

# Chesapeake Bay Submerged Aquatic Vegetation (SAV) Monitoring Program Webpage Wireframe Development






# The Issue

**No central resource to serve as a  
Chesapeake Bay SAV Monitoring  
Program information hub**

# Background

## Chesapeake Bay SAV Monitoring Program

	Who is monitoring?	Year started	Location	Purpose	Parameters monitored
<b>Tier 3</b> Sentinel Sites 	Chesapeake Bay Program SAV workgroup and partners	2022	~20 representative sites throughout the Bay	Identifying causal relationships by intensively monitoring ecological processes, drivers of change, and ecosystem responses	Parameters measured in Tier 2, plus cover of each SAV species, canopy height, epiphyte loading, shoot density, biomass, indications of herbivory, disease, or lesions, temperature, pH, salinity, chlorophyll a, turbidity, and dissolved oxygen concentration
<b>Tier 2</b> SAV Watchers 	Watershed monitoring groups and volunteers	2019	Tributaries throughout Chesapeake Bay	Ground-truthing aerial survey data, broad-scale condition assessments, and identifying and quantifying driver-response relationships	SAV species composition and total density, presence/absence of seeds, flowers, epiphytes, and filamentous macroalgae, indications of human impacts, water column and Secchi depth, sediment type, and shoreline type
<b>Tier 1</b> Aerial Survey 	Virginia Institute of Marine Science	1983	Bay-wide	Tracking progress towards SAV restoration goals	SAV acreage and density

Credit: [Webster et al. 2021](#)

# Background

## Chesapeake Bay SAV Monitoring Program



# The Solution

**Create a website to serve as a central hub for all Chesapeake Bay SAV Monitoring Program related information, standardized protocols, and data**

# Project Tasks

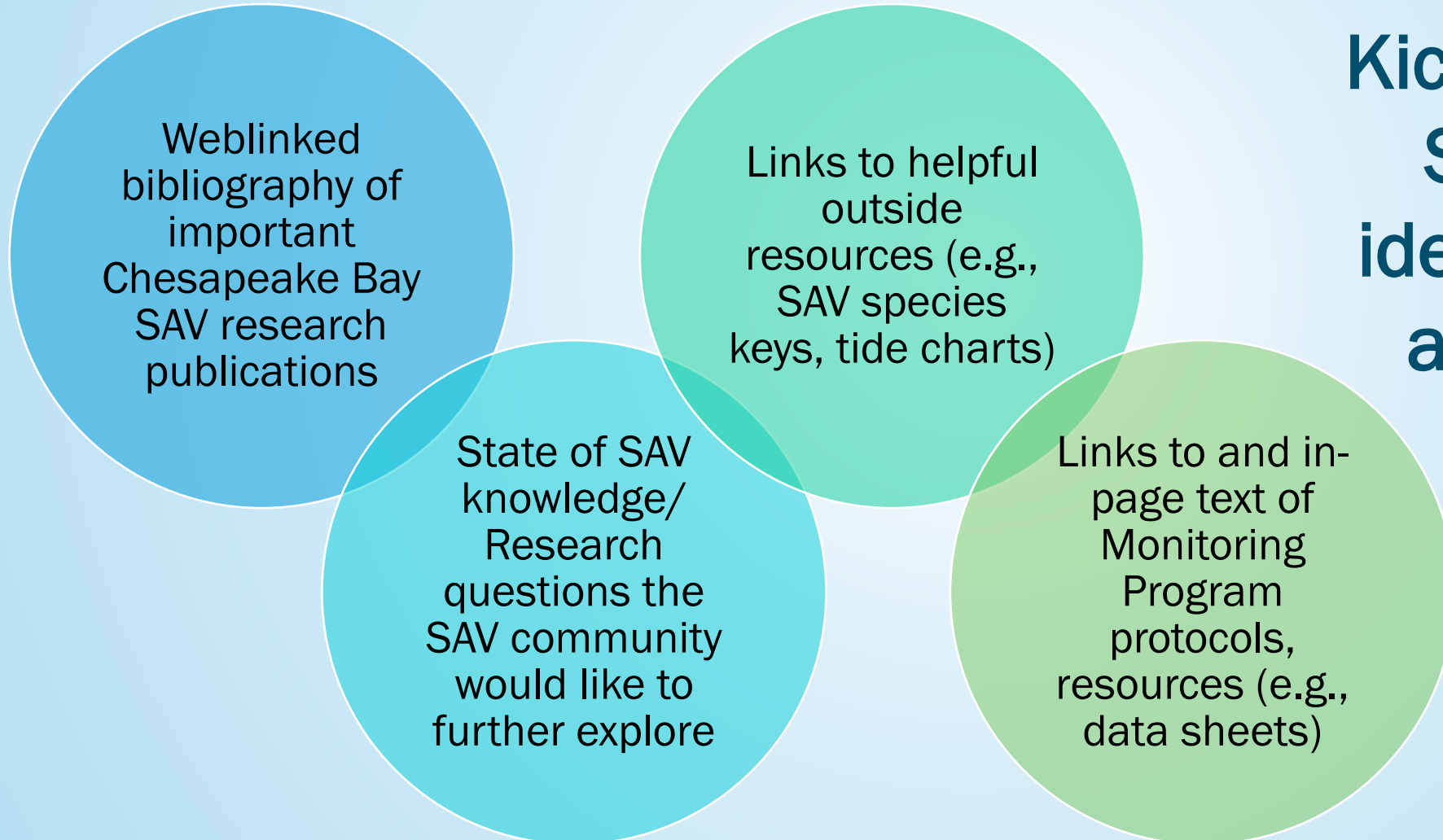
1

Stakeholder research

2

Development and revision of content, visualizations, and wireframes for the website

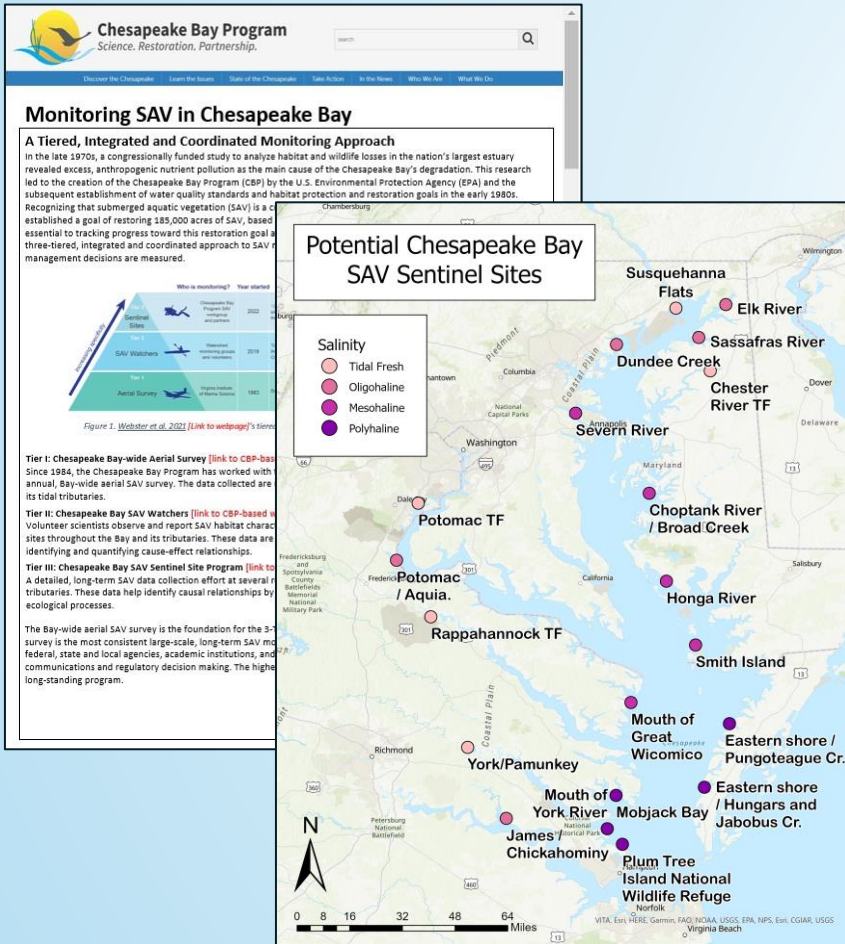
# Tasks – Stakeholder Research



**Kick-off Meeting:  
Stakeholder  
identified needs  
and interests**

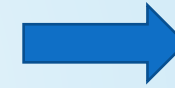


# Tasks – Wireframe Drafts



1

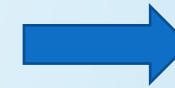
Wireframe Draft #1



Feedback Meeting #1

2

Wireframe Draft #2



Feedback Meeting #2


3

Wireframe Draft #3 –  
Final Product!



# Final Product

Webpage 1 – Landing Page



**Chesapeake Bay Program**  
*Science. Restoration. Partnership.*

[Discover the Chesapeake](#)
[Learn the Issues](#)
[State of the Chesapeake](#)
[Take Action](#)
[In the News](#)
[Who We Are](#)
[What We Do](#)

---

## Monitoring SAV in Chesapeake Bay

**A Tiered, Integrated and Coordinated Monitoring Approach**

In the late 1970s, a congressionally funded study to analyze habitat and wildlife losses in the nation's largest estuary revealed excess, anthropogenic nutrient pollution as the main cause of the Chesapeake Bay's degradation. This research led to the creation of the Chesapeake Bay Program (CBP) by the U.S. Environmental Protection Agency (EPA) and the subsequent establishment of water quality standards and habitat protection and restoration goals in the early 1980s. Recognizing that submerged aquatic vegetation (SAV) is a critical component of a healthy Bay ecosystem, the CBP established a goal of restoring 185,000 acres of SAV, based on historical abundance. Consistent, Bay-wide monitoring is essential to tracking progress toward this restoration goal and to protecting existing SAV beds. Currently, the CBP uses a three-tiered, integrated and coordinated approach to SAV monitoring to ensure the parameters needed to make informed management decisions are made.

Monitoring Approach	Who is monitoring?	Year started	Location	Purpose	Parameters monitored
Tier III Sentinel Sites	Chesapeake Bay Program SAV Watchers and partners	2022	10 representative sites throughout the Bay	Identifying causal relationships by monitoring monitoring ecological processes, drivers of change, and ecosystem responses	Parameters measured by Tier 2, plus cover of each bed species, canopy height, light penetration, shoot density, biomass, indicators of herbivory, disease, or biotic integrity, pH, salinity, chlorophyll a, turbidity, and dissolved oxygen concentration
Tier II SAV Watchers	Volunteer monitoring groups and volunteers	2019	Tributaries throughout Chesapeake Bay	Identifying habitat stressors using field-based water condition measurements, and identifying and quantifying other response relationships	SAV species composition and total density, percent abundance of each species, species richness, and biomass coverages, indicators of human impacts, water column and benthic health, sediment type, and granular type
Tier I Aerial Survey	Virginia Institute of Marine Science	1983	Bay-wide	Tracking progress towards SAV restoration goals	SAV acreage and density

Figure 1. Webster et al. 2021 [link to webpage]'s tiered illustration of the Chesapeake Bay SAV Monitoring Program


**Tier I: Chesapeake Bay-wide Aerial Survey** [link to CBP-based webpage once created]  
 Since 1984, the Chesapeake Bay Program has worked with the Virginia Institute of Marine Science (VIMS) to conduct an annual, Bay-wide aerial SAV survey. The data collected are used to report SAV acreage and density throughout the Bay and its tidal tributaries.

**Tier II: Chesapeake Bay SAV Watchers** [link to CBP-based webpage once created]  
 Volunteer scientists observe and report SAV habitat characteristics (e.g., species present, Secchi depth, sediment type) at sites throughout the Bay and its tributaries. These data are useful for a broad-scale condition assessment and for identifying and quantifying cause-effect relationships.

**Tier III: Chesapeake Bay SAV Sentinel Site Program** [link to CBP-based webpage once created]  
 A detailed, long-term SAV data collection effort at several representative locations throughout the Bay and its tidal tributaries. These data help identify causal relationships by monitoring drivers of change, ecosystem responses, and ecological processes.

The Bay-wide aerial SAV survey is the foundation for the 3-Tiered Chesapeake Bay SAV Monitoring Program. The aerial survey is the most consistent large-scale, long-term SAV monitoring program in the world and its data are used widely by federal, state and local agencies, academic institutions, and other organizations for research, education, public communications and regulatory decision making. The higher tiers of SAV data collection add detail and strength to this long-standing program.

Webpage 2 – Tier I: Chesapeake Bay-wide Aerial SAV Survey



**Chesapeake Bay Program**  
*Science. Restoration. Partnership.*

[Discover the Chesapeake](#)
[Learn the Issues](#)
[State of the Chesapeake](#)
[Take Action](#)
[In the News](#)
[Who We Are](#)
[What We Do](#)

---

## Tier I: Chesapeake Bay-wide Aerial SAV Survey

### Chesapeake Bay-wide Aerial Survey

The Virginia Institute of Marine Science (VIMS) [link to webpage] began monitoring submerged aquatic vegetation (SAV) coverage in the Chesapeake Bay in 1978. These efforts expanded in 1984 to a more comprehensive operation: the Chesapeake Bay-wide Aerial SAV Survey—a monitoring partnership between VIMS, the Chesapeake Bay Program (CBP), and additional state and federal partners. This Bay-wide aerial survey is the first tier of the Chesapeake Bay Program's SAV Monitoring effort. The Bay-wide Aerial survey is an annual aerial image gathering effort to assess the distribution, abundance, and density of SAV in the Bay and its tidal tributaries. The survey involves flying an airplane outfitted with a multispectral digital mapping camera and an inertial measurement unit (IMU) over designated flight lines to obtain imagery. Flight lines are positioned in areas known to be inhabited by SAV and in areas where SAV may be expected to occur. Flights are prioritized for areas of significant SAV coverage and are timed to occur during the peak biomass of the SAV species known to inhabit the area. Guidelines for aerial imagery acquisition are strict; conditions (e.g., tidal stage, plant growth, sun angle, turbidity, and wind) need to be nearly optimal for SAV detection.

Once obtained, the aerial imagery is visually examined to identify SAV beds. Images are scanned and both georectified (process by which imagery is assigned to a coordinate system) and orthorectified (a process by which image tilt and terrain effects are removed from imagery) to create orthophoto mosaics. From these mosaics, outlines of SAV beds are hand-drawn and delineated using GIS software. SAV density within the beds is estimated into four classes: 1 (<10% coverage); 2 (10-40% coverage); 3 (40-70% coverage); or 4 (70-100% coverage), by comparing the image to a crown density scale (see Figure 2). Information from supplemental ground surveys is tabulated and entered into the GIS data. Area for all SAV beds is then calculated in hectares.

SAV distribution data are organized into the CBP Segmentation Scheme [link to webpage] – 93 segments throughout the Bay grouped into four salinity zones: tidal fresh (<0.5 ppt), oligohaline (0.5-5 ppt), mesohaline (5-18 ppt), and polyhaline (18-25 ppt). These data are used to produce annual reports, tables, charts, and an interactive map that are made available on the VIMS website.


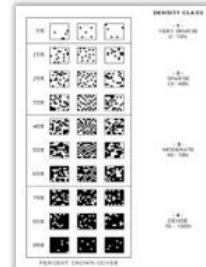
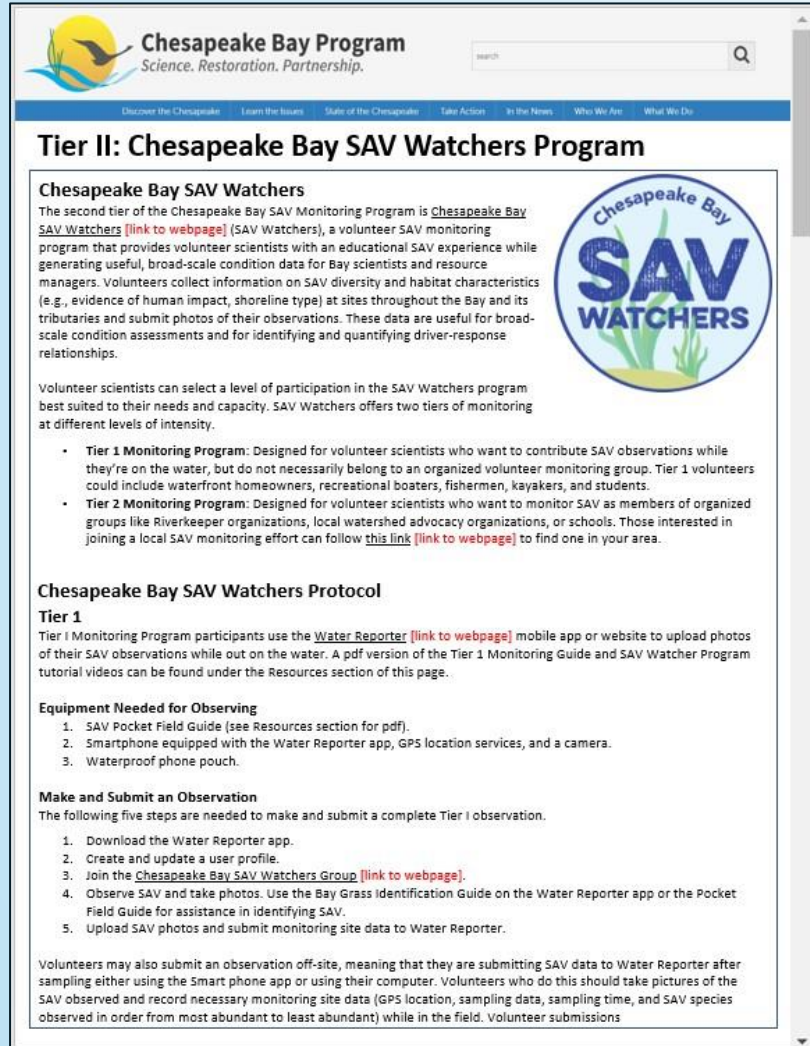



Figure 1. The 2019 WMS Aerial Survey flight lines.

Figure 2. A crown density scale used to determine the density of SAV beds. Diagram from VIMS.

# Final Product

## Webpage 3 – Tier II: Chesapeake Bay SAV Watchers Program



The screenshot shows the Chesapeake Bay Program website. The header includes the logo and navigation links. The main content area is titled "Tier II: Chesapeake Bay SAV Watchers Program". It features a sub-header "Chesapeake Bay SAV Watchers" followed by a paragraph describing the program. To the right is a circular logo for "Chesapeake Bay SAV WATCHERS". Below this is a section for "Chesapeake Bay SAV Watchers Protocol" with a sub-section for "Tier 1" and a list of "Equipment Needed for Observing".

**Chesapeake Bay SAV Watchers**

The second tier of the Chesapeake Bay SAV Monitoring Program is [Chesapeake Bay SAV Watchers](#) (link to webpage) (SAV Watchers), a volunteer SAV monitoring program that provides volunteer scientists with an educational SAV experience while generating useful, broad-scale condition data for Bay scientists and resource managers. Volunteers collect information on SAV diversity and habitat characteristics (e.g., evidence of human impact, shoreline type) at sites throughout the Bay and its tributaries and submit photos of their observations. These data are useful for broad-scale condition assessments and for identifying and quantifying driver-response relationships.

Volunteer scientists can select a level of participation in the SAV Watchers program best suited to their needs and capacity. SAV Watchers offers two tiers of monitoring at different levels of intensity.

- **Tier 1 Monitoring Program:** Designed for volunteer scientists who want to contribute SAV observations while they're on the water, but do not necessarily belong to an organized volunteer monitoring group. Tier 1 volunteers could include waterfront homeowners, recreational boaters, fishermen, kayakers, and students.
- **Tier 2 Monitoring Program:** Designed for volunteer scientists who want to monitor SAV as members of organized groups like Riverkeeper organizations, local watershed advocacy organizations, or schools. Those interested in joining a local SAV monitoring effort can follow [this link](#) (link to webpage) to find one in your area.

**Chesapeake Bay SAV Watchers Protocol**

**Tier 1**

Tier I Monitoring Program participants use the [Water Reporter](#) (link to webpage) mobile app or website to upload photos of their SAV observations while out on the water. A pdf version of the Tier 1 Monitoring Guide and SAV Watcher Program tutorial videos can be found under the Resources section of this page.

**Equipment Needed for Observing**

1. SAV Pocket Field Guide (see Resources section for pdf).
2. Smartphone equipped with the Water Reporter app, GPS location services, and a camera.
3. Waterproof phone pouch.

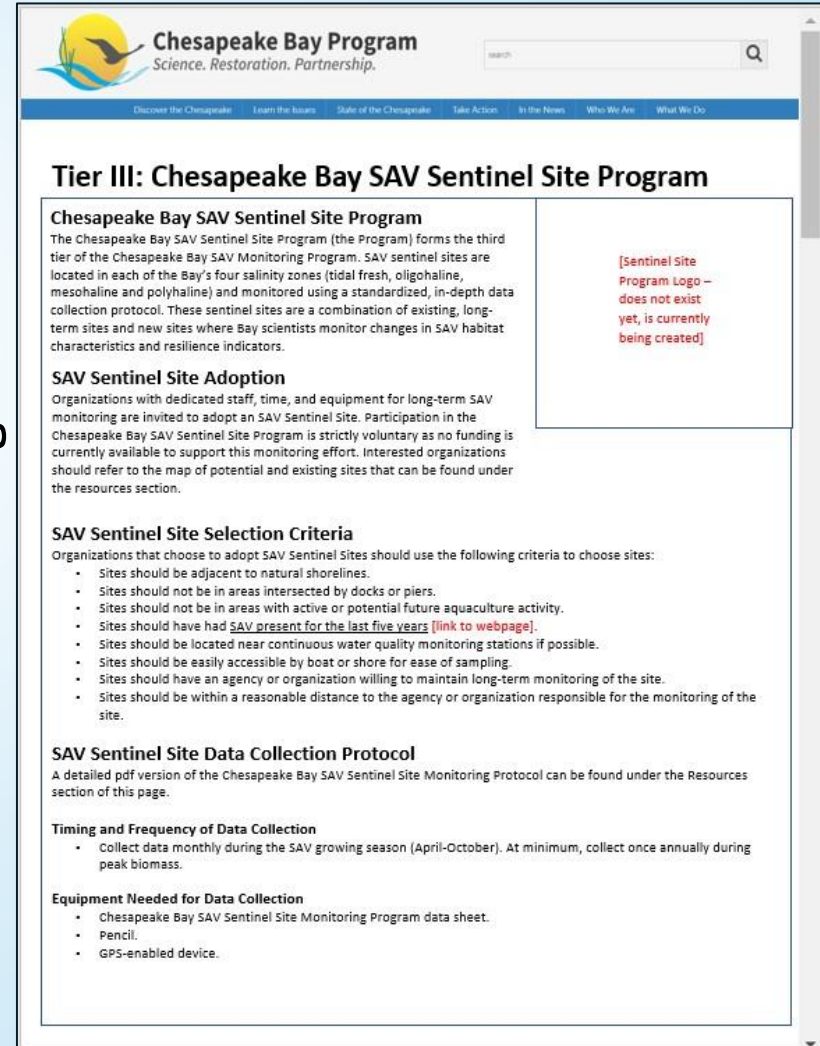
**Make and Submit an Observation**

The following five steps are needed to make and submit a complete Tier I observation.

1. Download the Water Reporter app.
2. Create and update a user profile.
3. Join the [Chesapeake Bay SAV Watchers Group](#) (link to webpage).
4. Observe SAV and take photos. Use the Bay Grass Identification Guide on the Water Reporter app or the Pocket Field Guide for assistance in identifying SAV.
5. Upload SAV photos and submit monitoring site data to Water Reporter.

Volunteers may also submit an observation off-site, meaning that they are submitting SAV data to Water Reporter after sampling either using the Smart phone app or using their computer. Volunteers who do this should take pictures of the SAV observed and record necessary monitoring site data (GPS location, sampling data, sampling time, and SAV species observed in order from most abundant to least abundant) while in the field. Volunteer submissions

## Webpage 4 – Tier III: Chesapeake Bay SAV Sentinel Site Program



The screenshot shows the Chesapeake Bay Program website. The header includes the logo and navigation links. The main content area is titled "Tier III: Chesapeake Bay SAV Sentinel Site Program". It features a sub-header "Chesapeake Bay SAV Sentinel Site Program" followed by a paragraph describing the program. To the right is a box containing a placeholder for the "Sentinel Site Program Logo". Below this is a section for "SAV Sentinel Site Adoption" and "SAV Sentinel Site Selection Criteria".

**Tier III: Chesapeake Bay SAV Sentinel Site Program**

**Chesapeake Bay SAV Sentinel Site Program**

The Chesapeake Bay SAV Sentinel Site Program (the Program) forms the third tier of the Chesapeake Bay SAV Monitoring Program. SAV sentinel sites are located in each of the Bay's four salinity zones (tidal fresh, oligohaline, mesohaline and polyhaline) and monitored using a standardized, in-depth data collection protocol. These sentinel sites are a combination of existing, long-term sites and new sites where Bay scientists monitor changes in SAV habitat characteristics and resilience indicators.

[Sentinel Site Program Logo – does not exist yet, is currently being created]

**SAV Sentinel Site Adoption**

Organizations with dedicated staff, time, and equipment for long-term SAV monitoring are invited to adopt an SAV Sentinel Site. Participation in the Chesapeake Bay SAV Sentinel Site Program is strictly voluntary as no funding is currently available to support this monitoring effort. Interested organizations should refer to the map of potential and existing sites that can be found under the resources section.

**SAV Sentinel Site Selection Criteria**

Organizations that choose to adopt SAV Sentinel Sites should use the following criteria to choose sites:

- Sites should be adjacent to natural shorelines.
- Sites should not be in areas intersected by docks or piers.
- Sites should not be in areas with active or potential future aquaculture activity.
- Sites should have had [SAV present for the last five years](#) (link to webpage).
- Sites should be located near continuous water quality monitoring stations if possible.
- Sites should be easily accessible by boat or shore for ease of sampling.
- Sites should have an agency or organization willing to maintain long-term monitoring of the site.
- Sites should be within a reasonable distance to the agency or organization responsible for the monitoring of the site.

**SAV Sentinel Site Data Collection Protocol**

A detailed pdf version of the Chesapeake Bay SAV Sentinel Site Monitoring Protocol can be found under the Resources section of this page.

**Timing and Frequency of Data Collection**

- collect data monthly during the SAV growing season (April-October). At minimum, collect once annually during peak biomass.

**Equipment Needed for Data Collection**

- Chesapeake Bay SAV Sentinel Site Monitoring Program data sheet.
- Pencil.
- GPS-enabled device.

# Recommendations

1

Development of a Chesapeake Bay segment specific, dichotomous SAV identification keys

2

The development of a centralized data management system that would allow users to input SAV data directly

3

Expansion of the Chesapeake Bay SAV Research bibliography section



# Questions?

