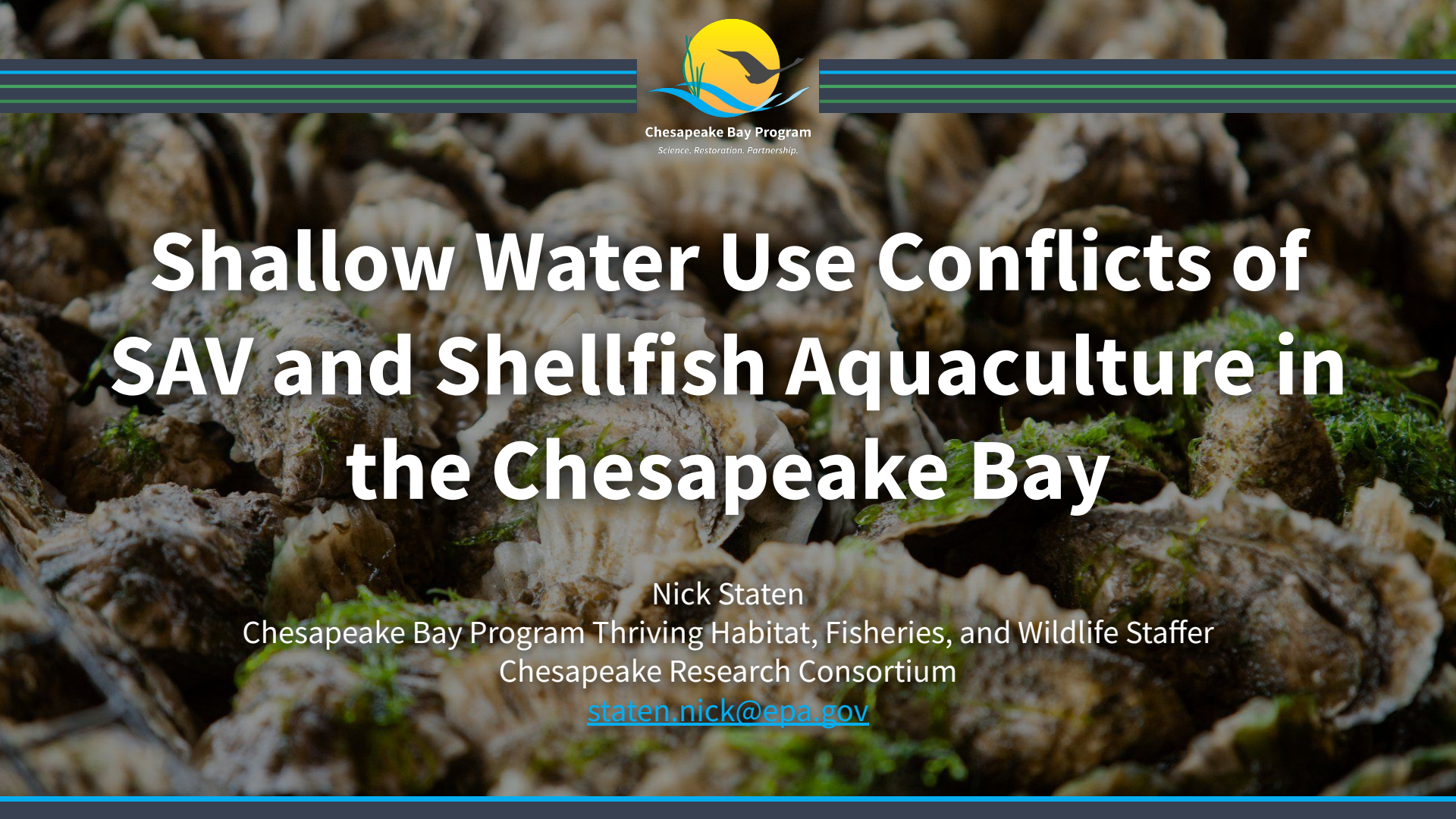

Shallow Water Use Conflicts of SAV and Shellfish Aquaculture in the Chesapeake Bay

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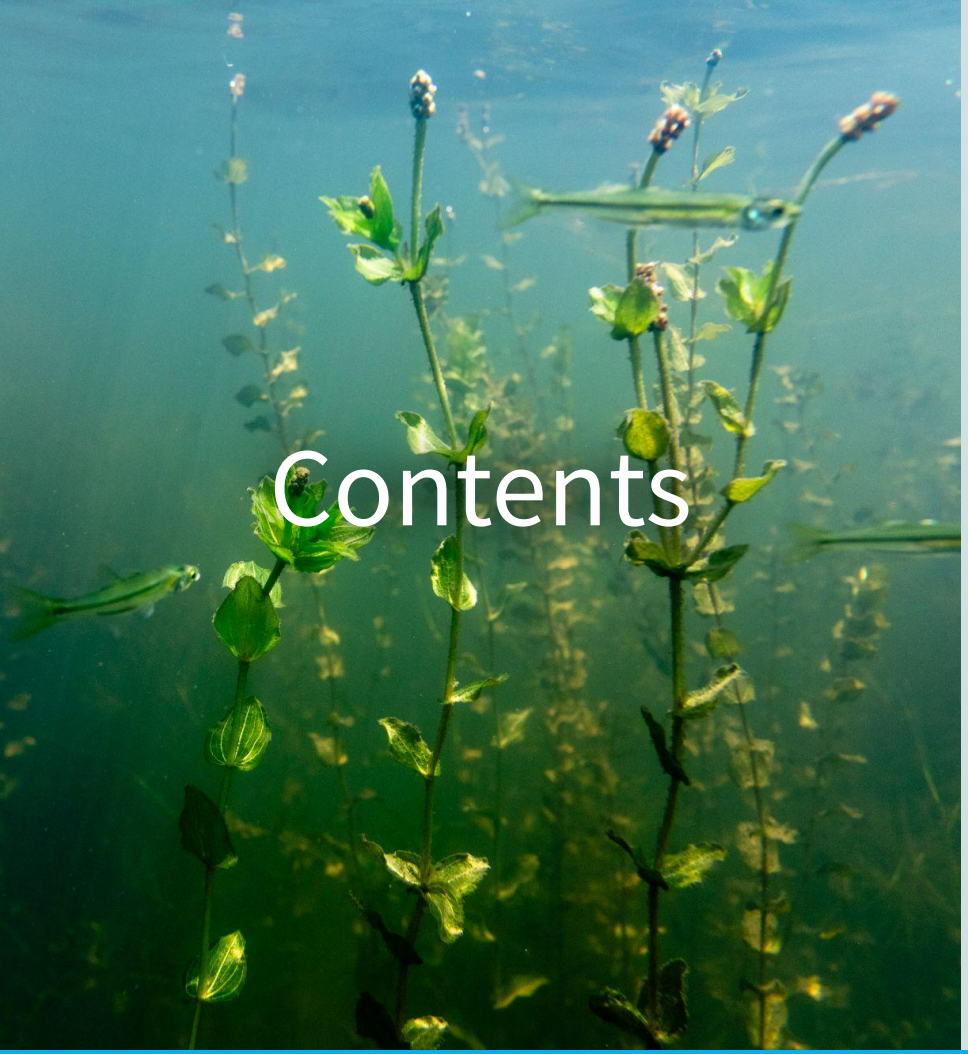


Contents

1. **Potential Mechanisms** of SAV & Aquaculture Interactions
2. **Factors influencing the extent** of SAV interactions
3. SAV and aquaculture interactions vary by **environmental setting** (e.g. salinity, depth)
4. SAV–aquaculture interactions vary by **aquaculture method**
5. Current **management frameworks** in Maryland and Virginia
6. Future Research Opportunities

1

Potential Mechanisms of SAV & Aquaculture Interactions

Potential Interactions with SAV

1

Light Limitation

Shading from aquaculture gear can negatively affect SAV.

2

Water Clarity/Quality Effects

Altered water chemistry and clarity from the presence of oysters.

3

Physical Interactions

SAV bed disturbance from gear or aquaculturists or wave energy attenuation.

Light Limitation

Even short term light decreases can negatively influence shoot density, above-ground biomass, below-ground biomass, canopy height, leaf area index, leaf width, and photosynthetic capacity of SAV, with effects lasting longer than one growing season (Skinner et al., 2014).

Water Quality Interactions

The presence of bivalve aquaculture has shown to enrich porewater PO4 and NH4 and positively influence growth rates of SAV (Booth and Heck, 2009; Peterson and Heck, 2001; Lunstrum et al., 2018).

There is potential that bivalve aquaculture can remove suspended solids in the water column, increasing light penetration (Wheat, E., & Ruesink, J. L. 2013).

High densities of bivalves could have negative effects through sulfide or ammonia accumulation in sediment (Booth and Heck, 2009; Santamaría et al.,1994)

Physical Interactions

The presence of bivalve aquaculture could dampen wave energy–reducing suspended solids–increasing water clarity and potentially improving seedling success (Smith et al., 2019; Gurbisz et al., 2025).

Aquaculture operation upkeep, gear structures, and aquaculturists can disturb sediment or SAV structures (Ferriss et al., 2019; Gurbisz et al., 2025).

2

Factors influencing the extent of SAV & Aquaculture Interactions

Factors influencing the extent of interactions with SAV

1 | Oyster Density

Low to moderate densities of oysters have shown an sediment enrichment effect while high density creates a sediment toxification effect.

2| Site Flushing Characteristics

Depending on the site's hydronymic profile, bi-valve's both positive or negative local water quality effects can be minimal.

3 | Extent of light limitation

Depending on how much light is blocked, there can be very minimal to extreme effects on the SAV bed's ability to recover.

4 | Timing of disturbance

SAV are more susceptible to negative lasting effects when stress is administered during critical life stages.

5 | Aquaculture Method

Some methods of harvest and upkeep are more intrusive than others.

1 | Factors influencing extent of SAV interactions - Oyster Density

Booth and Heck (2009): growth rates were highest in low **(15 ind. m-2)** and medium densities **(75 ind. m-2)** . High densities **(150 ind. m–2 in 1 m2 plots of H. wrightii)** negatively affected growth rates, shoot density, and plant biomass.

Burkholder & Shumway (2011): Burkholder and Shumway review over 62 ecosystems in trying to answer the question of whether bivalve aquaculture significantly contributes to eutrophication relative to land - based pollution sources. They found “bivalve aquaculture has been found to **contribute little to eutrophication except in some poorly flushed areas with high shellfish density** ”.

2 | Factors influencing extent of SAV interactions - Site Flushing Characteristics

Gurbisz et al. (2025): researchers found “periods of substantial chlorophyll a drawdown (up to ~30 µg l–1) and **water clarity increases** were associated **with lower current velocities** , suggesting that farm-scale filtration exceeded water renewal rates when tidal currents were slower.”

Burkholder & Shumway (2011): Burkholder and Shumway review over 62 ecosystems in trying to answer the question of whether bivalve aquaculture significantly contributes to eutrophication relative to land - based pollution sources. They found “bivalve aquaculture has been found to **contribute little to eutrophication except in some poorly flushed areas with high shellfish density** ”.

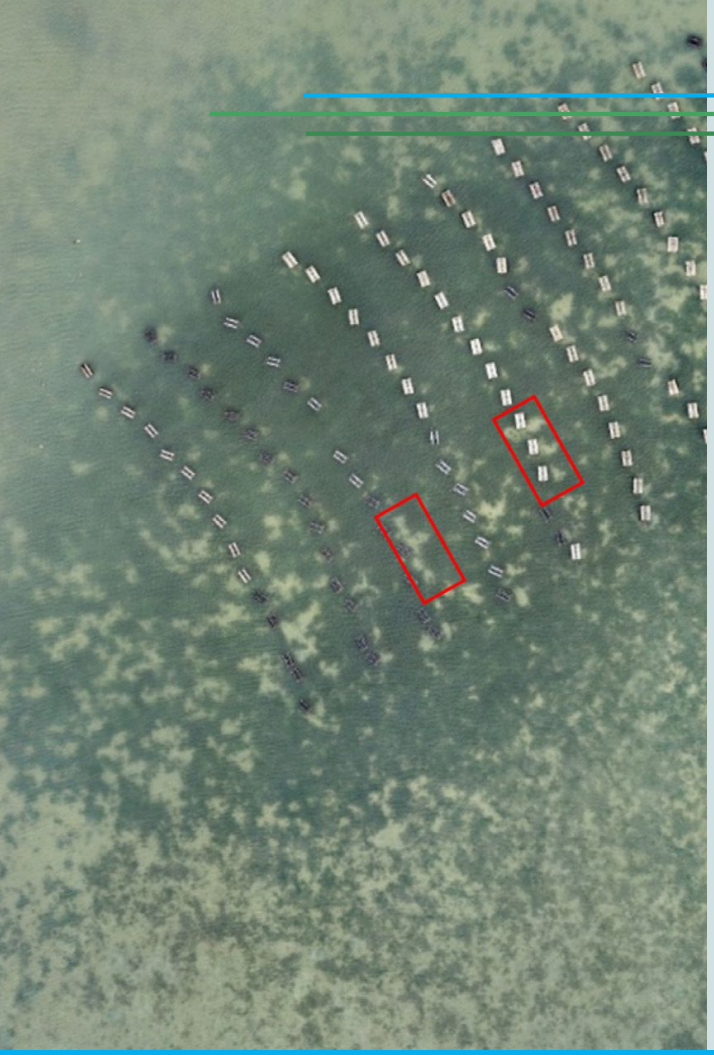
A Note About Opportunistic Macroalgae

- Macroalgae in abundance can smother SAV as it competes for bottom space, light and nutrients.
- Some literature (De Casabianca et al., 1997) has linked eutrophication associated with shellfish farming to increased presence of macroalgae.
- Others within the Chesapeake Bay (Shields et al., 2025) reinforce this observation but state it did not have an effect on percent cover of SAV within the shellfish aquaculture farm.
- Future research on how local oyster aquaculture-driven nutrient dynamics affect epiphyte loading and macroalgae prevalence would help illuminate the effect this could have on SAV in the Chesapeake Bay.

3 | Factors influencing extent of SAV interactions - Light Limitation

Subsurface irradiance, a ratio light passing down through the water column and the light reflected back up through the water column, is a measure of water clarity and amount of light able to be used by phytoplankton, algae and SAV.

- Skinner et al. (2014): Shoot density, above-ground biomass, below-ground biomass, canopy height, leaf area index, leaf width, and photosynthetic capacity all **declined along a gradient of increased shading** , with significant responses detected in as few as **67 days after exposure to 26% subsurface irradiance** .
- They used a handheld meter (LI1400 Datalogger with LI-192SA Underwater Quantum Sensor, LI-COR Inc., Lincoln, Nebraska, USA) to measure subsurface irradiance 1 cm below the water's surface.



3 | Factors influencing extent of SAV interactions - Light Limitation

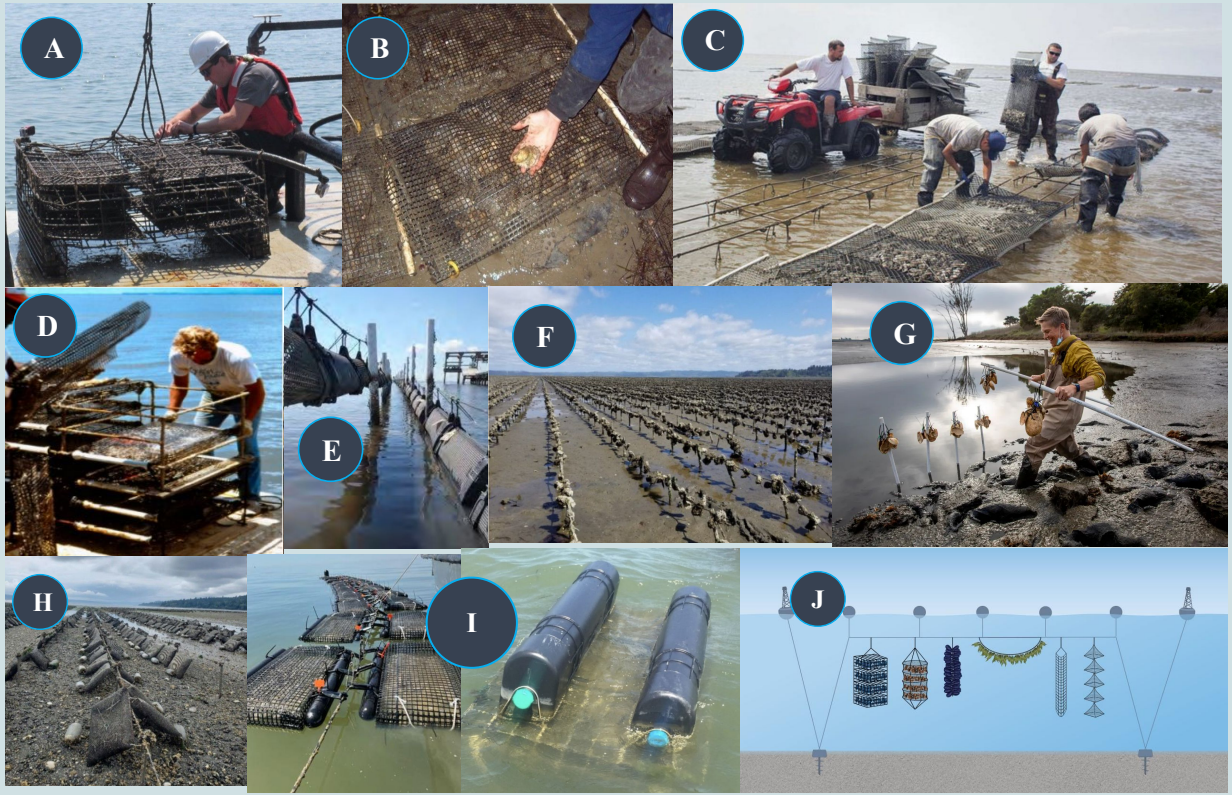
Low farm footprints show limited effect, if any, on an SAV bed's capability to recover.

- In a few studies on the effects of floating gear, low farm footprint – **such as 5%** (Bulmer et al., 2012) **or 6%** (Shields et al., 2025) – has shown no overall effect on the studied SAV bed.
- While there are reductions to abundance and density of SAV directly below floating gear, the availability of light to other parts of the bed allow resilience on a bed-wide scale.

4 | Factors influencing extent of SAV interactions - Timing

Burke et al. (1996): Burke et al. (1996) found that **spring is "an important time for both growth and storage of NSC reserves in Z. marina**, and the NSC reserves are generally depleted throughout the remainder of the year. Turbidity during this springtime 'window of opportunity' may jeopardize subsequent survival as a result of inadequate NSC reserves to maintain a positive carbon balance during the rest of the year."

5 | Factors influencing extent of SAV interactions - Aquaculture Method



Non-exhaustive list of types of oyster aquaculture:

(A) Oyster Cages

(B) Oyster Bags

(C) Racks and Bags in the Intertidal Zone

(D) Stacked Rack and Bag

(E) Suspended Oyster Cages

(F) Intertidal Longline Culture

(G) Stake Aquaculture

(H) Intertidal Tumble Oyster Systems

(I) Surface Longlines

(J) Suspended Longline Culture

3

Aquaculture Interactions with SAV by Environmental Setting

Interactions with SAV by Environmental Setting

1 | Depth

- SAV tends to be growing less than 2 meters
- Oyster aquaculture is limited by oxygen content in deeper waters

2| Salinity

- SAV species vary by salinity
- Oyster prevalence vary by salinity
- Oyster growth rates vary by salinity
- Oyster disease vary by salinity

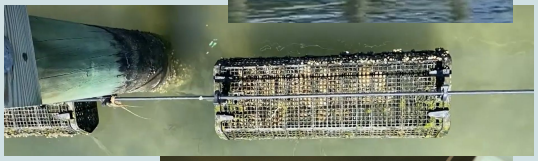
4

Common Aquaculture Methods in the Chesapeake Bay and their Potential Interactions with SAV

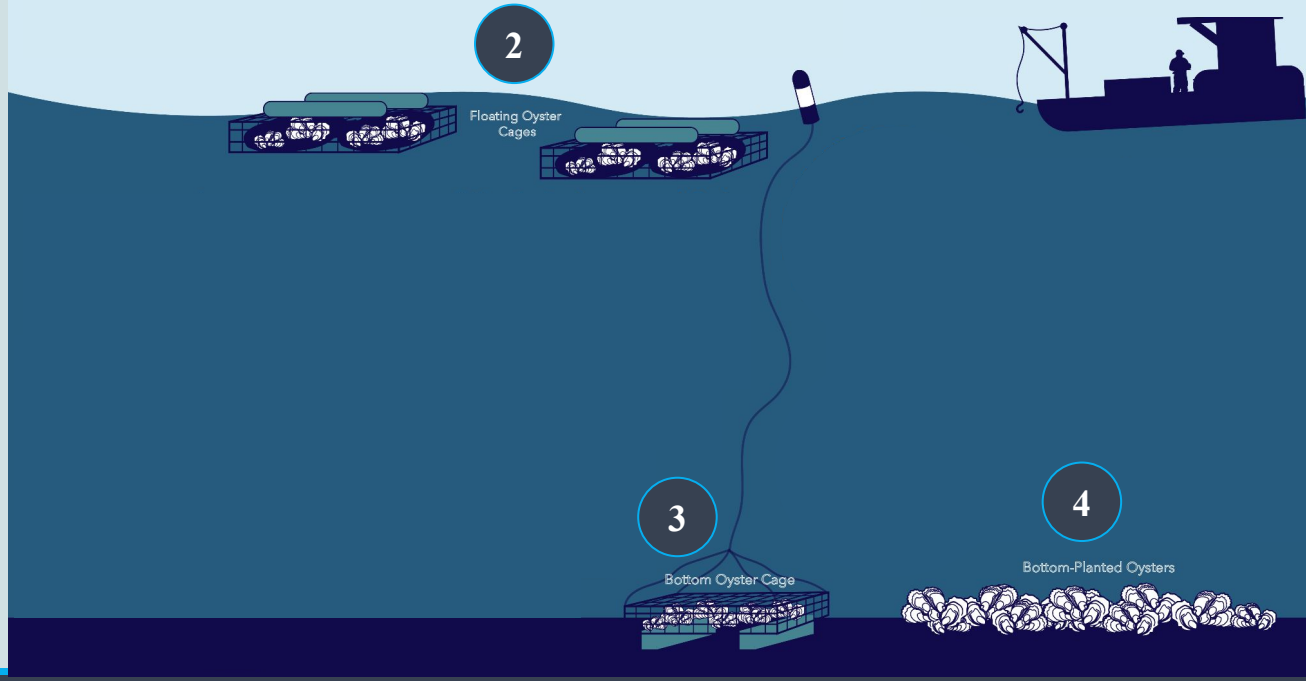
Common Aquaculture Methods in the Chesapeake Bay

1

Suspended cages



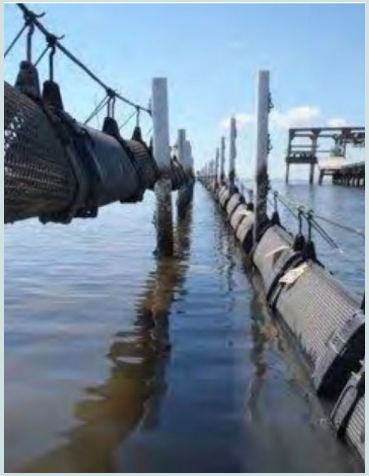
Full figure available here:
https://www.vims.edu/research/units/centerspartners/map/shellfish-aquaculture/about/

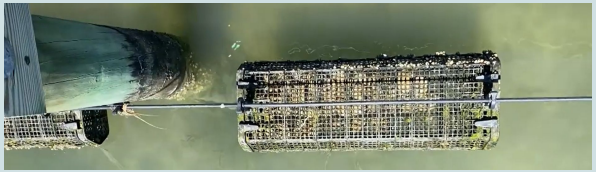


1 | Suspended cages

Potential Interactions:

1. Shading
2. Water Chemistry based on
   a. Oyster density
   b. Site flushing characteristics
3. Physical Interactions
   a. Potential for wave attenuation
   b. Potential for bed/sediment disturbance by aquaculturists





2 | Floating Gear

Potential Interactions:

1. High potential of shading
2. Water Chemistry based on
    a. Oyster density
    b. Site flushing characteristics
3. Physical Interactions
    a. Potential for wave attenuation
    b. Less potential for bed/sediment disturbance by aquaculturists

3 | On-bottom gear

Potential Interactions:

1. Shading
2. Water Chemistry based on
    a. Oyster density
    b. Site flushing characteristics
3. Physical Interactions
    a. Potential for wave attenuation
    b. High potential for bottom space competition
    c. High potential for bed/sediment disturbance by aquaculturists

4 | Direct on-bottom planting

Potential Interactions:

1. Water Chemistry based on
    a. Oyster density
    b. Site flushing characteristics
2. Physical Interactions
    a. Less potential for wave attenuation
    b. Bottom space competition
    c. Bed/sediment disturbance by aquaculturists
        i. High potential via dredging
        ii. Less potential via hand harvest via diving

5

Current Management Frameworks in Maryland and Virginia

Maryland

SAV/Aquaculture Interactions Management Framework

Maryland - Key Players: DNR, MDE, MD Dept of Ag., University System of Maryland

1

Maryland Department of Natural Resources (DNR)

DNR serves as the lead agency for:

- The development and overall **management of aquaculture** and aquaculture products;
- **Lease Permitting:** Coordinating and streamlining the process of applying for a State aquaculture permit;
- **Enforcement:** Enforcing laws, regulations, and rules related to aquaculture; and
- **Identifying economic development opportunities** related to aquaculture.

(§4–11A–03)

2

Maryland Department of the Environment (MDE)

The role of MDE in permitting relating to water column or submerged land leases is **to classify waters of Maryland as** :

- Approved, conditionally approved, or restricted for harvest; or
- Prohibited,

in order **to inform the DNR permitting process** .

(§4–11A–06) (§4–11A–08)

3

The Department of Agriculture

- The lead agency for the **marketing** of aquaculture products. (§4–11A–03)
- Responsible for **development of, and training and grants** for, shellfish aquaculture. (§4–11A–12)

4

The University System of Maryland

- The lead agency for **research** in aquaculture production and
- shall be responsible for **development of education and extension programs** which promote aquaculture as an industry. (§4–11A–03)

Maryland - Key Players: ARB and Aquaculture Coordinator

5

Aquaculture Review Board (ARB)

Consist of the following members charged with responsibility for an aspect of **the State aquaculture permitting process or oversight of permit compliance** :

1. The **Department of Natural Resources** , to be represented by the Aquaculture Coordinator, who shall serve as chair;
2. **Department of the Environment** ,
3. **Maryland Department of Health** , and
4. **Department of Agriculture** .
5. The **National Marine Fisheries Service** and
6. **The United States Army Corps of Engineers** shall be invited to designate a representative to the Review Board.

The Review Board shall:

1. **Coordinate** the development of **statewide aquaculture policy** and,
2. to the maximum extent feasible, the **streamlining of the application process** ;
3. **Track each application** as it is processed; and
4. **Ensure full and meaningful departmental communication with an applicant** during each stage of the application process. (§4–11A–03.1)

6

Aquaculture Coordinator

Employed by the Department, to **assist persons in obtaining the permits and licenses** necessary to conduct aquaculture in the State. (§4–11A–03).

The single point of contact for an applicant for all permits and licenses necessary to conduct aquaculture in the State. (§4–11A–03.1)

Maryland - Key Players: ACC

Membership

7

Aquaculture Coordinating Council (ACC)

The Coordinating Council shall consist of the following members:

- 1 member of the **Maryland Senate** designated by the President of the Senate;
- 1 member of the **Maryland House of Delegates** designated by the Speaker of the House;
- 1 representative of the **Department of Agriculture** designated by the Secretary of Agriculture;
- 1 representative of the **Department of Natural Resources Police** designated by the Secretary of Natural Resources;
- 1 representative of the **Department of Natural Resources, Fisheries Service** , designated by the Secretary of Natural Resources;
- 2 representatives of the **University of Maryland** designated by the President of the University of Maryland, College Park Campus:
  - 1 with expertise in aquaculture research; and
  - 1 representing the Maryland Cooperative Extension
- 1 representative of the **Department of Commerce** designated by the Secretary of Commerce;
- 1 representative of the **Department of the Environment** designated by the Secretary of the Environment;
- 1 representative of the **Maryland Department of Health** designated by the Secretary of Health;
- 3 **representatives of the aquaculture industry** designated by the Governor;
- 3 **tidal fisheries licensed harvesters** , including at least one who is a member of the **Maryland Watermen's Association** designated by the Governor;
- 1 representative designated by the President of the **University of Maryland Center for Environmental Science** ;
- 1 representative of the **Oyster Recovery Partnership** designated by the Oyster Recovery Partnership; and
- 1 representative of the **Maryland Farm Bureau** designated by the Maryland Farm Bureau.

(§ 4–11A–03.2)

Maryland - Key Players: ACC Responsibilities

Aquaculture Coordinating Council (ACC)

The Coordinating Council shall:

- **Curating recommendations to the Governor for advancing MD aquaculture:** Formulate and make proposals to the Governor each year for advancing Maryland aquaculture including recommendations for a fee structure on aquaculture operations;
- **Grant Program for implementing projects:** Establish and monitor a grant program for the implementation of appropriate projects;
- **Conduct applied studies of projects and products** that will expand the aquaculture industry in the State;
- **Conduct market tests** to determine acceptability and potential demand for new aquaculture products;
- Implement pilot projects and small commercial demonstrations to **resolve any outstanding quality or production issues and to educate [partners]** ;
- Support the aquaculture industry to **implement innovative procedures** and to comply with associated regulations;
- **Enhance the awareness of innovative aquaculture** products and programs among commercial buyers and the general public;
- **Investigate and enhance the area of State waters that is available to private lease** for purposes related to the aquaculture and seafood industries;
- **Provide for the establishment of Aquaculture Enterprise Zones** in the Chesapeake and coastal bays, so as to:
    - Streamline the permitting process in these zones;
    - Provide incentives for private investment in leasing operations; and
    - Encourage individuals with historical records in the commercial fishery to adapt their expertise to the raising and harvesting of seafood by aquaculture; and
- On a regular basis, **review State regulations impacting aquaculture and make recommendations** to the Aquaculture Review Board regarding any necessary or advisable regulatory changes.(§ 4–11A–03.2)

Maryland - Main Types of Areas Affect Aquaculture Leases

1 Aquaculture Enterprise Zones

Designated areas approved for the leasing of submerged land or the water column by the Department in consultation with the Department of the Environment and the Wetlands Administrator of the State Board of Public Works (§4–11A–01)

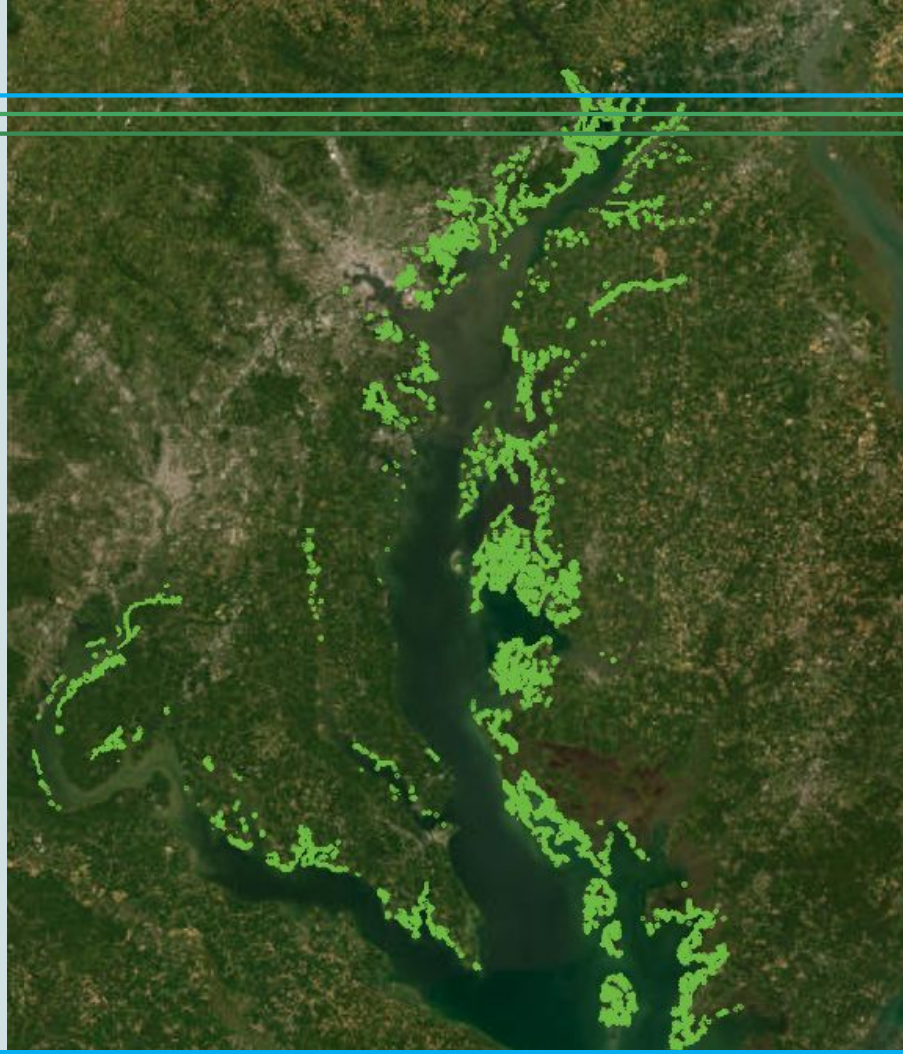
2 SAV Protection Zones

Defined as an area of submerged aquatic vegetation as mapped in an SAV survey…in 1 or more of the 5 [preceding] years" (§4–11A–01).

3 Public Shellfish Fishery Area

The public shellfish fishery area may not be leased for shellfish aquaculture (§4–11A–04).

4 Oyster Sanctuaries



Maryland - Types of Aquaculture Leases

Submerged Land Lease

Any land lying beneath the waters of the State leased by the State to any person for cultivating oysters and other shellfish for commercial purposes. (§4–11A–01)

Water Column Lease

A lease of the column of water on or under the surface of the water and above the surface of the submerged land. (§4–11A–01).

Maryland - Statutory Restrictions: Submerged Land Lease

A submerged land lease **may not** be located:

- Within a minimum of 50 feet of shoreline or any pier without the written permission of the riparian owner at the time of initial application for the lease;
- Within 150 feet of the public shellfish fishery or a registered pound net site;
- Within 150 feet of an oyster reserve or any Yates Bar located in an oyster sanctuary;
- Except as provided in paragraph (4) of this subsection, within 150 feet of a federal navigational channel;
- Subject to paragraph (3) of this subsection, in any creek, cove, bay, or inlet less than 300 feet wide at its mouth at mean low tide; or
- **In an SAV Protection Zone** .

A person with a submerged land lease in the Chesapeake Bay may cultivate shellfish on the submerged land, in temporary protective enclosures approved by the Department on the surface of the submerged land, or in any other manner authorized by the Department. (§4–11A–06)

Note:

SAV continues to expand and colonize between aerial survey data releases. Therefore, MDNR utilizes field surveys to ensure no submerged land lease activity is happening on SAV beds.

Maryland - Statutory Restrictions: Water Column Lease

A water column lease **may not** be located:

- Within a minimum of 50 feet of shoreline or any pier without the written permission of the riparian owner at the time of initial application for the lease;
- Within 150 feet of the public shellfish fishery or a registered pound net site;
- Within 150 feet of an oyster reserve or any Yates Bar located in an oyster sanctuary;
- Except as provided in paragraph (3) of this subsection, within 150 feet of a federal navigational channel;
- Subject to paragraph (2) of this subsection, in any creek, cove, bay, or inlet less than 300 feet wide at its mouth at mean low tide;
- **In an SAV Protection Zone** ; or
- In a setback or buffer from the Assateague Island National Seashore established by the Department.

A person with a water column lease in the waters of the State may cultivate shellfish:

- Subject to approval by the United States Army Corps of Engineers, on or under the surface of the water in a floating structure; or
- In any other manner authorized by the Department.

(§4–11A–08)

§4–11A–10. IN EFFECT

(c) A leaseholder may <u>not</u>:

(1) Place shellfish, bags, nets, or structures on submerged aquatic vegetation **without prior written approval** from the Department;

<u>How do you get written approval?</u>

(c–1) In approving the placement of shellfish, bags, nets, or structures on submerged aquatic vegetation under subsection (c)(1) of this section, **the Department**:

(1) **May <u>not</u> authorize harvesting by dredge** in areas where submerged aquatic vegetation is present;

(2) **Shall authorize for water column leases** [...] **in at least 10% of the area** where submerged aquatic vegetation is present; and

(3) **Shall authorize harvest by diving** in areas on any submerged land lease where submerged aquatic vegetation is present.

§4–11A–10. // EFFECTIVE JUNE 30, 2027 PER CHAPTER 113 OF 2024 //

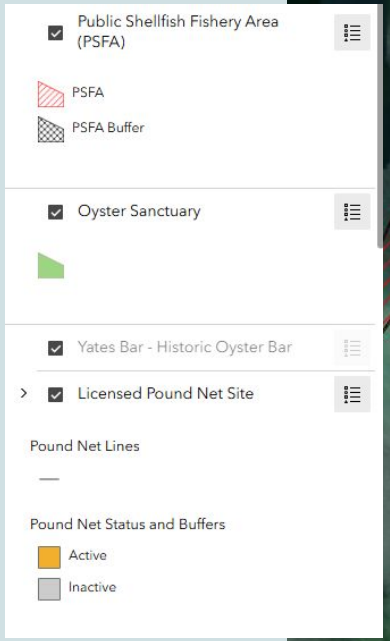
(c) A leaseholder may <u>not</u>:

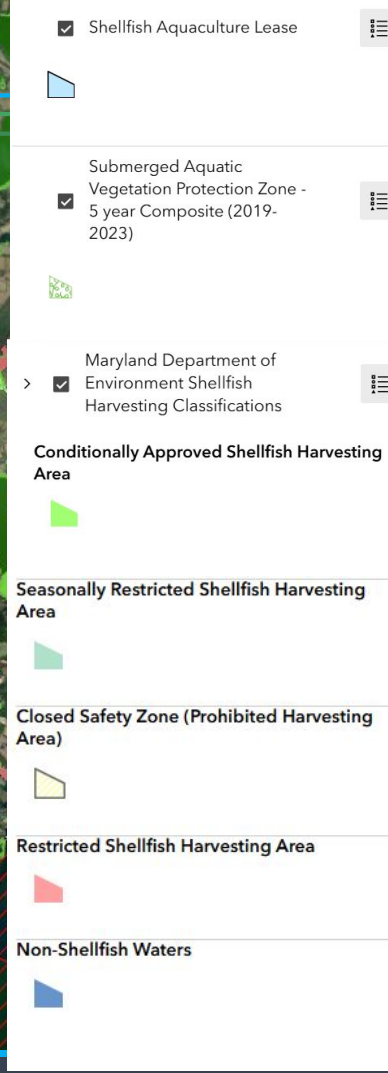
(1) Place shellfish, bags, nets, or structures on submerged aquatic vegetation;

(§4–11A–10)

Example: Talbot County

Maryland Aquaculture Siting Tool: https://experience.arcgis.com/experience/65ecfd2a1fdd41578d858efbd16f9ec0





Example sites where aquaculture is in SAV Protection Zones

A note about the 2026 Legislative Session

The bill number that extended the Submerged Aquatic Vegetation (SAV) aquaculture interaction in Maryland during the 2026 session is **HB0784** (Aquaculture - Placement of Shellfish, Bags, Nets, and Structures on Submerged Aquatic Vegetation - Extension). [1]

- **Extension Details:** The bill extends the authorization for certain aquaculture leaseholders, with prior written approval from the Department of Natural Resources (DNR), to place shellfish, bags, nets, and structures on SAV.
- **New Expiration Date:** The authorization is extended to June 30, 2030.
- **Key Provisions:** It includes safeguards such as prohibiting harvesting by dredge in these areas and limiting gear placement to a maximum of 10% of the SAV area.
- **Status:** As of April 2026, the bill passed both chambers. [1, 2, 3, 4]


Virgina
SAV/Aquaculture Interaction
Management Framework

Virginia - Key Players

1

Virginia Marine Resources Commission (VMRC)

The role of the VMRC as it relates to aquaculture/SAV interactions consists of **leasing aquaculture plots** and **regulating the gear used in these plots** . (§ 28.2-201)

2

Virginia Department of Health

The role of the VDH is to **define areas where shellfish harvest is not allowed** from a public safety standard perspective (VDH, n.d.)

3

Commissioner of Agriculture and Consumer Services, and the Aquaculture Advisory Board

The Commissioner has the authority to regulate aquaculture activities in the commonwealth with the policy advisory assistance of the Aquaculture Advisory Board which is composed of 7 members, appointed by the governor of Virginia (§ 3.2-2602).

The Commissioner of Agriculture and Consumer Services is responsible for:

- To **provide information and assistance in obtaining permits** relating to aquaculture activities;
- To **promote aquaculture** including encouraging investment in aquaculture facilities to expand production, processing capacity, and marketing
- To work with appropriate state and federal agencies to review, develop, and implement policies and procedures to **facilitate aquacultural development** ;
- To consult with and assist aquaculture industry groups, aquaculture associations, and academic institutions to develop, maintain, and **expand the aquaculture industry** ; and
- To **develop, support, and implement policies beneficial to Virginia aquaculture** .
(§ 3.2-2601)

Virginia - SAV Protection Areas

Virginia Marine Resources Commission (VMRC) uses VIMS annual aerial survey to **restrict[s] new leases on areas that have had SAV present** any of the 5 previous years

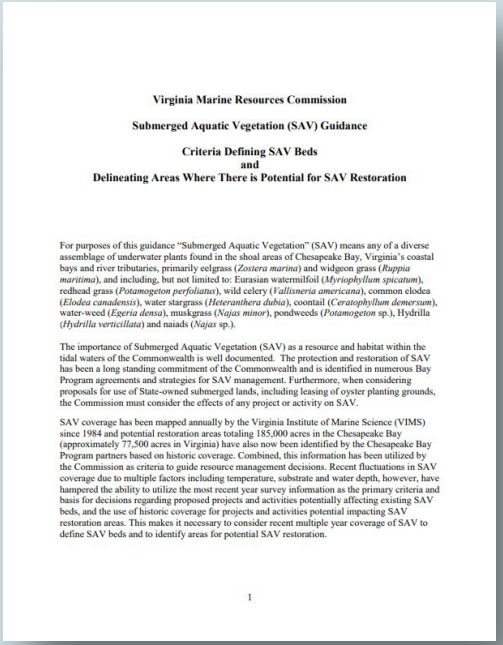
Some regulations include:

- The height of structures (no higher than 12 inches above the bottom substrate) (4VAC20-335-30).
- Toxicity of structures (4VAC20-335-30).
- No new structures shall be placed on existing stands of submerged aquatic vegetation (4VAC20-335-30).

Historical Notes
Derived from Virginia Register Volume 14, Issue 9, eff. January 1, 1998; amended, Virginia Register Volume 32, Issue 7, **eff. January 1, 2016** .

Exception

However, placement of structures or encroachment on these beds could be approved by VMRC if all mitigation measures to reduce impacts to SAV are considered and compensation explored (VMRC, 2017).



Virginia Marine Resources Commission

Submerged Aquatic Vegetation (SAV) Guidance

Criteria Defining SAV Beds and Delineating Areas Where There is Potential for SAV Restoration

For purposes of this guidance "Submerged Aquatic Vegetation" (SAV) means any of a diverse assemblage of underwater plants found in the shoal areas of Chesapeake Bay, Virginia's coastal bays and river tributaries, primarily eelgrass (*Zostera marina*) and widgeon grass (*Ruppia maritima*), and including, but not limited to: Eurasian watermilfoil (*Myriophyllum spicatum*), redhead grass (*Potamogeton perfoliatus*), wild celery (*Vallisneria americana*), common elodea (*Elodea canadensis*), water stargrass (*Heteranthera dubia*), coontail (*Ceratophyllum demersum*), water-weed (*Egeria densa*), muskgrass (*Najas minor*), pondweeds (*Potamogeton* sp.), Hydrilla (*Hydrilla verticillata*) and naiads (*Najas* sp.).

The importance of Submerged Aquatic Vegetation (SAV) as a resource and habitat within the tidal waters of the Commonwealth is well documented. The protection and restoration of SAV has been a long standing commitment of the Commonwealth and is identified in numerous Bay Program agreements and strategies for SAV management. Furthermore, when considering proposals for use of State-owned submerged lands, including leasing of oyster planting grounds, the Commission must consider the effects of any project or activity on SAV.

SAV coverage has been mapped annually by the Virginia Institute of Marine Science (VIMS) since 1984 and potential restoration areas totaling 185,000 acres in the Chesapeake Bay (approximately 77,500 acres in Virginia) have also now been identified by the Chesapeake Bay Program partners based on historic coverage. Combined, this information has been utilized by the Commission as criteria to guide resource management decisions. Recent fluctuations in SAV coverage due to multiple factors including temperature, substrate and water depth, however, have hampered the ability to utilize the most recent year survey information as the primary criteria and basis for decisions regarding proposed projects and activities potentially affecting existing SAV beds, and the use of historic coverage for projects and activities potential impacting SAV restoration areas. This makes it necessary to consider recent multiple year coverage of SAV to define SAV beds and to identify areas for potential SAV restoration.

1

Virginia - Leasing/Permitting Framework

On bottom oyster aquaculture less than 12 inches above the bottom lands?	**Oyster Ground Lease**
Bottom gear greater than 12-inches above the bottomlands and/or to be marked on the surface with buoys?	**Oyster Ground Lease & General Permit #4**
Floating Gear?	**Joint Permit Application**

Virginia - General Permit #4

General Permit #4 is described in more detail in 4VAC20-1130-10 et seq. and defines regulation pertaining to on-bottom aquaculture gear.

As it relates to SAV, the permit requires:

1. A general description of the area within 500 feet of the lease boundary, including SAV.
2. Accurately scaled drawings shall be included with the type of structures proposed to be deployed and the proposed deployment pattern.
3. The permittee shall minimize the adverse effects of the project upon adjacent properties and wetlands and upon the natural resources of the Commonwealth.
4. **No temporary protective enclosure shall be placed in or upon submerged aquatic vegetation beds** , and

Virginia - General Permit #4

General Permit #4 regulations on aquaculture placement on SAV

1. Consideration by the commissioner for authorizing the **placement of protective enclosures in currently unvegetated areas that are documented as historically supporting submerged aquatic vegetation (SAV)** beds shall **include consultation with the Virginia Institute of Marine Science** in order to determine the potential for impacts on SAV, within the term of the prospective lease.

    a. **If SAV colonizes** within the boundaries of the area designated for the temporary protective enclosures, the authorization for those structures under **this general permit shall remain in effect only for the remainder of the term of the lease** .

    The general permit shall be **renewed only [if]** [...] **the lease will not significantly interfere with the continued vitality of the SAV.**

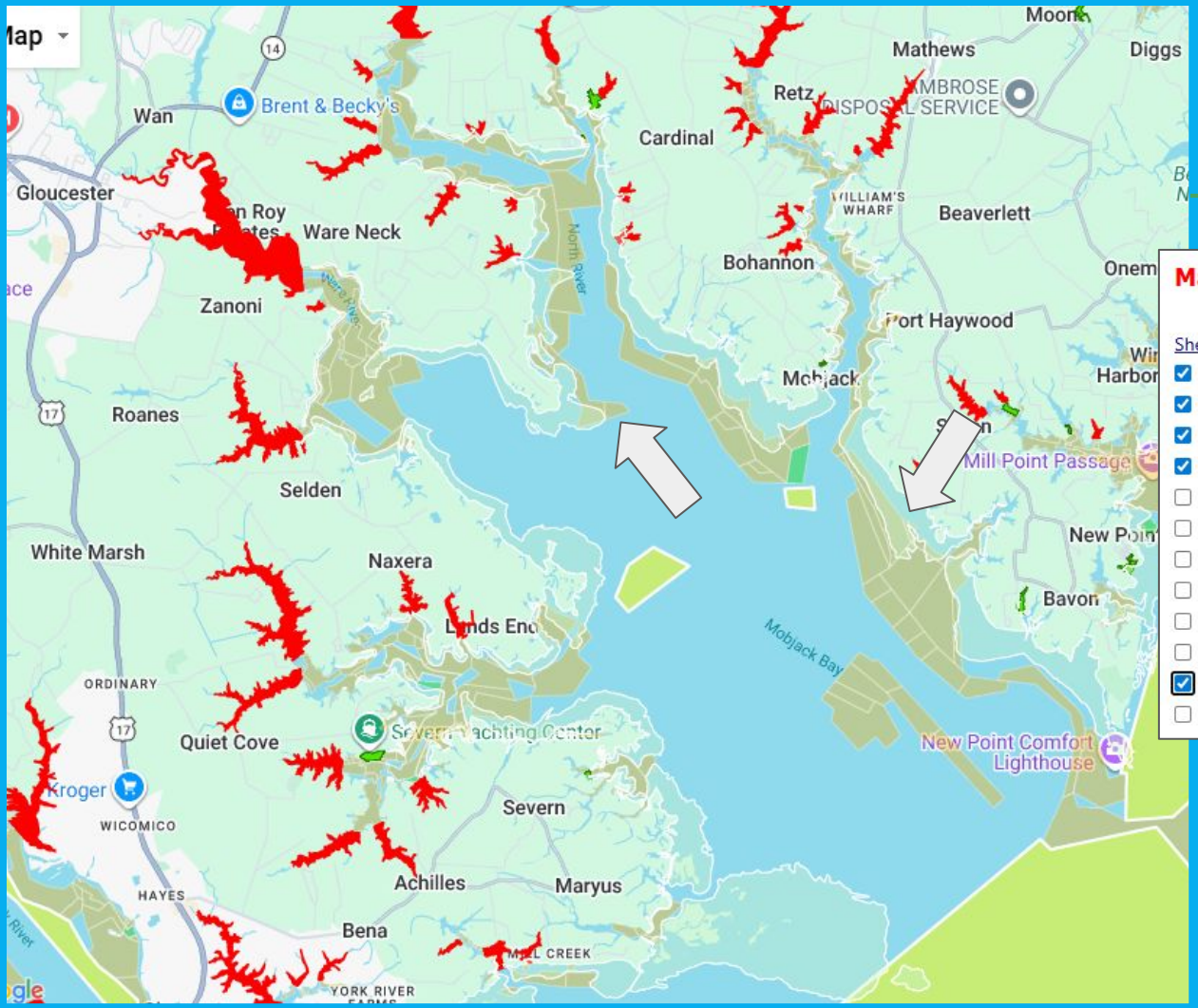
Virginia - Joint Permit Application

The Joint Permit Application, which is used for floating gear , is authorized by
§ 28.2-1205: Permits for the use of state-owned bottomlands.

1. This statute outlines the intention for the **commission to** **consult with other** **state agencies** , including
   a. the **Virginia Institute of Marine Science** ,
   b. the **State Water Control Board** ,
   c. the **Virginia Department of Transportation** , and the **State Corporation Commission** ,

   whenever the Commission's decision on a permit application **relates to or affects** the particular concerns or activities of those agencies including **water quality and submerged aquatic vegetation** .

Example - Mathews County

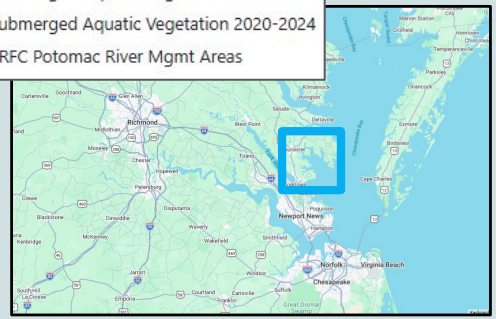


Map Layers

Shellfish Grounds

- [x] Private Oyster Ground Leases
- [x] Oyster Ground Applications
- [x] Shellfish Condemnation Zones By VDH
- [x] Open Harvest Areas 4 VAC 20-720
- [ ] VDH Growing Areas
- [ ] Public Grounds
- [ ] Public Clamming Grounds
- [ ] Oyster Sanctuaries
- [ ] State Marsh and Meadow Lands
- [ ] Submerged Aquatic Vegetation Sanctuaries
- [x] Submerged Aquatic Vegetation 2020-2024
- [ ] PRFC Potomac River Mgmt Areas

VMRC Chesapeake Map Map Tool: https://webapps.mrc.virginia.gov/public/maps/chesapeakebay_map.php



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Future Research Opportunities

Research Recommendations

1. Determine if a 5-6% farm footprint is the upper density limit to avoid long term negative effects on the underlying SAV bed from floating oyster aquaculture? Does this maximum acceptable footprint change by SAV species?
2. How does response to aquaculture vary between the two primary Chesapeake Bay SAV species: Eelgrass (Zostera marina) and Wideongrass (Ruppia maritina)?
3. Define types of sites in relation to their flushing characteristics and quantitatively describe how manipulating oyster densities affect local water/sediment quality in each site type.
4. Investigate the effect of wave/current attenuation for both on-bottom and off-bottom aquaculture gear and describe how it affects SAV health and reproduction metrics. If found, weigh these benefits to the shading and other negative effects caused by gear.
5. Explore the feasibility of implementing continuous measurement of SAV bed light availability in oyster aquaculture leases.
6. Determine the feasibility of deep water oyster aquaculture through suspended water column systems or floating surface gear.
7. Determine if oyster aquaculture-induced macroalgae growth should be a concern when permitting oyster aquaculture.

Thank you!!

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[All Photo Credits in Speaker Notes]

Read report here and consider providing feedback!