



Atlantic States Marine Fisheries Commission
Update to Habitat Management Series #15
Winter 2022



Update to Habitat Management Series #15: Submerged Aquatic Vegetation Policy

A Review of Past Accomplishments and Emerging Research
and Management Issues

Vision: Sustainably Managing Atlantic Coastal Fisheries

Atlantic States Marine Fisheries Commission

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A Review of Past Accomplishments and Emerging Research and Management Issues

prepared by

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Approved by the ISFMP Policy Board

January 27, 2022



A report of the Atlantic States Marine Fisheries Commission pursuant to
U.S. Fish & Wildlife Service Grant No. F21AC01999

Cover Photo Credit: Cornell Cooperative Extension Eelgrass Program, www.SeagrassLI.org

Executive Summary

Submerged aquatic vegetation (SAV) comprise some of the most productive ecosystems in the world. SAV is significantly important to many Atlantic States Marine Fisheries Commission (Commission or ASMFC) managed fish species and provides a variety of ecosystem services, especially important given climate change. SAV is afforded different degrees of protection and different management measures up and down the coast. In 1997, the Commission's Habitat Committee developed a policy to communicate the need for conservation of coastal SAV resources, and highlight state and Commission-based activities for implementation of a coastal SAV conservation and enhancement program. The Commission encouraged implementation of this policy by state, federal, local, and cooperative programs which influence and regulate fish habitat and activities impacting fish habitat; specifically, SAV.

In 2017, 20 years after the original policy was released, the Habitat Committee re-evaluated its recommendations and importance. Upon review, it was determined that the policy is still relevant, and arguably more important now than ever.

Another update was made in 2022 to further refine the definition of SAV, and to introduce the Commission's position on living shorelines and nature-based features. Other minor clarifying edits were also included.

The Habitat Committee has left the goals largely unchanged from the 1997 version. The primary goal is to preserve, conserve, and restore SAV where possible, in order to achieve a net gain in distribution and abundance along the Atlantic coast and tidal tributaries, and to prevent any further losses of SAV in individual states by encouraging the following:

1. Protect existing SAV beds from further losses due to degradation of water quality, physical destruction to the plants, or disruption to the local benthic environment, such as from coastal construction;
2. Continue to promote state or regional water and habitat quality objectives that will result in restoration of SAV through natural re-vegetation;
3. Continue to promote, develop, attain, and update as needed, state SAV restoration goals in terms of acreage, abundance, and species diversity, considering historical distribution records and estimates of potential habitat.
4. Continue to promote SAV protection at local, state and federal levels and when unavoidable impacts to SAV occur from permitted coastal alterations or other unintended actions, agencies should implement compensatory mitigation for the functional and temporal impacts.
5. Encourage monitoring and research to address management-oriented information gaps.
6. Provide funding for pilot projects and other demonstration restoration areas.

There are six key components to achieving the goal of this policy: 1) Assessment of historical, current and potential distribution and abundance of SAV; 2) Protection of existing SAV and associated habitat; 3) SAV restoration and enhancement; 4) Public education and involvement; 5) Research; and 6) Implementation through pilot demonstration areas.

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Acknowledgements

The Habitat Committee would like to acknowledge all of the partners and staff who took the ASMFC 1997 SAV Policy to heart and implemented it. In particular, we thank the early pioneers in North Carolina and Virginia –

Bob Noffsinger, Wilson Laney, John Stanton, and John Gallegos of the U.S. Fish and Wildlife Service; Dean Carpenter of the Albemarle Pamlico National Estuary Program (APNEP);

Anne Deaton of the North Carolina Division of Marine Fisheries (NC DMF); and Don Field of the National Ocean Service, NOAA for their organization and regular mapping efforts.

Also thanks to Rob Allen and Keith Johnston of the North Carolina Department of Transportation's Photogrammetry section. Their team's collaboration with APNEP and NC DMF during the project's second cycle (2012-2014) translated into great gains in efficiency during aerial image acquisition.

For their assistance with providing, reviewing, and/or updating information in this document (in some cases multiple times), we thank Soren Dahl, Kathryn Ford, Kate Frew, and others that we might have forgotten to mention.

Additionally, we would like to extend our gratitude to Bob Orth of the Virginia Institute of Marine Science for his May 2, 2017 presentation to the Habitat Committee on SAV in the Chesapeake Bay. The presentation and subsequent discussion helped guide the direction of this update to the SAV Policy.

PUBLICATION CITATION

Atlantic States Marine Fisheries Commission. 2022. Update to Habitat Management Series #15: Submerged Aquatic Vegetation Policy. Arlington, VA.

This report is a publication of the Atlantic States Marine Fisheries Commission pursuant to U.S. Fish & Wildlife Service, Grant No. F21AC01999.

Preface

The Atlantic States Marine Fisheries Commission (Commission) was formed in 1942 as a means to conserve and enhance interjurisdictional fisheries of the Atlantic coast. The Commission and its 15 member states and associated jurisdictions which also serve on the Commission's Interstate Fisheries Management Policy Board (District of Columbia, NOAA Fisheries, Potomac River Fisheries Commission, and U.S. Fish and Wildlife Service) recognize that marine fisheries cannot be adequately managed without due consideration for marine fish habitat; however, the Commission does not have the capability to regulate marine fish habitat or activities other than fishing that may cause adverse impacts. Under these circumstances, the Commission recognizes that it is imperative to collaborate with the state and federal agencies that hold such authority, and equip them with the recommendations and guidance necessary to help provide for the conservation of healthy marine fish habitat.

Submerged aquatic vegetation (SAV) comprise some of the most productive ecosystems in the world (Orth et al. 2006a). SAV is significantly important to many Commission managed fish species, and is afforded different degrees of protection up and down the coast. In 1997, the Commission's Habitat Committee developed a policy (ASMFC 1997) to communicate the need for conservation of coastal SAV resources, and highlight state and Commission-based activities for implementation of a coastal SAV conservation and enhancement program. This policy was modeled after a similar policy prepared by the Chesapeake Bay Program (Chesapeake Executive Council 1989), and background information relied heavily on the Commission's publication *Atlantic Coastal Submerged Aquatic Vegetation: A Review of its Ecological Role, Anthropogenic Impacts, State Regulation, and Value to Atlantic Coastal Fisheries* (Stephan and Bigford 1997). The intent of the original policy was not to hold marine fisheries agencies accountable for the suggested state activities, but rather to efficiently communicate the goals of the policy to the agencies or organizations that can best carry out the prescribed activities, and encourage the participation of these agencies in achieving policy goals.

In 2017, 20 years after the original policy was released, the Habitat Committee re-evaluated its recommendations and importance. Upon review, it was determined that the policy is still relevant, and arguably more important now than ever due to new or intensifying threats that could reduce water quality or damage SAV habitat, such as aquaculture and coastal development (Short et al. 2011, Lefcheck et al. 2017). Our objective was to provide updates to the scientific research and management issues, including emerging issues over the past 20 years.

In 2022, the Habitat Committee made another update to further refine the definition of SAV and SAV habitat, and to update the language in *Policy II. Protection of Existing SAV* to clarify the Commission's position on the installation of living shorelines and nature-based features. Minor changes were also made for clarity and to better incorporate the current status of SAV and current or emerging threats to these important habitats and nursery grounds.

Introduction

BACKGROUND

SAV or SAV systems, which include both true seagrasses in saline regions and freshwater angiosperms that have colonized lower salinity regions of estuaries, are among the most productive ecosystems in the world (Orth et al. 2006a). They perform a number of irreplaceable ecological functions, which range from chemical cycling and physical modification of the water column and sediments, to providing food and shelter for commercial, recreational, as well as ecologically important organisms, and are especially critical for juvenile development of many fish and invertebrate species (Thayer et al. 1997, Heck et al. 2003, Ralph et al. 2013). Due in part to their status as a nursery habitat, SAV is also a key linkage among not only other marine ecosystems, but terrestrial ones as well (Heck et al. 2008). The majority of ASMFC-managed species utilize SAV for refuge, attachment, spawning, food, or prey location for at least part of their life cycle (data from Kritzer et al. 2016, *ACFHP Species-Habitat Matrix*). Conservation of these vital habitats is critical not only for successfully managing our Atlantic fisheries, but for all who depend on healthy aquatic ecosystems.

The Commission established a policy on SAV in 1997 because of the important role SAV plays in the habitat of Commission-managed species. Both marine and freshwater SAV is covered by the policy because some managed species utilize both during their ontogenetic development. Both natural events and human activities can threaten local and regional SAV health and abundance, and result in impacts to fisheries. SAV loss has been reported worldwide (Orth et al. 2006a, Waycott et al. 2009) and in most Atlantic coastal states (see 'SAV Efforts by Atlantic Coast States and Federal Partners since the Policy was Released' below). Some reasons for the decline are pervasive threats along the coast. Water quality issues, caused by sedimentation and eutrophication, especially from algal blooms, reduce water column transparency and prevent SAV from photosynthesizing. Climate change-induced heat waves and storm events have big impacts on temperature and salinity in the shallow water environments where SAV grow. These threats and others have led to massive die-offs. Certain regions, like Long Island, New York bays and the Indian River Lagoon, Florida now have only a fraction of historic SAV coverage. Coastal construction, including dredging and filling, is also a major threat to SAV. The Chesapeake Bay saw declines in all SAV species in all areas of the bay in the early 1970s (Orth and Moore 1983, Orth et al. 2002a). In 1993, researchers identified the main influencers on SAV abundance and distribution: water clarity, suspended sediments, nitrogen, phosphorus, and chlorophyll *a* (Dennison et al. 1993). Since then, managers have been using these indicators for specific water quality targets. The current restoration target is 130,000 acres by 2025 (*Submerged Aquatic Vegetation (SAV) - Chesapeake Progress*). Conservation measures have also slowed, and in some cases reversed, SAV decline in other locations, including parts of Florida (SAFMC 2014).

The Commission encouraged implementation of the original policy by state, federal, local, and cooperative programs which influence and regulate fish habitat and activities impacting fish habitat; specifically, SAV. The development of the original policy was overseen by the Commission's Habitat Committee, with scientific guidance from experts in the field of SAV ecology. The 2018 version of the SAV policy was updated by distributing the 1997 policy to SAV and habitat experts and incorporating their changes. The final draft was approved by the Habitat Committee January 16, 2018 and by the Policy Board February 8, 2018. This 2022 version contains minor changes to the 2018 version by noting emerging issues associated with implementing some shoreline protection measures and associated SAV losses.

DEFINITION OF SUBMERGED AQUATIC VEGETATION

In general, SAV normally refers to all macrophytes, including macroalgae, found in aquatic systems ranging from freshwater to marine. For the purposes of this document, ASMFC's definition of SAV refers to rooted, vascular, flowering plants that, except for some flowering structures, live and grow below the estuarine and marine water surface. Because of their requirements for sufficient sunlight, seagrasses, the estuarine and marine constituent species of SAV, are found in shallow coastal areas of all Atlantic coastal states, with the exception of Georgia and South Carolina. In those states, freshwater inflow, high turbidity, and tidal amplitude combine to inhibit their growth. SAV growth is seasonal, and during winter months, leaf blades may not be present.

ASMFC's definition of SAV habitat includes SAV beds and standing populations of various species and densities, including bare areas of sediment within a bed. This definition also accounts for the average physical requirements of depth and light availability for SAV community persistence. SAV habitat is characterized by the current or historical presence of rhizomes, roots, shoots, or reproductive structures associated with one or more SAV species. Mapping and surveying during the active growing season enhances the ability to identify SAV habitat.

There are at least 13 species of seagrasses common in US waters to which this definition of SAV and these policies may apply. In the New England and northern Mid-Atlantic regions, eelgrass (*Zostera marina*) dominates coastal shallow waters, with two other species also occurring – widgeon grass (*Ruppia maritima*) and, from North Carolina southward, Cuban shoalgrass (*Halodule wrightii*). South towards Florida, turtlegrass (*Thalassia testudinum*) and manatee grass (*Syringodium filiforme*) become dominant along with Cuban shoalgrass and several species of Halophila. One species of Halophila, Johnson's seagrass (*H. johnsonii*), was listed as threatened in 1998. Its critical habitat was designated in 2000, and in 2002 the National Oceanic and Atmospheric Administration (NOAA) published a recovery plan for the species¹. In light of recent genetic studies, which indicate that Johnson's seagrass shares a predominance of its genome with paddle weed (*Halophila ovalis*), NOAA is evaluating the threatened status of this species for delisting (Waycott et al. 2021). Widgeon grass (*Ruppia maritima*), which can tolerate both fresh and saltwater, has the broadest range of all species (Orth 1997).

In addition to the seagrass species that fall under ASMFC's definition of SAV, approximately 20 – 30 species of freshwater macrophytes may be found in the tidal freshwater and low salinity areas of the estuaries of the eastern United States. These lower salinity communities can be quite diverse, with as many as 10 species co-occurring at a single location. Wild celery (*Vallisneria americana*), redhead grass (*Potamogeton perfoliatus*), sago pondweed (*P. pectinatus*), horned pondweed (*Zannichellia palustris*), common elodea (*Elodea canadensis*), coontail (*Ceratophyllum demersum*), and southern naiad (*Najas quadalupensis*) are a few of the native species that will dominate these areas while two non-native (invasive) species, Eurasian watermilfoil (*Myriophyllum spicatum*) and hydrilla (*Hydrilla verticillata*), will also be found in many areas.

Finally, the updates and the original policy acknowledge that there will be situations where it may be appropriate to undertake control measures for invasive species of SAV. However, where native SAV species have been eliminated and invasive species are of functional value it may be more appropriate to protect the invasive species from development activities (e.g. see Ramus et al. 2017). These situations should be evaluated on a case-by-case basis.

¹<https://www.fisheries.noaa.gov/species/johnsons-seagrass.html>

SAV EFFORTS BY ATLANTIC COAST STATES AND FEDERAL PARTNERS SINCE THE POLICY WAS RELEASED

In 2017, the Habitat Program Coordinator sent out a survey asking each partner a series of questions based on the goals and components of the original policy statement (results in Figure 1).

Of the eleven states that have marine seagrass within their borders and responded to the survey, seven of the eleven have implemented a resource assessment and monitoring strategy to quantitatively evaluate SAV distribution and abundance. One state is currently in the process of developing an assessment. Ten states have put measures in place to limit permanent and irreversible direct and indirect impacts to SAV and their habitats. Evaluation of the effectiveness of these measures has been mixed along the coast: three states have carried out an evaluation and five have not. Two states have evaluations in development, and one state has conducted an evaluation in the past, but is not currently doing so. Fifty-five percent of states have set restoration goals, whereas 45% have not. Most (81%), however, have identified the key reasons for SAV loss in their state. Seven states have identified suitable areas for protection and restoration, and two are in the process of doing so. One state has not, and one identifies areas as needed. All states either incorporate SAV education in their outreach or citizen science programs, either directly or via other entities (such as National Estuarine Research Reserves). Most states have also supported SAV research and follow specific Best Management Practices (10 and 8 states, respectively).

Most of the federal partners do not have regulatory authority pertaining to SAV, but do serve in an advisory role and can designate specific SAV areas as protected. More than half have developed technical guidance or SAV standards, and promote Best Management Practices. While they have not implemented the Commission's SAV Policy, most have implemented other, similar policies to protect SAV.

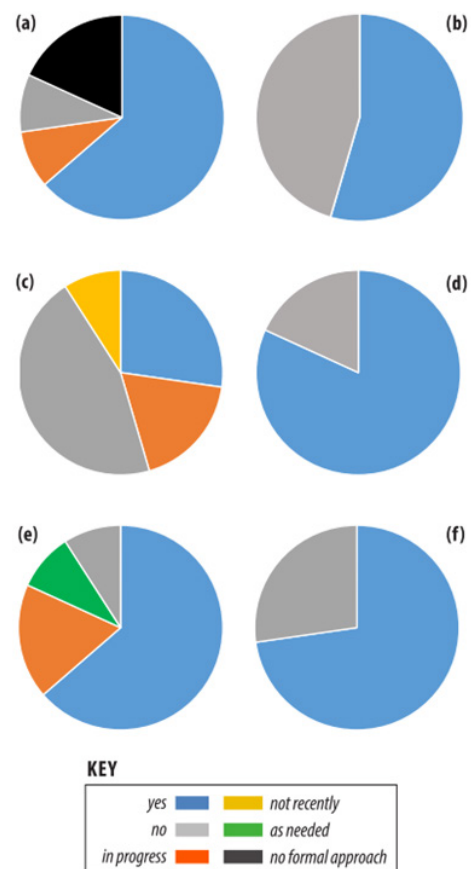


Figure 1. State responses to the following questions: (a) Has your state implemented an SAV resource management assessment and monitoring strategy? (b) Has your state set restoration goals? (c) Has your state reviewed the effectiveness of their assessment and monitoring programs? (d) Has your state identified reasons for loss and/or addressed the need for SAV improvement? (e) Has your state identified areas for protection or restoration? (f) Does your state follow specific Best Management Practices?

Policy Statement

GOAL

The Habitat Committee found that the original goals are still relevant today, and have left them largely unchanged from the 1997 version. The primary goal is to preserve, conserve, and restore SAV where possible, in order to achieve a net gain in distribution and abundance along the Atlantic coast and tidal tributaries, and to prevent any further losses of SAV in individual states by encouraging the following:

1. Protect existing SAV beds from further losses due to degradation of water quality, physical destruction to the plants, or disruption to the local benthic environment such as from coastal construction;
2. Continue to promote state or regional water and habitat quality objectives that will result in restoration of SAV through natural re-vegetation;
3. Continue to promote, develop, attain, and update as needed, state SAV restoration goals in terms of acreage, abundance, and species diversity, considering historical distribution records and estimates of potential habitat.
4. Continue to promote SAV protection at local, state and federal levels and when unavoidable impacts to SAV occur from permitted coastal alterations or other unintended actions, agencies should implement compensatory mitigation for the functional and temporal impacts.
5. Encourage monitoring and research to address management-oriented information gaps.
6. Provide funding for pilot projects and other demonstration restoration areas.

There are six key components to achieving the goal of this policy: 1) Assessment of historical, current and potential distribution and abundance of SAV; 2) Protection of existing SAV and associated habitat; 3) SAV restoration and enhancement; 4) Public education and involvement; 5) Research; and 6) Implementation through pilot demonstration areas.

I. ASSESSING THE RESOURCE

Determining current status and identifying trends in health and abundance are key factors in management of SAV resources. In an effort to develop consistent monitoring techniques among regions, SAV mapping protocols have been identified by NOAA's Coastal Change Analysis Program (C- CAP, Dobson et al. 1995), and updated in 2001 (NOAA 2001).

Policy: At a minimum, each member state should ensure the implementation of an SAV resource assessment and monitoring program which will provide a continuing quantitative evaluation of SAV distribution and abundance and the supporting environmental parameters. The optimal coast-wide situation would be a monitoring system which would establish consistent monitoring techniques among regions so that the data are comparable. For example, SeagrassNet is used at several locations along the Atlantic coast and other areas worldwide to assess trends in health of discrete SAV beds using comparable techniques. In addition to evaluating distribution and abundance, monitoring should also evaluate trends in the overall health of existing SAV beds.

Action: *ASMFC* — Support (financially, politically, or through the sharing of resources and information) and promote states to adopt an SAV mapping and monitoring plan. Assessment and data collection should have relevant metrics and scales to inform specific management questions and goals (Bernstein et al. 2011, Neckles et al. 2012, Roca et al. 2016). When possible, promote universal metrics for monitoring along the coast to allow for inter-state comparisons.

States — *ASMFC* members should encourage their appropriate state agencies or departments to implement regular statewide or regional SAV monitoring programs which will identify changes in SAV health and abundance cumulatively on a coast-wide basis if they are not already doing so (see “SAV Efforts by Atlantic Coast States and Federal Partners since the Policy was Released” above for more information). Surveys should minimally be on a five-year basis, and preferably annually, for areas considered to be especially at risk of severe declines from anthropogenic activities, disease, or other factors. Aerial images captured from a plane allow for standard comparability across regions, if resources allow. A good map provides spatial extent and rough approximations of density. However, aerial-based assessment results can vary considerably based on image quality, SAV bed plant densities, visual signature interpretation and extent of surface level verification. Above ground biomass (e.g., shoot density and canopy height) from sentinel beds can allow for a closer look at plant health and bed dynamics.

II. PROTECTION OF EXISTING SUBMERGED AQUATIC VEGETATION

A concerted effort should be made to protect those areas where SAV currently exists and habitat where SAV could potentially occur, since it can be problematic to successfully restore or mitigate SAV losses. Habitat where SAV habitat could potentially occur, a buffer, allows room for SAV seed dispersal, normal seasonal expansion, and would resolve the difficulty of accurately mapping belowground plant structure. Impacts which result in losses of SAV and SAV habitat, such as direct alterations to a vegetated area or indirect actions within a watershed, should be minimized. Primary causes of existing SAV and SAV habitat loss include coastal construction, reduced water clarity due to increased nutrients (and subsequent algal blooms), and sediment delivery to ambient waters from development and agriculture. Climate change is expected to have an effect on SAV distribution and abundance as water temperature, salinity, and water depth change. Shading from docks, propeller dredging from boating, and bottom disturbing fishing gear also contribute to SAV loss (e.g., Orth et al. 2002b).

Since the original policy was released, SAV has been facing emerging issues including coastal construction (e.g., boom in the installation of new boat mooring areas, port expansions), and significant increases in aquaculture in shallow coastal waters, both of which can conflict with the conservation of SAV. This is especially true for shellfish aquaculture. Aquaculture has the potential for conflicts that requires careful ocean planning, and siting should not occur within or adjacent to areas of existing SAV or SAV habitat until further research can be completed that examines whether specific aquaculture practices, such as shellfish aquaculture, can co-exist with SAV.

Additionally, there has been increasing interest in the use of living shorelines or nature-based features² to provide shoreline stabilization, wave attenuation, and erosion control instead of using bulkheads and other shoreline hardening measures. The term “living shoreline” has itself progressed to take on a more general meaning, encompassing a wide variety of

²Nature-based features are created by human design, engineering, and construction for specific services such as coastal hazard risk reduction.

projects that integrate ecological principles into the engineering design. When designed correctly, living shorelines can provide a benefit to adjacent SAV beds by stabilizing highly erodible sediment that may be negatively impacting SAV, while continuing to support the necessary sediment supply to maintain the beds. Some living shorelines efforts have the purpose of restoring SAV. In contrast, poorly designed living shorelines or hardened shorelines can significantly and negatively impact adjacent SAV beds by altering nearshore hydraulics and reducing the necessary sediment supply. Permitting processes have been developed on the federal level and in some states to encourage the use of living shorelines. While correctly designed living shorelines and nature-based features can provide benefit to adjacent SAV beds, there have been examples of poor living shoreline and nature-based feature design and implementation that reduced the acreage of SAV beds or damaged the beds during construction.

Because SAV requirements for growth and survival are stringent, controlling the type, extent, intensity, and duration of impacts to SAV will further other efforts to restore and protect coastal fish habitat. Furthermore, protection and conservation of SAV should be prioritized as an assured and cost-effective approach to the preservation of SAV.

Policy: Member states and federal partners should use existing regulatory, proprietary (submerged lands), and resource management programs, and in addition, develop new programs to limit permanent direct and indirect impacts to SAV and SAV habitat.

Action: *ASMFC, States, and Federal Partners* — Review and evaluate the effectiveness of existing administrative procedures, regulatory, proprietary, and resource management programs to protect existing SAV and their habitats. This includes: fishing impacts; aquaculture; erosion control, living shoreline and nature-based shoreline implementation; coastal construction; water quality standards; indirect vessel impacts such as elevated wakes and direct vessel impacts from hulls, propellers, and personal watercraft; runoff from land-based development and agriculture; and compensatory mitigation.

ASMFC — Support and promote the development of water quality standards by the Environmental Protection Agency and member states that can be implemented to protect SAV habitat (i.e. light attenuation, total suspended solids, chlorophyll *a*, dissolved inorganic nitrogen, dissolved inorganic phosphorus, critical life period).

Support and promote responsible siting, design, and construction of living shorelines and nature-based features over the use of hardened structures to the maximum extent practical. Avoidance and minimization measures should always be demonstrated before unavoidable impacts to SAV are considered. Generally, avoidance of SAV habitat (i.e., either present or historically present) plus room for a buffer should be a critical constraint that influences the selection and design of a living shoreline or nature-based feature project. Where impacts to SAV habitat are truly unavoidable to accomplish project goals without compromising the integrity of the design, compensatory in-kind mitigation should be used to offset the lost ecological functions.

Support and promote the development of technical guidelines and standards as well as expand research where needed to objectively evaluate fishing gear, propeller scarring, dredging, coastal construction, and bottom

fishing impact, and develop best management practices to avoid disturbance and standard mitigation strategies when disturbance is unlikely to be avoided.

States — ASMFC members should determine which actions are causing disturbance to SAV habitat, develop objective methods and research to evaluate impacts when the extent and longevity of the disturbance is not well documented, and propose best management practices, and when necessary, improvements in state regulation and management. This may include, for example, conditions pertaining to harvesting shellfish or finfish in SAV habitat by use of mechanical means and the placement and operations of aquaculture activities to protect existing SAV habitat.

States and federal partners should promote the use of living shorelines and nature-based features and develop new programs to provide shoreline stabilization, wave attenuation, and erosion control which limit permanent direct and indirect impacts to SAV, SAV habitat, and the immediate surrounding buffer area.

Encourage state and federal regulatory agencies to make improvements as necessary to ensure that living shorelines and other nature-based features adequately address fisheries habitat concerns and consider new approaches to ecosystem management that result in multiple objectives. Specifically, SAV habitat should not be negatively impacted by shoreline construction activities including living shorelines and nature-based features.

III. RESTORATION OF SUBMERGED AQUATIC VEGETATION

In addition to minimizing impacts to existing SAV resources and SAV habitat, restoration of former SAV habitat should improve the likelihood of achieving an overall net gain. In cases where monitoring assessments show SAV is in decline due to poor environmental quality, sufficient environmental quality standards must be attained before restoration can occur. Planning will induce maximum restoration program effectiveness. Even with adequate environmental quality, SAV restoration is challenging due to herbivores, community ecological imbalances, human impacts, and the risk of newly planted shoots to uproot easily. Good planning and use of scientifically-based restoration protocols will help ensure success where environmental conditions warrant. Examples of tools and protocols include habitat suitability models (Vaudrey et al. 2013), site-specific planning and testing (Leschen et al. 2010), and restoration strategies (Orth et al. 2006b, van Katwijk et al. 2016). To be successful, water quality conditions that historically and currently support SAV should be compiled regionally and used to identify potential SAV restoration sites.

Policy: Conservation through effective management of existing resources is preferred over restoration. Restoration programs should include confirmation of existing environmental conditions necessary for successful SAV restoration, or re-establishment of environmental conditions necessary for successful SAV restoration, prior to restoration actions occurring or being considered for compensatory mitigation purposes. Restoration methods should incorporate scientifically based protocols. Restoration goals should consider potential and historical SAV spatial footprint.

Action: *ASMFC, States, and Federal Partners* — ASMFC should partner with/promote/support other state and federal agencies, departments, NGOs, universities, and other entities to support SAV restoration activities. ASMFC members should contribute or take the lead on setting state restoration goals for SAV acreage and providing current literature and best management practices to state and federal agencies.

States — ASMFC members should encourage their appropriate state agency or department to set regional or state restoration goals for SAV acreage, abundance, and species diversity considering historical records of abundance and distributions and estimates of potential habitat. Identify reasons for losses, and address any need for habitat improvement prior to restoration. Based on scientific protocols, identify areas currently suitable for SAV restoration, and consider them for protection and future use, or immediate use in restoration projects. Implement science-based transplanting and planting protocols, and support their use by other organizations.

IV. PUBLIC EDUCATION AND INVOLVEMENT

An informed and involved public will provide a firm foundation of support for SAV protection and restoration efforts. Education and involvement are important facets of increasing public awareness and stewardship (e.g., Figure 2).

Policy: ASMFC and member states should promote and support public education and stewardship programs that will increase the public’s knowledge of SAV, its importance as fish habitat, and commitment to SAV conservation.

Action: *ASMFC, States, and Federal Partners* — ASMFC in coordination with member States, federal agencies, and non-profits will promote and support the improvement of policy maker and public understanding of the value, habitat requirements, status, significant threats, cumulative human impacts, and trends in abundance of SAV. States should include this information in their aquatic education programs.



Figure 2. Seagrass habitat conservation signage in Jamestown, Rhode Island. Photo and sign courtesy of the Atlantic Coastal Fish Habitat Partnership.

States — ASMFC members should encourage their appropriate state agency or department to promote the involvement of citizen's groups in activities such as Tier 2 sampling of remotely sensed and mapped SAV locations; water quality monitoring programs; reporting of impacts, especially cumulative impacts such as dock and pier expansions; losses or perturbations; and SAV restoration and protection activities. One way to aid in increasing awareness would be to share area maps online (preferably not requiring GIS software capabilities).

V. SCIENTIFIC RESEARCH

Through scientific research, we will improve our knowledge and understanding of SAV to ensure that efforts to protect and restore the resource will be effective. Further information on growth, physiology, reproduction, genetics, life cycles, disease, transplanting (successes and failures), environmental requirements, and anthropogenic impacts is needed to protect and restore SAV.

Policy: ASMFC and member states should promote and support those research projects which will improve our knowledge of SAV and its benefits as fish habitat.

Action: *ASMFC, States, and Federal Partners* — On a coast wide basis, support research financially, politically, and through data and results sharing in the following areas:

1. The relationship between SAV and the environmental quality of fish habitat and the relative importance of SAV to other, high quality habitat types. This should include the development of specific habitat functions of SAV (e.g., spawning, feeding, growth, refuge), taking into consideration the benefits to managed fish species across their ranges.
2. Improving methodologies for SAV transplanting and restoration techniques and determine the ecological functioning of transplanted vs. naturally vegetated areas.
3. Improving our understanding of the relationships between SAV and managed fish species, including fishery production patterns associated with different landscape or bed forms and sizes within the context of location within the system, as well as the influence of human disturbance and consequences of altering seagrass landscapes vis-à-vis fragmentation and isolation.
4. The specific physical requirements for SAV survival, on a regional basis, as well as the effects of eutrophication, sediment loading, indirect (pesticides) and direct (herbicides) impacts to epiphyte grazers, disease, physical disturbance, climate change (e.g., respiratory stress from increased temperatures), and natural perturbations on growth and survival of SAV. Efforts should be made to identify the primary threat(s) to SAV health in each locale. This will help identify potential sites for SAV restoration.
5. The effects of reduced genetic diversity and difference in physiology (e.g., annual vs. perennial, below-ground biomass) on the ability of seagrass populations to survive habitat alterations. Research should also identify regional differences in SAV requirements.
6. The potential effect of climate change on SAV, including range expansion and contraction, temperature tolerance, susceptibility to disease, etc.

VI. POLICY IMPLEMENTATION

Habitat Program

This policy was distributed to all Commissioners and other interested persons for use in promoting local and regional protection of SAV habitat. The Commission's federal partners, including the U.S. Fish and Wildlife Service and NOAA Fisheries, were encouraged to adopt and implement this policy. Other federal agencies, such as the U.S. Army Corps of Engineers and the Environmental Protection Agency, were briefed on the policy, and encouraged to adopt it as well.

The Commission will continue to progress in its commitment to facilitate communication among local, state, and federal fishery and habitat managers, as well as assist marine fisheries agencies in transmitting this updated policy to habitat protection agencies (Appendix I).

Fishery Management Planning

Under the Atlantic Coastal Fisheries Cooperative Management Act, the Commission may require that states implement certain facets of fishery management plans, termed "compliance criteria." The following is a list of compliance criteria which the Commission will continue to consider for adoption in fishery management plans (FMP) for species with demonstrated reliance on SAV habitat (Laney 1997):

1. Preparation of an annual status report by each state and federal partner on implementation and results, where applicable, of each aspect of the policy.
2. Transmission of the policy by each state and federal partner to all agencies with habitat regulatory and management authority or organizations which can have a significant positive or negative impact on SAV.
3. Preparation of state plans to identify and objectively demonstrate through research, fishing gear and practices employed by any state regulated fishery which may negatively impact SAV; and development and implementation of best management practices and strategies to significantly reduce, or when possible, eliminate negative impacts identified pursuant to Section II where appropriate to achieve SAV objectives.

In addition, the policy should continue to be incorporated by reference into FMPs for species with demonstrated reliance on SAV habitat. These FMPs should include background information on the importance of SAVs, and recommendations which parallel the prescribed activities of the policy.

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