



CETACEANS: WHALES AND DOLPHINS



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Objective

Students will explore the natural history of whales and dolphins around the world. Content will be focused on how whales and dolphins are adapted to the marine environment, the differences between toothed and baleen whales, and how whales and dolphins communicate and find food. Characteristics of specific species of whales will be presented throughout the guide.

What is a cetacean?

A cetacean is any marine mammal in the order **Cetaceae**. These animals live their entire lives in water and include whales, dolphins, and porpoises. There are **81 known species** of whales, dolphins, and porpoises. The two suborders of cetaceans are **mysticetes (baleen whales)** and **odontocetes (toothed whales)**. Cetaceans are **mammals**, thus they are warm blooded, give live birth, have hair when they are born (most lose their hair soon after), and nurse their young.

How are cetaceans adapted to the marine environment?

Cetaceans have developed many traits that allow them to thrive in the marine environment. They have streamlined bodies that glide easily through the water and help them conserve energy while they swim. Cetaceans breathe through a **blowhole**, located on the top of their head. This allows them to float at the surface of the water and easily exhale and inhale. Cetaceans also have a thick layer of fat tissue called **blubber** that insulates their internal organs and muscles. The limbs of cetaceans have also been modified for swimming. A cetacean has a powerful tailfin called a **fluke** and forelimbs called **flippers** that help them steer through the water. Most cetaceans also have a **dorsal fin** that helps them stabilize while swimming.

MYSTICETES

The suborder **mysticeti**, meaning "mustached whale" includes whales that have **baleen plates** that hang from the gums of the upper jaw of the whale. Baleen is made of mostly of **keratin**, a similar to our hair and fingernails. The baleen plates are arranged similar to a broom or a comb, and work like a **filter**. Mysticetes will take huge amounts of water and food into their mouths and then force the water out through the baleen, trapping food inside.

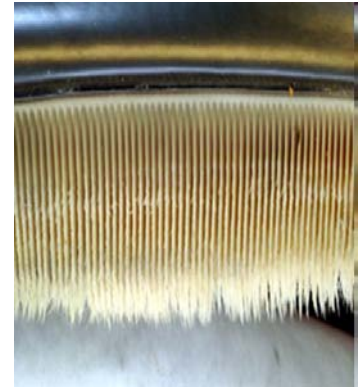


Photo: <http://ak.aos.org>



Mysticetes contain the **largest animals** on earth, but eat some of the smallest animals in the ocean! Most mysticetes eat plankton. Depending on the species, mysticetes also eat small schooling fishes and a variety of tiny crustaceans such as krill, copepods, and amphipods.

Mysticetes are different from other cetaceans in that they tend to be **solitary animals** and travel alone or in small groups, unless gathering for calving, mating, and feeding. Mysticetes are also characterized by **long seasonal migrations**. Unlike toothed whales, mysticetes have **paired blowholes** shaped in a V-position. There are **four families** of mysticetes. **Balaenidae** contains whales with arched jaws, such as Right whales and Bowhead whales. **Neobalaenidae** contains only one species, the Pygmy Right Whale. **Eschrichtiidae** also contains only one species, the Grey Whale. **Balaenopteridae** contains the most diversity, including all whales with throat grooves that allow for expanded water and food intake (see Humpback whale pictured below). The blue whale, the largest living animal on the planet, is in Balaenopteridae.





Striped Dolphin

ODONTOCETES

The suborder **odontoceti** includes all toothed cetaceans. Odontocetes swallow food whole, and their teeth are adapted for grasping, gripping, and tearing food. The number of teeth in a whale changes dramatically by species. The bottlenose dolphin has 88 teeth, while the narwhal has only two teeth, one of which is formed into a 10-foot long tusk in males narwhals. Toothed whales eat a wide variety of prey. Most odontocetes eat fish, but some eat invertebrates such as crabs and squid. The Sperm whale is the deepest diving marine mammal, and hunts Giant Squid that live in the deep ocean. Orcas, or Killer whales, are top predators and will eat fish, birds, and even other whales!



Generally, odontocetes are smaller than mysticetes. Odontocetes are also more **social** than mysticetes, and live together in family groups called **pods**. While all cetaceans have two nostrils, odontocetes have a muscular flap covering one nostril. Thus, odontocetes only have **one blowhole**.

Odontoceti contains much more **diversity** than mysticeti. Today, there are about **65 species** that include dolphins, whales, and porpoises. Odontoceti is broken up into **9 families**. Sperm whales (**Physeteridae**) have their own family and are the largest odontocete, growing as long as 59 feet (18 m).

Photo: www.animal.discovery.com **Kogiidae** contains dwarf and pygmy sperm whales that do not have heads as large as the Sperm Whale. **Monodontiidae** includes narwhals and belugas that have great neck flexibility and live in the Arctic. **Delphinidae** contains the bulk of the dolphin species, including Orcas and bottlenose dolphins. The family **Phocoenidae** contains porpoises, which have spade-shaped teeth, while delphinidae species have cone-shaped teeth. Deep diving skim feeders are grouped into the family **Ziphiidae**, and there are three families of river dolphins that have adapted to living in freshwater (**Platanistidae**, **Iniidae**, and **Pontoporiidae**).

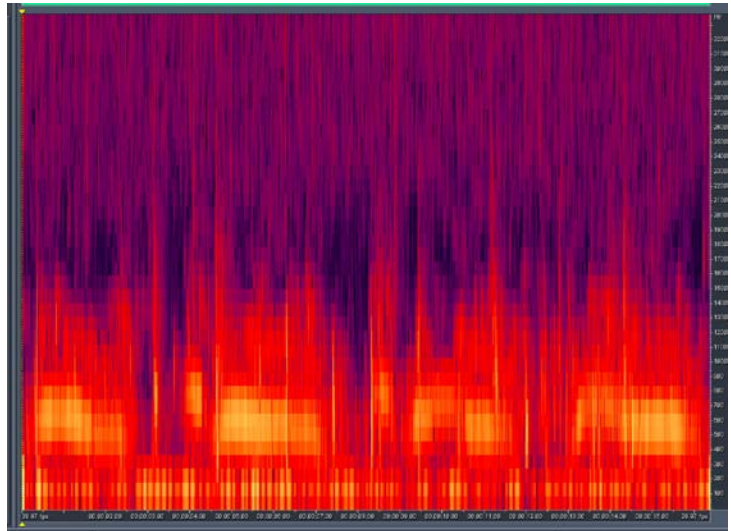


Photo: www.narwhalwhales.com

COMMUNICATION!

Cetaceans live in water that is commonly dark and turbid (cloudy). Thus, sight is not the primary method by which they find their way around the deep blue. Cetaceans have adapted to the marine environment through the use of **echolocation**, in which cetaceans emit sounds that bounce back to them from objects and the ocean floor. In this way, the whale can **navigate**, **find food**, and **socialize**. Each whale species has its own set of calls, and different populations of whales often make calls that differ from other populations.

Mysticete calls have **long, low frequency sounds** known as whale songs. **Odontocetes** produce rapid bursts of **high-frequency clicks and whistles**. Humans can listen to whale calls through a **hydrophone**, an underwater microphone. We know that different types of calls have different meanings and uses, but we have not begun to decode the language of the whales.



A spectrogram shows the frequencies of whale calls.

To hear whale Calls:

-Many Species Calls (Cornell Lab of Ornithology)

<http://macaulaylibrary.org/browse/scientific/10530450>

-Humpback Whale (National Geographic)

<http://www.pmel.noaa.gov/vents/acoustics/whales/sounds/whalewav/akhumphi1x.wav>

-Many Species calls (Scripps Institute)

http://cetuc.ucsd.edu/voicesinthesea_org/Flash/

-Right Whales, ship traffic noise, and spectrogram information (Cornell Lab of Ornithology)

<http://www.listenforwhales.org/Page.aspx?pid=432>

Other Resources:

Lesson Plan: "Why do whales make sounds?"

<http://www.nationalgeographic.com/xpeditions/lessons/08/g35/ccwhalesounds.html>

Activities: Includes games and interactive activities to help students understand the size of whales, echolocation, memorization and differences between species of whales, where whales live around the world, population dynamics of pods of whales, and the use and meaning of scientific names.

<http://www.swbg-animals.org/just-for-teachers/guides/pdf/whales-4-8.pdf>