



Introduction to Acoustics

Acoustics is the branch of physics that is concerned with the properties of sound.

Bioacoustics is the branch of acoustics concerned with sounds produced by or affecting living organisms, especially relating to communication. **Bioacousticians** are scientists that study these sounds.

For whales, their sense of sound, above all other senses, is the most important. It's how they "see" their world. Have you ever gone swimming off the northern coast of the United States? Could you see very far in the water? It's pretty murky—not because it's polluted, but because there is so much plankton (free floating plants and animals) floating in the water. Off the coast of Massachusetts, you can only see about 30 ft. on a good day. (That's not even a whale's body length in some cases.) So, sound is critically important to whales for communication, hunting, and navigating—the use varies depending on the type of whale.

In order to help scientists understand and organize the diversity of life on Earth, animals are classified into kingdom, phylum, class, order, family, genus, and species. For whales, the first classification is as follows:

Kingdom: Animal

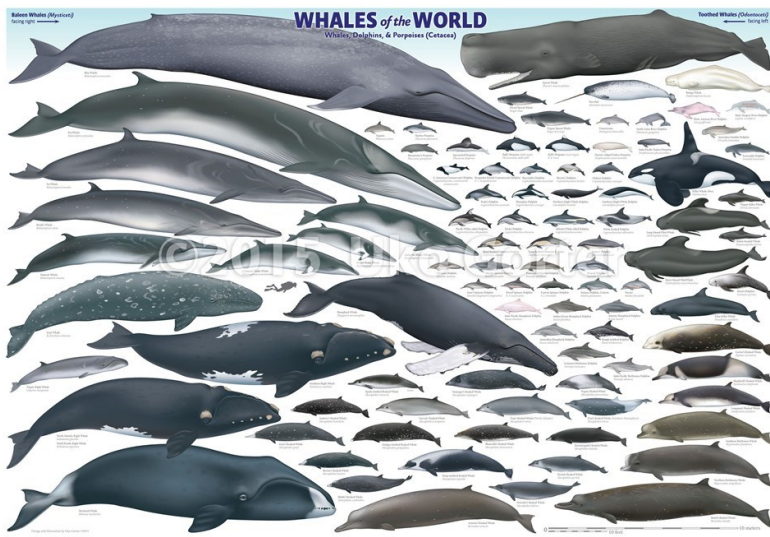
Phylum: Chordate

Class: Mammals

Order: Cetacean (whales, dolphins, and porpoises)

Sub-Order: Odontocete (Toothed) or Mysticete (Baleen)

OVER 90 DIFFERENT SPECIES OF WHALES



Uko Gorter created this amazing poster illustrating all the species.

[\(Click here to get one!\)](#)

This poster includes the over 90 species of the whales, dolphins and porpoises that we know of today. On the right side, you will see all the toothed whales (they tend to be smaller and there are more species). On the left side, you will see the baleen whales (they tend to be larger, but there are fewer species.) Whether a whale has baleen or teeth in their mouth influences how they feed and the social structure of the species, as well as the sounds they produce and how they use them.



Introduction to Acoustics

Baleen Whales vs. Toothed Whales

	Mysticete (Baleen) ("Moustache" whale)	Odontocete ("Toothed" whale)
In their mouth	Baleen plates are bristled triangular plates hanging in a comb-like fashion from their top jaw that they use to filter lots of fish or plankton out of the water	Teeth are used to grab or catch one fish at a time. Others, like orcas, use them to take bites out of their prey.
Prey	Lots of fish or plankton	One fish, squid or bite at a time
Social structure	Solitary	Tend to live in groups. They work cooperatively to corral fish and take turns feeding.
Communication	Tend to have low frequency sounds that travel over huge distances (hundreds of miles)	High frequency sounds that travel short distances because they aren't very far from one another.
Echolocate?	NO	YES

Uses of Sounds

Communicating

Squeaks, whistles, and moans are all words that describe the sounds that whales make when communicating. In order to understand what these different sounds mean, scientists put a hydrophone (an underwater microphone) in the water to record sounds, while recording behavior at the surface. Using these two data collection methods together, scientists are just beginning to understand what these different sounds mean.

Echolocation

Only toothed whales use echolocation. The animals send out a sound wave from their heads and based on the return echo, they essentially create a picture of their world. They use echolocation to find prey. Each click often sounds the same but will speed up as the prey gets closer. It is a fairly consistent and recognizable clicking sound.



Activity: Acoustics

ACTIVITY : Let's Hear Some Sounds

While listening to these sounds, keep in mind that toothed whales communicate using high-frequency or high pitched sounds and that baleen whales communicate using low-frequency or low pitched sounds. You also might hear repetitive clicking sounds—echolocation clicks (which are a big clue that it is a toothed whale.)

Click on a sound below and write down whether you think it's a baleen whale or a toothed whale. (Sounds are from [NOAA's Sounds in the Ocean's website](#))

1. [Sound 1](#) _____
2. [Sound 2](#) _____
3. [Sound 3](#) _____
4. [Sound 4](#) _____
5. [Sound 5](#) _____
6. [Sound 6](#) _____
7. [Sound 7](#) _____
8. [Sound 8](#) _____
9. [Sound 9](#) _____
10. [Sound 10](#) _____

What do you think toothed whales might say to each other when they are communicating? _____

Do you think baleen whales might be saying something different? What might they be saying? _____



Activity: Acoustics

The ocean has many sounds—some natural and some human made. Spend some times with the sounds of the ocean. Whales are creating sounds, but did you know that fish, invertebrates and seals also make sounds? Click on the following links to hear what sounds these animals make. (These sounds are from the [DOSITS](#) website.) On the space next to the animal, write what the sound makes you think of or draw a picture of some of the sounds. Please feel free to explore more sounds from the [DOSITS](#) website.

Fish Sounds

[Black Drum](#)

[Northern Seahorse](#)

[Oyster Toadfish](#)

[Haddock](#)

Marine Invertebrates

[Mantis Shrimp](#)

[Snapping Shrimp](#)

[Sea Urchin](#)

[Spiny Lobster](#)

Anthropogenic Sounds

(If any of these sounds remind you of one of the sounds from above, make a note of it.)

[Air Gun](#) (used for gas/oil exploration)

[Dredging Sounds](#)

[Torpedo](#)

Seal Sounds

[Bearded Seal](#)

[Ringed Seal](#)

[Weddel Seal](#) (make sure you listen to all 3 sounds)

[Crabeater Seal](#)

Natural Sounds

[Icebergs Colliding](#)

[Lightening](#)

[Rainfall](#)

[Ice Cracking](#)

Describe how you think whales react to these sounds and noises (unpleasant sounds)? _____



Answers

Click on a sound below and write down whether you think it's a baleen whale or a toothed whale.

1. Sound 1 Baleen (right whale)
2. Sound 2 Baleen (minke whale)
3. Sound 3 Toothed (pilot whale)
4. Sound 4 Baleen (humpback whale)
5. Sound 5 Toothed (beaked whale)
6. Sound 6 Baleen (sei whale)
7. Sound 7 Toothed (beluga whale)
8. Sound 8 Toothed (sperm whale)
9. Sound 9 Toothed (Atlantic white-sided dolphins)
10. Sound 10 Baleen (fin whale)

The other answers are simply your own thoughts!