**Overview**

Do the benefits of using sonar outweigh the costs? As *Sea of Sound* explains, the U.S. Navy uses sonar as part of their operations. However, organizations such as the National Resources Defense Council and The Humane Society argue that sonar use is detrimental to some marine organisms.

**Learning Objectives**

Students will:

- know what sonar is, how humans use it in the ocean, and what impacts it may have on marine mammals.
- understand that there are significant arguments about the value and use of sonar in the ocean.
- use facts and data to support their arguments and conclusions about sonar use in the oceans.

**Activity Overview**

- Students watch *Sea of Sound* video.
- Students do research and prepare their “arguments”.
- Students hold in class debate.
- Students write opinion papers using arguments and evidence from class hearing.

**Prior knowledge**

Before beginning this set of activities, students should have general background knowledge on the following:

- **Sonar**: a system for measuring or detecting underwater objects using sound waves. When sounds are transmitted and the reflected signals are measured, this is called Active Sonar. In contrast, Passive Sonar systems are listen only.
- **Masking**: when one sound covers makes it more difficult to hear another sound.
- **Stranding**: when a marine mammal, like a dolphin, washes up on a beach, either dead or alive.
Student Debate on the Use of Sonar

- **Cetacean:** large aquatic mammal with no hind limbs (ex: whales, porpoises, narwhals) commonly “whales and dolphins.”
- **NGO:** a non-governmental, not-for-profit organization, like the Nature Conservancy or the Humane Society.

**Teaching Tips**

- There are many successful formats for in-class debates. Two that would work well are:
  - Opposing counsel: set up the debate like a courtroom with a judge (likely you) who moderates the proceedings. Under this model you can appoint lead counsel for each side, whose job is to coordinate the arguments. This model can include opening and closing arguments.
  - Open forum: you open the debate by asking the question and then let student momentum carry it from there. A score-sheet is useful to keep track of which students have commented, and how compelling, well argued, and evidence-based their arguments have been.
- Evaluation: Students write a short opinion paper after the debate, synthesizing facts and arguments and presenting their own reasoned, well-supported opinions. This is an opportunity to emphasize the use of evidence and data in supporting argument.

**Resources and Extension Activities**

- DOSITS “Thinking Inside the Box” Activity: Classroom-ready activity in which students simulate sonar use for mapping a model of the ocean floor (built in a copy paper box). Students use Excel and data in this hands-on activity. (Find it at [http://dosits.org](http://dosits.org) in the Resources/Teachers section. Classroom Activities/Thinking Inside the Box)
- DOSITS ([http://dosits.org](http://dosits.org)) has other teacher resources about People and Sound in the Sea, the Science of Sound in the Sea, and a Technology Gallery, as well as detailed tutorials about the Effects of Sound, a Science Tutorial and a Technology Tutorial. There is also a tutorial focused on sonar.

**National Science Education Standards**

**PHYSICAL SCIENCE:** Interactions of Energy and Matter

**LIFE SCIENCE:** Interdependence of Organisms; Behavior of Organisms

**SCIENCE AND TECHNOLOGY:** Understanding About Science & Technology

**PERSONAL AND SOCIAL PERSPECTIVES:** Natural Resources; Environmental Quality; Science and Technology in Local, National & Global Challenges

**Ocean Literacy Principles** *(http://oceanliteracy.wp.coexploration.org/?page_id=756)*

**The ocean supports a great diversity of life and ecosystems. (5)**

- Grades 6-8—B5 and B9
- Grades 9-12—C27 and C28
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The ocean and humans are inextricably linked. (6)

- Grades 6-8—D18, E1, and E6
- Grades 9-12—D11, D12, and E6

Acknowledgments

By Elizabeth Rice, Ph.D. and Susan Dodge, M.S.Ed. for Sea of Sound. Adapted from Saving Seas: Navy Sonar and its impact on whales and their kin. http://www.entanglements.net/saving_seas/topic_pages/sonar.htm. If reproducing this version, please cite Sea of Sound as the source and provide the URL: www.seaofsound.org.
The US Navy uses sonar to detect submarines and other potential threats in the ocean. Low and mid frequency sounds travel farther in water than in air so sounds stay louder farther from their sources than they would in air. The Navy uses sonar systems that generate very loud sounds at a variety of frequencies. Some anecdotal and forensic evidence suggests that some types of sonar can result in the deaths of some whales and dolphins. The mechanism is not clearly understood, but evidence is pointing to behavioral responses to the loud sounds. Navy officials have acknowledged that sonar can be a problem for some whales and have begun tests to better determine its impacts, but they are reluctant to abandon or strictly curtail the use and development of sonar arrays, citing national security concerns.

Do the benefits of using sonar outweigh the costs?

Potential Arguments

➢ **Anti-sonar**
  - Sound travels farther in water than air, so the range of potential impact of sounds is higher underwater than it is above the surface.
  - What are effects of sonar on marine mammals? Use data to support.
  - Some sonar-testing sites are near marine mammal sanctuaries and rich ecosystems. What effect does this have? Use data and maps to illustrate.
  - The Navy isn’t required to file environmental impact statements, for reasons of national security. However, lawsuits from animal rights organizations have forced Navy and industry to negotiate.
  - Current research suggests a relationship between marine mammal strandings and mid-frequency sonar. More research about the precise impacts of sonar is needed.
  - A potential compromise might be to find suitable locations or times to test and use sonar that will not impact whales.

➢ **Pro-sonar**
  - What is sonar? How does it work? Why does the Navy need it?
  - The Navy needs to have on-going training on sonar operations in flexible locations.
  - There is scientific uncertainty about impacts of sonar on marine mammals. The main problem for whales may be displacement, disruption, and stress, rather than death.
  - Sonar noise is only one of many ocean noise issues impacting whales and other marine life.
  - Some environmental groups and industry representatives may be perceived to gain by prolonging the conflict and stalemate.
Debate: Sonar

Resources


• US Navy’s Official Website for the Undersea Warfare Training Range has information about a sonar array that the Navy plans to build in the Atlantic coast of the United States. The project overview and fact sheet sections are particularly useful for understanding the proposed project and the Environmental Impact Statement process. [http://bit.ly/dMzLtO](http://bit.ly/dMzLtO)
