Cetaceans 4th Grade Curriculum—Lesson 7: How Do Whales Eat?[1]

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Description

Students will learn the differences between how baleen and toothed whales feed. Students will learn how sound waves are used for echolocation.

Objectives

By the conclusion of activities, students will:

- Be able to describe the basic diet of baleen whales and toothed whales
- Be able to describe the three basic feeding strategies used by baleen whales: gulp feeding, skim feeding, and bottom feeding
- Be able to explain echolocation and the way odontocetes use it to find food
- Be able to explain how sound travels

What You Will Need

- Ability to project a PowerPoint presentation
- Copy of PowerPoint presentation: *Eating Like a Whale* (this can be downloaded from https://www.flseagrant.org/education/cetaceans/)
- Internet connection (to show some of the videos in the presentation)
- Optional: Speakers for PowerPoint presentation
- *Investigating Sound Waves* activity:
  - Tuning fork(s)
  - Copy of page 10 to project or printed copies to hand out to the students
  - Shallow, clear pan of water
  - Laptop/computer
- *Dolphin Polo* activity:
  - Five blindfolds
  - Copies of page 7-5 for each student
- *Eat Like a Whale* activity:
  - Four plastic dishpans or similar tubs
  - Container of dry parsley
  - Six small plastic combs
  - Roll of paper towels
  - Pair of kitchen tongs
  - Pens for students to use on paper towels
  - Straws
  - Plastic sandwich bags
  - Small pieces of foam or other small floating objects (e.g., foam beads)
  - Feeding instructions cards (page 7-7), cut out and laminated

Standards

Florida Sunshine State Standards

Science

- **SC.4.N.1.2** Compare the observations made by different groups using multiple tools and seek reasons to explain the differences across groups.
- **SC.4.N.1.5** Compare the methods and results of investigations done by other classmates.
- **SC.4.P.10.1** Observe and describe some basic forms of energy, including light, heat, sound, electrical, and the energy of motion.
- **SC.4.P.10.3** Investigate and explain that sound is produced by vibrating objects and that pitch depends on how fast or slow the object vibrates.

Strategy

There is an instructional PowerPoint presentation. Several optional activities reinforce concepts introduced in the presentation.

Presentation: Eating Like a Whale (PowerPoint)

Teacher Script

Slide 1. Today we are going to learn how different types of whales and dolphins get their food.

Slide 2. Baleen whales, or mysticetes *(MISS-ti-seats)*, are some of the largest animals on the planet, but they eat very small food items. Many baleen whales eat plankton. Plankton is made up of very small organisms—many are microscopic—that float in the ocean. Plankton contains animals like copepods and krill that are eaten by baleen whales. Some copepods are smaller than a grain of rice! Baleen whales may also eat small fish, which swim in large schools.

Slide 3. Toothed whales, or odontocetes *(oh-DON-tuh-seats)*, eat larger prey items—usually fish, but sometimes invertebrates (animals without backbones) like squid. Sometimes they even eat other marine mammals.

Slide 4. *[Note: if you have already taught Lesson 2, the students will have seen the information on this slide. In this case, use the slide to review previously introduced information.]* Since baleen whales feed on fairly small food items, they need a way to filter their prey out of the ocean water. The baleen in their mouths acts as this filter. However, different baleen whales have different feeding behaviors, as we will see in the next few slides.

Slide 5. There are three major feeding strategies for baleen whales—gulp feeding, skim feeding, and bottom feeding. Whales that are closely related to each other use similar feeding strategies.

Slide 6. Gulp feeders, like blue whales and humpback whales, have throat pleats that allow them to take a large amount of water into their mouths. Look for these in the two videos that we are about to see. What you will not be able to see is that the whales use their tongues to push the water through the baleen after they close their mouths. This traps the fish and plankton on the inside of the baleen in the whale's mouth. We will now see two videos of humpback whales feeding on small fish. In the second video, you will see the humpback using a technique called "bubble net feeding" to concentrate the fish into a small area to make it easier to feed on them.

Slide 7. *[Click on the video clip to start it—it is narrated, so you will want to have the sound turned on. Clip lasts about 1 minute 17 seconds.]*

Slide 8. *[Click on the video clip to start it—it is narrated, so you will want to have the sound turned on. Clip lasts 2 minutes 19 seconds.]*

Slide 9. Kick feeding is another method whales use to group fish together. This video shows a humpback whale named Pinpoint. Pinpoint is using his tail to scare fish so that they group together in a school. When you watch Pinpoint kicking the surface, notice when his body position changes for a deep dive. When he comes back to the surface, he has his open mouth exactly where he was "kicking" the surface with his tail! *[Click on the video clip to watch it—it has sound, but the audio is not necessary. It runs about 1 minute.]*

Slide 10. In the next video, we will see a right whale using skim feeding. It is probably eating tiny copepods. A copepod is about the same size as a grain of rice. You will be looking at the tip of the whale's upper jaw and part of its head. You will see the baleen plates hanging from the top jaw. Right whales and bowhead whales both obtain food by skim feeding at the surface, but they also feed underwater.

Slide 11. *[You will need to click on the link to access the video from the Arkive website. Video lasts 35 seconds.]*

Slide 12. The third type of feeding is called bottom feeding. Gray whales will roll on their sides and grab a mouthful of mud, which contains many types of invertebrates. What is an invertebrate? [*Answer: An animal that does not have a backbone.*]

Slide 13. *[You will need to click on the link to access the video from the Arkive website. Video lasts 46 seconds.]* The whale is swimming along on its right side—you can see mud streaming out of the back of its mouth. *[When the whale rights itself, the students will be able to see the mud quite clearly.]*

Slide 14. Odontocetes or toothed whales do not have baleen to help them filter food out of the water; instead, they rely on being able to grab larger prey items, like fish and squid. So how do they find their prey? They cannot always see their prey...

Slide 15. ... so they use a process called echolocation to help them figure out where things are in the water. *[This is also explained in Lesson 2.]* Odontocetes will produce a sound wave, which hits an object in the water and then bounces back to them. Based on the time taken for the sound to come back, the whale or dolphin can tell how far away the object is. Let's listen to some of the sounds produced by different toothed whales. *[Click on the little speaker symbol next to any of the whales' pictures to hear the sound. Point out that some of the sounds are like drumbeats, others are squeaks, and some are a combination of both.]*

Slide 16. Odontocetes' heads are specially designed for echolocation. They use the forehead region, known as the melon, to produce the sounds and transmit them into the water. The lower jaw detects the returning sounds and carries the vibrations to the ear bones. Odontocetes have ears, but they do not have earlobes to help them trap sounds. This makes it hard to see the ears on whales and dolphins.

Slide 17. Toothed whales use many feeding strategies.

Slide 18. These include suction feeding, which is commonly observed in beluga whales. Belugas eat many prey items that dwell on the seafloor. They are able to pucker their lips and use suction to capture their food.

Slide 19. Herding is when a group of dolphins surrounds a school of fish to pack them as tightly as possible. Dolphins then take turns swimming through the school and feeding

one at a time. *[You will need to click on the link to access the video from the Arkive website. Video lasts 1 minute.]*

Slide 20. Strand feeding is when a toothed whale chases a school of fish or other prey into shallow water. The whale pushes the prey onto the shore and then lunges onto the shore to catch the prey in its mouth. *[Click on the video clip to start it—it is narrated, so you will want to have the sound turned on. Clip lasts about 19 seconds.]*

Slide 21. Mud-ring feeding is when a group of dolphins uses a circle of mud to catch fish. The action usually begins with one dolphin suddenly swimming off. It then dives below the surface, circling a shoal of fish and stirring up mud along the way. On cue, the other dolphins in the group move into position, forming a barrier to block any underwater escape routes. As the circle of mud rises to the surface, the fish are trapped. Their only option is to leap out of the water and straight into the open mouths of the waiting dolphins.

Slide 22. Unfortunately, people often feed toothed whales. This may teach the animals to beg for food from humans. This puts them in danger of being hit by boats or becoming entangled in fishing gear. Swallowing fishing lures or eating foods that are not part of their natural diets may make the animals sick. For these reasons, it is illegal to feed marine mammals in the US. *[Click on the video clip to start it—it is narrated, so you will want to have the sound turned on. Clip lasts about 30 seconds.]*

Slide 23. To summarize what we've learned about whale feeding: Baleen whales feed on relatively small prey items by gulping, skim feeding, or bottom feeding. Toothed whales use echolocation to find their larger prey items, grab them with their toothy jaws, and swallow them whole. The toothed whales use strategies such as suction, herding, and mud-ring and stranding feeding to catch fish.

Activity: Investigating Sound Waves (modified from SeaWorld's Good Vibrations activity)

https://seaworld.org/-/media/migrated-media/seaworld-dotorg/pdfs/classroom-activities/grades-5_8/5_8_good_vibratrions.pdf

You can perform this activity as a demonstration, or you can set up a series of stations for the students to rotate through in small groups—depending on the supplies available. The steps below are for a demonstration.

1. Explain to the students that they will be learning about sound, a type of energy that can travel through gases, solids, and liquids. Sound is the vibration of molecules. These vibrations travel in waves, and they travel at different speeds depending on the medium. Sounds travel slowest through gases (e.g., air), faster through liquids (e.g., water), and fastest of all through solids (e.g., bone). This is because gases, liquids, and solids are made of particles called molecules. In gases, the molecules are far apart; in liquids, they are closer together. In solids, they are even closer together. You can use the diagram provided on page 7-6 to illustrate this.
2. Explain that sound travels at about 340 meters/second (0.2 miles/second) in air, but in water, it can travel at about 1,600 meters/second (1 mile/second). Write these numbers on the board.
    - Ask the students whether sound travels faster in air or in water [*Answer: water*].
    - Ask the students to estimate how much faster sound travels through water than through air [*Answer: 4.7. Guesses of four to five times faster are acceptable*].

- Show the students a tuning fork. Explain that when tuning forks are hit on the U-shaped portion, they produce sound waves that we hear as a particular musical note.
- Show the students how to get sound from a tuning fork. Make sure the class is very quiet. Holding the fork by the single prong at the base of the U (don't hold the U-portion), strike the side of the U-portion on a solid surface (it doesn't need to be hard like a rock; a solid rubber or plastic surface works well and won't damage the tuning fork). You should hear a clear but faint humming sound for about five seconds. Ask the students to raise their hands if they were able to hear the sound. If necessary, repeat the process after moving to a new location in order to let everyone hear the sound. Explain that the students are hearing the sound because the sound waves are traveling through the air and into people's ears, where ear bones detect the waves as a musical note.
- Encourage students to cup their hands around their ears (simulating larger earlobes) and repeat step 2. Ask the students to keep their hands cupped at their ears and turn their backs to you. Strike the tuning fork again. Have them turn back towards you and remove their hands. Strike the tuning fork a third time. Ask the students whether they noticed any difference in the three sounds. When did the tuning fork produce the clearest or loudest sound? [*It should be when they were facing you with their hands cupped around their ears.*] Explain that the cupped hands help trap the sound so our ears can hear it.
- To show how sound waves travel through water, you will need a shallow pan or a clear plastic storage box into which you have poured water to be about 1 inch deep. Set the pan on an overhead projector and allow the water to settle. If using an Elmo projection device, you may want to put a dark sheet of paper or plastic under the pan. Hold a tuning fork by the handle and strike the tines on a hard surface. While the tuning fork is vibrating, place the tips of the tines in the

water (slowly, or you will get a big splash!). Ask the students what they see and hear (you may need to repeat the process a couple of times). They should be able to see small ripples developing, then spreading away from the tuning fork. They may hear a faint sound from the tuning fork after you strike it. Explain that the ripples are the sound waves being converted into water waves.

- Remind the class that whales and dolphins do not have earlobes, so the animals need another way to trap the sound waves so they can hear them. Ask if anyone remembers how they do this [it was in the slideshow]. They use their lower jaw! Explain that you are going to demonstrate how this works by striking a tuning fork and touching the bottom tip (the bottom of the part you are holding) to the lower jaw of one of the students. Ask for a student volunteer, and do this procedure. Ask the student what happened when you touched the tuning fork to their jaw. They should be able to hear the note more clearly and, perhaps, be aware of a vibration in the jaw. Repeat this for any student who is willing.
- Ask the students if they could hear the sound better when it was in air or when it traveled through their jaw. [*They should have heard it more clearly through their jaw.*] Ask them why they think they could hear it better through their jaw. [*The jawbone is a solid, so sound waves move through it faster than through air, which is a gas.*]

Activity: Dolphin Polo (Sea World/Busch Gardens Dolphins K–3 Classroom Activities)

(https://seaworld.org/-/media/migrated-media/seaworld-dotorg/pdfs/classroom-activities/grades-k_4/k_4_dolphin_polo.pdf?version=1_201811145309)

Suggestion: set ground rules for movement (i.e., no running; require students to drag one foot when walking to ensure they move slowly).

Dolphin Polo

OBJECTIVE

The student will play a game to experience how dolphins use echolocation to find their food.

ACTION

1. Write on the board or show the word *echolocation*. Circle the two smaller words: *echo* and *location*. Ask students if they know what each word means. Explain that dolphins find food and each other by using echoes. Echolocation is a way that dolphins "see" by using sounds. Show Figure 1 to help illustrate echolocation.
2. To begin the game, have the students hold hands and form a circle about 3 to 4.5 m (10 to 15 ft.) across. Blindfold a volunteer "dolphin" and steer him or her to the center of the circle. Choose five students to be "fish." "Fish" stand inside the circle.
3. Explain that the game Dolphin Polo is played like "Marco Polo." The dolphin calls out "dolphin" (similar to real dolphins sending out clicking sounds), and the fish respond by calling "fish" (similar to the echoes that bounce back). The dolphin tries to find the fish by following the sounds of their voices. When the dolphin tags a fish, the fish sits outside the circle.
4. After a few minutes, call a time-out and ask the students what would help the dolphin catch the fish. In the ocean, dolphins hunt together in pods. Add a few blindfolded dolphins to the center of the circle and see if the hunting gets any easier.

BACKGROUND

Dolphins make clicking sounds that they send through the water. When the clicks hit an object, the sound waves bounce back, or "echo," to the dolphin. This activity is called echolocation. A dolphin can get a lot of information from these echoes. For instance, a sound that bounces off a rock is different from a sound that bounces off a fish. Echoes from near objects bounce back faster than echoes from far objects. So, dolphins can use echolocation to tell how far away an object is, how big it is, what shape it is, and if it's moving. Echolocation helps dolphins stay together, find food, avoid predators, and steer through dark, murky water.

MATERIALS

- a large play area, at least 6 by 9 m (20 by 30 ft.)
- five blindfolds
- copy of page 7-5

Dolphin Polo Echolocation Chart

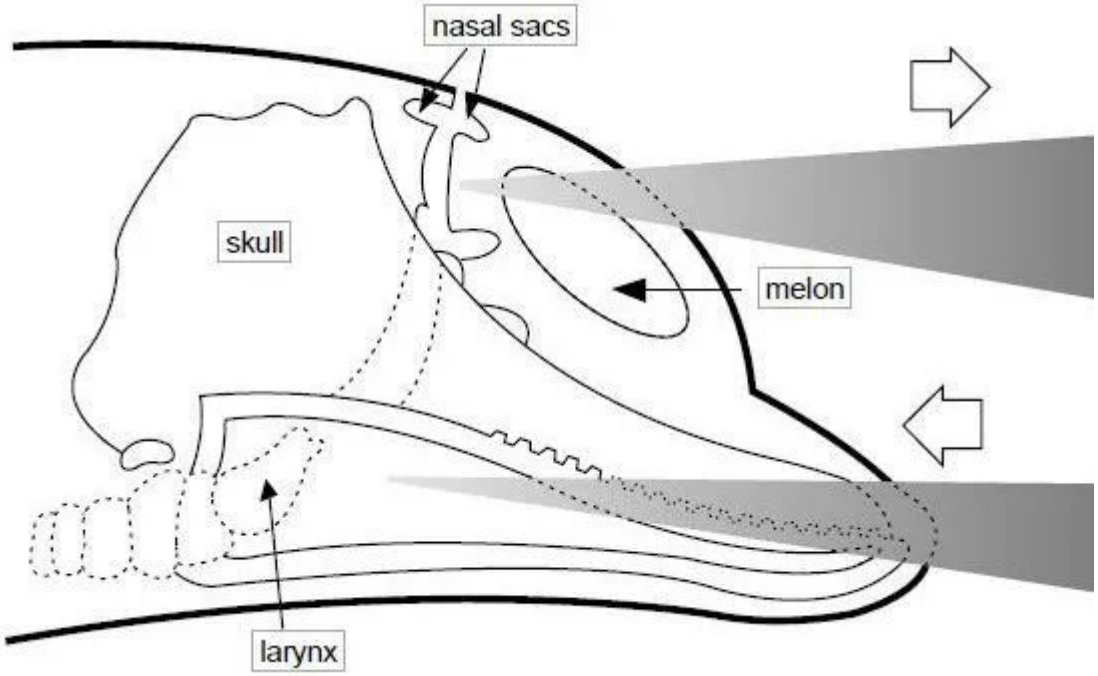


Figure 1.

1. A dolphin sends "clicks" into the water through its melon.
2. The clicks hit an object, then bounce back to the dolphin.
3. The echoes reach the dolphin's lower jaw.
4. The echoes from the object tell the dolphin the object's size, shape, and location.

A dolphin creates sounds by moving air between nasal sacs that lie beneath its blowhole. The clicks pass through the fat-filled melon (the rounded region of a dolphin's forehead) and are focused into a beam that is projected forward into the water. The sound waves in this beam bounce off objects in the water and return (to the dolphin) in the form of an echo, which is received by the dolphin's lower jaw.

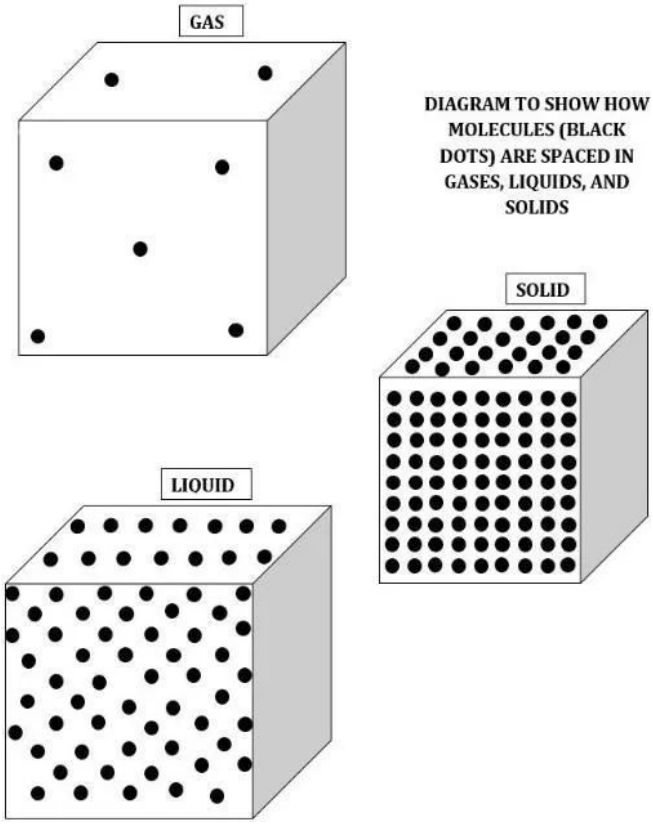


Figure 2.

Activity: Eat Like a Whale

(Modified from Jean-Michel Cousteau Ocean Adventures' *Whale Adaptations* activity: https://www-tc.pbs.org/kqed/oceanadventures/educators/pdf/OceanAdv-WhaleAdapt.pdf)

1. Prepare supplies ahead of time.
    - Cover tables or countertop with newspaper or towels.
    - Fill four plastic tubs with water. Add about two tablespoons of dry parsley flakes to each tub. Place the tubs on top of newspapers or towels.
    - Cut apart and laminate the "Feeding Instructions" cards (pages 7-7). Place one of the cards next to each tub.
    - Add a few small pieces of foam or other floating objects to the "bottom feeders" tub. These represent fish or squid.
    - Place four combs next to the "skimmers" tub and one next to each of the "gulpers" and "bubble feeders" tubs.
    - Place a pair of tongs next to the "bottom feeders" tub.
- Explain to the students that, for this activity, they are going to become cetaceans and experiment with the different feeding styles they learned about in the PowerPoint presentation. Ask if they can remember any of the different baleen whale feeding styles (skimming, gulping, bubble net feeding, bottom feeding). Write these on the board.
- Divide the class into four groups. Have each group come up with a group name. Give each group four paper towels and a pen. Ask them to write BOTTOM FEEDER on one paper towel, SKIMMER on another, GULPER on a third, and BUBBLER on the fourth. Have them write their group's name on the paper towels.
- Give each group two plastic sandwich bags. Tell them to use one bag for the "gulper" activity and the other for the "bubbler" activity.
- Give each group of students three or four straws (one less than the number of students in the group). Explain that these are to be used with the "bubbler" activity.
- Explain that the groups will have a turn at all of the four stations. At each station, the students will simulate one of the whale feeding behaviors. The instructions for the activity are provided at the station. [You can also briefly explain what to do at each station.]
- Assign each group of students to a starting location, and explain how they will rotate (e.g., when you tell them to, they will rotate to the right). The students should leave all of their paper towels except the one they will be using. Once they have completed one station, they should carefully bring that paper towel back to a central point and collect the paper towel for their next station. [Have a few desks set up with newspaper or towels where students can set the wet paper towels.]
- Start the rotations. As the groups finish their assigned tasks, you may need to replenish the parsley in a few of the tubs.
- Once the students have completed all of the four stations, have the students look at their four paper towels.
    - Ask the groups: which type of feeding method seemed to catch the most prey?
    - Discuss with the students—did all groups have the same answer to the question above?
    - What types of food did the biters have the most success in catching? [Probably floating beads or foam, i.e., fish or squid.]

Cut out and laminate the feeding instructions cards below.

Skimmers

Hold the back of a comb with your thumb and fingertips. Dip the teeth of the comb into the water as far as you can without getting your fingers wet. Use the comb to scoop parsley ("plankton") out of the water. Tap the bottom of the comb on the paper towel labeled "Skimmer" to make the parsley fall onto the paper towel. Each person in the group should make one scoop with the comb. Leave the combs next to the tub.

Gulpers

One person should take a plastic bag and use it to scoop up some water and parsley. The other people should hold combs over the tub of water (so the combs are on their sides). The first person should pour the water carefully and slowly over one of the combs, trying to trap the parsley on the comb. It might be helpful to almost close off the top of the bag so only a small amount of water can come out of it. Once there is some parsley on the comb, switch to another comb. Each person holding a comb should periodically tap the comb onto the paper towel labeled "Gulper," then continue collecting parsley. Do this until the bag is empty. Leave the combs next to the tub.

Bottom Feeders

One person at a time, take the tongs and use them to grab food (plankton, small fish, squid) out of the water. Put any prey that you catch onto the paper towel labeled "Bottom feeder." Repeat. Pass the tongs to the next person, who will repeat these steps. Leave the tongs next to the tub when finished.

Bubblers

One person should hold a plastic bag open by its flaps, then carefully submerge the bag until it is on the bottom of the pan. All of the other group members should use straws to create a bubble ring in the water. Move the bottom of your straw and try to concentrate the food into the middle of the

pan (over the bag). The person holding the bag should raise the bag up, filling it with as much parsley as they can. One of the students who had a straw will now need to hold a comb over the tub of water (so it is on its side). The person holding the bag will carefully and slowly pour the water over the comb, trying to trap the parsley on the comb. It might be helpful to almost seal off the top of the bag with your hands so only a small amount of water can come out of the bag. Once there is some parsley on the comb, stop pouring water, tap the comb onto the paper towel labeled "Bubbler," and continue collecting parsley. Do this until all of the water has been drained from the bag. Dispose of your straws and bag. Leave the comb next to the tub.

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