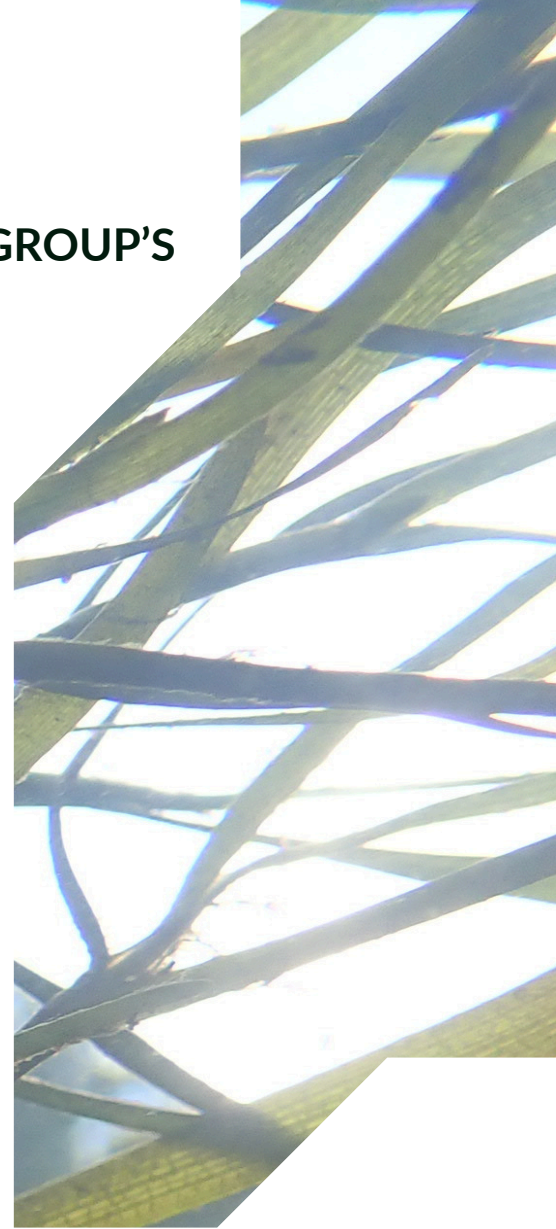


DELAWARE'S STATEWIDE  
SUBMERGED AQUATIC VEGETATION WORKGROUP'S

# SAV SEEKERS

A METHODS MANUAL FOR MONITORING  
SUBMERGED AQUATIC VEGETATION  
WITHIN DELAWARE WATERS



## Acknowledgements

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This program was inspired by the Chesapeake Bay Program's *SAV Watchers* volunteer monitoring program (Chesapeake Bay Program, 2019) and adapted for Delaware's waterways and goals.

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Image 1. SAV Seeker wading in open water during a survey.

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## Introduction to the Delaware SAV Seekers Monitoring Methods

### *What is Submerged Aquatic Vegetation (SAV)?*

Submerged aquatic vegetation (SAV), also referred to as seagrass, bay-grass, and underwater grasses, are rooted, vascular, flowering, aquatic plants and grasses that grow and thrive completely underwater. These underwater plants can grow across a variety of conditions including freshwater, brackish and saltwater environments. SAV plays a vital role within aquatic habitats by providing food, shelter and breeding grounds for fish. SAV also provides habitat for birds and other wildlife, including many ecologically important species. It has been estimated that a single acre of SAV can be home to as many as 40,000 fish and 50 million small invertebrates, making it one of the most biodiverse habitats in aquatic ecosystems (Greater Atlantic Regional Fisheries Office, 2020).

In addition to supporting wildlife, SAV provides valuable ecosystem services. It stabilizes shorelines, increases oxygen levels in the water, helps reduce wave energy and traps sediment. SAV habitat can protect vulnerable shorelines and act as a frontline protection to offset impacts from climate change such as increased energy from storms and greenhouse gas emissions through carbon sequestration. Preserving and restoring SAV is important to the health and resiliency of Delaware watersheds.

### *Importance of SAV Monitoring*

Monitoring SAV is important for understanding the health and distribution of these critical habitats in Delaware's waterways. Regular monitoring helps identify changes in SAV extent, percent coverage, and species composition over time, providing valuable insights into environmental conditions such as water quality and aquatic habitat suitability. By collecting data, we can identify potential restoration efforts, detect potential threats, and inform conservation strategies to protect these ecologically and economically significant plants and habitats. As of 2024, no state-wide organized effort has been made to track how much, how dense, and what types of SAV plants grow in Delaware's watersheds.

The Delaware Statewide Submerged Aquatic Vegetation Workgroup (DeSSAV) has made it a priority to develop a volunteer monitoring protocol for SAV to ensure consistent and reliable data collection across Delaware's watersheds. This initiative is a collaborative effort, with partner agencies from across the state coming together to combine their expertise and resources. By working as a team, these organizations aim to create a user-friendly protocol that empowers volunteers to contribute meaningfully to the conservation and restoration of SAV habitats, which are vital for maintaining healthy aquatic ecosystems.

### *Goals of the Volunteer Monitoring Program*

Did you know that studies have shown that involving the community in monitoring programs, like the Chesapeake Bay SAV Watchers, increases awareness and creates stronger connections to the environment (Webster et al., 2021)? By combining science and community effort, this Volunteer Monitoring Program is looking to gather vital information about SAV across the state while inspiring people to care for and restore local waterways here in Delaware. The goals of this Program include:

1. **Streamline Delaware SAV Monitoring:** Create reliable and consistent data collection efforts on the presence, percent coverage, and species composition of SAV, filling critical gaps in monitoring efforts.
2. **Connect Communities to Conservation:** Foster a sense of stewardship and environmental awareness by involving local communities in the conservation and restoration of aquatic ecosystems. Educate volunteers about the importance of SAV, its role in ecosystem health, and the factors impacting its growth and survival.
3. **Support Conservation and Restoration Efforts:** Provide valuable data to inform management decisions, track changes in SAV habitats over time, and guide restoration projects to maintain healthy ecosystems.
4. **Build Partnerships and Ensure Sustainability:** Strengthen collaborations between volunteers, scientists, government agencies, and conservation organizations to enhance statewide SAV monitoring efforts to ensure the long-term success and reliability of research and volunteer-driven SAV data collection.



Image 2. DeSSAV Co-chair Brittany Haywood collecting water quality data.

## Getting Started

The Delaware Statewide Submerged Aquatic Vegetation Workgroup (DeSSAV) Volunteer Monitoring Program provides multiple exciting opportunities for involvement in SAV data collection. This Program is managed by the DeSSAV to provide consistent oversight across the state, and allows for multiple opportunities for a range of audiences from novice to established scientist to become involved including:

- Scientists, researchers, or community engagement specialists looking to participate in the DeSSAV Volunteer Monitoring Program are invited to join the **Monitoring Committee** of the DeSSAV Workgroup.
- Organizations wishing to run the Program at their local level within the state of Delaware can take on the role of **Program Coordinator**, where they recruit and train volunteers to gather SAV data.
- Individuals looking to volunteer their time to collect SAV data in their area can become **SAV Seekers**, receiving training and heading into the field to collect valuable data firsthand.

All roles are essential to advancing the understanding and protection of submerged aquatic vegetation in Delaware.

### Program Coordinators

Program Coordinators play a critical leadership role in the DeSSAV Volunteer Monitoring Program, serving as the primary link between the DeSSAV Workgroup and volunteer SAV Seekers. Program Coordinators are individuals from partner organizations—such as conservation groups, environmental non-profits, community groups, and academic institutions—that take on the responsibility of running the program at a local level.

Program Coordinators receive thorough training and certification through a "train-the-trainer" model provided by DeSSAV experts. This model ensures that Program Coordinators are well-prepared to train, support, and manage their teams of SAV Seekers. Through this approach, the program maintains consistent, high-quality data collection while allowing for flexibility to meet local needs.

As a Program Coordinator, you can expect to:

- Attend DeSSAV's specialized training sessions and obtain certification.
- Recruit and onboard SAV Seeker volunteers from your local community.
- Facilitate training workshops for your volunteers, ensuring they are comfortable with field protocols, SAV identification, and data collection tools.
- Organize and coordinate field surveys in collaboration with your volunteers.
- Serve as a resource for your team by providing ongoing guidance and answering questions.
- Oversee data quality and ensure timely submission of volunteer-collected data to the DeSSAV Workgroup.
- Foster a sense of community among volunteers by coordinating group surveys and educational opportunities.

Program Coordinators also play an essential role in shaping the program by providing feedback from their field experiences, helping refine protocols, and identifying emerging needs. The data gathered by the volunteers they manage directly informs statewide SAV research, restoration, and conservation efforts.

If your organization is interested in taking on a Program Coordinator role, please contact the DeSSAV Workgroup at [DeSSAV.workgroup@gmail.com](mailto:DeSSAV.workgroup@gmail.com)

## SAV Seekers

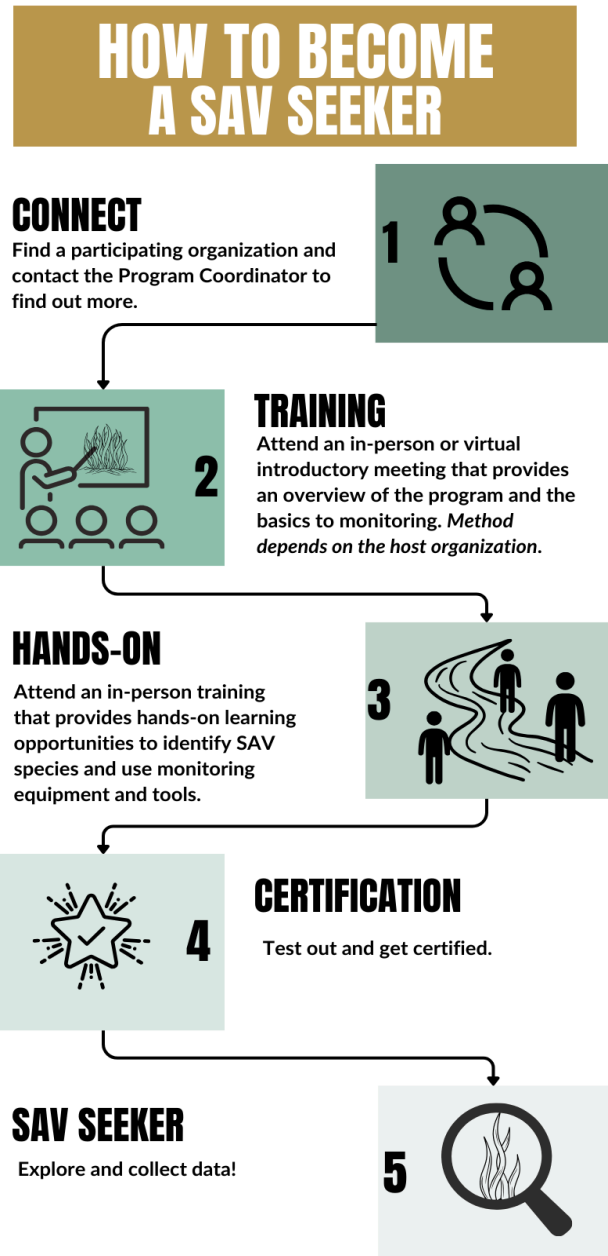
SAV Seekers receive training through their local Program Coordinator. These folks should be enthusiastic individuals who care about protecting Delaware’s aquatic ecosystems, and are comfortable wading or kayaking in water to collect data. Once trained, the SAV Seeker can operate independently or as groups to go out and collect SAV data in coordination with their local Program Coordinator.

You can expect to attend trainings, collect scientific data related to water quality, SAV species and cover with digital applications and printed datasheets, use scientific equipment, navigate waterways independently, take images, and report data to Program Coordinators. Ideal candidates are:

- **Age:** 18+ (or accompanied by a guardian if younger).
- **Interests:** Passionate about environmental conservation and eager to learn about SAV.
- **Skills:** Comfortable working outdoors in wet or uneven conditions; access to a kayak or small boat is helpful for areas that can’t be waded.
- **Commitment:** Able to attend a training session—no prior experience is needed! Dedicate at least one day a month during the growing season to collecting data.

## Program Features

1. **Training Sessions:** Hands-on workshops covering SAV identification, monitoring equipment, and practice surveys. Participants earn a certificate upon completion.



2. **Resources Provided:** Step-by-step guides, datasheet templates, equipment lists, and safety tips.
3. **Ongoing Support:** Access to Program Coordinators for questions, data submission, and additional guidance.

Please note that the exact materials, steps, and training methodologies may vary depending on your host organization, however the end data that is collected is all the same. To find out more information about the program or find a Program Coordinator in your area visit our webpage at: [DelawaresSAV.org/volunteer](http://DelawaresSAV.org/volunteer) or email [DeSSAV.workgroup@gmail.com](mailto:DeSSAV.workgroup@gmail.com)

## Monitoring Basics

Effective monitoring of Submerged Aquatic Vegetation (SAV) relies on standardized protocols to ensure consistent, reliable, and comparable data collection across Delaware's waterways. This section provides an overview of the methodologies used to assess SAV distribution, abundance, and habitat conditions. By following these protocols, participants can contribute to an ongoing dataset that informs management decisions, drives restoration projects, and enhances our understanding of SAV spatially across the First State. The protocol is designed to accommodate varying levels of expertise, from professional researchers to trained community volunteers. The outlined sections will detail field survey techniques, sampling procedures, data documentation, and quality assurance practices to support comprehensive monitoring efforts.

### How Data is Stored

All data collected will be stored in a centralized database maintained by the Delaware Department of Natural Resources and Environmental Control (DNREC). Access will be available to volunteer organizations/institutions and Program Coordinators that are registered with the Delaware Statewide Submerged Aquatic Vegetation Workgroup (DeSSAV). A public version of the dataset will also be available, containing general survey information only. Personal identifiers will not be included in the public release. To ensure this dataset is useful and legally obtained, volunteers must follow the permissions requirements outlined in this protocol.

## Key Terms

Table 1. A list of common terms, abbreviations and definitions used during SAV monitoring .

Term	Definition
<b>Algae</b>	Simple plant-like organisms that can grow in water. Some algae are beneficial for ecosystems, while excessive algae growth (often due to nutrient pollution) can harm water quality, oxygen levels, and be toxic.
<b>Dissolved Oxygen (DO)</b>	The amount of oxygen present within the water. It is crucial for the survival of aquatic plants and animals.
<b>Diversity</b>	The variety and abundance of different SAV species within a specific area, often used as an indicator of ecosystem health and resilience.
<b>Epiphytes</b>	Small organisms, such as algae or invertebrates, that live on the surface of plants. Their presence can indicate nutrient levels in the water.
<b>Hypoxia</b>	A condition where there is a significantly low level of oxygen in the water, which can stress aquatic life and harm plant growth.
<b>Macroinvertebrates</b>	Small, visible animals, like insects, worms, and crustaceans, that live in the water. They are important indicators of water quality.
<b>Microinvertebrates</b>	Tiny invertebrates, often microscopic, that live in the water and contribute to the ecosystem's functioning, especially in nutrient cycling and food webs.
<b>pH</b>	A measure of the acidity or alkalinity of water. SAV grows best in certain pH ranges, with extreme levels harming plant growth.
<b>Restoration</b>	The process of returning a damaged ecosystem to a healthy and functional state, often by reintroducing species or improving environmental conditions.
<b>Salinity</b>	The amount of dissolved salts in water, usually measured in Parts Per Thousand (ppt). It influences the types of plants and animals that can live in an area.
<b>Secchi Depth</b>	A measure of water transparency, indicating how deep sunlight can penetrate the water, which affects plant growth.
<b>Sediment Type</b>	The composition of the bottom material in a water body, such as sand, mud, or clay, which impacts plant growth.
<b>Submerged Aquatic Vegetation (SAV)</b>	Underwater, flowering plants that grow entirely underwater in freshwater or brackish environments, providing habitat and supporting aquatic ecosystems.
<b>Substrate</b>	The material at the bottom of a water body, such as mud, sand, or rocks, which serves as the anchor for plants.
<b>Survey Point</b>	A specific location along a transect where measurements and observations are recorded.
<b>Transect</b>	A path used for sampling the environment, often used in ecological studies to observe and collect data systematically.
<b>Turbidity</b>	The cloudiness or haziness of water caused by suspended particles like sediment, plankton, or pollutants. It affects light penetration and can hinder plant growth.
<b>Tide Stage</b>	The phase of the tide, such as high or low.
<b>Ebb Tide</b>	The period when the tide is falling, and water flows away from the shore.
<b>Low Tide</b>	The point when the water level reaches its lowest height along the shoreline.

<b>Slack Tide</b>	A short period between the ebb and flood tides when water movement temporarily pauses.
<b>Flood Tide</b>	The period when the tide is rising, and water flows towards the shore.
<b>High Tide</b>	The point when the water level reaches its highest height along the shoreline.

## *What You'll Be Doing- Preparations*

### Selecting Sites

The first step in monitoring SAV is selecting a site to monitor, and is an important step in collecting meaningful data. You may collect data almost anywhere there is water- think narrow streams, larger rivers, bays, even tax ditches, and/or ponds! There are multiple factors to consider when selecting a site and your Program Coordinator can assist you with this task. SAV Seekers are encouraged to plan ahead and consider access, safety, and areas of interest. While there is flexibility in site selection, there are key factors and guidelines to follow to ensure successful and safe data collection. These factors include habitat conditions, time of year restrictions related to a species growing season, and current environmental conditions.

### Scenarios and Site Navigation

Surveys can be conducted either by wading or by using a vessel (boat or kayak) depending on water depth and accessibility:

- For depths up to 1 meter (~3 feet) or hip depth, wading is recommended, wearing either waterproof shoes with good traction or waders (hip or chest).
- In deeper waters exceeding 1 meter (~ 3 feet), kayaks are the preferred method, allowing shallower depths to be explored where a larger vessel cannot navigate, but motorized boats may be necessary for navigating larger or deeper sites. *Note: this protocol uses a kayak length as a point of reference for an area to collect data.*

SAV Seekers are encouraged to explore waterways at their own pace, revisiting known SAV areas and venturing into undersampled or unexplored regions to expand data collection. Sampling can and should occur even in areas where SAV hasn't been seen — the absence of SAV is just as valuable as its presence when tracking ecosystem health and changes over time. Every data point helps build a clearer picture of SAV distribution and habitat conditions. For guidance, coordinate with your Program Coordinator to identify starting points or areas of interest. To plan boat and/or kayak launches, use DNREC's public boat launches and ramps map at <https://dnrec.delaware.gov/fish-wildlife/fishing/access/>.

## Public Versus Private Access

SAV Seekers must consider land ownership when planning water access points and survey areas. **For any locations not publicly owned, written permission is required to conduct surveys, collect data, or utilize private property access points.** If you do not have permission to access someone's private property, do not trespass! To assist with this process, a template is provided in Appendix A. If you plan to survey your own land, please complete the template and return it to your Program Coordinator.

## Habitat Conditions

Submerged aquatic vegetation grows underwater where conditions are just right. There are a variety of factors that influence what grows where and should be considered when selecting sites to monitor:

- **Sunlight:** These plants need light to make food, so they tend to grow in shallow water where sunlight can reach the bottom. Water clarity is also important, so they will grow in areas that have less turbid waters, allowing sunlight to penetrate through water without blockage.
- **Salinity:** How salty the water is matters because some plants prefer fresh water, while others thrive in salty or brackish water. See Appendix B for a list of common species listed by salinity zone.
- **Water Movement:** While some plants can handle strong currents, others need calm waters to stay rooted.
- **Substrate:** These plants need soft sand, mud, or other stable materials to anchor its roots. Bottom sediment type matters because different plants prefer different textures or nutrient availability.
- **Temperature:** Each plant has a range of temperatures where it grows best.

All these factors combine to determine where SAV can live and grow. To best gather data and study where these plants grow in our waterways, we use a variety of equipment to collect these environmental parameters.

## Sampling Timing

Timing fieldwork to monitor SAV is crucial to capture peak growth periods for each species. Each species is a little bit different; however, typically between early summer and mid-fall when plants are flowering are the best times. By aligning fieldwork with these growing seasons, data collection can more accurately reflect the health and extent of SAV habitats. Common species and their prime flowering times are outlined in the table below. Note, we are only beginning to study the growth patterns of our local Delaware species, so there may be plants growing and flowering outside of the timing outlined in Table 2.

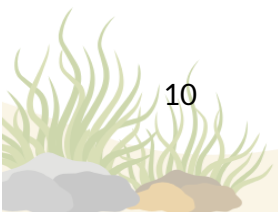


Table 2. Flowering period of common SAV species with general salinity range. The life cycle/growing period of the plant is noted. A winter annual is a plant that primarily grows during the winter months, produces seed and then dies within a year; a perennial grows during the summer months, produces seed and lives two or more years; and a facultative perennial can either function as an annual or perennial based on environmental factors. (Maryland Department of Natural Resources, n.d.; Thayer et al., 2016; University of Maryland, Cooperative Extension Service, Sea Grant Extension Program et al., n.d.; U.S. Fish & Wildlife Service, 2019)

Common Name	Scientific Name	Flowering Months	Life Cycle	Salinity Range
Wild Celery / Tapegrass	<i>Vallisneria americana</i>	July - September	Perennial	0-0.5 ppt
Water stargrass	<i>Heteranthera dubia</i>	June - September	Perennial	0-5 ppt
Curly pondweed	<i>Potamogeton crispus</i>	May - June	Winter annual	0-5 ppt
Canadian waterweed	<i>Elodea canadensis</i>	May - October (rare)	Perennial	0-5 ppt
Coontail	<i>Ceratophyllum demersum</i>	July - September	Perennial	0-5 ppt
Slender pondweed	<i>Potamogeton bertcholdi</i>	August - September	Winter annual	0-5 ppt
Redhead grass	<i>Potamogeton perfoliatus</i>	July - August	Perennial	5-18 ppt
Horned Pondweed	<i>Zannichellia palustris</i>	May-August	Perennial	0-18 ppt
Widgeon grass	<i>Ruppia maritima</i>	June - September	Facultative perennial	5+ ppt
Eelgrass	<i>Zostera marina</i>	May-August	Perennial	18+ ppt

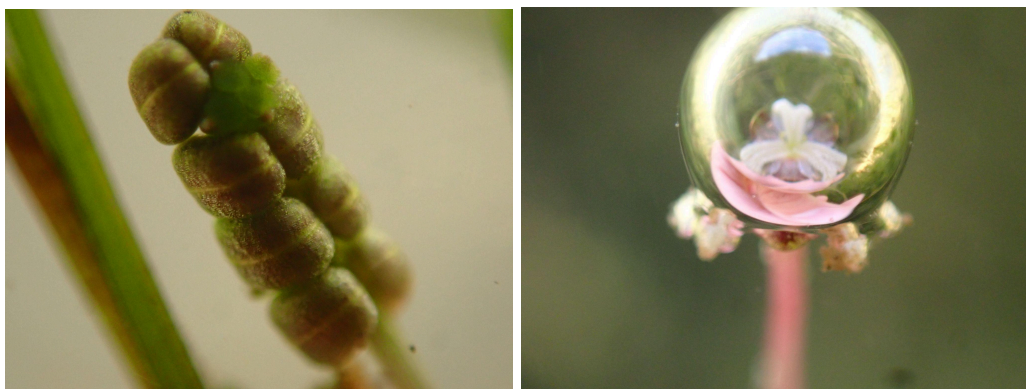


Image 3. Inflorescence from *R. maritima* (left) and *E. canadensis* (right).

## Determining “Weather” Or Not To Go

When planning fieldwork, understanding and assessing decision factors is essential to ensure safety and success. Environmental factors such as weather conditions, water temperature, tides, and visibility play a critical role in determining whether it's safe to proceed. Additional considerations, like wind speed, storm forecasts, and the presence of marine hazards, should also be evaluated. By carefully weighing these factors and staying informed through reliable data sources, teams can make well-informed decisions to minimize risks and optimize fieldwork outcomes. Environmental conditions should be reviewed each time you head out:

- **Rain event** - Surveying should never be done during a rain event or after significant rainfall as it can cause cloudy water situations. Rain events, even upstream ones, can make surveying difficult due to cloudy water. Wait at least 2 days (48-hours) for things to clear up.
- **Tides** - Sampling is best conducted at low tide if you are wading. If you are boating, knowledge of the area's tides are crucial. In some areas mid range or high tides are best for site access, and others require low tides.
- **Weather** - Sunny weather is best for sampling. Avoid rainy, overcast weather as it can make seeing the bottom difficult. Pro tip: Wear polarized sunglasses to help reduce glare on the water surface.
- **Temperature** - Avoid in-water work in extreme heat to prevent associated hazards for field crew.

## Other Safety Considerations

Safety is paramount when planning and conducting surveys. SAV Seekers should follow these safety guidelines:

- **Check Environmental Conditions:** Always check the weather forecast, tide schedules, and water conditions before heading out. Avoid surveying during inclement weather.
- **Avoid Hazardous Areas:** Do not enter waterways that appear dangerous, including those with downed trees, debris, or fast-moving water. If obstacles or unsafe conditions are encountered during a survey, end the survey immediately and leave the area.
- **Time of Day:** Avoid surveying at dusk or dawn when visibility is limited. Plan surveys for daylight hours when there is ample sunlight for both safety and better SAV visibility.
- **Emergency Preparedness:** Bring a fully charged phone and wear appropriate safety gear (such as a life jacket).
- **No-no to Solo Sampling:** Avoid sampling in water alone. If comfortable being around/on the water by yourself, alert someone to your plans, including your expected return time.
- **Beat the Heat:** Make sure you bring plenty of water, sunscreen, hats or wear lightweight long sleeve shirts or pants.

## *Why You'll Be Sampling*

It is crucial to gather consistent, high-quality information about submerged aquatic vegetation and the conditions in which it grows. Consistent, high-quality information about SAV and its growing conditions is essential for effective monitoring and management. SAV plays a critical role in

aquatic ecosystems by improving water quality, providing habitat for fish and wildlife, stabilizing sediment, and supporting overall biodiversity. Reliable data allows scientists to track changes in SAV distribution, percent coverage, and health over time, helping to identify trends and potential threats such as pollution, climate change, or invasive species. High-quality information also ensures that conservation efforts and management strategies are based on accurate, scientifically sound evidence, leading to better protection and restoration of these vital ecosystems.

For this effort, this data collection process is divided into three key parts to ensure a systematic and thorough approach.

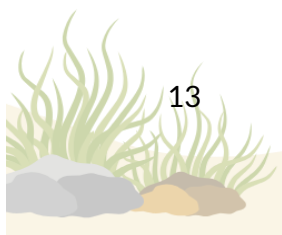
1. **Site Description** establishes the context for each survey by documenting the "who, what, and where" of the sampling effort.
2. **Habitat Characteristics** captures site-specific environmental factors, such as water depth, sediment type, and salinity, that influence SAV growth and distribution.
3. Finally, **SAV Species** focuses on the detailed characteristics of SAV, including its presence, species composition, and percent coverage.

Together, these sections form a comprehensive framework for data collection.

## Site Description

This section captures the essential who, where, and what the site looks like for every survey. It provides the foundation for understanding each survey effort, documenting key elements such as the location, conditions, and individuals involved. Accurate and thorough location information is critical for reliability and usefulness of data. It allows researchers to correlate SAV health with specific site characteristics and environmental factors, like tide or weather conditions. This data also makes it possible to track patterns, such as seasonal SAV growth, or explain differences between sites.

1. **Date:** The date of the survey is essential for tracking seasonal patterns in SAV growth and understanding how environmental conditions change over time.
2. **Time Start:** Documenting the start time helps correlate observations with specific environmental conditions, like light availability and tide influence.
3. **Recorder Initials:** Capturing the initials of the person recording field data helps track submissions, support data validation, and resolve any questions during review.
4. **Organization:** Recording the affiliated organization helps track regional efforts and maintain consistency in training, protocols, and data submission across different groups.
5. **Monitoring Role:** Documenting the role of each participant helps track data consistency and support quality assurance. Differentiating between SAV Seekers and Program Coordinators allows for more accurate interpretation of submitted observations.
6. **Observer(s):** Identifying who conducted the survey ensures accountability and allows for follow-up questions or clarifications about data collection methods and observations. *If you are sampling alone, you will be both recorder and observer.*
7. **Survey Type:** Specifying the survey method (wading, kayaking, motorboat, or other vessel) helps interpret data accuracy and coverage, as different approaches offer varying levels of access, visibility, and sampling efficiency.
8. **Waterbody Name:** Naming the specific waterbody ensures location data is accurate and helps identify broader habitat trends across different water systems.



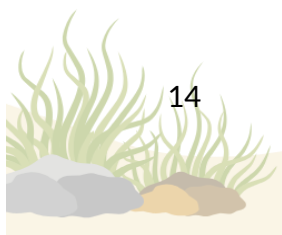
9. **Waterbody Type:** Noting whether the site is tidal or non-tidal helps determine the influence of water movement on SAV distribution and habitat stability.
10. **Tide Stage:** Recording the tide stage (like high, low, ebb, flood or slack tide) provides insight into water depth and visibility, both of which can impact SAV detection and coverage estimates.
11. **Weather:** Weather conditions, like cloud cover or wind, impact water clarity and visibility, influencing the accuracy of SAV identification and percent coverage estimates.
12. **Precipitation Within 48-hours:** Recent rainfall can affect water quality by altering salinity, depth, and/or turbidity.
13. **Site Description:** A detailed description of the site provides context for interpreting data and capturing unique environmental features. This aids in locating and contextualizing the site during future surveys.
14. **Permission to Survey:** Indicating if you have permission to collect data on private property is essential to our dataset. If your survey site is not on public land, you must obtain written landowner permission and submit the completed permission form (Appendix A) to your Program Coordinator. *Note: you must complete this even if you are the private landowner.*
15. **Time End:** The end time provides a complete picture of survey duration, which can affect the amount of data collected and observation quality. Tracking time can also provide insight into volunteer hours.

## Habitat Characteristics

This section focuses on habitat characteristics, consisting of collecting water quality and sediment data, which are critical for a comprehensive SAV survey because these factors directly influence SAV growth, health, and distribution. Water quality parameters such as temperature, salinity, dissolved oxygen, light availability, and nutrient levels determine the conditions under which SAV can thrive. Sediment characteristics, including grain size and stability, can affect root anchorage and nutrient availability. By analyzing these factors alongside SAV presence and health, researchers can better understand the environmental conditions necessary for SAV success, identify potential stressors, and develop targeted conservation or restoration strategies to support these vital ecosystems.

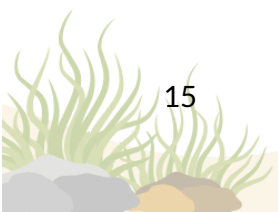
Data fields to be collected include (*items denoted with an asterisk (\*) are optional, depending on available equipment*):

1. **GPS Coordinates (Latitude and Longitude):** Recording GPS coordinates ensures precise documentation of each sample point's location. This is crucial for accurately mapping SAV distribution, tracking changes over time, and enabling consistent comparisons across surveys. Precise coordinates also help identify specific areas for future monitoring or restoration efforts.
2. **Shoreline Type:** Documenting the shoreline type provides context about the surrounding environment, such as its natural or altered state. Shoreline characteristics, like vegetated or artificial/armored structures, can influence water quality, sediment dynamics, and SAV habitat suitability, offering insights into potential factors impacting SAV presence and health.
3. **Erosion Presence:** Recording visible shoreline erosion helps identify areas where habitat degradation may be impacting SAV growth and water quality. Signs such as undercut



banks, exposed roots, or slumping soil indicate active erosion, which can contribute to increased turbidity and sedimentation in nearby waters.

4. **Sediment Type:** Sediment type plays a critical role in determining the suitability of the substrate for SAV growth. Different species have their own preference in substrate they can grow in. Understanding sediment composition helps identify the ecological characteristics of the site and guides restoration planning.
5. **Water Depth:** Depth is a key factor determining the availability of sunlight to SAV beds. Depth data helps identify suitable habitats for SAV growth. Greater depths can limit photosynthesis, especially in turbid waters. Depth is measured in centimeters (cm).
6. **Temperature\*:** Temperature is a key factor influencing SAV growth and reproduction. Excessive heat may stress SAV and limit oxygen availability. Monitoring temperature helps identify thermal conditions that support or hinder SAV health and can track changes due to seasonal variations or climate impacts. Temperature is measured in degrees Celsius (°C).
7. **pH\*:** pH indicates the acidity or alkalinity of the water, which directly affects SAV growth and species diversity. Most SAV species thrive within a specific pH range. Deviations outside this range can impact growth or indicate potential environmental stressors.
8. **Secchi Depth\*:** Secchi depth is a measure of water transparency or turbidity, which is linked to the amount of light that can penetrate through the water column. This parameter is vital for understanding SAV growth, as clearer water allows for better light availability at bottom. Secchi depth also serves as an indicator of water quality, helping identify factors like sedimentation or algal blooms that may affect SAV and aquatic habitats. Secchi depth is measured in centimeters (cm).
9. **DO\*:** Dissolved oxygen, or DO, is a critical measure of water quality and ecosystem health. Not only does SAV rely on adequate oxygen levels for survival, DO readings also indicate broader aquatic health, as low oxygen levels (hypoxia) can stress aquatic life. DO is measured in milligrams per Liter (mg/L).
10. **Salinity\*:** Salinity is a critical factor influencing SAV distribution, as different species have varying tolerances to salt levels. Changes in salinity can alter the composition and health of SAV beds. Monitoring salinity helps identify suitable habitats for specific SAV species and detect environmental shifts that may impact these ecosystems, such as freshwater inflows or rising sea levels. Salinity is measured in parts-per-thousand (ppt).
11. **Macroinvertebrate Presence:** Macroinvertebrates are aquatic animals without backbones that are large enough to see without a microscope.
12. **Macroinvertebrate Type:** Indicating the type of macroinvertebrate, such as aquatic insects, worms, bivalves, and/or crustaceans, can provide additional insight into the aquatic habitat and ecosystem. Macroinvertebrates rely on SAV for food and shelter, and their presence or absence can provide insights into the ecological status of the area.
13. **Macroinvertebrate Photos Taken:** Documenting photographs of macroinvertebrates observed during sampling provides valuable visual records to support species identification, presence/absence confirmation, and ecological context. These images contribute to long-term data quality and serve as reference material for training and outreach.
14. **Macroalgae Presence:** Recording the presence of macroalgae provides insight into the overall health and balance of the aquatic ecosystem.
15. **Macroalgae Percent Cover:** Indicating the spatial coverage of macroalgae in an area is important to help researchers assess ecosystem dynamics and identify potential stressors



to aquatic habitats. Macroalgae can compete with SAV for light and nutrients, and their abundance may indicate nutrient enrichment or other environmental changes.

16. **Macroalgae Photos Taken:** Documenting photographs of macroalgae observed during sampling provides important visual evidence to support identification and confirm presence within the sampling area. These images contribute to long-term data quality and serve as reference material for training and outreach.
17. **SAV Presence:** Documenting SAV presence is an important step in assessing habitat health and distribution. The presence or absence of SAV provides insights into site conditions, such as light availability, water quality, and substrate suitability. This information is critical for detecting changes in SAV populations over time, evaluating the success of restoration efforts, and identifying areas in need of conservation.
18. **SAV Percent Cover:** The percent coverage of SAV within an area provides insight into the health and productivity of the ecosystem. High spatial coverage can indicate a stable, thriving aquatic environment, while low spatial coverage may suggest disturbance, pollution, or unfavorable environmental conditions. This information can aid in restoration efforts and management decisions.

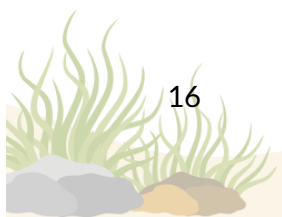
## Identify SAV Species

This section captures detailed information about the presence, species composition, and condition of SAV at each sampling site. This data goes beyond general site observations, focusing on identifying SAV species, estimating their percent coverage, and noting specific characteristics. SAV findings provide critical insights into the health and biodiversity of aquatic habitats. Recording the species present and their percent coverage helps identify shifts in community composition over time, which may signal changes in environmental conditions. This data is essential for assessing ecosystem health, informing restoration efforts, and guiding resource management decisions.

Accurate identification of SAV is essential for effective monitoring and management efforts in the Mid-Atlantic region. In addition to the training you will receive, a variety of resources are available to help distinguish between SAV species. Field guides such as the "[Field Guide to Submerged Aquatic Vegetation of the Chesapeake Bay](#)" provide detailed descriptions, photographs, and identification keys for common species. Online tools like [Maryland's Dept. of Natural Resources, Eyes on the Bay: SAV Identification Key](#) use a dichotomous key for aiding in identifying SAV species. Utilizing these resources can help ensure accurate identification and better data collection in both freshwater and marine environments.

Data fields to be collected include:

1. **SAV Species Name:** Identifying the species present is critical for understanding the biodiversity and ecological function of the aquatic habitat. Each species of SAV plays a unique role in the ecosystem, providing habitat, stabilizing sediment, and contributing to nutrient cycling. The species composition can also be an indicator of water quality, as some species are more tolerant of pollution or low oxygen levels than others.
2. **Attachment Type:** Indicating how the SAV is being observed- whether rooted in place, freely floating, or entangled in wrack or debris- can help distinguish actively growing vegetation from detached within the study area.



3. **Flowers and/or Seeds:** Documenting the presence of flowers and seeds is essential for understanding the reproductive dynamics and timing of our SAV populations. These structures also serve as critical identifiers for distinguishing between species, aiding in accurate identification.
4. **SAV Photos Taken:** Documenting photographs taken of SAV specimens provide essential visual documentation to support accurate species identification and data verification. Standardized photo practices, such as those laid out in Appendix C, ensure consistency across observations and allow experts to confirm identifications if needed. These images strengthen data quality and create a visual archive for future reference and training.
5. **Plant length:** Measuring plant length helps track SAV growth and above-ground biomass. Variations in length can help track growth and health over time.
6. **Leaf Coverage:** Documenting the condition of the SAV plant surface (leaves, blades, stems, etc.) helps identify potential stressors that may affect plant health and function. When sediment, algae, or other materials accumulate on the plant, it can reduce light availability and limit photosynthesis.
7. **Sampling Point Notes:** This section provides an opportunity to document additional observations that could impact the interpretation of the survey results or aid future monitoring. Noting any disturbances (e.g., boating, construction, or fishing activity) is helpful.



Image 4. SAV Seekers examining plant specimens.

## Equipment and Materials

Here is a list of things to have on hand before you begin surveying. *Optional items are denoted with an asterisk (\*)*.

- Datasheet(s)
- Clipboard
- Pencil
- Camera/device with photo capabilities (underwater camera, if possible)
- Photo ID Card (laminated, if possible)
- Watch/time keeping device
- Smartphone (or device with internet access) or handheld GPS device
  - Survey123 application downloaded *\*if submitting data in-field*
- Secchi Disk\*
- Field/Identification Guide
- YSI or other handheld instrument(s) that measures environmental parameters (pH, temperature, Dissolved Oxygen, and/or salinity)\*
  - pH meter/tabs (pH)
  - thermometer (temperature)
  - refractometer (salinity)
- Foldable measuring stick\*
- Extendable rake\*
- Dry bag/ or waterproof bag to hold equipment
- Anchor or anchor pole for boating/kayaking surveys
- Meter tape\*



*If accessing the water via vessel, be sure to include proper safety equipment to your packing list (such as life jackets, etc.)*

## Protocol

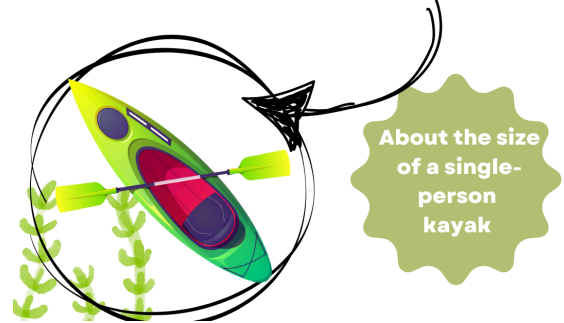
### *Step-by Step Guide to Sampling*

Take pages 19-25 with you while sampling.

Each survey should consist of a transect that is *no more than* 100 meters (328 ft) in length with 10 Sample Points. The transect should run parallel to the shoreline or follow the path of the river/stream. Each Sample Point is a 3 m (10 ft.) circle for which you are the center. This is the approximate length of a single person recreational kayak. For each Sample Point, GPS coordinates will be recorded for the center point of that circle where you are either standing, wading, or sitting in your kayak or small boat.

## METERS AND FEET CONVERSION

1 meter = 3.3 feet  
3 meters = ~10 feet

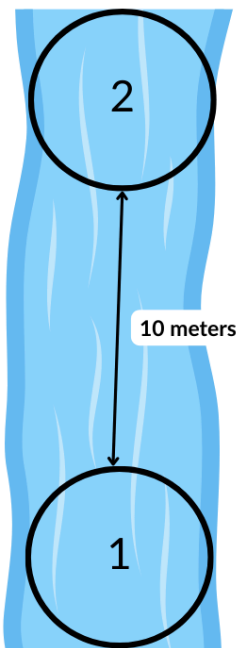


1. Gather your equipment - see "Equipment and Materials" checklist above
2. Prepare for data collection.
  - Digital collection: Start Survey123 application
  - Datasheet collection: Prepare datasheets for data collection
3. Complete the **Site Description** section:
  - **Date:** Record the date in DD/MM/YYYY format.
  - **Time Start:** Record the time you get in the water ready to begin.
  - **Recorder initials:** Record the initials of the person physically recording the data into the datasheet or online application.
  - **Organization:** Identify which organization you are working with for this effort.
  - **Monitoring Role:** Indicate if you are a trained SAV Seeker or Program Coordinator.
  - **Observer(s):** Record the full name(s) of the person(s) conducting the survey.
  - **Survey Type:** Indicate the method of survey (e.g., wading, kayaking, motorboat,).
  - **Waterbody Name:** Name of the river, stream, bay or pond you are sampling in.
  - **Waterbody Type:** Identify if you are sampling in tidal or non-tidal waters.
  - **Tide Stage:** Specify the tidal stage (e.g., ebb, low, slack, high, flood, N/A).
  - **Weather:** Select the weather at the time of sampling (e.g., sunny, cloudy, windy). Note any factors that may impact visibility or sampling quality.
  - **Precipitation Within 48-hours:** Note if there has been significant precipitation within the two days prior to sampling.
  - **Site Description:** Provide a brief description of the site, including notable features or landmarks (e.g., bridge crossings, shoreline type), describe starting and ending points, marine debris or site usage. An example description is "Brandywine Creek State Park, Thompson's Bridge parking lot path under bridge."
  - **Permission to Survey:** Indicate if you have permission to survey, or if you are on public lands. *If you are on private lands and indicate 'yes' you are required to have a completed copy of the permissions document in Appendix A, even if you are the landowner.*
4. Determine a randomly chosen point to begin surveying. All sample points are a 3 meter (10 feet) circle for which you are the center. Always document in your notes if spacing constraints prevent ideal distances and explain the reasoning. To select your starting point:

- **Narrow Streams** (Less than 3 meters/10 feet wide): If the stream or waterbody is narrower than 3 meters across, position yourself in the center of the stream. Make a note in your **Site Description** that the stream is narrow and your location represents the midpoint of the waterbody.
- **Wider Streams or Waterbodies** (greater than 3 meters/10 feet wide): ensure that your sampling point is *at least* 1.5 meters (5 ft) from the shoreline.
- **Group Sampling:** If you are working as part of a group, it is critical to avoid overlapping sample areas during a sampling event. Each participant should be spaced *at least* 3 meters (10 ft) apart to prevent duplicate data collection. A good rule of thumb is to maintain 3 meters of distance from each other in all directions, ensuring that each sample circle is distinct and non-overlapping. *Due to spacing limitations, group sampling multiple transects is not ideal for narrow streams <3 meters.*

### Narrow stream

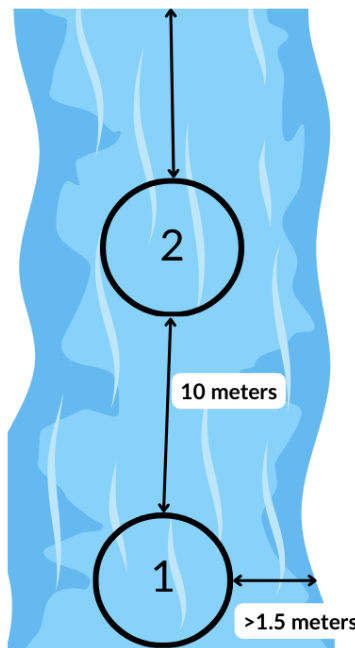
< 3 Meters wide



Centered in channel

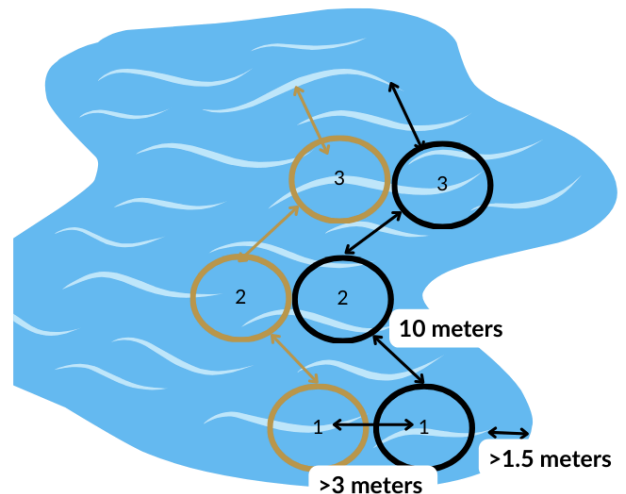
### Wide stream

> 3 Meters wide



### Open water




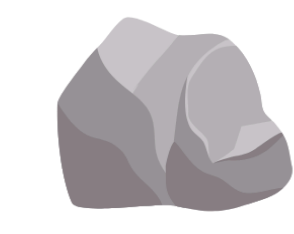
> 3 Meters wide



Group surveys need to be >3 meters from center to center

- Record the first sample for the **Habitat Characteristic** section *regardless if SAV is present or not*. This should be “point 1” on the datasheet.
  - **GPS Coordinates (Latitude and Longitude):** Point that marks your location along the transect. If using a smartphone’s mapping application (e.g., Google Maps or Apple Maps) or handheld GPS, set your point location record coordinates as latitude and longitude in decimal degrees (e.g., *Latitude 39.816800 and Longitude -75.569684*).
  - **Shoreline Type:** Identify the adjacent shoreline type. Observe the area where the land meets the water adjacent to your sample point and classify the shoreline type as either natural or armoured as highlighted in Appendix D. If the shoreline doesn’t clearly fit one category, choose the dominant type (over 60% coverage).

- **Signs of Erosion:** Indicate if the shoreline appears to be eroded or not. Observe the shoreline adjacent to your sample point and determine if signs of erosion (e.g., exposed roots, falling soil, sloughing vegetation) are present on at least 60% of the visible shoreline within your sample view. Reference Appendix D.
- **Sediment Type:** Indicate the dominant bottom sediment type. Observe the substrate at the sample point visually or pull a sample with your hand, oar, or other firm object. If the bottom is out of reach, you can examine the nearby area to gain insight on what the bottom type may be. Record the dominant sediment type at the site (area over 60% covered in this type).

Sediment Size Chart			
Silt	Sand	Pebble-Cobble	Boulder
< 0.05 mm	0.05 - 2.0mm	0.5cm-25cm	> 25cm
			
Smooth, muddy texture that can easily cloud water when disturbed.	Gritty texture, often found in areas with moderate water movement.	Rounded particles and larger stones often found in shallow, flowing water.	Largest stone, often found in the piedmont area of Delaware in faster waters.

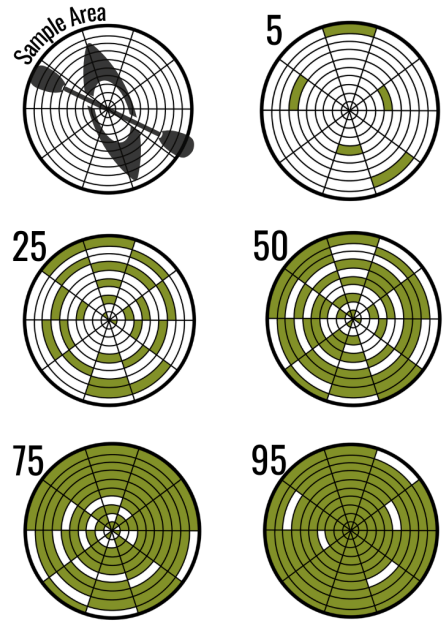
Graphic: Kayla Clauson, DE DNREC

- **Water Depth:** Measure and record the depth at site in centimeters (cm). Use a measuring stick, pre-measured rope, or an oar. Lower the instrument vertically into the water at the sampling point until it gently touches the substrate. Record the depth in centimeters (cm), avoiding pushing the equipment into soft sediment. If the depth varies within the sample area, pick a depth that is most representative.
- **Temperature\*:** Temperature reading from an instrument or thermometer in degrees Celsius. Submerge probe or thermometer below water's surface, ensuring it is fully submerged and not in contact with the bottom sediment. Wait for reading to stabilize, then record that value in degrees Celsius.
- **pH\*:** Reading from a pH instrument. Submerge equipment below water's surface, ensuring it is fully submerged and not in contact with the bottom sediment. Wait for reading to stabilize, then record that value.
- **Secchi Depth\*:** Use a Secchi disk to measure water transparency in centimeters (cm). Use a Secchi disk attached to a calibrated rope. Lower the disk into the water on the shady side of the vessel or sampling point to minimize glare. Gradually lower the disk until it is no longer

visible. Raise the disk slowly until it reappears and record the depth in centimeters. If the bottom is visible throughout, record the total water depth as the Secchi depth.

- **DO\***: Dissolved Oxygen from an instrument recorded in mg/L. Submerge probe below water's surface, ensuring it is fully submerged and not in contact with the bottom sediment. Wait for reading to stabilize, then record that value in mg/L (milligrams per liter).
- **Salinity\***: Salinity reading from an instrument in Parts Per Thousand (ppt)
  - If using meter: Submerge probe below water's surface, ensuring it is fully submerged and not in contact with the bottom sediment. Wait for reading to stabilize, then record that value in Parts Per Thousand (ppt).
  - If using a refractometer: place a few drops of sample on the prism, close the cover, point the prism towards the light, then read the scale.
- **Macroinvertebrates**: Document if macroinvertebrates are within the sample site. Visually inspect the SAV and the surrounding sediment and/or rocks for visible macroinvertebrates.
- **Macroinvertebrate Type**: Indicate the type of macroinvertebrate(s) observed.
- **Macroinvertebrates Photos Taken**: Indicate if photos were taken of any macroinvertebrates. Take photos on the designated Photo ID sheet.

## PERCENT COVER



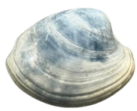
Graphic: Kavita Clauson, DE DNREC

# MACROINVERTEBRATES

Macroinvertebrates are aquatic animals without backbones that are large enough to see without a microscope.

## Bivalves

Bivalves are aquatic mollusks with two hinged shells that filter food from the water and often live on or in the bottom sediment.



Hard clam



Ribbed mussels



Invasive clam

Freshwater mussel



Oysters

Photo: Delaware Sea Grant

## Crustaceans

Shell-covered animals like crabs, shrimp, and amphipods that crawl, swim, or cling to SAV.



Crawfish



Amphipod



Grass shrimp

Photo courtesy of Astro/Naturalist CC BY-NC cropped and toned



Blue crab

## Insects

Includes aquatic insect larvae, worms, and snails that live in or around SAV beds and sediments.



Mayfly larvae

Photo: Brittany Sturgis, DE DNREC



Caddisfly larvae



Two freshwater snails

- **Macroalgae Presence:** Document if macroalgae is present in your sample area. Visually inspect the sample area for evidence of macroalgae, looking for filamentous, leafy, or mat-like structures.
  - **Macroalgae Percent Cover:** Indicate the overall percent cover of macroalgae present within the sample area. Reference the scale to guide your decision. Always underestimate your coverage if between two numbers.
  - **Macroalgae Photos Taken:** Indicate if photos were taken of any macroalgae.
  - **SAV Presence:** Document if SAV was or wasn't found in your sample area. Visually inspect the sample area for evidence of SAV. If unable to inspect the bottom, use an oar, throw rake, or firm object to feel along the bottom and pull anything that may be there up for observation. If there is SAV, indicate 'yes' and move on to the next section to record species information. If there is no SAV, indicate 'no', completing the sample site.
  - **SAV Percent Cover:** Indicate the overall bed coverage within the sample area. Assess the overall coverage of SAV in the sample area. Reference the scale to guide your decision. Always underestimate your coverage if between two numbers.
  - **SAV Area Photos:** Take photos of the overall assessment area if SAV is present. Indicate if photos were taken of any SAV. If you have SAV present, you should always take a photo of it.
6. If SAV is present, record your findings in the **SAV Species** section.
- **SAV Species:** Indicate what species are present. Record scientific name of plants. Reference Appendix E for a list of common and scientific names. Carefully observe the plants within the sample area. Use a field guide or identification key to distinguish species. If you cannot identify the species level, indicate the genus. If the species is unknown, indicate so. If more than 5 species are present, use the extra space on the back of the protocol.
  - **Attachment Type:** Indicate where the plants are being observed in the sampling area. You can select all applicable:
    - Rooted- attached directly to bottom
    - Floating- drifting on surface through sample site
    - Attached- stuck on a pile of debris
  - **Flowers and/or Seeds:** Identify if there are flowers and/or seeds present. Visually observe the bed and indicate if there are any observed flowers and/or seeds present.
  - **SAV Species Photos:** Take photos of each species being identified on the designated sheet. See *Step-by-step Guide to Photos* section and/or Appendix C for best photo practices.
  - **Plant Length\*:** Measure the length of each species in the sample area in centimeters (cm). Measure the length of each species from base

## Measuring Plant Length



Place measuring stick at base of plant and measure the tallest length of 10 different individual plants of each observable species.

to terminal end. Take 10 (ten) measurements total, each a different individual plant of the same species that is most representative of the bed. If there are not at least 10 in the sample area, take as many as available and make a note. Record measurements in centimeters (cm), avoiding plant removal if possible.

- **Leaf coverage:** Indicate if there is anything covering *at least* 25% of the leaves/blade surfaces. Look for sediment, epiphytes, or other. If multiple things are found covering the plant(s), select all that apply. *See image to the right for examples.*
- **Sampling Point Notes:** Record any other information about the SAV or site area that isn't captured in the survey but may be important.

7. After recording all applicable sections of the datasheet for this point, navigate 10 meters (33 feet) along your transect to the next point.
8. At your next sample site, repeat the steps outlined above to capture **Habitat Characteristics** and **SAV Species** Data, if applicable. This will be "point 2", and so on.
9. Repeat steps above along the transect until you've sampled 10 times. If you'd like to continue sampling, start a new datasheet or Survey123.
10. **Time End (Site Description):** Record the time when you are done sampling.
11. Submit your data according to the methods indicated by your Program Coordinator.

## Sediment on leaves



## Clear leaves



## Step-by-Step Guide to Photos

The SAV Seekers Photo ID Sheet is a standardized background for photographing SAV and associated organisms while sampling. It should be laminated or kept in a clear waterproof sleeve so that wet specimens can be placed directly on it while in the field. The light background and included ruler help provide clear, consistent images.

### How to Use the Photo ID Sheet

1. Ensure the sheet is laminated or in a protective clear sleeve (like a binder pocket).
2. Place the sheet on a flat, dry surface when possible. Preferably a clipboard.
3. Fill out header information with a grease pencil or dry erase marker:
  - a. Recorder initials
  - b. Organization
  - c. Date of the survey
4. Circle sample point number- this number will correspond to which point you are at along your transect (1-10).
5. Photo number- this number will correspond to the number order of images taken at this sample point. Each time you take a photo, you will change the photo number to match.
  - a. *Example:* You are at sample point number 3, you have two SAV species and one macroinvertebrate. Your photo sheet numbers will look like this:
    - Sample point 3, photo 1: SAV species 1
    - Sample point 3, photo 2: SAV species 2
    - Sample point 3, photo 3: Macroinvertebrate
6. Take the photo- lay specimen flat and straight as possible against the sheet, aligning along the ruler as best as possible.
  - a. If the plant is longer than the sheet, capture the most representative part of the plant, which is typically the upper (terminal) portion.
  - b. If flowers and/or seeds are present, take additional close-up photos.
  - c. try to capture leaf edges arrangement or other distinctive features.

### Tips for Quality Photos

1. Use natural light when possible and avoid heavy glare.
2. Make sure the specimen is not folded or tangled, laying it as flat as possible.
3. Keep hands, shadows and gear out of photos.
4. See Appendix C for more photo examples.

## Example Photo ID Card



### SAV Seekers Photo ID

Recorder Initials: K.C.

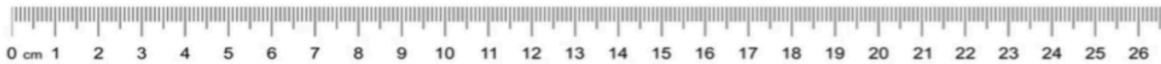
Organization: DESSAV

Date: 9/11/2025

Sampling Point: 1 2 **3** 4 5 6 7 8 9 10

Organism Name: CABOMBA CAROLINIANA

Photo #: 4



Place organism here and/ or ensure top portion is displayed in image.

### How to Name Your Photos

The Photo ID sheet should be utilized in photos with corresponding survey information on it. Due to possible limitations of having the information viewed at all times, there is a naming system in place to best organize and catalog all photos from survey efforts prior to submitting to your Program Coordinator. There are two possible ways to submit photos:

1. If using Survey123 in-field → photos uploaded directly and a unique identifier is automatically applied.
2. If using paper datasheets → send Program Coordinator datasheet and corresponding photo files with the naming convention.

Name any photos you submit with the following format →

RecorderInitials-Org-DDMMYYYY-SamplePoint#-Photo#.jpg

Example: KC-DESSAV-09012025-03-Photo2.jpg

This means:

- KC = Recorder initials
- DESSAV = Organization name
- 09012025 = Date (day-month-year) → September 1, 2025
- 03 = Sample point number
- Photo2 = Second photo taken at that site

## Step-by-Step Guide to Submitting Data

All field data collected by SAV Seekers must be entered into the online database. There are two approved pathways for data submission, and your Program Coordinator will guide you on which option to follow:

1. **Paper Datasheets:** If you record your data on paper in the field, you must scan or photograph your datasheets to submit to your Program Coordinator. Depending on your coordinator's process, they may either enter the data into the database on your behalf or direct you to transcribe your own datasheet entries into Survey123.
  - a. If submitting a paper datasheet, you will have to include any photos you take to your Program Coordinator following the naming system laid out in *How to Name your Photos*.
2. **In-field Application:** If you use the digital application on your smartphone or other device, your observations will be uploaded directly from the field.

It is ultimately up to your Program Coordinator how they will collect and have data input into the database. If you are unsure, confirm with your Program Coordinator.

### In-field Application (how to use app)

Think of Survey123 as a virtual datasheet. The online datasheet is formatted to collect the same information as the paper datasheets. You can download Survey123 to your device, or you can access it through a website. You will have the option to enter data either way when you go to the survey.



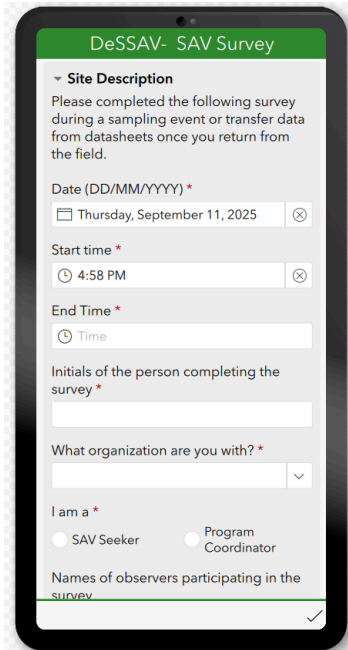
If you want to use the application, it is available in the Apple Store and in the Google Play Store – search for “ArcGIS Survey123” and select the application with this icon.

The survey will be publicly available, so a login isn't required, but you can get an ArcGIS Online account for free [here](#).

To access the survey, scan the QR code or follow the link. You will be given the choice to open the survey in your browser or in the Survey123 application.



<https://arcg.is/4iqn00>

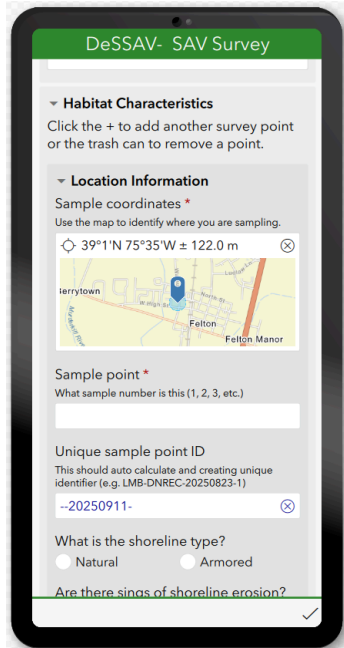


When you open the survey, you will see information to be completed. Many fields have options to select from so you do not have to manually type your answers. This helps standardize results and makes it quicker for the data collector to enter information. The survey is modeled after the datasheet, so sections and fields should match, but this survey is set up with conditional fields. That means you will see different questions depending on the answers you give. This makes the survey more efficient - only showing you the appropriate questions to complete. There are some required fields that are noted by a red asterisk (\*). You will not be able to submit the form if those fields are not completed.

The survey is broken out into two main sections:

**Site Description** - This is the general information about who is completing the survey, site conditions, weather, and site access permissions. Select the most appropriate answers and be sure to make notes or comments about conditions or the sample area.

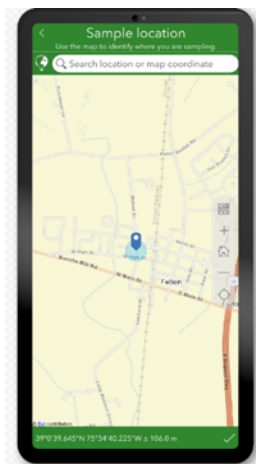
**Habitat Characteristics** - This is a repeating section so, everything needs to be completed for each sample site. Here you will collect coordinates, physical and chemical parameters about the area and the water, and information about any SAV that is found. It is important to remember if you don't see SAV, still complete this section - no SAV is still important data to collect!

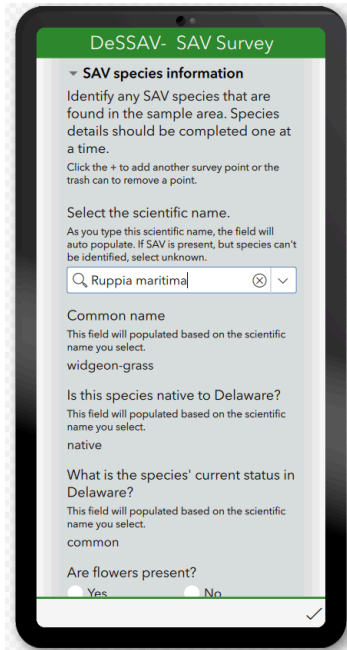


### Survey123 Tips

#### *Creating a sample point:*

*To enter your coordinates, tap/click on the map and it will open it full screen. You can pan around the map manually, enter an address, or enter coordinates to zoom to a spot. Once you are at your location, click the checkbox at the bottom and it will save your point and bring you back to the survey.*





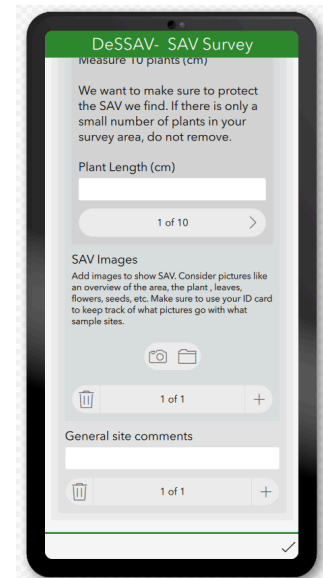
If you find SAV, you will enter species information within the **SAV species information** section. You will be able to enter details for multiple species one at a time. Start typing the scientific name and the survey will narrow down your options. If you are uncertain about the specific species, you can select the genera spp. or just choose unknown. Some of the information will automatically populate the form once you select the species.

Take up to 10 plant length measurements.

Survey123 Tips

*Uploading pictures:*

*You have the ability to upload pictures with your survey. Make sure you put the right pictures with the right species and use your ID card. Think about the pictures you are uploading. You want to make sure they show key features to help identify the species.*



Once you enter all of the information about an individual species, you can add another species or add your next survey point.

Survey123 Tips

*Adding a new point or species:*

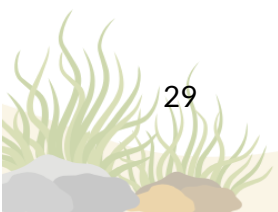
*This survey is designed to allow you to enter multiple survey points and species. Look for a plus (+) sign to add new information and look for a trash can to delete information if it shouldn't be there.*

If you have completed your survey, you can click/tap the check mark at the bottom of the survey to submit.

Survey123 Tips

*Submitting surveys:*

*If you haven't completed all "required" fields, you will not be able to submit your survey. Go back and review your form and complete all required fields.*



## Appendix A Permission to Collect SAV Data on Private Property

The Delaware Statewide Submerged Aquatic Vegetation Workgroup (“DeSSAV”) coordinates the SAV Seekers Volunteer Monitoring Program to document the presence, abundance, and health of submerged aquatic vegetation (SAV) in Delaware waterways. The data collected is shared publicly to inform SAV restoration and management practices. Surveys that occur on private property, including private subaqueous lands where rooted vegetation occurs requires permission to collect data. Permission is not required when surveys occur on public subaqueous lands.

### Permission:

I, \_\_\_\_\_ (First and Last Name), the undersigned property owner or authorized representative, hereby grant permission to the SAV Seekers Volunteer Monitoring Program to survey my property located at (Property Address or Parcel Number(s)):

\_\_\_\_\_  
\_\_\_\_\_

for the \_\_\_\_\_ (Year) season(s) and publicly share SAV data collected.

This permission is granted for the purpose of SAV monitoring activities, which may include, but is not limited to visual surveys, photographic documentation, water quality measurements, and non-destructive SAV sampling. Data collected will be stored in an online Delaware Department of Natural Resources and Environmental Control (DNREC) maintained geographic information system (GIS) database. Publicly available datasets will contain SAV Seeker survey information only and will not include sensitive details such as property ownership.

### Acknowledgment:

I understand the scope and purpose of this access and data collection, and I grant permission for SAV monitoring and data sharing activities as described.

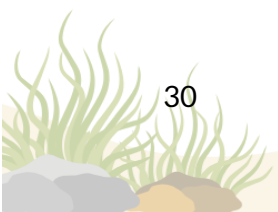
### Property Owner/Representative:

Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

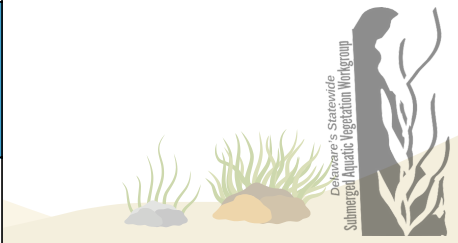
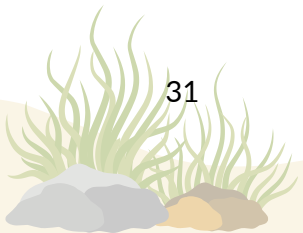
For questions, please contact the Delaware Statewide SAV Workgroup at [Dessav.workgroup@gmail.com](mailto:Dessav.workgroup@gmail.com)



# Appendix B Salinity Table

Species	Diversity			
	Tidal Fresh (0-0.5 ppt)	Oligohaline (0.5-5 ppt)	Mesohaline (5-18 ppt)	Polyhaline (18-30 ppt)
Eelgrass ( <i>Zostera marina</i> )				X
Sago Pondweed ( <i>Stuckenia peckinata</i> )		X	X	X
Widgeon grass ( <i>Ruppia maritima</i> )		X	X	X
Horned Pondweed ( <i>Zannichellia palustris</i> )		X	X	X
Redhead grass ( <i>Potamogeton perfoliatus</i> )		X	X	X
Coontail ( <i>Ceratophyllum demersum</i> )		X	X	
Canadian waterweed ( <i>Elodea canadensis</i> )		X	X	
Curly pondweed ( <i>Potamogeton crispus</i> )		X	X	
Water stargrass ( <i>Heteranthera dubia</i> )		X	X	
Tapegrass ( <i>Vallisneria spiralis</i> )	X			

Graphic: Kayla Clauson (DNREC), Integration and Application Network ([ian.umces.edu/media-library](http://ian.umces.edu/media-library))



## Appendix C Best Photo Practices



Close up of flower



Leaf arrangement against ruler



Close up of turion



Visible leaf morphology against ruler



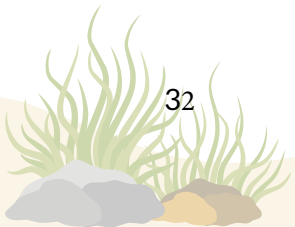
Close up of leaf detail against ruler



Leaf edges in detail



Flower stems and stipules close up



## Appendix D Shoreline Type Examples

### EROSION

An eroded shoreline shows signs of land loss, such as exposed roots, undercut banks, or collapsed sections of soil.



Eroded marsh



Eroded marsh

### ARMORED SHORLINES



Rip-rap/Rock walls



Bulkhead

### NATURAL SHORELINES



Marsh



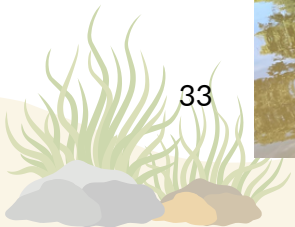
Sandy beach



Wetland



Forested



## Appendix E Common and Scientific SAV Names

Scientific Name	Common Name
<i>Cabomba caroliniana</i>	carolina fanwort
<i>Callitriche heterophylla</i>	large water-starwort
<i>Ceratophyllum demersum</i>	coontail
<i>Elodea</i> spp.	unknown waterweed
<i>Egeria densa</i>	Brazilian waterweed
<i>Elodea canadensis</i>	broad-leaved waterweed
<i>Elodea nuttallii</i>	nuttall's waterweed
<i>Heteranthera dubia</i>	grassleaf mud-plantain
<i>Hydrilla verticillata</i>	hydrilla
<i>Myriophyllum</i> spp.	unknown milfoil
<i>Myriophyllum aquaticum</i>	parrot's-feather
<i>Myriophyllum heterophyllum</i>	broadleaf water-milfoil
<i>Myriophyllum spicatum</i>	eurasian water-milfoil
<i>Najas</i> spp.	unknown naiad
<i>Najas canadensis</i>	slender naiad
<i>Najas gracillima</i>	thread-like naiad
<i>Najas guadalupensis</i>	Southern naiad
<i>Najas minor</i>	brittle naiad

Scientific Name	Common Name
<i>Potamogeton</i> spp.	unknown pondweed
<i>Potamogeton berchtoldi</i>	slender pondweed
<i>Potamogeton crispus</i>	curly pondweed
<i>Potamogeton diversifolius</i>	water-thread pondweed
<i>Potamogeton epihydrus</i>	nuttall's pondweed
<i>Potamogeton foliosus</i>	leafy pondweed
<i>Potamogeton natans</i>	floating pondweed
<i>Potamogeton nodosus</i>	longleaf pondweed
<i>Potamogeton perfoliatus</i>	clasping-leaf pondweed
<i>Potamogeton pulcher</i>	spotted pondweed
<i>Potamogeton robbinsii</i>	flatleaf pondweed
<i>Ruppia maritima</i>	widgeon-grass
<i>Stuckenia pectinata</i>	Sago pondweed
<i>Vallisneria americana</i>	tape-grass
<i>Zannichellia palustris</i>	horned pondweed
<i>Zostera marina</i> var. <i>stenophylla</i>	eel-grass
Unknown spp.	unknown species



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