

TTCD Lesson Plan (8): Beluga Echolocation Game

Unit: Beluga Monitoring	Grade(s): 3-12	Class Size: 1-30	Lesson Duration: 60 minutes	Location: Classroom, gym or outside
Topic(s):	Beluga			
Student Prerequisites:	Understand that a beluga is a marine mammal that plays an important cultural and environmental role in our region.			
Essential Questions:	Why is echolocation important to belugas? What can make it easier or harder for whales and dolphins to catch their prey using echolocation? What types of noise pollution occur in Cook Inlet? How might this affect belugas?			
Student Objectives:	Students will learn how belugas and other marine mammals use sound to locate their prey.			
Standards:	Supports NGS Standards: 4-LS1-1 From Molecules to Organisms: Structures and Processes Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. 4-LS1-2 From Molecules to Organisms: Structures and Processes Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. 5-PS3-1: Use models to describe phenomena. Cultural Standards: E.2: Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them by: understand[ing] the ecology and geography of the bioregion they inhabit. B.4: Culturally-knowledgeable students are able to build on the knowledge and skills of the local cultural community as a foundation from which to achieve personal and academic success throughout life by: identify[ing] appropriate forms of technology and anticipat[ing] the consequences of their use for improving the quality of life in the community.			
Local Context:	Explain that the students inside the circle are actually under the water in Cook Inlet. The belugas that we are monitoring this season use echolocation to navigate and find food.			

Vocabulary:	Adaptation, echolocation, marine mammal, beluga, noise pollution
Dena'ina language words:	
Materials:	• Optional: Beluga skull or large drawing/photograph of its skull • Several blindfolds (could use a bandana, a tie, strips of an old T-shirt, scarf, etc.) • Optional: 2-4 small pill bottles or film containers filled with beans or beads • Optional: a bell or other sound-making device different than the shakers • half -sheets of plain paper for assessment tool • Crayons or colored pencils • Portable speaker • Computer or phone with bluetooth technology
Instructor Prep:	If using, fill your small containers with beads or beans to make shakers. If using a classroom, move desks aside to make a large enough space for all students to stand in a circle with nothing in the middle. If doing the activity outside or in the gym, bring a speaker to play the beluga recordings in the introduction, and the noise pollution sounds at the end.
Introduction:	<i>Pair and Share:</i> Give students 1-3 minutes to discuss the question “what is a marine mammal?”, then have several pairs share their ideas with the whole group. Remind students that marine mammals have special adaptations that help them move, eat, breathe, and reproduce underwater, even though they are mammals, like us! One of these adaptations is their ability to create pictures of their surroundings using sound, instead of light, as a way of seeing underwater. Researchers have learned that belugas use sound, in the form of clicks, to locate their food. Does anyone know what belugas like to eat? (Beluga whales have a varied diet consisting of octopus, squid, crabs, shrimp, clams, snails, and sandworms. They also eat a variety of fish, including salmon, eulachon, cod, herring, smelt, and flatfish. [NOAA Fisheries]) Explain that this use of sound is called echolocation, and that belugas use it to see up to 100 feet in front of them even in murky or dark water. We will be playing a game to demonstrate how this works. Play a recording of belugas echolocating, available through NOAA Fisheries. Compare this with a recording of belugas communicating with each other. Ask students if they notice a difference between the sounds in the two clips. Pre-Assessment: Have students work individually or in groups of 2-3 to draw a diagram and/or explain in words how belugas find food (5 minutes).
Activity:	1. Form a large circle, with everyone facing in and nothing in the middle of the circle.

	2. Choose one student who is comfortable wearing a blindfold to step into the center of the circle, and hand them your bell or other noisemaker if you have one. The adjacent students should help close the gap so that the circle remains intact. This student, once blindfolded, becomes the first beluga. 3. Choose two students to be prey. They can choose what type of fish or shellfish they would like to be, or you can assign them. If using shakers, give each prey a container of beads or beans. Have them join the center of the circle. 4. The beluga's goal is to catch its prey using echolocation. Every time the blindfolded "beluga" shouts "fish" or uses the noisemaker, the students playing the fish must immediately reply by also shouting "fish" or by using their shaker. The beluga will need to follow the sound to tag the fish. 5. Important: Ask the children standing in the circle to keep the beluga safe and gently steer them back towards the middle if needed. Demonstrate what this looks like - we are not pushing our beluga, simply being a gentle guiding wave. 6. If a prey student gets tagged, they return to the circle and give their shaker to another student, who then becomes prey. After a few minutes, switch out the beluga with another student who wants to try. 7. After a few rounds of the game, take a break to explain that whales and dolphins are finding it more difficult to catch their prey using echolocation because of the noise pollution created by human activities. Ask students if they can come up with any examples of noise pollution in the ocean caused by humans. Have students raise their hands to share. Examples include boats, military exercises, and drilling for oil. If the internet is available, use Ocean Conservation Research's Sound Library to play examples of some of the noises students come up with. 8. Try one or two rounds of the game with noise pollution: Have students in the circle make noise by clapping their hands and stamping their feet throughout the game.
Wrap Up:	Ask the group: When we played the game with sound pollution, was it harder for the beluga to locate their prey? <i>Pair and Share:</i> Have students turn to a person near them and discuss possible ideas for ways to reduce noise pollution in the ocean. Have several pairs share their ideas with the whole group. Ongoing research on this topic suggests solutions such as redesigning the propellers of vessels, changing shipping routes, and using lower-intensity seismic vibrations (used to find oil and gas underneath the ocean floor). Have students revisit their diagram/explanation and make changes or add any new details they learned, using a different color of pencil or pen (5 more minutes). <i>Evidence of Learning:</i> includes use of new vocabulary words, richer explanations of concepts, or more accurate details added to their diagram.

Lesson Adaptations:	• In the introduction, have younger students <i>Pair and Share</i> to come up with as many marine mammals as they can think of. • Whales and dolphins often work together to catch their prey. Choose two students to wear blindfolds and work together to catch the fish. Did the prey find it harder to escape? • Sometimes predators will work together to chase prey into a smaller space to make it easier to catch them. Ask the students forming the circle to take a step closer to shrink the circle. Did this make it easier for the belugas to catch their prey? • Designate one student to be a piece of plastic trash in the ocean. Give them a shaker, and have them join in with the prey. Explain that belugas and other marine mammals sometimes cannot tell the difference between food and trash in the ocean that is a similar size and makes a similar sound when using echolocation. For example, a plastic bag might “appear” to be a tasty fish!
Extensions:	Addition to wrap up: For older students, facilitate a brief discussion about what types of noise pollution students think are most harmful to belugas. Have students think-pair-share to identify potential ways to mitigate the harm caused by various types of noise pollution. If students are engaged and motivated, provide them with a simple template for drafting comments to submit to their village council about steps the community could take or precautions they could advocate for. Whales produce the loudest sounds made by any animal. While scientists know that some whales produce these sounds without releasing air, just how they do it remains a mystery. When humans communicate verbally we expel air, whales do not. Let’s try to make some whale sounds together! Instruct students to take a deep breath, plug their nose with one hand, and try to communicate with another student without releasing any air. You should be able to make some funny, low- or high-pitched “whale sounds.”
Reflections:	How did it go? What did students understand most/least? What could change about instruction or lesson plan?
Resources Used	Voices in the Sea; Whale Sounds Lesson NOAA Fisheries Whale and Dolphin Conservation Ocean Conservation Research Sound Library