

Science Tech Trek: Sound Waves and Dolphins

Teacher Post Trip Guide



Post Trip Overview

After completing their Science Tech Trek, students will have the opportunity to reinforce and extend their understanding of sound with post-field trip learning activities in the classroom. Teachers will guide their learners through a review of sound wave structure and the relationship between wavelength and pitch. Then, learners will get to begin exploring the relationship between amplitude and volume and how sound relates to the sounds animals make to communicate.

Supported Amplify Science Lessons

4th grade Amplify Unit: Waves, Energy, and Information

Lessons:

- | | |
|-----------------------------------|------------------------------|
| 1.2 Exploring Waves | 3.1 Investigating Amplitude |
| 1.4 Exploring Sound Waves | 3.2 Investigating Wavelength |
| 2.1 Sound on the Move | 3.3 How Sounds Can Differ |
| 2.2 Visualizing How Sound Travels | |

Supported NGSS Standards

4-PS4-1: Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

4-PS4-3: Generate and compare multiple solutions that use patterns to transfer information.

Science and Engineering Processes	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models <ul style="list-style-type: none"> Develop a model using an analogy, example, or abstract representation to describe a scientific principle. (4-PS4-1) 	PS4.A: Wave Properties <ul style="list-style-type: none"> Waves, which are regular patterns of motion can be made in water by disturbing the surface. When waves move across the surface of deep water, the wave goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks) 	Patterns <ul style="list-style-type: none"> Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena (4-PS4-1) Similarities and differences in patterns can be used to sort and classify designed products (4-PS4-3)

Supported Common Core Standards

SL.4.2: Paraphrase portions of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.

SL.4.3: Identify the reasons and evidence a speaker provides to support particular points.

STT Central Phenomenon Questions	Science Tech Trek Learning Objectives
<p>Learners are scientists who use evidence of dolphin vocalization to answer a question about how dolphins communicate:</p> <p>You are a scientist on a submarine using a tool known as a hydrophone to record animal noises in the ocean. You have observed and recorded a pod of dolphins. You heard two sounds: A and B. One of the other scientists thinks that both sounds came from one dolphin. Is this possible?</p>	<p>Students will be able to...</p> <ul style="list-style-type: none"> • Identify the amplitude and wavelength of a sound wave • Define pitch as a change in sound waves that causes sound to be high or low • Compare and contrast the visual and auditory differences between high and low pitch • Develop a model to explain that pattern changes in visual representations of sound correspond with changes in pitch: higher pitches have shorter wavelengths and lower pitches have longer wavelengths • Construct an argument to support or disagree that dolphins can alter the sounds they make

Post-Trip Guide

Logistics	
<p>Facilitated by classroom teacher at school Time: 20-30 minutes</p>	
Learning Objectives	Materials
<p>Students will be able to...</p> <ul style="list-style-type: none"> • Identify the structure of a sound wave: amplitude and wavelength • Define pitch as a change in sound waves that causes sound to be high or low • Compare and contrast the visual and auditory differences between high and low pitch • Support reasoning with scientific data by explaining which animals made each sound 	<ul style="list-style-type: none"> • Printed Science Tech Trek summaries (examples on last page) • Pencils • Colored pencils/crayons/markers
Prep	
<ul style="list-style-type: none"> • Print two copies of each Science Tech Trek summaries (one for each partner) 	
Facilitation Outline	
<p>Quick Outline</p> <ol style="list-style-type: none"> 1. Reviewing learning objectives and Science Tech Trek concepts 2. Expanding students' thinking on sound 3. Creative connection <p>1. Reviewing Learning Objectives and Science Tech Trek Concepts <i>5 minutes</i></p> <ul style="list-style-type: none"> • Make sure students have their Science Tech Trek summaries and a writing utensil. • Review the learning objectives for students' investigation of dolphins and sound. • Remind students of the scenario from their Science Tech Trek: 	

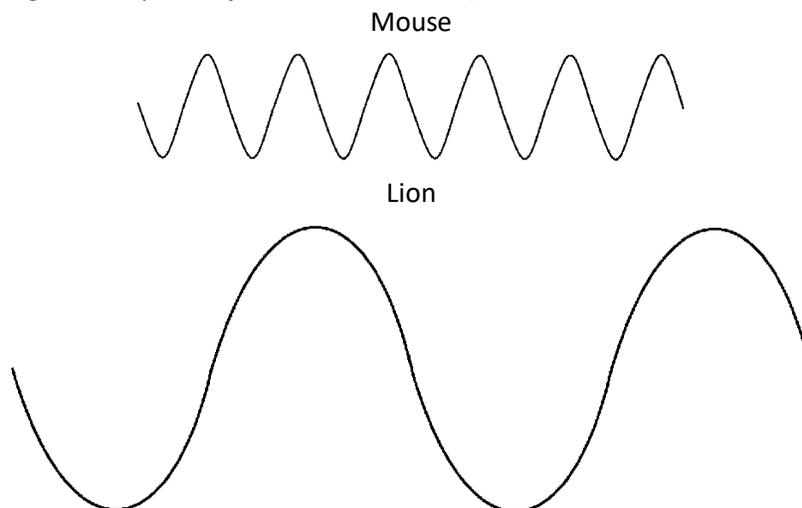
Students are scientists and have recorded noises from a pod of dolphins. They've heard two sounds, Sound A and Sound B. Another scientist thinks that both sounds came from one dolphin. Is this possible?

- Have students share with a partner about what they found and what kind of wavelengths high and low pitches have. (Students should refer to the fill-in-the-blank box on the front page of their STT summary.)
- Review students' findings as a whole group:
 - Guiding Questions:
 - Can one dolphin make two different sounds? How do you know?
 - What did you discover about dolphins' sounds?
- Facilitate brief discussion to review sound waves, wavelength, and pitch:
 - Guiding Questions:
 - What is wavelength? (*the distance from one wave peak to the next*)
 - What does a high pitch sound like? What does a low pitch sound like?
 - Does a low pitch sound have a long or short wavelength? (*long*)
 - If a sound has a short wavelength, is it high pitched or low pitched? (*high pitched*)
- Have students complete questions 1 and 2 on their summary, and recording an answer for the second part of question 2.

2. Expanding Students' Thinking on Sound

12 minutes

- Have students share with a partner about the differences between wavelength and amplitude. Then, discuss as a whole group:
 - Guiding Questions:
 - How is wavelength different from amplitude? (*amplitude is the height of a wave, and wavelength is the distance between wave peaks*)
- Have students label amplitude on the graphs in their summaries.
- Prompt discussion about how amplitude affects sound:
 - Guiding Questions:
 - If changing the wavelength of a sound changes its pitch, what do you think changing the amplitude might do?
 - (Draw the mouse and lion sound waves on the board or a piece of paper) Think back to how you squeaked like a mouse and roared like a lion in your Science Tech Trek. This is what the sound waves looked like. How does the amplitude compare for each? (*amplitude for lion is larger or amplitude for mouse is smaller*)



- What did the pitch sound like for the mouse's squeak and the lion's roar? (*the mouse's squeak was high-pitched, and the lion's roar was low-pitched*)
 - Now, squeak like a mouse. Roar like a lion. How does the volume compare for each? (*the mouse's squeak is quieter, and the lion's roar is louder*)
 - In a sound wave diagram or graph, if we represent pitch by making the wavelength long or short, how do you think we could represent a loud or quiet volume? (*changing the height, or amplitude, of the sound wave*)
- Explain that amplitude represents volume in a sound wave. Have students record their answer to the second part of question 3.
 - Have students share answers for question 3 with the whole group.

3. Creative Connection

3-13 minutes

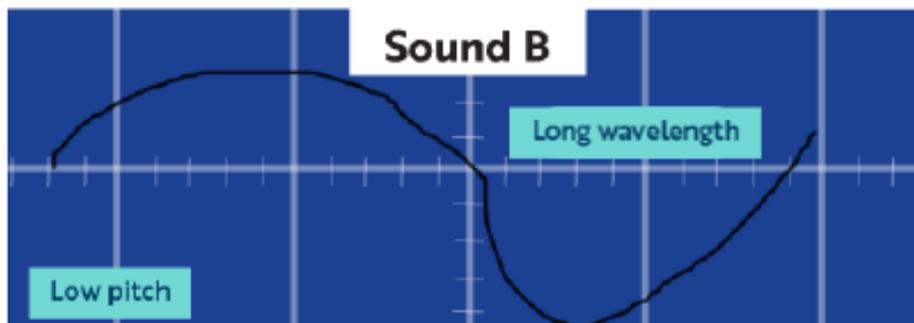
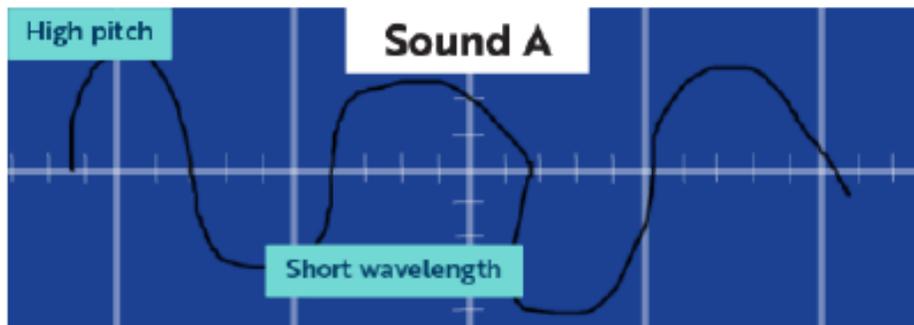
- Brainstorm a list of animals in addition to mice and lions that make high-pitched or low-pitched sounds to communicate.
- Have students select and draw these animals in the corresponding boxes for question 4.
- Share photos of your students' post-trip learning with #SheddLearning via Twitter, Instagram, or Facebook! Or email the photo with your school name to learning@sheddaquarium.org and for Shedd to tweet from @SheddLearning.



Student A.

My model shows that one dolphin **could** have made both sounds. Sound A has a **high** pitch and a **shorter** wavelength. Sound B has a **low** pitch and a **shorter** wavelength.

could	could not	longer
high	low	shorter



Science Tech Trek Summary Example

1) Circle your answer. Wavelength is the...
height of a sound wave or the distance from one wave peak to the next

2) Check that wavelength is labeled on your graph. If it is not, add it in. What does a wave with a longer wavelength sound like?

3) Check that amplitude is labeled on your graph. If it is not, add it in. What do you think a wave with a larger amplitude would sound like?

4) Draw pictures of animals that you think make lower-pitched sounds and higher pitched sounds.

Animal with lower-pitched sound	Animal with higher-pitched sound