

Sailing with STEAM

SCIENCE, TECHNOLOGY, ENGINEERING, ART AND MATH AT SEA

Grades 6-12

Every sail on the Gundalow incorporates elements of STEAM into the program, but our Sailing with STEAM sails challenge students to go deeper with additional learning opportunities in engineering, math, technology, art or science. During each 2.5-hour sail, teachers select from a variety of STEAM learning stations that help connect the classroom curriculum to the experience out on the water.

The gundalow, *Piscataqua*, serves as a unique floating classroom and lab, sailing on the tidal waters of New Hampshire and southern Maine. Our Sailing with STEAM Sails use hands on and inquiry-based learning strategies to engage students. Our STEAM station options include: learning to navigate and use a compass, exploring marine life through a plankton tow and touch tank, using our 3D watershed model to talk about human impact on the watershed, testing water quality with a variety of oceanographic tools, looking at examples of engineering and simple machines onboard, calculating cargo capacity and speed, and using your senses for drawing.

Frameworks, Standards and Principles

Human Impact on the Watershed: Students use our 3D watershed model to explore how our actions on land impact the watershed and river on which we sail

Next Generation Science Standards

- 4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.
- 4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
- 5-ESS2-2. Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.
- 5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment
- MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
- MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment
- HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Marine Food Chain: Using a plankton net, student engage in a 5-minute tow to collect plankton. After looking at the plankton under magnification, students, student work their way up the food chain by looking at various filter feeders and eventually a lobster.

Next Generation Science Standards

- 5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.
- 5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
- MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
- HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

NH Frameworks: Social Studies

- SS:GE:4:3.1: Illustrate the components of Earth's physical systems, e.g., a climate or a model of the water cycle.
- SS:GE:4:3.5: Investigate how humans interact with ecosystems
- SS:GE:4:5.1: Illustrate how people modify the physical environment
- SS:GE:6:3.4: Explain how human activities influence changes in ecosystems

Estuary Literacy

- Principle 2 Estuaries are dynamic ecosystems with tremendous variability within and between them in physical, chemical, and biological components.
- Principle 3 Estuaries support an abundance of life, and a diversity of habitat types

Ocean Literacy

- Principle 5: The ocean supports a great diversity of life and ecosystems.

Sense of Place: During the sense of place station, students work with a nautical chart, compasses, binoculars, and other tools to determine their location. Based on students interest, the crew will discuss the history or ecology of the region through which we are sailing.

NH Frameworks: Social Studies

- SS:GE:6:1.2: Apply the spatial concepts of location, distance, direction, scale, movement, and region,
- **SS:GE:12: Places and Regions Students will demonstrate an understanding of the physical and human geographic features that define places and regions as well as how culture and experience influence people's perceptions of places and regions.**
 - SS:GE:12:2.2: Investigate how relationships between humans and the physical environment lead to the formation of ‘place,’”

Ocean Literacy

- Principle 6: The ocean and humans are inextricably interconnected.

Water Quality: Using oceanographic sampling tools, students explore the various qualities of the river water. Students will test for temperature, salinity, dissolved oxygen, pH, and potentially nitrates and turbidity.

Next Generation Science Standards

- MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

NH Frameworks Social Studies

- SS:GE:4:5.1: Illustrate how people modify the physical environment

Math on the Gundalow: During this station, students use real world math skills to determine the cargo capacity of the Gundalow. Additionally, students can calculate depth and speed through the water.

Engineering: The Gundalow is an excellent example of engineering principles at work. Students will identify different examples of engineering on the vessel and use a block and tackle to discover mechanical advantage (this can also be added as a 4th abbreviated station based on teacher’s interest)

Next Generation Science Standards

- 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost
- MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

Art on the Water: Look closely at the Gundalow, not as a whole, but as a sum of lots of parts. During this station, students are given time to make observations and sketch what they see with an emphasis on shading and seeing simple shapes and small details.

Otter Trawl: (optional group activity) For interested groups that are sailing in Great Bay or other small rivers, we are happy to substitute a group activity with our otter trawl. Discover what's on the bottom of our rivers.

Estuary Literacy

- Principle 2: Estuaries are dynamic ecosystems with tremendous variability within and between them in physical, chemical, and biological components.
- Principle 3: Estuaries support an abundance of life, and a diversity of habitat types