MYSTIC SEAPORT THE MUSEUM OF AMERICA AND THE SEA TM

Mystic Seaport for Educators
Science on the 38th Voyage of the *Charles W. Morgan*
Lesson 2 of 6: Eavesdropping on Echolocation
Teacher Worksheet

Name:_____

Questions:

1. Listen to the following recordings. List the source and describe what you hear.

	Source	Description of Sound
1		
2		
3		

2. Whales use sound for hunting, communication, and navigation. In fact, some scientists believe that noise-detection is much more developed in marine mammals than in humans. Why might sound, rather than visual cues, be a particularly important sense in the underwater environment? *This question addresses MS-PS4-3: Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.*

Students should note that visibility tends to be unreliable underwater, particularly considering the vast depths and distances over which organisms travel and communicate. At the very least, students will also understand that water provides a consistent medium through which sound can travel. More advanced students may also recognize that sound can travel farther and faster in water than in air through the SOFAR channel.

3. The horizontal layer in the ocean known as the SOFAR channel allows sound to travel for thousands of miles. Why might whales need to send signals over this distance? *This question addresses MS-PS4-3: Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.*

Potential reasons may include finding different species of prey, navigating, and communicating within their own species or to specific individuals.

4. In 2010, an article was published at Cornell University with the title "*Acoustic Maps of Ocean Noise Reveal How Shipping Traffic Affects Whales."* Think about this title. How might shipping noise affect whale behavior? Why? *This question addresses MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.*

Students should begin to recognize that there are a variety of anthropogenic noises in the ocean in addition to signals transmitted from marine organisms. The most complete answer to this question will consider the first part of the title and infer that shipping noise can interfere with echolocation. Students should consider the effects of this interference, including loss of direction, inability to find prey, and inability to communicate with other species. Incorrect answers may consider only the physical effects of shipping, including impeding whale migration and movement patterns, ignoring the title's emphasis on acoustic mapping.

5. Now that you have a greater understanding of whale communication and noise pollution, consider other anthropogenic (man-made) noise in the ocean. *This question addresses MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems; and MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.*

    a. Besides shipping, what might be the sources of this other anthropogenic noise?

Other sources of anthropogenic noise in the ocean may include submarines, research vessels, and oil rigs. Smaller sources of noise, such as those produced by an individual human, have a relatively minimal effect on echolocation

    b. How will a rise in human population affect the level of noise in this environment?

Students are expected to infer that a rise in human population will result in a greater amount of ocean usage. More advanced students may recognize that a population increase will also force humans to seek a greater number of resources from the ocean

    c. Choose one source of "noise pollution", and design a method for lessening this pollution in the future.

Answers will vary depending on which source of noise pollution the student chooses to examine. Potential methods for minimizing noise pollution may include the following: creating a “noise budget” to limit the amount of anthropogenic noise entering the ocean, sequestering noise-producing technology to certain areas of the ocean, continuing to monitor whale populations to determine which noises produce behavioral change, and/or continuing to seek resources elsewhere.