# Unit 2. Lesson 6. Recording Sounds From Wild Marine Mammals

Lesson Objectives:

- Students will gain an understanding of the technology used by researchers to study underwater sound.
- Students might want to explore the internet books to learn more about acoustic oceanography.

Vocabulary Words: hydrophone, SOSUS

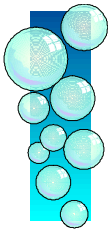
There are good reasons for improving our understanding of the way in which marine mammals communicate and navigate. Biologists and researchers are accomplishing this task using recordings of animals in the wild and in aquaria around the world.

Collecting sounds from underwater is a huge task, and many techniques are being used (hydrophones, arrays and more). Computer models and further mammalian studies are being used to interpret the meaning of the sounds collected.

## Problems Researchers Face

Recording sounds from marine mammals is not an easy task. There are four problems that all researchers face in doing so:

- Determine which animals make sound
- How to make accurate recordings
- Finding the animals
- How to make a quality recording of a moving animal

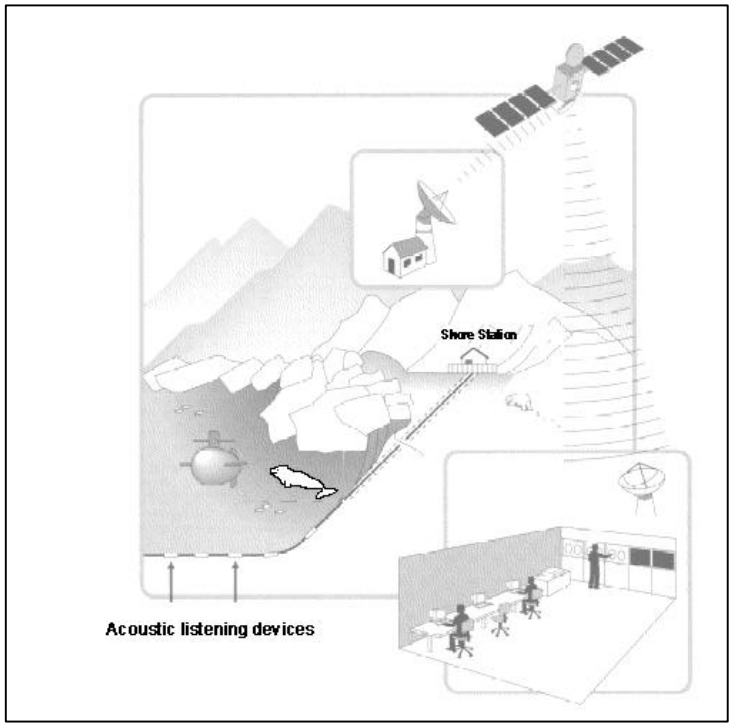


The marine environment provides a difficult environment because it is wet! Instruments must be able to withstand the water and be leak proof. In addition, the instruments must be able to withstand the effects of salinity, temperature, pressure, and motion. At the same time, they must be very sensitive and able to clearly record both high and low frequencies.

# Tools Developed to Solve Recording Problems

The recording of marine mammal sounds occurred purely by accident. During World War 1 (1914-1918), Sir William Henry Bragg developed the **hydrophone**. The hydrophone is an instrument that was developed to 'hear' enemy submarines. Additionally, the hydrophone detected marine mammal sounds underwater. This was a very pleasant surprise to researchers around the world. Suddenly, there was a way to learn more about the sounds generated by marine mammals.

The work of Sir William Henry Bragg continued to be of great interest to the military, as well as the research community. The military made acoustic networks of passive hydrophone detector arrays, and laid them in the Atlantic and Pacific Oceans. Hydrophone arrays are located at intervals of 5 to 15 miles along a linking cable connected to shore station(s). These stations exist worldwide. Over the years, many more arrays were set down. As the military continued to use the hydrophone arrays for military purposes and submarine detection, the data collected from marine mammals sounds provided excellent research materials for scientists all over the world. The SOund SUrveillance System became known as SOSUS. SOSUS made it possible to detect, and differentiate different whale calls and help track migrating whales.

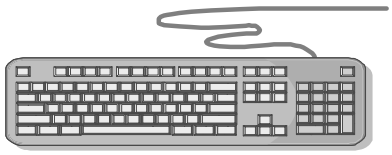


In addition to hydrophone arrays (SOSUS, and individual arrays) scientists use towed arrays behind a ship to record animal sounds. This can be done using two to hundreds of sensors attached to a towline that is trailed behind a slowly moving ship. This is a useful method, because it can be used to track a moving animal. The drawback of this method is ship noise is also recorded.

Technology has allowed scientists to also track animals by attaching sensors to the animal. Having the ability to attach a sensor without injuring the animal allows the normal, wild behavior of the animal to be recorded. Information obtained from these recordings includes how often and how deep an animal dives, sounds individual animals make, and location of migration paths. The animals usually wear the small sensor or tag either on their backs, or fins. The information is either relayed from the sensor to a satellite and back to the shore or ship, or it is recorded on the tag that is later recovered to retrieve the data. There are two difficulties with this method of tracking and listening to animals. The first is that the sensors are expensive and often lost. The second is that the sensors often are battery powered and have a limited lifetime.

## A Deeper Look

There is a lot of information about Marine Mammal Acoustics on the internet. Some of the sites contain sounds that have been recorded from marine mammals, while others contain information. A few interesting websites include:



- http://newport.pmel.noaa.gov/whales/sounds.html
- http://www.pinger.ios.bc.ca
- http://oceanographer.navy.mil/content.html

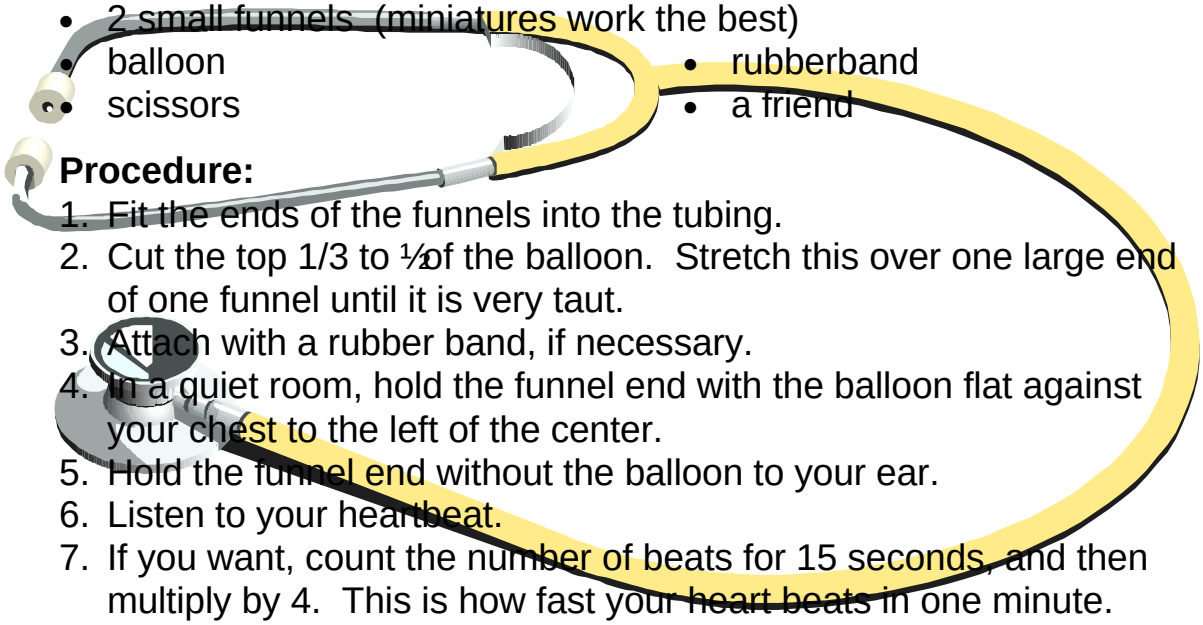
Also, do a web search for SOSUS and you will come up with many different research topics and results.

# Activity 6-1. Listen to the Sound!

When scientists record underwater sound, they might pick up the snapping of crab claws, bubbles popping, speed boats, marine mammals and children swimming. Try the next activity to see what kinds of sounds you can listen to that you do not hear easily.

**MATERIALS:**

- 12 inches of plastic aquarium tubing
- 2 small funnels (miniatures work the best)
- balloon
- scissors
- rubberband
- a friend



**Procedure:**

1. Fit the ends of the funnels into the tubing.
2. Cut the top 1/3 to ½ of the balloon. Stretch this over one large end of one funnel until it is very taut.
3. Attach with a rubber band, if necessary.
4. In a quiet room, hold the funnel end with the balloon flat against your chest to the left of the center.
5. Hold the funnel end without the balloon to your ear.
6. Listen to your heartbeat.
7. If you want, count the number of beats for 15 seconds, and then multiply by 4. This is how fast your heart beats in one minute.

**Variation**

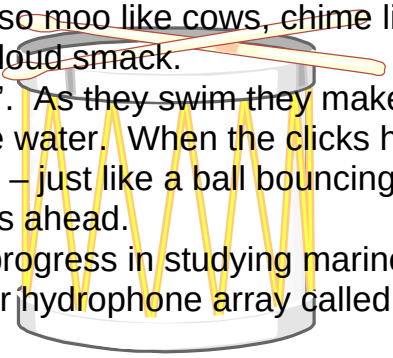
Listen to your belly. Perhaps you just ate a meal and your stomach is digesting the food.

Listen to other peoples heartbeats. People of different age and physical state will have different heartbeats.

Have your friend blindfold you and take you to different things to listen to. Tell your friend what you are hearing. It may take some practice. Remember, this is how scientists discover new marine mammal sounds. Some things to listen to might include:

- A fishtank.
- The wall of an adjoining room.
- A running refrigerator.
- A desk top with someone tapping their fingers on it.
- The floor as people go down a flight of stairs nearby.

# Student Information Sheet 6. Fun and Interesting Facts about Sounds



- White beluga whales are nicknamed the “sea canaries” because they cheep and chirp like birds. They can also moo like cows, chime like bells, or press their lips together with a loud smack.
- Whales and dolphins use sound to ‘see’. As they swim they make clicking noises, which travel through the water. When the clicks hit something solid, an echo bounces back – just like a ball bouncing off a wall. The echo tells the animal what lies ahead.
- The military helped scientists to make progress in studying marine mammal sounds through the use of their hydrophone array called SOSUS.
- Since the famous composer Beethoven was almost deaf, he used his teeth to compose music. To help him hear while he was writing, he would hold one end of a stick between his teeth and put the other end against the piano strings. When he played a note, the sound traveled through the stick, through his teeth, and skull bones directly to his inner ear.
- Some toy guns emit sounds of 170 decibels! That is in the range for permanent ear damage!
- If you play your portable cassette player with the earphones on at over more than ½ its possible volume, you are damaging your inner ear.
- Snakes “hear” by setting their heads on the ground. A sensitive bone in the head picks up vibrations. The vibrations travel to the snake’s brain via a **cochlea**, similar to the one inside the human ear. Others hear sounds through special organs. Crickets ‘hear’ through membrane-like eardrums on their thighs, spiders pick up vibrations through leg hairs, tarantulas feel vibrations on the soles of their feet, and fish use lateral lines and hearing sacs in their heads.
- Why do astronauts use a radio to talk to each other in space? Sound waves can not travel in space because there are no air molecules or medium to carry them. Radio waves *can* travel where there are no molecules.
- Sound travels 4 times as fast through water as it does through air.
- Marine mammals are not the only animals that communicate with sounds that humans can not hear. The male elephant can hear the love call of a female cow many kilometers away. Humans can not hear these sounds because they are higher or lower than the frequency heard by the human ear.