submerged aquatic vegetation (SAV) in a body of water. The water is clear, and the sunlight filters through, creating a dappled light effect on the plants. The vegetation consists of long, thin, green stems with small, pointed leaves. Some stems are in the foreground, while others are further back, creating a sense of depth.

Submerged Aquatic Vegetation

*Brooke Landry
Maryland DNR and
Chair, SAV Workgroup*

Establish a more thorough understanding of climate change impacts on SAV recovery potential in Chesapeake Bay.

- Temperature
 - Sea Level Rise
 - Increasing CO₂
 - changes in rainfall and the frequency and intensity of storms
 - increased eutrophication
 - proliferation of epiphytes
 - increased shoreline armoring
 - higher sediment sulfide levels
 - invasive species
 - expanding *Lyngbya* and other filamentous BGs
 - pathogens (ie. *Labyrinthula spp.*)
- ↑** } These will directly effect SAV physiology, productivity, health, reproduction, and survival.

With ~20 species of SAV in the Bay and three primary communities (TF+OH, MH, PH), there are dozens to hundreds of questions to answer under this broad topic to ascertain the long-term potential for SAV recovery in the Bay.

-Some questions have already been answered and currently funded projects (EESLR and Climate Modeling Projects) and workshops (rising temps) are aiming to answer others.

Determine the habitat requirements for recovering SAV as opposed to established SAV beds.

- Our current habitat requirements (N, P, TSS, Chl a, K_d /Secchi depth) are based on the presence of existing beds rather than seedlings or newly established/restored beds.

This was identified as a goal of the TS III, but at the time it was determined that there was not sufficient data to establish updated requirements.

Between 2012 and 2018, however, SAV expanded rapidly in areas throughout the Bay in response to improving water quality, including in areas where SAV had not been observed in decades. Consequently, there may be sufficient data to attempt this exercise now.

Determine the impact of the expanding aquaculture industry on our ability to reach segment-specific and Bay-wide SAV restoration targets.

- As aquaculture expands in areas where SAV was historically present but is now absent, the physical space in which SAV can recover with improvements in water quality may be limited and prevent attainment of segment-specific SAV restoration goals.

There are currently funded projects assessing various impacts of aquaculture on SAV recovery (Cassie Gurbisz/Jeremy Testa and Erin Shields work).

Identify the potential mutualistic relationships between SAV restoration and bivalve restoration.

- In freshwater restoration projects, would it be beneficial to co-locate SAV restoration and freshwater mussel restoration to the mutual benefit of each?
- In saltier water restoration projects, would it be beneficial to co-locate SAV restoration and oyster restoration/aquaculture to the mutual benefit of each?

There is a STAC report coming out soon on this spring's freshwater mussel workshop that may speak to the first bullet, which DC DOEE is very interested in.

Researchers at ODU and VIMS are tackling aspects of this questions, as are researchers at SMCM and UMCES.

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.

- *Zm* is expected to continue decreasing in the Bay due to increasing Bay water temperatures and persistently insufficient water clarity. In the absence of *Zm*, it is likely that *Rm* will expand into areas historically dominated by *Zm* and provide similar ecosystem services,
- It is not clear if the services provided by *Rm* will be as beneficial to the ecosystem as those provided by *Zm* (timing and stability are in question).

Marc Hensel, a post-doc at VIMS, is actively working on solving some of *Ruppia's* mysteries. Another recent VIMS graduate also addressed some of this in her dissertation, but not all (Emily French).

-The question of fisheries impacts is unanswered.

Identify SAV's role in Chesapeake Bay's carbon sequestration potential.

More specifically:

- Quantify the ability of freshwater, mesohaline and polyhaline SAV to sequester carbon.
- Quantifying blue carbon sequestration in SAV beds by species and assess effects of bed impermanence (expansion - retraction) on blue carbon sequestration and storage.

More is known about seagrass (*Zm*) carbon sequestration potential.

There is a major gap in knowledge regarding freshwater and mesohaline species potential.

Determine the contribution of *Zannichellia palustris* (horned pondweed) to baywide SAV totals and interactions with other species.

- The distribution and abundance of *Zp* is not well understood in Chesapeake Bay, though it appears to be expanding.
- *Zp* is a cool water species that dies back before the aerial survey captures its distribution, so is not included in Bay-wide totals.
- *Zp* has a broad salinity tolerance and is found in all salinity zones, though is most prevalent in OH and MH.
- Does its presence increase or decrease the likelihood that another SAV will colonize the same area later in the spring?

The distribution of *Zp* in the Bay could potentially be determined using satellite imagery from PlanetScope Dove satellites.

SAV Watcher data could be used to target image assessment.

Develop algorithms to advance efforts in the use of Artificial Intelligence in the automated detection of SAV from satellite imagery.

- Significant field data is necessary to fully train the algorithms to accurately detect and quantify Chesapeake Bay SAV. This data could come, in part, from the SAV Sentinel Site Program.

During the STAC workshop on SAV and Satellite Imagery as well as during the recent STAC Advanced Monitoring workshop, the need for continued development of algorithms for SAV quantification was highlighted. Dick Zimmerman, ODU, is currently funded to work on this but is in need of additional support to collect field data throughout the Bay to train the algorithms. Additional field data would assist with training and also provide data necessary for biomass quantification as well as acreage and density. Biomass quantification would allow for greater understanding of carbon sequestration capacity and flux by CB SAV.

Determine potential to restore *Zostera* populations in the Chesapeake by facilitating the migration of potentially more heat resistant *Zostera* seeds from North Carolina.

- There are several sub-questions associated with this topic regarding *Zostera's* genetics and plasticity.
- This also begs the question as to whether entirely different species, such as *Halodule wrightii*, should be considered for Bay restoration.

Two of our workgroup members, Erin Shields and Jessie Jarvis, have submitted a proposal to do this work. Another, Jon Lefcheck, is co-leading a workshop on this topic with *Zostera* scientists from mid-Atlantic and New England states.

Chesapeake Bay SAV Sentinel Site Program Implementation

The Chesapeake Bay SAV Sentinel Site Program will be necessary to track climate impacts on SAV.

Implementation of the Program will begin this summer but is currently unfunded. Funding will be necessary to obtain and process the samples needed to determine biomass, productivity, and consequently carbon sequestration of the Bay's SAV. Without funding, basic parameters will be collected while any samples that need processing will be delayed for when funding is obtained. Determining the carbon sequestration potential of CB SAV is of interest to multiple federal agencies to determine its role in global carbon budgeting and balancing. It is also necessary to move forward in the voluntary carbon market.

*Could funding be allocated as part of the broader SAV Monitoring effort?

A project to develop web content for CB SAV Monitoring Program web pages, which include the SAV Sentinel Site Program, the aerial survey, and the SAV Watcher Program, was recently completed. The webpages will be published this spring.

Chesapeake Bay Native SAV Nursery

- Identify the possibilities and logistics of establishing a Chesapeake Bay SAV nursery. The purpose would be to grow native and locally-adapted SAV stock to use in SAV restoration/mitigation efforts.

With the development of a technical guidance manual for SAV in Chesapeake Bay, interest in direct SAV restoration will expand. Seed sources need to be protected and managed, which will lead to a bottleneck in the restoration process. To alleviate that bottleneck, reduce stress on donor beds, and also to enhance our ability to quickly capitalize on good water quality conditions, it will be necessary to establish a native SAV nursery to facilitate the recovery of SAV in Chesapeake Bay.

Determine if microplastics are affecting the health of the Bay's SAV beds and if those beds are serving as sources/sinks for microplastics which then make their way up the food chain.

- Recent evidence suggests SAV beds could be trapping microplastic particles, especially those encrusted with epiphytes that grow on SAV as a result of eutrophication, therefore acting as a sink. This would potentially facilitate uptake by numerous species as well as hinder SAV growth by affecting nutrient cycling.

Research outside of the Bay has shown that SAV beds do trap microplastics just as they trap suspended sediments.

Additional work has shown food chain impacts and impacts on nutrient cycling. Impacts in CB are not known, however.

Determine the importance of bioturbators (rays, etc) to SAV meadow health and productivity.

Bioturbators include

- Rays
- Crabs
- Turtles
- Some fish
- Anything that digs around in the sediment of SAV beds

Aside from one study conducted decades ago, very little is known about the role of bioturbators in maintaining or affecting SAV bed health.

What impact does clamming have on SAV and potential SAV habitat?

- Clamming in mid-Chesapeake Bay tributaries is expanding. What impact does clamming and its associated disturbances (ie. turbidity plumes) have on SAV and potential SAV habitat?
- Are SAV Protection Zones sufficient?

There is sufficient evidence and research to show clamming impacts on SAV – that is why the practice is outlawed in the coastal bays and in Virginia. In areas of Maryland, however, clamming is allowed outside of SAV protection zones.

Assess the impact of living shoreline construction and placement on SAV habitat, as well as identify best practices for the incorporation of SAV restoration into living shoreline designs.

- Do softening approaches such as living shorelines support long-term increases in SAV?
- Are some living shoreline designs more amenable to SAV recovery or direct restoration success?

Cindy Palinkas and Lori Staver, UMCES, have conducted research in this area. Brooke Landry, DNR, has recently been funded to address this question specifically. Questions will remain regarding various living shoreline designs, however.

Management Board requested Action Items in Response to recent SRS presentation.

Management Board recognizes that achieving our water clarity goals via reductions in nitrogen, phosphorus, and total suspended sediment loads identified in our TMDLs is the most effective action toward realizing our SAV goals. As a result, the Management Board commits to taking benefits to SAV into consideration when applying funds (including the new federal Infrastructure Funding) to BMP implementation and welcomes input from the SAV Workgroup in identifying BMP types and locations (ex. co-location with SAV beds, oyster/mussel projects) that may be particularly co-beneficial to SAV restoration.

SAV Workgroup will include actions in their next 2-year Logic and Action Plan (LAP) to collaborate with STAR, the Fisheries GIT, and others as appropriate to improve our understanding of:

- Local effect of flow/Stormwater run-off on SAV density and acreages and options for targeting BMPs that would protect priority SAV areas.
- Co-location of land-based BMPs, oyster/mussel restoration, and SAV

Science and Research Needs– December, 2021

Chesapeake Bay Program



Questions?

Presentation template by SlidesCarnival.