



# Exploring Community Science in Mallows Bay-Potomac River National Marine Sanctuary

## Lesson Specifications

### Age

8-12

### Timeframe

One 45-minute classroom session  
One 90-minute pool mission

### Materials

#### Lesson:

- Computer w/ internet
- Projector
- Paper for students

#### Scuba:

- All required scuba gear
- Mesh bags per student
- Materials to set up obstacle course
- Non-glass bottles with lids (min 3 per student)

### Key Words

community science, dive briefing, submerged aquatic vegetation

### Standards

PADI, SSI, NAUI, Ocean Literacy Principle 6, Climate Literacy Principle 6



The remains of wooden steamships known as the Ghost Fleet can be found throughout Mallows Bay-Potomac River National Marine Sanctuary. Photo: Matt McIntosh/NOAA

## Activity Summary

This lesson introduces students to Mallows Bay-Potomac River National Marine Sanctuary and the important resources it protects. Students plan a dive briefing for a simulated dive in the sanctuary. Students practice buoyancy control, awareness of their environment, buddy, and dive group, as well as air management during the pool mission that requires them to brief and guide a dive through a buoyancy control obstacle course.

## Learning Objectives

Students will be able to:

- Explain the importance of Mallows Bay-Potomac River National Marine Sanctuary using examples.
- Explain the importance of submerged aquatic vegetation (SAV).
- Explain how sediment pollution affects SAV.
- Give an example of how scientists and community divers work together to collect data used to protect our environment.
- Deliver an appropriate dive briefing.



Mallows Bay provides a valuable habitat for a variety of species. Photo: David J. Ruck/NOAA

## Essential Questions

1. What are national marine sanctuaries and why are they important?
2. What important resources are protected by Malloys Bay-Potomac River National Marine Sanctuary?

3. What is submerged aquatic vegetation (SAV), why is it important, how is it impacted by pollution, and how is it monitored?

## National Marine Sanctuary Diver Performance Requirements

At the surface, students will:

- Streamline gear prior to entry.
- Perform a comprehensive buddy check.
- Review necessary hand signals.
- Establish an air management plan.
- Perform a weight check and adjust weighting as necessary.
- Deliver a dive briefing with all required elements.

Underwater, students will:

- Demonstrate proper descent techniques and awareness of the environment.
- Demonstrate proper buddy awareness and air management.
- Demonstrate appropriate use of hand signals.
- Demonstrate appropriate buoyancy control.
- Maintain group control and safety while guiding a dive and collecting simulated SAV samples.



A map of the National Marine Sanctuary System in the U.S. and its territories.

## Background Information

### Mallows Bay-Potomac River National Marine Sanctuary

NOAA's Office of National Marine Sanctuaries serves as the trustee for a network of underwater areas encompassing more than 620,000 square miles of marine and Great Lakes waters. The network includes a system of national marine sanctuaries and Papahānaumokuākea and Rose Atoll marine national monuments. Few places on the planet can compete with the diversity of the National Marine Sanctuary System, which protects America's most iconic natural and cultural marine resources. The system works with diverse partners, treaty holders, and stakeholders to promote responsible, sustainable ocean uses that ensure the health of our most valued ocean places. Healthy aquatic ecosystems, whether fresh, brackish, or marine, are the basis for thriving recreation, tourism, and commercial activities that drive coastal economies.

Mallows Bay-Potomac River National Marine Sanctuary was designated in 2019 and is the first marine sanctuary in the state of Maryland. Located approximately 30 miles south of Washington, D.C. on the Potomac River, the sanctuary protects a diverse collection of shipwrecks and habitats for hundreds of estuary species including birds, aquatic mammals, and invertebrates. The sanctuary is also a popular recreation area, renowned for its paddling and fishing. Visitors cannot help but be impressed by the collection of nearly 200 historic shipwrecks, some dating back to the Revolutionary War, and the remains of the largest assemblage of World War I wooden steamships known as the famed "Ghost Fleet." These ships were commissioned by President Woodrow Wilson in 1917 as part of the U.S. Emergency Fleet during World War I.

Beyond the Ghost Fleet, this section of the Potomac River also forms part of the traditional homeland and cultural landscape of the Piscataway Conoy Confederacy and Sub-Tribes and the Piscataway Indian Nation of Maryland, as well as the Patowomeck Indian Tribe of Virginia. Evidence of their occupation is provided through both archaeological investigations and cultural traditions of the Piscataway people indicating that the tribes occupied this area of the Potomac for thousands of years. During that time, the waters of Mallows Bay were unspoiled and held an abundance of fish and other marine life that supported the tribes, as well as wildlife on land and in the air. Over time, development, pollution, and other human impacts have affected the water quality, habitats, and wildlife at Mallows Bay. The abundance of submerged aquatic vegetation (SAV) acts as one indicator of ecosystem health. With the efforts of community scientists, NOAA, and the tribes, Mallows Bay is being monitored and the data will help to ensure the bay remains healthy for future generations to enjoy.

The sanctuary is a low salinity (brackish) embayment located on the Potomac River. The Potomac and its tributaries comprise the second largest watershed to drain into the Chesapeake Bay, one of the world's most productive estuaries and home to thousands of species. Freshwater from the Potomac,



A map of Mallows Bay-Potomac River National Marine Sanctuary the location and proximity of Washington D.C. Image: NOAA

including Mallows Bay and its tributaries, mixes with saltwater from the ocean resulting in the brackish water of the Chesapeake.



Drone footage shows ship hulls in shallow water with vegetation growing from them. Photo: Kevin Olson/NOAA

### What is SAV, Why is It Important, and How Can It Be Conserved?

Submerged aquatic vegetation provides many important ecosystem services. It provides habitat for commercially important species like blue crabs and striped bass, is a form of “blue carbon,” and helps to buffer the pH (the acidity or basicity) of estuary waters. Additionally, SAV protects shorelines from erosion and captures suspended sediment. These ecosystem services are especially important as the human population continues to grow and the impacts of climate change increase.



Submerged aquatic vegetation provides ecosystem services. Photo: Will Chesapeake Bay Program

SAV are important sentinel species as they are sensitive to changes in water quality. Approximately 90% of the historical extent of SAV in the Chesapeake disappeared around the mid-1900’s as a result of poor water quality, including sediment pollution. Sediment in runoff can increase turbidity, which can block the light SAV need to grow.

Recent conservation efforts in the Chesapeake Bay focus on reducing sediment pollution and helping SAV reestablish in areas within its historic range. The National Marine Sanctuary Foundation partners with the Maryland Department of Natural Resources to maintain a real-time water quality and weather monitoring buoy adjacent to Mallows Bay in the Potomac River. The data provided by this buoy is an important tool in planning and assessing conservation efforts within the sanctuary.



Drone footage shows the tributaries that feed into Mallow's Bay-Potomac River National Marine Sanctuary. Photo: Kevin Olson/NOAA

### Contributions of Community Science

Community science, public participation in scientific research, is gaining in popularity. Community scientists are trained in data collection methods. The data they collect are available to researchers trying to answer real-world questions. To survey SAV, the shipwrecks, or other variables that help to monitor the health of Mallow's Bay-Potomac River National Marine Sanctuary, it takes both community divers and scientists. NOAA depends upon volunteer organizations to collect this important data.

In the fall of 2022, a volunteer diving team of special operations veterans with the non-profit organization Force Blue conducted a SAV survey in Mallow's Bay-Potomac River National Marine Sanctuary. The survey was completed in collaboration with Maryland Department of Natural Resources and Charles County Government who manages the park that offers access to the sanctuary.

Most of the sanctuary is very shallow. As a result, many SAV surveys can be conducted visually from kayaks or by drones. Historically, aerial images were used to conduct SAV surveys along both the Maryland and Virginia shorelines of the sanctuary. The information gathered through aerial observations or even by kayak is limited. Therefore, having community divers conduct a SAV survey of the sanctuary provided a deeper understanding of the depth of SAV growth and identified the types of SAV in the sanctuary. This information is vital to scientists as they determine the health of the sanctuary over time.



Volunteers from Force Blue completed a SAV survey in Mallows Bay. Photo: Megan Osserman/NOAA

<b>Vocabulary</b>	
blue carbon	carbon captured and stored by marine and coastal ecosystems thus mitigating some impacts of climate change
community science	public participation in scientific research; sometimes also referred to as citizen science
ecosystem services	benefits to humans provided by healthy ecosystem function
estuary	a body of brackish water located where a river meets the sea
sediment pollution	excess soil particles in the water resulting from runoff; most sediment pollution occurs from accelerated human land-use activities like construction
sentinel species	organisms monitored as indicators of ecosystem health
submerged aquatic vegetation (SAV)	rooted aquatic plants that grow completely underwater
turbidity	measure of particles suspended or dissolved in water
watershed	an area of land that channels rainfall, snowmelt, and runoff into a common body of water

## Preparation – Classroom

Review slide deck. Be aware of important information, as well as suggestions for instruction, located in slide notes.

Familiarize yourself with how to manipulate the [Eyes on the Bay](#) data interface in order to help students gain environmental data for their dive briefing.

## **Procedure**

### ***Introduction***

Follow the prompts in the slide deck notes to introduce the following concepts:

- What are national marine sanctuaries and why are they important?
- Where is Mallows Bay-Potomac River National Marine Sanctuary and what resources does it protect?
- What is SAV and why is it important?
- What is sediment pollution and how can it affect SAV?
- How do scientists and community divers work together to conserve our environment?
- What are the most important components of a dive briefing?

### ***Activity***

1. Discuss the important parts of a dive briefing.
2. Give students time to outline their dive briefing and discuss it with a partner in order to gain feedback.
3. Allow students time to practice their dive briefing prior to delivering it to the whole group.

### ***Debrief***

Discuss the activity using the questions below. These questions are also included in the slide deck. Accept all reasoned responses. Some possible responses are in italics.

- What are three components of a dive briefing? *A good dive briefing describes the site, outlines the dive plan, and includes how the dive will be organized.*
- Why is a dive briefing important? *A dive briefing is important for safety, which should always be the number one priority of any dive.*

## **Preparation – Pool Mission**

Use easily located materials (e.g., hula-hoops) to set up a buoyancy control course as is often used in confined water for buoyancy control specialties.

Add simulated submerged aquatic vegetation (SAV), i.e., water bottles filled with variable amounts of water to ensure they float at various depths in the pool. Instruct students that they are to collect a specified number of SAV samples as they navigate the buoyancy course. This is similar to the data collection performed by community divers in Mallows Bay-Potomac River National Marine Sanctuary.

## Procedure

1. Explain the different aspects of the buoyancy course and the simulated SAV survey.
2. Give each student time to brief and guide divers through the course.

### **Dive Briefing**

- Explain the simulation procedure and objectives. Emphasize the importance of safety (air and buddy checks) and good buoyancy control. These objectives are more important than the objective of the simulation.
- Prior to entry, perform all standard safety and weight checks.

### **Dive**

Participate in the dive mission as described above.

### **Debrief**

Upon completion of the pool mission, assess student understanding by asking the following questions. Accept all reasoned answers:

- What was one part of your dive brief that you felt went well? What is one area you feel you could improve?
- How well did you pay attention to your dive group? Why do you feel this way?

Education Standards	
Dive Industry Standards	PADI Seal Team SSI Scuba Ranger NAUI Junior Scuba Diver or Passport Diver
Ocean Literacy Principles	#6: The ocean and humans are inextricably interconnected. (a,b,c,d,f,g)
Climate Literacy Principles	#6: Human activities impact the climate system.

## Additional Resources

Linked Resources:

- [Explore the Blue: 360° Mallows Ghost Fleet](#)
- [Volunteering with NOAA](#)
- [Mallows Bay Aerial Footage](#)
- [Eyes on the Bay Charts and Data Summary](#)

NOAA's Office of National Marine Sanctuaries <http://sanctuaries.noaa.gov/>

Mallows Bay - Potomac River National Marine Sanctuary  
<https://sanctuaries.noaa.gov/mallows-potomac/>



Ocean Literacy Principles <http://oceanliteracy.wp2.coexploration.org/>

Ocean Guardians Dive Club Lessons  
Additional lessons available.

[https://sanctuaries.noaa.gov/education/ocean\\_guardian/dive-club/](https://sanctuaries.noaa.gov/education/ocean_guardian/dive-club/)

Citizen Science at NOAA <https://oceanservice.noaa.gov/citizen-science/>

Force Blue <https://forceblueteam.org/>

Submerged Aquatic Vegetation <https://www.fisheries.noaa.gov/feature-story/submerged-aquatic-vegetation-habitat-worth-sav-ing>

Additional Educational Materials:

Water Quality Monitoring in Mallow's Bay-Potomac River National Marine Sanctuary

<https://nmssanctuaries.blob.core.windows.net/sanctuaries-prod/media/docs/20220819-mallow-bay-sav-ing-ecosystem-functioning-lesson.pdf>

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## For More Information

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