

## Comparing Sounds from the Ocean

### Subject:

Students identify ocean sounds through pitch and intensity as measured by RavenLite software. This information is then applied to birds in their local environments.

Grade Level: 7th-8<sup>th</sup>

Average Learning Time: Three one hour lessons

### Lesson Summary: (Overview/Purpose)

This lesson is the culmination of a sound unit. The students will get to see and explore a real-life use of sound information, such as pitch and intensity, that scientists use to identify marine mammals. They will then use this information to identify and distinguish native birds in their area. In addition they will get to experience both with using and creating their own dichotomous key.

### Overall Concept (Big Idea/Essential Question)

Students will explore how specific qualities of sound, such as pitch and intensity, are used by scientists to distinguish various ocean species. Furthermore students will collect sounds and create their own dichotomous keys to be used to identify birds.

### Specific Concepts (Key Concepts)

- Ocean animals give off sounds with varying pitch, intensity and patterns.
- Scientists use dichotomous keys to help identify species.
- Pitch relates to the frequency of sound waves and intensity relates to the energy in a wave.

### Focus Questions:

1. How can scientists tell different marine animals apart without visual information?
2. How can pitch and intensity be represented visually?
3. How and why are dichotomous keys used?
4. How can sonic information from the ocean be gathered and used by scientists.
5. In what other ways can we use sound to study animals?
6. How can local birds be identified through song?

### Objectives:

- Students will be able to use sound characteristics such as pitch and intensity to identify 3 out of 4 marine mammals through the use of dichotomous keys.
- Students will be able to create their own dichotomous keys with 90% accuracy.

### Background Information:

Students should have a good understanding of the properties of a sound wave that determine pitch and intensity. In addition, they should have looked at wave diagrams and understand the difference between wavelength and amplitude. This lesson is meant to show students a real life application of sound analysis as well as a look into how ocean mammals and birds communicate.

### Materials:

- 20 different ocean sound clips (4 or 5 sounds per group)
- Ipad or computer for each group
- headphones for each student
- 5 rockstars (connection to Ipad or Ipod so 5 different students can listen to the sounds at once)
- computer access for each group
- something to record with (MP3 player)
- bird song recordings

### Technical Resources:

- Raven Lite software program (free download available through Internet)

### Teacher Preparation:

The teacher should become familiar with RavenLite and how to read the spectrograms that are produced. Look through all the ocean sounds to familiarize yourself with their patterns. Contact a local bird organization to get a list of possible bird species in your area at the seasonal time of the lesson. Obtain song recordings for these birds for your students to use to identify birds. It will be much easier for students to search for birds from a short inventory rather than looking through a broad bird identification resource.

### Keywords:

- pitch
- intensity
- spectrogram
- dichotomous key

### Lesson Procedure: (In the 5E Model)

#### **1. Engage:**

Present students with a problem. Scientists had recorded the sounds in an area off the coastline. Show video clip about scientists at Woods Hole Oceanographic Institute using acoustics for right whale research. (Note: Genevieve Davis is working on a longer clip that I hope to use in my classroom as well). They want to use this information to help them identify what species use the area. Unfortunately many of the sounds seem the same and they need a more accurate way to determine what species are there. Play some of these sounds for the students and brainstorm with students on the overhead differences that the students believe they are hearing.

#### **2. Explore:**

Separate students into small groups and give them each recordings of 4 different sounds. Have 5 different stations. Each station has an IPAD with 4 different sounds and a rockstar (an adaptor to an IPAD or IPOD which allows up to 5 headphones) and headphones. Have the students listen to the 4 different sounds on their IPAD and record characteristics of each sound. Then have the students open each sound in Raven Lite, a software program that shows a wave graph and a spectrogram for each sound. There is a free download you can get through the Internet. Help students figure out how to read the graphs. (Note: students in my class have already used wave graphs through audacity so they will be familiar with wave graphs. It is the spectrogram that must be explained). Have them try to link the differences that they noted previously with the spectrogram qualities. (For instance; pitch, intensity, length of call, etc..)

### **3. Explain:**

Gather students together. Display the spectrograms on the whiteboard and go over how to read them. Ask, "How can these be used to identify different species?"

Why would scientists need to use sound to identify different species (often can hear animals but not see, i.e. whales, birds)

### **4. Elaborate:**

Explain that sounds are often used to identify different species. Scientists use something called a dichotomous key which can be used to identify various species. Model a key by choosing one student in the room. Brainstorm questions that could narrow down this student (i.e., sex, hair color, height, etc)

Have students get back into their original groups and have them create dichotomous keys for 10 different species (They may choose 10 species from the original 20) Once each group is done have them choose one of their sounds (anonymous name, i.e. a, b or c) and have other groups use the dichotomous keys that this group created to see if they can determine the species based on it.

### **5. Evaluate:**

Up to now we have been dealing with information gathered from our ocean. Now the students will gather information from their local environment. Explain to them that they will be gathering information from their local area, specifically birds and creating a key for the native birds in their area.

Students will again work in their original groups. Give each group an MP3 player. Have them go outside and record any bird sound that they hear. They then need to come inside and check their recordings with a bird resource data bank that the teacher has set up beforehand (Put together resource bank with the most likely birds that they will hear.) Load the sound clips into Raven Lite and look for information on pitch, intensity and length of call.

Have each group create a dichotomous key for the local birds that we find based on the spectrograms. Review the key from each group in order to gauge their understanding of the sound qualities and dichotomous keys.

#### Standards:

##### **National Science Standards:**

- ◆ Use appropriate tools and techniques to gather, analyze, and interpret data.

##### **Ocean Literacy Principles:**

- ◆ New technologies sensors and tools are expanding our ability to explore the ocean. Ocean scientists are relying more and more on satellites, drifters, buoys, subsea observatories and unmanned submersibles.

##### **New Hampshire State Standards:**

- ◆ S:PS2:6:3.1 Explain that the pitch of a sound is dependent on the frequency of the vibration producing it.
- ◆ S:PS2:6:3.2 Explain that sound vibrations move at different speeds, have different wavelengths; and establish wave-like disturbances that emanate from the source.
- ◆ S:SPS1:8:1.4 Construct and use a dichotomous key to classify a given set of objects or organisms

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