

Curriculum

Science Spotlight: Baleen Whale Evolution

Overview

Summary

Science Spotlight: Baleen Whale Evolution is a small exhibit located on the Level 3 of the Museum. While visiting, students will gain an understanding of how whales have evolved into two main groups: whales with teeth and whales with baleen. Students will learn how whales eat, the differences between toothed and baleen whales, and study different species of whales. While visiting the Museum, students will examine three skull specimens to observe the evolution of baleen, noting similarities and differences between the skulls. Students will look at other fossil specimens in order to infer evolutionary relationships between the fossils and their modern-day relatives.

Essential Questions

Why do some whales have baleen and others have teeth?

How have whales evolved over time?

NGSS Standards

NGSS MS-LS4-2: Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.

Pre-Visit Activity

To maximize the use of time during your visit, it would be helpful to introduce some key concepts and vocabulary to your students prior to visiting by incorporating the following activity into your lesson plan:

Title: How do whales eat?

Objective

- Students will be able to identify the two different types of whales (baleen and toothed whales).
- Students will learn about the differences between how whales feed.
- Students will be able to test and compare different methods of feeding in the two groups of cetaceans.

Materials Needed

- Clear Tupperware containers or bowls
- Small items to represent the food plankton (dried herbs, sequins, beads, etc.)
- Large items to represent fish (packing peanuts, cereal, rubber fishing bait, etc.)
- Toothbrushes, paintbrushes, or small handheld brooms to be used as “baleen”

- Tongs or chopsticks to be used as “teeth”
- Paper towels

Vocabulary

- *Cetacea*: An order of aquatic, mostly marine mammal that comprises the whales, dolphins, or porpoises
- *Mysticeti*: A suborder of Cetacea that comprises the baleen whales
- *Odontoceti*: A suborder of Cetacea that comprises the toothed whales
- *Baleen*: The mouth plates of baleen whales that serve as a strainer to catch plankton and krill while a whale is feeding
- *Plankton*: Small organisms that float or drift in great numbers in bodies of salt or fresh water
- *Krill*: A shrimp-like animal that is a major food source for the baleen whales
- *Migration*: Traveling great distances across the ocean to breed or feed

Activity

Prior to beginning this activity, set aside the materials each group will need. Fill each clear container about $\frac{3}{4}$ full with water. Divide the small and large “food items” among each container and place them in the water. Most of the “ocean animals” should float. Place both kinds of utensils (“baleen” and “teeth”) next to the containers along with paper towels for the students to collect the “food” on. Begin a class discussion by showing an image of a toothed whale. Ask students what kind of food they think this whale eats. Next, show an image of a baleen whale and ask students what kind of food they think this type of whale eats. Explain that some whales have teeth while others have baleen. Explain that baleen acts as a filter or strainer and allows whales to catch small organisms such as plankton and krill to eat. Show an image of plankton or krill and compare the size of the whale to the plankton. Ask students to discuss the following questions:

How much do whales need to eat?

How can the largest animal alive survive on the smallest animal alive?

You may want to show a video of whales eating. Some good examples would be orcas hunting in pods and humpback whales using bubble nets.

In groups, have students take turns using the “baleen” and “teeth” utensils to collect the “food” floating in the water. Have students separate what they collect and record the results. How many plankton and how many fish? After each student has had a turn, ask them to share their results with the class. Engage students in a class discussion about which method of feeding allows for more food consumption and how that affects each type of whale. Some questions to discuss include:

Why did whales evolve into two different groups?

Is baleen more effective than teeth? Why or why not?

You may want to discuss some other differences between toothed and baleen whales including:

- Toothed whales have a small tongue; baleen whales have a large tongue
- Toothed whales have one blowhole; baleen whales have two blowholes

- Toothed whales live in complex social systems, often gathering in pods; baleen whales tend to be solitary but occasionally gather in small groups to feed or travel
- Toothed whales use echolocation; there is no evidence to suggest baleen whales use echolocation
- In toothed whales the males are usually larger than females; in baleen whales the females are usually larger than males

Museum Visit Activity

Before visiting the Museum, print out a copy of the accompanying worksheet for each of your students. Explain to students they will be observing specimens of toothed and baleen whales while visiting the exhibit, using the worksheet to record their observations. Review the worksheet with students prior to your visit, clarifying what information they should collect when at the Museum.

Since this exhibit is small, we recommend dividing students into small groups. Each group should spend 15-20 minutes in the exhibit, examining the specimens and completing the worksheet.

While viewing the specimens on display, engage with students by asking the following questions:

- Can you describe what this specimen looks like?
- What do you notice about the jaw of this specimen?
- What do you think this specimen eats?
- Does the baleen remind you of anything you have seen before?
- What do you think the baleen feels like?

**If you are planning on doing Post Visit Activity #2 with your students, you will want to visit the *Fossil Mysteries* exhibition during your time at the Museum. In *Fossil Mysteries*, take students to see the giant ground sloth, the mastodon, the megalodon, the brontothere, and the ammonite. Ask students to discuss the size of each animal, how the animal looks, where the animal lives, and what the students think the animal ate.

Post-Visit Activities

The following activities can be incorporated into your lesson plans after your visit to The Nat. They are designed to further enhance the student's understanding of anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.

Activity #1

Title: Research Whales

Objective

Students will research different whales to learn more about the similarities and differences that are found among the species.

Materials Needed

Access to a computer or tablet with internet connection
 Pictures of different kinds of whales (toothed and baleen)

Research materials on the whales

Activity

Begin by reviewing with your class what they have learned, both in the pre-visit activity and while visiting the Museum. Engage students in a discussion about the differences they noticed in the ancient whale skull and the minke whale skull and ask students for their ideas on why whales evolved into two different groups.

Next, divide your class up and assign each group two toothed whales and two baleen whales to research. This activity can be done in groups of two, four, or individually.

Here is list of whales to start with:

- Toothed Whales: sperm whale, killer whale, Baird's beaked whale, pilot whale, narwhal, and beluga
- Baleen Whales: blue whale, gray whale, minke whale, humpback whale, pygmy right whale, and bowhead whale

Once students have been assigned four whales, they can begin their research. To guide the research process, suggest students first classify their whales as baleen or toothed. Students can then look for information about size, shape, habitat, food, social habits, physical characteristics, and color. Each group should write a brief description of their assigned whales, including information on the similarities and differences found between them.

Once students have completed their research, they can present their findings to the class in the form of a presentation. This can be a poster, a research folder, a visual diagram, drawings, a mini museum exhibit, etc.

Activity #2

Title: Comparing Fossils to their Modern Living Relatives

Objective

Students will research different modern animals and compare them to their extinct ancestors to understand the anatomical similarities and differences among them.

Materials Needed

- Access to a computer or tablet with internet connection
- Pictures of different kinds of animals and their fossil relatives
- Research materials on the modern animals and their fossil relatives

Activity

Before you begin this activity, print out copies of the worksheet Modern Animals and their Extinct Ancestors. Begin the activity by reviewing with the class the animals they saw when they visited the Fossil Mysteries exhibition. Explain to students that in the same way the whales they learned about

evolved over time, other animals have also evolved over time. Discuss ways that animals have evolved including size, food sources, and habitats. Inform students they will be looking at other animals that have changed over time, looking for similarities and differences in the animals and discussing why the animals evolved as they did.

Next, divide students into groups of two. Assign each group one of the modern animals to compare with the animal's extinct ancestor and provide them with copies of the Modern Animals and their Extinct Ancestors worksheet. Ask students to look for similarities and differences between the animals. Have them discuss the following questions:

- How have the modern animals changed over time?
- Why do you think these animals evolved in the way they did?

Once students have had time to look over the pictures of their assigned animals, they can begin their research. Their research should answer the questions discussed above. To guide the research process, suggest that students look for information about the size, habitat, food, physical characteristics, and habits of both the modern animal and their extinct relative.

Once students have completed their research, they can present their findings to the class in the form of a presentation. This can be a poster, a research folder, a visual diagram, drawings, etc.

Extensions

Whale Watching

Depending on the time of year, you may want to take your students on a whale watching trip. The San Diego Natural History Museum partners with Hornblower Cruises and Events to provide gray whale watching excursions. You can learn more about whale watching here:

<https://www.sdnhm.org/calendar/public-programs/whale-watching-with-the-museum/gray-whale-watching/>

Adopt a Whale

Many agencies sponsor whale adoption projects. They will send students a picture of their whale and information about recent sightings. Below are some agencies you can adopt a whale through:

- National Wildlife Federation: <https://www.shopnwf.org/Adoption-Center/Adopt-a-Humpback-Whale/index.cat>
- Pacific Whale Foundation: <https://www.pacificwhale.org/you-can-help/adopt-a-whale/>
- World Wildlife Fund: <https://gifts.worldwildlife.org/gift-center/gifts/Species-Adoptions.aspx>