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SAFMC Policy for Protection and Enhancement of Estuarine and Marine Submerged Aquatic Vegetation (SAV) Habitat

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The South Atlantic Fishery Management Council (SAFMC) and the Habitat Advisory Panel have considered the issue of the decline of Estuarine and Marine Submerged Aquatic Vegetation (SAV) or seagrass habitat in Florida and North Carolina as it relates to Council habitat policy. Subsequently, the Council's Habitat Committee requested that the Habitat Advisory Panel develop the following policy statement to support Council efforts to protect and enhance habitat for managed species.

Description and Function:

In the South Atlantic region, SAV is found primarily in the states of Florida and North Carolina where environmental conditions are ideal for their propagation. The distribution of SAV habitat is indicative of its importance to economically important fisheries: in North Carolina, total coverage is estimated to be 130,000 acres (Deaton et al. 2010); in Florida, the nearshore seagrass coverage is estimated to be 2.2 million acres with an additional 2-3 million acres offshore in the Gulf of Mexico (Yarbro and Carlson, 2013).

SAV is designated through Fishery Management Plans as Essential Fish Habitat for several federally managed species, including Penaeid shrimp, spiny lobster, snapper-grouper species, and cobia. It is also designated as Habitat Area of Particular Concern for snapper-grouper species and juvenile summer flounder. SAV is critically important to numerous state managed species, and a diverse assemblage of fauna that are prey to federally managed species; SAV provides valuable ecological and economic functions. Food and shelter afforded by SAV result in a complex and dynamic system that provides a primary nursery habitat for various organisms important both to the overall system ecology, to commercial and recreational fisheries, and to non-harvested fish, shellfish, manatees, and sea turtles. Using ecological services valuations of Costanza et al. (1997) and Orth et al. (2006), Florida seagrass ecosystems alone provide services worth more than \$20 billion a year. For more detailed discussion, please see Appendix 1.

Threats and Status:

Natural events, human activities, and global climate change influence the distribution and quality of SAV habitat. Natural events may include regional shifts in salinity or light availability because of drought or excessive rainfall, animal foraging, storm events, cold temperatures, or disease. Human-related activities can affect SAV through physical disturbance or alteration of habitat or water quality degradation. SAV is extremely susceptible to physical disturbance because of its vulnerable location in shallow, nearshore waters. Activities such as dredging for navigational channels or marinas, propeller scarring, bottom-disturbing fishing activities, and shoreline alteration can inflict damage or mortality on SAV directly. SAV is also vulnerable to water quality degradation and in particular to suspended sediment and eutrophication, due to its relatively high light requirements. Changing land use and increasing population threaten water quality in the coastal zone. The most recent syntheses of research describe a global crisis for SAV ecosystems (Orth et al. 2006; Waycott et al. 2009). Climate change and sea level rise could cause

large-scale losses of SAV habitat due to rising water levels and temperatures, changing weather patterns, and a collapse of barrier islands. The major anthropogenic threats include:

- (1) light limitation due to
 - (a) increased particles and colored dissolved organic matter (CDOM) in runoff from land;
 - (b) increased phytoplankton in coastal waters due to elevated nutrient inputs from runoff;
 - (c) sediment resuspension from wind, wave, or boat action.
- (2) mechanical damage due to:
 - (a) propeller damage from boats;
 - (b) bottom-disturbing fish-harvesting techniques;
 - (c) dredging and filling.

SAV habitat in both Florida and North Carolina has experienced significant losses over the last 65 years. However, conservation measures taken by regional, state and federal agencies have slowed, and in some areas reversed, the decline. For example, in both North Carolina and Florida, progress has been made to map, monitor, and assess change in seagrass distribution so that appropriate management actions can be taken. In Florida, several National Estuary Programs have worked collaboratively with local governments and industry to reduce nutrient inputs, especially nitrogen, to estuarine and coastal waters. These efforts have resulted in significant increases in SAV acreage. Other advancements in seagrass protection and enhancement have been made, such as prop scar restoration, establishment of no motorized vessel zones around shallow grass beds, and implementation of more stringent stormwater runoff rules. The threats to this habitat and the potential for successful conservation measures highlight the need to continue to address the causes of SAV decline. Therefore, the SAFMC recommends immediate and direct action be taken to stem the loss of this essential habitat and to restore SAV beds where feasible. For more detailed discussion, please see Appendix 2.

SAV POLICY

Because of the economic and ecological value of SAV ecosystems, the SAFMC considers it imperative to take directed and purposeful action to protect remaining habitat and to support actions to restore SAV in locations where they have occurred in the past. The SAFMC strongly recommends that a comprehensive adaptive management strategy be developed to address the decline in SAV habitat in the South Atlantic region, including the Indian River Lagoon which has suffered more than a 50% decline in SAV in since 2011 due to a large and persistent phytoplankton bloom. Furthermore, as a stepping stone to such a long-term protection strategy, the SAFMC recommends the adoption of a reliable status and trend survey methodology (mapping and monitoring) to verify the location, health, and coverage of SAV at sub-regional and/or local scales (e.g., Florida's Seagrass Integrated Monitoring and Mapping Program and/or Virginia Institute of Marine Sciences' annual mapping of Chesapeake Bay).

The SAFMC will encourage the South Atlantic states to assess the status and trends in SAV ecosystems and will consider establishing specific plans for protecting and revitalizing, where necessary, the SAV resources of the South Atlantic region. This action can be achieved by the following four integrated components:

Monitoring and Research:

Periodic mapping and monitoring of SAV in the region are required to determine how distribution has changed spatially over time, the progress toward the goal of a net resource gain, and what management actions are needed to reach established goals.

The SAFMC supports efforts to:

- Develop and standardize imagery acquisition and resource mapping protocols, with regional

modification as necessary to achieve effective results (Yarbro and Carlson 2013).

- Develop and maintain a Geographic Information System database for essential habitat including SAV and use that information for assessment of trends in SAV extent (e.g., SIMM or OBIS-SEAMAP).
- Evaluate water quality criteria needed to support SAV survival and growth and support policy making to manage quality and quantity of surface runoff.
- Research and document causes and effects of SAV losses, including cumulative impacts, watershed runoff, shoreline development, shading associated with pier and dock, development, invasive species, and extreme weather conditions (drought, tropical storms, algal blooms, etc).
- Encourage states to minimize impacts to SAV by developing design criteria for docks and piers which establish minimum height, maximum width and materials.
- Investigate effective restoration techniques, including ecological function and cost/benefit.
- Research potential effect of climate change on SAV habitat. •

Planning:

Establishing goals, objectives, and measures of success is essential to evaluate progress and to provide a framework to direct future actions. The SAFMC supports:

- Watershed planning which incorporates SAV as an integral part of a healthy ecological system and utilizes change in SAV distribution as an indicator of system health.
- The regulatory definition of SAV habitat as: shallow water habitat with appropriate sediment, depth, light penetration and wave energy, including areas without existing SAV.
- Comprehensive planning initiatives as well as interagency coordination, partnerships, and planning to protect SAV habitat and increase awareness.
- The establishment of standardized SAV survey protocols for reviewing coastal development permit applications. This action includes survey windows, survey methods, and in-water work windows.
- The Habitat Advisory Panel members in actively seeking to involve the SAFMC in the review of projects which will impact, directly or indirectly, SAV habitat resources.

Management:

Based on assessment of monitoring data, research results and planning, management actions should be developed or modified as necessary to address primary issues affecting SAV habitat. Conservation and expansion of SAV habitat are critical to the maintenance of the living resources that depend on these systems. A number of federal and state laws and regulations apply to activities that eliminate or modify SAV habitat, either directly or indirectly (Appendix 3). However, state and federal regulatory processes have been uneven in their effectiveness to prevent or slow the loss of SAV acreage. While restoration results through repair of bottom topography and planting of SAV have improved, these efforts are extremely costly and unsustainable if the causes of SAV loss are not corrected (eg. Insufficient water clarity, continued prop scarring). Efforts to improve water clarity in areas where SAV was once abundant have resulted in the expansion and creation of SAV habitat on a much larger scale than is feasible through bottom recontouring and plantings alone. Declines in SAV acreage continue in a number of localities in the South Atlantic region (Yarbro and Carlson 2013) and it has often been difficult to implement effective resource management initiatives due to: the lack of adequate documentation of losses and specific cause/effect relationships, public resistance to additional coastal development regulations, and insufficient funding (for more detailed discussion, please see Appendix 3).

SAFMC supports:

- Review and modification of state and federal rules to ensure protection of SAV from impacts such as dredging, propeller scarring, marina and pier construction, and bottom-disturbing fishing activity.

- Review of state water quality standards and rules to determine if changes are needed to protect and enhance SAV.
- Development of SAV restoration guidelines for both high and low salinity SAV to accelerate successful, cost-effective SAV restoration.

Education and Enforcement:

Educating and engaging the public on the value of SAV habitat will aid in the protection of existing SAV habitat and garnish support for additional management measures that may be needed. Enforcing existing regulations to sustain SAV health minimizes the need for additional regulatory actions.

SAFMC supports:

- Design of education programs to heighten the public's awareness of the importance of SAV. An informed public will provide a firm foundation of support for protection and restoration efforts.
- Review of existing regulations and enforcement to determine their effectiveness.
- Coordination with state resource and regulatory agencies to ensure that existing regulations are being enforced.
- Development of economic analyses on the economic benefits of protecting and enhancing SAV habitat.

SAFMC SAV Policy Statement- Appendix 1

ECOSYSTEM SERVICES

Worldwide, submerged aquatic vegetation (SAV) constitutes a common shallow-water habitat type. These angiosperms have successfully colonized standing and flowing fresh, brackish, and marine waters in all climatic zones, and most are rooted in the sediment. Estuarine and marine SAV beds, or seagrasses, occur in the low intertidal and subtidal zones and may exhibit a wide range of habitat forms, from extensive collections of isolated patches to unbroken continuous beds. The bed is defined by the presence of either aboveground vegetation, its associated root and rhizome system (with living meristem), or the presence of a seed bank in the sediments, as well as the sediment upon which the plant grows or in which the seed bank resides. In the case of patch beds, the unvegetated sediment among the patches is considered SAV habitat as well.

There are seven species of marine SAV or seagrass in Florida's shallow coastal areas: turtle grass (*Thalassia testudinum*); manatee grass (*Syringodium filiforme*); shoal grass (*Halodule wrightii*); widgeon grass (*Ruppia maritima*); star grass (*Halophila engelmannii*); paddle grass (*Halophila decipiens*); and Johnson's seagrass (*Halophila johnsonii*) (See distribution maps in Appendix 4). *H. johnsonii* is listed by the National Marine Fisheries Service as a threatened plant species. Areas of seagrass concentration along Florida's east coast begin south of Daytona Beach and include Mosquito Lagoon, Banana River, Indian River Lagoon, Lake Worth and Biscayne Bay. In 2010, seagrasses in these estuaries covered about 241,000 acres; an additional 159,000 acres of seagrass occur on the Atlantic side of Key Biscayne (Yarbro and Carlson 2013). Florida Bay, located between the Florida Keys and the Everglades, also has an abundance of seagrasses (145,000 acres), and seagrasses in the Florida Keys National Marine Sanctuary, west and south of the Florida Keys, comprise 856,000 acres. Large-scale losses (47,000 acres) of seagrasses have occurred in the Banana River since 2011. Seagrass acreage in the Southern Indian River Lagoon, Florida Bay and Biscayne Bay are likely stable, but trends in acreage of beds on the ocean side of south Florida are unclear because current estimates date to 1992.

The three dominant SAV species found in North Carolina are shoalgrass (*Halodule wrightii*), eelgrass (*Zostera marina*), and widgeon grass (*Ruppia maritima*). Shoalgrass, a subtropical species, has its

northernmost distribution at Oregon Inlet, North Carolina. Eelgrass, a temperate species, has its southernmost distribution in North Carolina. Areas of seagrass concentration in North Carolina are in southern and eastern Pamlico Sound, Core Sound, Back Sound, Bogue Sound and the numerous small southern sounds located behind the beaches in Onslow, Pender, Brunswick, and New Hanover Counties (See distribution maps in Appendix 4).

In addition meso- and oligohaline SAV species occur in shallow waters along the western shoreline of Pamlico Sound and the Neuse and Pamlico river tributaries. Widgeon grass is the dominant species in western Pamlico Sound due to its large tolerance to fluctuating salinity and water clarity conditions. In river tributaries, horned pondweed (*Zannichellia palustris*) is often the first species to emerge in the spring, and is replaced by widgeon grass or other species as water temperatures increase (NCDWQ 2007). Other species that occur in western Pamlico Sound and its tributaries include eelgrass, shoal grass, wild celery (*Vallisneria americana*), redhead pondweed (*Potamogeton perfoliatus*), and southern naiad (*Najas guadalupensis*). Many of the tributaries and shallow waters supporting lower salinity grass species are important nursery grounds for Penaeid shrimp, are designated Primary or Secondary Nursery Areas, and thus, are Essential Fish Habitat.

Marine SAV serve several valuable ecological functions in the marine estuarine systems where they occur. Food and shelter afforded by seagrasses result in a complex and dynamic system that provides a primary nursery habitat for various organisms that are important both ecologically and to commercial and recreational fisheries. Organic matter produced by seagrasses is transferred to secondary consumers through three pathways: herbivores that consume living plant matter; detritivores that exploit dead matter; and microorganisms that use seagrass-derived particulate and dissolved organic compounds. The living leaves of these submerged plants also provide a substrate for the attachment of detritus and epiphytic organisms, including bacteria, fungi, meiofauna, micro- and macroalgae, and macroinvertebrates. Within the seagrass system, phytoplankton are present in the water column, and macroalgae and microalgae are associated with the sediment. No less important is the protection afforded by the variety of living spaces in the tangled leaf canopy of the grass bed itself, and this is especially critical to the juvenile stages of many important fish. The structure of the beds can also provide a refuge from acoustic stressors in the adjoining water column, including dolphin whistles and boat noise (Wilson et al. 2013). In addition to biological benefits, seagrasses also cycle nutrients and heavy metals in the water and sediments, and dissipate wave energy (which reduces shoreline erosion and sediment resuspension).

Fish may associate with seagrass beds in several ways. Resident species typically breed and carry out much of their life history within the meadow (e.g., gobiids and syngnathids). Seasonal residents typically breed elsewhere, but predictably utilize seagrasses during a portion of their life cycle, most often as a juvenile nursery ground (e.g., sparids and lutjanids). Transient species can be categorized as those that feed or otherwise utilize seagrasses only for a portion of their daily activity, but in a systematic or predictable manner (e.g., haemulids).

In Florida, many economically important species utilize seagrass beds as nursery and/or spawning habitat: spotted seatrout (*Cynoscion nebulosus*), grunts (Haemulids), snook (*Centropomus* spp.), bonefish (*Albulu vulpes*), tarpon (*Megalops atlanticus*) and several species of snapper (Lutianids) and grouper (Serranids). Densities of invertebrate organisms are many times greater in seagrass beds than in bare sand habitat. Penaeid shrimp, spiny lobster (*Panulirus argus*), bay scallops (*Argopecten irradians*), green sea turtles (*Chelonia mydas*) and manatees also depend on seagrass beds.

In North Carolina, 40 species of fish and invertebrates have been captured in seagrass beds. Larval and juvenile fish and shellfish including gray trout (*Cynoscion regalis*), red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), mullet (*Mugil cephalus*), spot (*Leiostomus xanthurus*), pinfish (*Orthopristis chrysoptera*), gag (*Mycteroperca microlepis*), white grunt (*Haemulon plumieri*), silver perch (*Bairdiella chrysoura*), summer flounder (*Paralichthys dentatus*), southern flounder (*P. lethostigma*), blue crabs (*Callinectes sapidus*), hard shell clams (*Mercenaria mercenaria*), and bay scallops (*Argopecten irradians*) utilize seagrass beds as nursery areas. Seagrasses are the sole nursery ground for

bay scallops in North Carolina. Seagrass meadows are also frequented by adult spot, spotted seatrout, bluefish (*Pomatomus saltatrix*), menhaden (*Brevortia tyrannus*), summer and southern flounder, pink and brown shrimp, hard shell clams, and blue crabs. Offshore reef fishes, including black sea bass (*Centropristis striata*), gag (*Mycteroperca microlepis*), gray snapper (*Lutianus griseus*), lane snapper (*Lutjanus synagris*), mutton snapper (*Lutianus annalis*), and spottail pinfish (*Displodus holbrooki*), also spend a portion of their life cycles in seagrass beds. Ospreys, egrets, herons, gulls and terns feed on fauna in seagrass beds, while swans, geese, and ducks feed directly on SAV itself. Green sea turtles (*Chelonia mydas*) also utilize seagrass beds, and juveniles may feed directly on the seagrasses.

SAFMC SAV Policy Statement- Appendix 2

STATUS

SAV habitat is a valuable natural resource which is now threatened by overpopulation in coastal areas and nearby watersheds. Worldwide, SAV has declined in area since the mid-twentieth century, and light limitation is the primary factor limiting SAV distribution (Orth et al. 2006; Waycott et al. 2009). Several processes contribute to decreases in water clarity in estuarine and coastal regions; heightened nutrient inputs from coastal watersheds (due to development) fuel the growth of phytoplankton, which in turn reduce light available to benthic vegetation. Higher nutrient levels may also increase the biomass of epiphytes on SAV blades, reducing the light available for photosynthesis. Groundwater enriched by septic systems also may infiltrate the sediments, water column, and near-shore SAV beds with the same effect. Increases in the turbidity of overlying waters, resulting from sediment in runoff, dredging, channelization, boat traffic, and resuspension of bottom sediments, also may reduce the amount of light available to SAV. Changes in the timing and volume of river runoff due to climate change may also result in reduced light availability to coastal SAV. For example, increased and prolonged runoff from highly polluted/colored rivers, especially during spring and summer, appear to reduce light levels in Florida's Indian River Lagoon and jeopardize the survival of SAV. With excessive water column productivity, lowered dissolved oxygen concentrations may result and are detrimental to invertebrate and vertebrate grazers. Loss of these grazers may result in overgrowth by epiphytes and loss of food for predators. SAV losses resulting from reduced light availability can be more subtle and are often difficult to assess in the short term (months).

Although not caused by humans, disease ("wasting disease" of eelgrass in North Carolina) has historically impacted SAV beds. Activities that directly damage SAV beds, such as dredging and filling, bottom-disturbing fishing gear, propeller scarring and boat wakes are readily observed and are subject to regulations (See Appendix 3). Other indirect causes of SAV loss or change in SAV species may be ascribed to changing hydrology which may in turn affect salinity levels and circulation; reduction in flushing can cause an increase in salinity and the ambient temperature of a water body, stressing plants and ultimately changing the dominant SAV to more salt-tolerant species. Increases in flushing can mean decreased salinity, with possible species changes, and increased turbidity and near-bottom mechanical stresses which damage or uproot plants.

Large areas of Florida where SAV was once abundant have experienced significant losses since the mid-twentieth century. In some areas, SAV occurs at a fraction of historical areas. One of these depleted areas is Lake Worth in Palm Beach County where dredge and fill activities, sewage disposal, and stormwater runoff have almost eliminated this resource. Historically, North Biscayne Bay lost most of its SAV from urbanization and small losses continue. The Indian River Lagoon lost many SAV beds due to stormwater runoff directly and indirectly (via phytoplankton blooms) from reduced water clarity. Recent gains in the Northern Indian River Lagoon, due to concerted efforts to reduce nutrient and particle inputs, improved SAV acreage and brought a few locations close to historical levels; however, 47,000 acres of seagrass have recently disappeared due to a massive and recurring phytoplankton bloom. Many seagrass beds in Florida have been scarred from boat propellers disrupting the physical integrity of the beds. Florida's assessment of dredging/propeller scar damage indicates that Dade, Lee, Monroe, and Pinellas Counties have the most heavily damaged seagrass beds. Vessel registrations, both commercial and recreational, tripled from 1970-71 (235, 293) to 1992-93 (715,516). More people are engaged in marine activities, which affects the limited resources of fisheries and benthic communities.

In North Carolina, distribution and abundance of SAV vary seasonally and interannually. Growing

seasons vary by species with peak abundance of high salinity species between April and October, and low salinity species between May and June. In North Carolina, total SAV coverage is conservatively estimated at 130,000 acres. This figure is based on an interagency coastwide mapping effort from 2006-2008 that identified 130,000 acres of seagrass. However, field groundtruthing verified that the delineation based on aerial imagery underestimated SAV occurrence in the meso- and oligohaline estuaries due to lower water clarity. However that mapping provided a baseline for future mapping events so that trends can be determined. Prior to that, SAV had not been remapped in comparable methodology to evaluate trends. NC Division of Marine Fisheries (NCDMF) now maintains an inventory of SAV mapping on the coast and the SAV Partnership, an interagency group of federal, state, and NGO representatives with interest in managing SAV, developed a monitoring plan that includes repeat mapping on 5 year cycles, staggered regionally. In 2012-2013, most of the marine SAV in high salinity waters were remapped (Currituck, eastern Pamlico, Core, and Bogue sounds) and the results are pending.

While quantified trends are not available, anecdotal information from resource agency staff on long term trends is available for some regions. Compared to North Carolina's low-moderate salinity SAV community, the high salinity seagrasses appear relatively stable. Mapping results of core areas of seagrass, such as behind the Outer Banks in Pamlico Sound and Core Sound, indicate there has not been a large change in coverage since the 1980s (D. Field/NOAA, pers. com, 2010). However, seagrass in Bogue Sound appears to have become less dense and patchier. In areas where SAV occurs to a lesser extent (Albemarle Sound, Neuse and Pamlico rivers, and waters south of Bogue Sound) SAV was reported to be more abundant in the 1970s, declined in the 1980s, and has been increasing since the early 2000s. These latter areas are located in closer proximity to riverine discharge and stormwater runoff. Under conditions of low rainfall and runoff, such as during droughts, improved water clarity and higher and less fluctuating salinity could be allowing expansion of distribution in these waters with less optimal water clarity conditions (Deaton et al. 2010). It is unclear how much influence sediment and nutrient loading from stormwater runoff or wastewater treatment effluent has on these fluctuations. In addition to weather related changes, seagrass habitat continues to be impacted by individually small, but cumulative, coastal development activities, such as dredging for navigational channels, marinas, and docks. Impacts from private projects are often reduced, but not always avoided. Several past and proposed North Carolina Department of Transportation projects related to ferry channels or bridges have impacted or will impact much larger areas of seagrass. Projects with a public benefit are allowed to have unavoidable SAV impacts, but mitigation is required. Bottom disturbing fishing activities, such as mechanical clam harvest, crab dredging, or shrimp trawling can damage SAV. A recommendation of the NC Coastal Habitat Protection Plan (CHPP) requires that habitat be protected from fishing gear damage through modifications to fishing boundaries and improved enforcement. The Division of Marine Fisheries, through the Fishery Management Plan process and rule changes, has moved shrimp trawling and oyster dredging boundaries to avoid impacting SAV.

SAFMC SAV Policy Statement- Appendix 3

PAST MANAGEMENT EFFORTS

Conservation of existing SAV habitat is critical to the maintenance of the organisms depending on these systems. A number of federal and state laws require permits for modification and/or development in SAV-bearing waters. These include Section 10 of the Rivers and Harbors Act (1899), Section 404 of the Clean Water Act (1977), and the states' coastal area management programs. Section 404 prohibits deposition of dredged or fill material in waters of the United States without a permit from the U.S. Army Corps of Engineers. The Fish and Wildlife Coordination Act gives federal and state resource agencies the authority to review and comment on permits, while the National Environmental Policy Act requires the development and review of Environmental Impact Statements. In addition to federal guidelines, states have

rules related to development activities and SAV (Table 1). The Magnuson-Stevens Fisheries Conservation and Management Act was amended to require that each fishery management plan include a habitat section. The SAFMC's habitat subcommittee may comment on permit requests submitted to the Corps of Engineers when the proposed activity relates to habitat essential to managed species. State and federal regulatory processes have accomplished little to slow the decline of SAV habitat. Many of the impacts, especially those affecting water clarity, cannot be easily controlled by the regulations as enforced. For example, water quality standards are written so as to allow a specified deviation from background concentration; in this manner, standards allow a certain amount of degradation. An example of this is Florida's Class III water transparency standard, which defines the compensation depth to be where 1% of the incident light remains. The compensation depth for SAV is in well in excess of 10% and for some species is between 20 and 25%. The standard allows a deviation of 10% in the compensation depth which translates into 0.9% incident light or an order of magnitude less than what the plants require. Large-scale, direct mitigative measures to restore or enhance impacted areas have met with little success. Management of nutrient loads, especially nitrogen, from surface and ground waters is essential to restore the water clarity necessary to support SAV ecosystems. Where efforts have been successful, it has resulted from collaborative partnerships among industry, local and regional governments, and National Estuary Programs. Some of the approaches to minimize propeller scar damage to SAV beds include: education, improved channel marking, restricted access zones (complete closure to combustion engines, pole or troll areas), and improved enforcement. When SAV restoration and mitigation are undertaken, the SAFMC understands the need for extended monitoring, not only to determine success from plant's standpoint but also to assess the recovery of faunal populations and the functional attributes of the ecosystem as a whole. The SAFMC also encourages long-term trend analysis of SAV distribution and abundance, using appropriate protocols and Geographic Information System approaches, to inform management and permitting decisions.

Table 1. Summary of guidelines for SAV protection used by the federal regulatory and commenting agencies, as well as the state agencies of Maryland and Virginia (Source: Orth et al. 2002; NC Department of Environment and Natural Resources; FL Department of Environmental Protection)

Categories	North Carolina	Florida	Maryland	Virginia	US Army Corps of Engineers (Baltimore District)	US Environmental Protection Agency	US Fish and Wildlife Service	National Marine Fisheries Service
Dredging of new channels	Allowed if no significant adverse impact to SAV, PNAs, oyster beds, wetlands. Can seek variance.	Regulatory – allowed after impacts are avoided and minimized, and appropriate compensatory mitigation is provided for any remaining impacts that cannot be avoided or minimized. Proprietary - allowed if not contrary to public interest and appropriate compensatory mitigation is provided.	Not allowed in water \leq 3 ft. at MLW.	Limit channels to minimum dimensions necessary; avoid SAV.	Not allowed in waters \leq 2 ft. MLW in main channel. \leq 1.5 ft. MLW in spurs; presence of SAV overrides these parameters	Generally, no new dredging except in historic channels.	Avoid shallow water habitats; not recommended in areas without piers & historical deepwater access.	Not recommended within existing SAV beds or adjacent shallows with potential for bed expansion
Dredging in SAV beds	No new dredging in SAV allowed. Can seek variance. Maintenance dredging is allowed.	Regulatory – allowed after impacts are avoided and minimized, and appropriate compensatory mitigation is provided for any remaining impacts that cannot be avoided or minimized. Proprietary - shall not be approved unless there is no reasonable alternative, project is not contrary to public interest and appropriate compensatory mitigation is provided for impacts.	Allowed in areas where there were historic channels	Usually not allowed.	Prohibited upstream of 1.5-2 ft. contour and in existing beds (see text for exceptions); channel dimensions may be restricted where slumping occurs.	Allowed in channels or historic channels only; not recommended otherwise.	Not recommended.	Not recommended.
Timing restrictions on dredging	Dredging moratoriums requested by resource agencies.	Dredging restrictions required by resource commenting agencies (e.g., presence of listed species).	Prohibited within 500 yards of SAV beds, April 15-October 15.	Restrictions may be placed if in proximity to living resources.	April 1- June 30; April 15-October 15 (species with two growing seasons).	March 31-June 15.	March-June	Species-dependent; April-October 15 for most species; April 1- June 30 for horned pondweed.
Dredging in areas that historically supported SAV	Not allowed if SAV habitat. DMF defines that to include areas documented to have SAV within past 10 years.	Considered during the application review process.	Not recommended where SAV occurred during the previous growing season.	Considered during the application review process.	Depends on depths and why SAV disappeared. Check soils.	Not recommended	Not recommended	Not recommended where SAV has been documented during the past 2-3 growing seasons.
Dredging near SAV beds/buffer zones	Reviewing agencies would consider on case by case basis .	Considered during the application review process. Addressed as part of the Secondary Impact Analysis.	See timing restrictions on dredging above.	Considered during the application review process.	3 ft. buffer/1 ft. dredged below existing bottom; 15 ft. buffer from MHW & for SAV w. dense tuber mats.	3 ft. buffer/1 ft. dredged	3 ft. buffer/1 ft. dredged below existing bottom.	Recommend buffers around existing beds; no dredging in areas with potential bed expansion.
Depositing dredged material on SAV	Not allowed. Can seek variance.	Proprietary – prohibited, beach compatible dredge material must be placed on beaches or within the	Prohibited	Locate to minimize impacts	Recommend against		Recommend against	Recommend against

		nearshore sand system.						
Pier Construction	Not allowed through GP process if water < 2 ft MLW. Could be permitted through major process – case by case	Minimal sized structures are exempt from permitting. Larger structures require full permit review (Regulatory – allowed after impacts are avoided and minimized, and appropriate compensatory mitigation is provided for any remaining impacts that cannot be avoided or minimized. Proprietary - allowed if not contrary to public interest and appropriate compensatory mitigation is provided.)	Pier out to avoid dredging of SAV beds; minimize pier dimensions.	Limit to minimum necessary for water access, locate to avoid SAV.	Pier out, construct community piers or mooring piles to avoid dredging of SAV beds; maintain suitable pier height above SAV.		Pier out to avoid dredging of SAV beds; construct community rather than multiple individual piers.	Maintain 1:1 ratio of deck width to deck height above MLW.
Marina development near SAV	Allowed if no significant adverse impact to SAV.	Regulatory – allowed after impacts are avoided and minimized, and appropriate compensatory mitigation is provided for any remaining impacts that cannot be avoided or minimized. Proprietary - allowed if not contrary to public interest and appropriate compensatory mitigation is provided.	Prohibited in areas ≤ 4.5 ft. unless dredged from upland and adverse impacts to SAV are minimized.	Undesirable near SAV, or in waters less than 3 ft. at MLW.	Avoid historical SAV beds for new marina construction; maintain buffer for marina expansion.	Avoidance of SAV recommended	Avoid	Recommend against new marinas or expansion in existing beds or adjacent shallows with potential for bed expansion.
SAV harvest	Permit required.	Permit required.	Permit required.	Permit required.				Limited harvest of hydrilla in the Potomac.
Fishing activity	Mechanical harvest of shellfish and trawling not allowed over SAV- through rule boundaries.	Mechanical harvest of shellfish limited to open shellfish harvesting areas, and prohibited over SAV through permit conditions. Shrimp trawling is prohibited in areas of Florida that are of high conservation value for SAV (e.g., Big Bend Region closed Areas).	No hydraulic clam dredging in existing SAV.	No clamming in water depths < 4 ft.				
Aquaculture activities	No new permits in existing SAV. Can renew if its grown into lease.	By rule, aquaculture activities on sovereignty submerged lands shall be designed to minimize or eliminate adverse impacts on sea grasses. In practice, aquaculture leases have not been historically authorized		No new permits in existing SAV.				

		over any areas containing SAV.						
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SAFMC SAV Policy Statement- Appendix 4

SAV Distribution Maps - insert from the 2009 SAFMC Fishery Ecosystem Plan