



Science Unit: *Beluga Whale*

Lesson 3: *Hunting whales: Using sound to find prey*

School Year: 2015/2016

Developed for: Champlain Heights Annex, Vancouver School District

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Grade level: Presented to grades 1-2; appropriate for grades 1-4 with age appropriate modifications

Duration of lesson: 1 hour and 20 minutes

Notes: This class requires an area like the library where students can hear very quiet ticking watches – or a class that can be quiet as they work.

Objectives (Objectives refer to the science topic and/or the process of science.)

1. Learn about the properties of sound and matter.
2. Students will explore through observation that sound bounces off smooth hard materials and is absorbed by soft materials
3. Students will review how marine mammals use the fact that sound reflects off objects (echolocation) to find their prey and to navigate in the ocean and how human made noise can in turn make this difficult.

Background Information

An echo is a sound that is repeated because the sound waves are reflected back. Sound waves can bounce off smooth, hard objects in the same way as a rubber ball bounces off the ground. Although the direction of the sound changes, the echo sounds the same as the original sound. Echoes can be best heard in small spaces with hard walls or with hard surfaces all around (like caves). But sounds are NOT always reflected. If they meet a soft surface, like curtains or cushions, they will be absorbed and will not bounce back. When sound waves reach a soft surface their energy is soaked up and they can not travel further. Surfaces that are smooth bounce the sound wave evenly, while a rough surface sends sound waves off in various directions, reducing the strength of the reflection.

Vocabulary

Echolocation: The use of sound waves and echoes to determine where objects (prey and obstacles) are in a space. Belugas use echolocation to navigate and find food in dark or cloudy ocean waters

Absorption: The process by which energy (like sound) is retained without reflection

Materials

- Ticking small watches
- 5" by 5" cork boards
- Masking tape
- Two 18 inch cardboard tubes
- Paper plates
- Data sheets and pencils
- Metal trays
- Selection of large books
- Computer connected to internet



In the Classroom

Introductory Discussion

1. Short description of 'hook' to capture student's attention.
 - Ask how animals use sound (communication e.g., warning of danger, navigation and finding prey e.g., echolocation, maintaining contact and keeping territories e.g., howling wolves, finding a mate, e.g., bird calls). Get them to try to give examples of animals that use sounds in these ways.
 - Play back some of the different sounds used by marine mammals (humpback whales, beluga echolocation, dolphins, seal), fish and also some of the sounds humans make (sounds of ships, airgun) and discuss our negative effects on marine mammals. A wide variety of these sound clips can be found in the audio gallery here: www.dosit.org
 - Ask students what an echo is? Ask what is echolocation. Explain to the students that today we are going to be belugas making echolocation clicks and learning how belugas find their prey by "bouncing sound" or bouncing their clicks off prey and listening for the returning clicks.
2. Explain that when we are listening for sounds bouncing that the whole class must be as quiet as mice (or even quieter).
3. Briefly describe science experiment/activity.
 - A loud ticking watch will be inserted into an 18 inch cardboard tube. A second tube of the same size is placed in a V shape next to the first tube and students listen at the end of this second tube to see if they can hear anything (they should not be able to hear the ticks of the watch).
 - The students then make observations as they place firstly a metal tray at the notch of the two tube V (they should be able to as the metal surface easily reflects the ticks into the second tube) and then a cork board at the same notch of the two tube V (they should not be able to as the cork board surface absorbs the ticking sounds). If time allows, different materials (e.g., paper plate, piece of cardboard, or someone's hand) can be placed at the V.
 - The students describe what they have learnt by writing a simple concluding sentence.
4. Briefly describe the processes of science that the students will focus on: students will make observations on what type or material sound bounces or reflects off the best and why.

Science Activity/Experiment

Activity Title:

Using sound to find prey – what material makes sound bounce?

Purpose of Activity:

To learn about the properties of sound and matter. Sound waves will reflect off smooth hard materials (like metal) but will be absorbed by soft materials like cork board (or paper plates).

Experimental Observations:

Students will observe how well sound waves are being reflected off materials with different properties, a metal tray and a cork board.



Methods and Instructions:

1. The class is split into groups of 4-5 students each with their own desk area. Each student will be provided a data sheet to record their observations. Each group is provided with 2 tubes, one ticking watch, one metal tray, one cork board, one paper plate, two large books and some masking tape. Each desk area will set up two 18 inch long cardboard tubes in a V shape (see picture in data sheet). Placing each tube on a book and keeping it in position with masking tape is best. Positioning the two tubes on the side of the table will help students to easily listen at the end of the tube. A ticking watch will be placed at the end of one tube and masking tape put over the end to stop it falling out or hearing ticks from this end of the tube.
2. Observation 1: Students will listen for the ticking noise at the opposite tube end of the second tube and record their observations (did they hear ticking? They should not). It is important that when doing this task everyone is quiet. It is best that when everyone is set up the teacher asks for silence for the few minutes the students need to each listen carefully.
3. Observation 2: Then the metal tray is held by one of the students at the sharp V end as shown in the second picture on the work sheet (ticks should bounce/reflect of the metal tray and be heard). It is important to hold the tray and cork board at a distance (about 2 inches) and an angle that will result in a reflection of ticks down into the second tube (imagine a line coming out of the center of each tube and position the tray where these two lines intersect). The scientist or teacher should check that the students have this set up right.
4. Observation 3: Repeat with a cork board at the sharp end of the sharp V end (in this case ticks will be absorbed by the cork board and not be heard) and if time with the paper plate or other test materials.
5. Conclusion: Once everyone has completed the bouncing sound test ask them to write one concluding sentence that summarizes their observations. A sentence like “sound bounces better off hard surfaces than soft ones” is one conclusion or “Soft surfaces absorb sounds while hard surfaces reflect sound”. Gather the whole class together to discuss each group’s observations.

Closure Discussion

1. Ask which groups could hear ticks being bounced off the metal tray? Ask why they thought they could? Introduce the word reflection. Discuss how sound reflection is critical for echolocation to work.
2. Ask which groups could hear ticks being bounced off the cork board? Ask why they thought they could not? Introduce the word absorption.
3. Ask if anyone could not hear clicks with the metal surface. Discuss that everyone has slightly different hearing abilities, just like some people need glasses for improving their sight. Discuss the need to protect your ears as loud sounds (rock concert, working outside in an airport) can damage the hairs that allow us to hear sounds. Discuss how whales protect themselves (they have to move away).
4. Ask if the noise the class sometime made it harder to hear the ticks bouncing off the metal tray? Talk to the students about how human-made sounds would make it harder for beluga to hear their clicks being reflected off their fish prey. Discuss what that might mean (belugas find less food). Discuss what we might do to help belugas (not approach too close in whale watch boats or make loud noises in important feeding areas).

Extension of Lesson Plan

1. Test different materials and surfaces (porous material, concave surface, irregular surfaces).
2. Test if blind-folded students can tell if a metal tray is in front of their face (or not) by simply making clicking sounds and listening to the sound bouncing back (or not). Humans can echolocate!



Name _____

Date _____

Bouncing Sound

Method: Place ticking watch in one end of tube and listen at the other end.

1. Observation: NO Reflecting Surface

What do you **hear**?



2. Observation: Metal Plate Reflecting Surface

What do you **hear**?



tivk

3. Observation: Cork Plate Reflecting Surface

What do you **hear**?



Conclusion: What did you learn today?
