Harmonizing with Humpbacks Activity Sheet

Name: _____ **Date:** _____

Instructions:

1. Gather your materials to harmonize with humpbacks! (Colored pencils, highlighters, Internet connection and speakers.)
2. You will make a spectrogram to chart the sound you hear. You will be listening for differences in pitch and volume of the sounds.
    a. **Pitch**: the highness or lowness of sound. Think about a deep voice versus a high, squeaky voice.
    b. **Volume**: quantity or power of sound; degree of loudness. Think about a whisper versus a loud scream.
3. Read the guide below to help you understand how to plot the sound.

Spectrogram Background Information

A spectrogram is an image made by graphing sounds. Time is on the x-axis in seconds and pitch is on the y-axis. If the pitch increases, the line on the graph goes up.

Volume is represented by color. As the sound gets louder, the line gets brighter in color. If the sound stops, you will have a gap in the line for that given amount of time of silence. See Figure 1 for an example whale song that changes in pitch and volume.

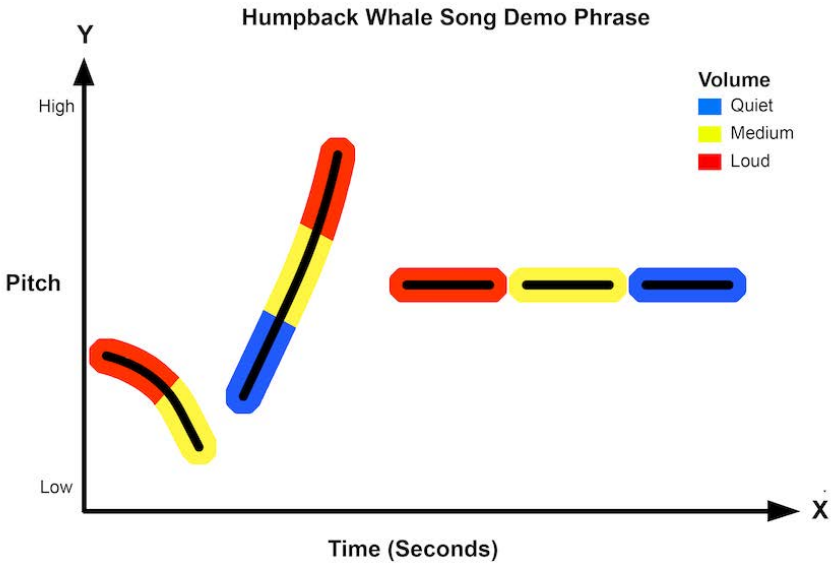
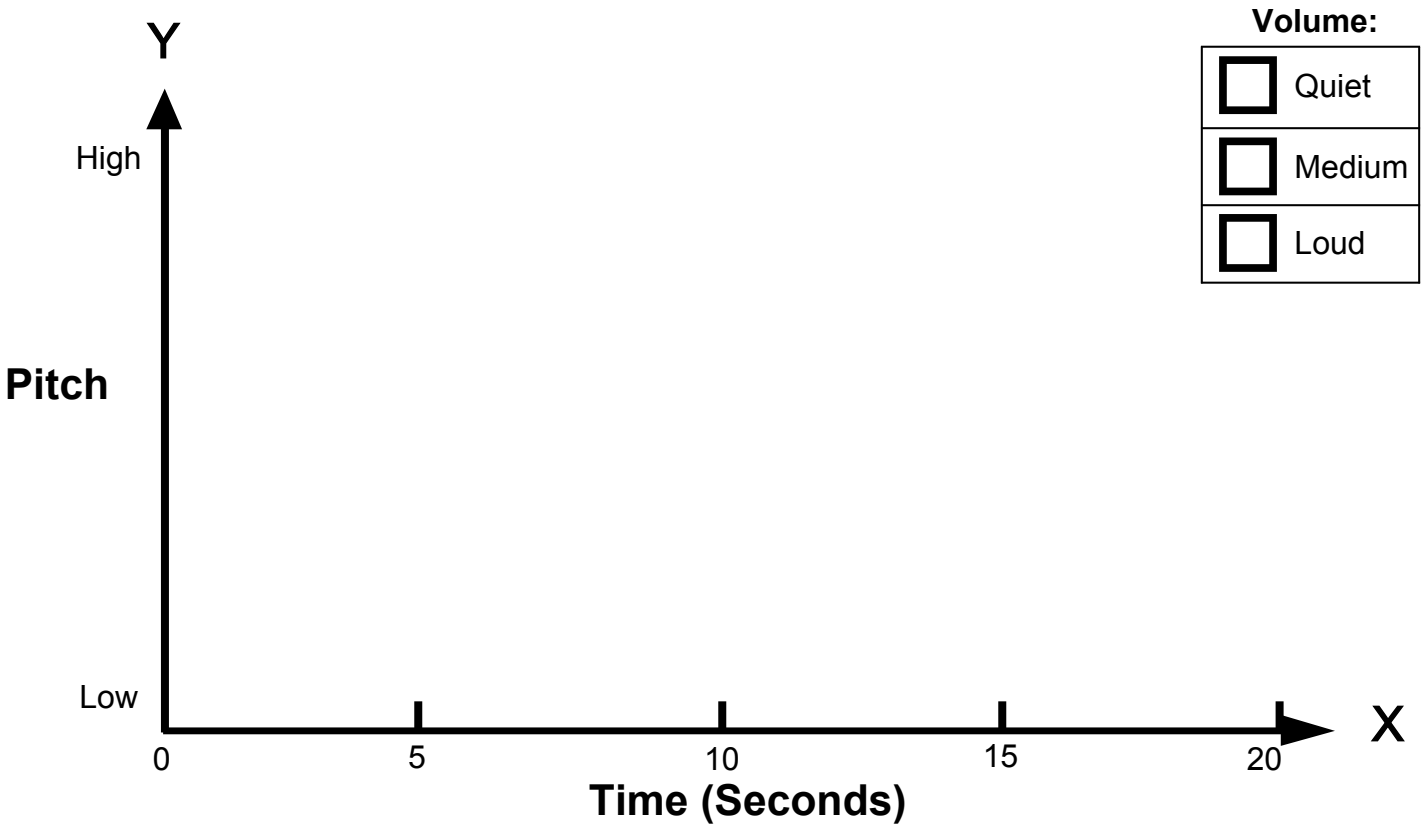


Fig. 1. This spectrogram is an example of a whale song that started with 1) a loud, low pitch that dropped even lower while getting quieter; 2) a swooping sound that got higher in both pitch and volume; 3) and finally 3 short sounds with the same pitch but decreasing volume.

4. Practice making sounds with different pitches and volumes.
    a. Visit The Chrome Music Lab to experiment with using your own voice to make a spectrogram. This will help you to 'see' the sounds you are making. Try and make the spectrogram from Figure 2 above! (*www.musiclab.chromeexperiments.com/Spectrogram/*)
    Note: If you enjoy playing with the Chrome Music Lab, build in extra time here and keep experimenting!
5. Go to the NOAA Fisheries Sounds in the Ocean page to listen to the sample humpback whale song (19 sec). (*www.fisheries.noaa.gov/national/science-data/sounds-ocean#humpback-whale*)
6. Describe the sound you heard.

7. Listen again to the same whale song. Use the graph below to plot the **pitch** of the whale song over time. *Note: You may have to listen to the sound repeatedly as you create your spectrogram.*
8. Assign three different colors of highlighters to represent **volume**: quiet, medium, and loud. Fill in the table legend on the graph on your worksheet to indicate which color you are using to represent each volume.



9. Listen once more to the same song and highlight the line as the sounds change in volume.
10. Describe the sound again using the spectrogram as a reference.

Activity Questions

Name: _____

1. How did making the spectrogram help you to describe the whale song?

2. What additional information can scientists get from a spectrogram of a whale song (compared to just listening)

3. Read the paragraph about whale songs and fill in the blanks using the vocabulary below:

Humpback Whale Background Information

Humpback whales are famous for their complex songs. Only the male humpbacks sing, and they only sing during the _____ season in Hawai'i. The _____ is usually alone in a head-down, tail-up position. If the singer is following a cow and calf pair, he is called a(n) _____. When another whale joins in on the song, he is called a(n) _____. Humpback whales do not have vocal cords. They produce sounds by pushing air through tubes and chambers in their _____ system. Scientists use _____ to listen to, and record, whale songs. Researchers can play the songs into a computer that creates a(n) _____, which is a picture of each sound. Whale researchers study patterns on spectrograms to learn about why whales sing, and how they react to other whales around them. Scientists have developed some _____ to try to explain why whales sing. Scientists also study whale songs to learn about how _____, caused by people, affects the behavior of whales. Ship engines, military sonar, and explosions used by oil and construction companies make loud sounds under water that may cause changes in the whales' _____.

Vocabulary:				
	***behavior**	***escort**	***mating**	***singer**
	***hydrophones**	***noise pollution**	***spectrogram**	***joiner**
	***respiratory**	***hypotheses**		

4. Did you see any evidence of noise pollution in your music lab spectrograms (*Hint: what happened when people were talking nearby*)?

5. How do you think noise pollution can affect whale behavior?

6. Research and describe other ways sound is represented visually.