

◆ Exploring Underwater Habitats ◆

Grade Level: 8th-12th

Length of Lesson: Three 45-minute class periods

Goals:

- Make a hydrophone and modify ROV to attach the hydrophone
- Use the hydrophone in conjunction with underwater camera on the ROV
- Explore and monitor local aquatic habitats

National Science Standards:

- LS1.C: Organization of Matter and Energy Flow in Organisms
- LS2.A: Interdependent Relationships in Ecosystems
- LS2.B: Matter and Energy Transfer in Ecosystems
- ESS2.A: Earth Materials and Systems
- ESS3.A: Natural Resources
- ESS3.B: Natural Hazards
- ESS3.C: Human Impacts on Earth Systems
- PS4.A: Wave Properties
- PS4.C: Information Technologies and Instrumentation
- ETS1.A: Defining and Delimiting an Engineering Problem
- ETS1.B: Developing Possible Solutions

Materials:

- SeaPerch ROV with attached underwater camera, and connected monitor
- Hydrophone materials:
 - Condenser microphone element
 - #24 audio cable, 25 feet
 - 1/8" mono phone plug
 - Mini audio amplifier/speaker
 - Rubber electrical (not PVC) tape
 - Battery holder (fits "C" cell)
 - Alkaline "C" cell battery
 - #24 insulated wire, 1 ft. each of orange, white, and blue
 - 35mm plastic film canister
 - Vegetable or mineral oil
 - 9v battery
 - Soldering iron and solder
 - Wire stripper
 - Silicone seal

Background

It was once thought that the ocean was a silent place. However, if you were to drop a hydrophone or other underwater microphone into the water, you would find that, quite the opposite, the ocean is an incredibly noisy place. Sound travels well in the water, so even small noises can be transferred for quite a distance.

A hydrophone picks up acoustic signals from under the water and transfers them to a receiver above water, allowing you to hear them. Scientists use hydrophones to listen to sounds from all types of marine animals, from mammals such as seals and whales, to fish and sharks, to invertebrates. Sound is a universally important sense for all animals – it is the first alert of danger. Even when an animal’s eyes are focused in one direction, the animal can still hear sounds from all directions. While sound is important for all animals, it is especially emphasized underwater because of the properties that carry sound further than in air.

While light travels better in air than in water, because in water it is quickly scattered and absorbed, sound travels better in water than in air. Some underwater sounds, such as a whale’s call, can travel for several miles! One way that marine animals can navigate their surroundings using sound is to use a feature called echolocation or biosonar – similar to the sonar that naval vessels use to detect submarines or other underwater objects. The animal produces a series of clicks – short pulses of sound – and then listens to the echo. The animal can tell from the echo whether the sound waves have bounced off of an object or not, and can even distinguish different sizes, shapes, and movement of objects. Toothed whales, including dolphins, orcas, porpoises, and sperm whales, use this echolocation to navigate and to find food.

Fish and invertebrates also rely heavily on sound. They use grunts, clicks, croaks, and snaps for many purposes, including attracting a mate and scaring off potential predators. As you can see, sound is very important in the marine environment, and scientists can learn a lot about animals and how they use this important sense by listening to the sounds they make.

Lesson: LAUNCH

1. Follow the instructions (with pictures of each step) at [this website](#) to construct a hydrophone.
2. Attach the hydrophone to your SeaPerch ROV in a secure place.
3. Run the wire from your hydrophone with the tether from your ROV. Attach the two wires together periodically to keep it neat and prevent tangling.
4. Test your SeaPerch with the hydrophone attached in a container of water or pool. Ensure that the hydrophone works correctly – if you snap your fingers underwater, does the hydrophone pick up the noise?

Lesson: INVESTIGATE

1. Take the SeaPerch ROV to a local water source, such as a pond, lake, river, etc.
2. Launch the SeaPerch into the water and use the hydrophone and camera to observe the local population.
3. While you are observing, think about these questions:
 - a. Where do you find the most organisms? (*Hint: look around pilings, docks, and other vertical objects*)
 - b. Are the places where you visually see more organisms necessarily the places where you hear the most sounds?
 - c. Can you distinguish which organisms make which sounds? What types of animals are the noisiest?
4. Record your observations.

Lesson: PRACTICE

1. When you return to the classroom, compare observations. Did the organisms act the way you expected them to?
2. Try to identify organisms you saw or heard. How many species did you observe?
3. (Optional) Write a formal report about your observations.

