Student Name: _____

Similarities and Differences between Whale, Dolphin and Porpoise Echolocation Sounds

Bats and toothed whales (a group which includes whales, dolphins and porpoises) echolocate to navigate and find their food. These animals emit short, high frequency sounds that bounce off objects and return to their ears. They then use the information in the returning echoes to get information from their surroundings.

The individual characteristics of echolocation sounds and types of sound produced vary depending on species. Most echolocation sounds are classified as clicks, buzzes, or creaks, but these are produced at different stages of prey hunting. For instance, sperm whales produce clicks that are repeated at long, regular intervals while they are searching for prey. Once the find prey, however, the click interval shortens as they get closer to the prey item and ultimately end in a series of rapid pulses that can sound like buzzes or creaks.

In this activity you will explore whale, dolphin and porpoise echolocation sounds to identify characteristics that are common to toothed whales as well as determine how individual species are different.

Procedure:

Step 1: Download the following sound files:

- Beaked whale clicks from (http://www.dosits.org/files/dosits/beakedclick.mp3).
- Dall's Porpoise Sounds from (http://www.dosits.org/files/dosits/Dalls-CC0803.mp3)
- Harbor Porpoise clicks from (http://www.dosits.org/files/dosits/HarborPClicks.mp3)
- Narwhal sounds from (http://www.dosits.org/files/dosits/nar_whis-pulse.mp3)
- Sperm whale sounds from (http://www.dosits.org/files/dosits/sperm-buzz1.mp3)
- Spinner dolphin clicks from (http://www.dosits.org/files/dosits/spinnerclicks.mp3)
- To do so, type in the above address and when the sound is playing right click and select "Save As". Save this to a folder you can easily access.

Step 2: Open the Beaked Whale clicks ("beakedclick.mp3") file in Audacity. With Audacity open, select File→Open→ and select the file you just downloaded.

Step 3: Open the Dall's Porpoise sounds ("Dalls-CC0803.mp3") in Audacity as a separate track in the same window. To do this, select File→Import→Audio and then select the file.

Step 4: Repeat Step 3 for the rest of the files: Harbor Porpoise clicks ("HarborPClicks.mp3"), Narwhal sounds ("nar_whis-pulse.mp3"), Sperm Whale sounds ("sperm-buzz1.mp3"), and Spinner Dolphin clicks ("spinnerclicks.mp3").

Step 5: Play each track. To play, make sure you select the Solo button on the left menu for each track you want to hear, otherwise it will play all tracks simultaneously. Listen carefully to each track.

Think and write: What do you notice about each animal's sounds?

Think and write: What do you notice about the difference between animals' sounds?

Generally toothed whale echolocation sounds are classified as clicks, buzzes, or creaks. In Table 1, identify which sounds you hear in the different animal files. If you hear more than one type of sound, identify which time periods in the recordings you hear the different sounds.

Table 1: Types of echolocation sounds present in toothed whale sound files

Species	Clicks Present?	Buzzes Present?	Creaks Present?
Beaked Whale			
Dalls Porpoise			
Harbor Porpoise			
Narwhal			
Sperm Whale			
Spinner Dolphin			

Using the zoom button (the magnifying glass in the top left toolbar), zoom in on a sound you identified as a buzz or creak.

Think and write: What do you notice about the individual sounds that make up the buzz or creak?

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Think and write: How do these sounds relate to the click sounds you observe in other species?

Think and write: Toothed whales make echolocation sounds when they are finding and hunting food. How could we use the information in these sound files to help explain more specifically what the animals are doing?

Let's focus more on the sperm whale sound file. Go ahead and remove the other tracks from the project by selecting the x button at the top left of each file (but not for the sperm whale file).

Think and write: What do you notice about the pattern of pulses made by the sperm whale?

Using the cursor button at the top left, click on the first sound made by the sperm whale. Notice at the bottom of your screen you see a "Selection Start" time. Repeat this for the first 6 clicks and enter the Selection Start times in Table 2.

Table 2:

Click number	Selection Start Time	Inter Click Interval
1		
2		
3		
4		
5		
6		

Now calculate the time between clicks, or the Inter Click Interval. To do this, subtract the previous click's start time from the current click start time. For example, the Inter Click Interval for Click 2 will be calculated as the Selection Start Time for Click 2 minus the Selection Start Time for Click 1. Click 1 will not have an Inter Click Interval.

Think and write: What do you notice about the Inter Click Intervals for the first 6 clicks?

Think and write: You are a whale biologist and want to look at the variation in Inter Click Intervals for all clicks in this Sperm Whale sound file. You could repeat the above procedure for all of the clicks, but this would take you a long time since there are hundreds of clicks in this sound file. Instead, you must devise a time-saving, streamlined method. Come up with your own procedure for investigating the variation in Inter Click Intervals across this sound file. Describe your method:

Now, apply your method to the sound file. Make sure to record your data in a table or graph in the space below.

Think and write: Based on your data, what conclusions can you make about the behavior and biology of the sperm whale?

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