

## WhaleWorks: Investigating Whale Adaptations

*Material adapted from:*

*Jean-Michel Cousteau Ocean Adventures, PBS, "Whale Adaptations"*

<http://www.pbs.org/kqed/oceanadventures/educators/pdf/OceanAdv-WhaleAdapt.pdf>

### Introduction:

All organisms have adaptations that help them survive. Some adaptations are structural, like the insulating blubber on a whale; other adaptations are behavioral, such as the different whale feeding patterns. Adaptations are the result of evolution. Adaptations usually occur because a gene mutates, or changes by accident. Some mutations can help an animal or a plant survive better than those of its species that don't have the mutation. For example, a whale born with a more streamlined shape than that of other whales can swim faster and catch more food. Because the whale can catch more food, it is healthier than other whales, lives longer and breeds more. Eventually, over thousands of years, the beneficial mutation—a more streamlined body—is found throughout the species. Thus, today's whales look much different than their ancient, land-dwelling ancestors.

The four activities in this collection demonstrate different adaptations that help whales survive. Students will explore:

- How sound travels through air, solids and water, relative to whale undersea communication and navigation
- The role of blubber in keeping whales and other marine mammals warm in their cold pelagic (open-ocean) habitats
- Different whale feeding methods
- The distinction between toothed and baleen whales

### Objectives:

Students will be able to:

- Observe, feel and hear vibrations in air, solids and water and communicate their observations
- Infer and discuss why sound is an effective means of communication
- Explain the importance of insulation in terms of how blubber maintains marine mammal body temperature in the ocean
- Describe common feeding methods for toothed and baleen whales
- Formulate a hypothesis and draw conclusions based on data they gather

### Ocean Literacy Principles

These activities support:

- Essential Principle # 5: The ocean supports a great diversity of life & ecosystems

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Materials:

(Materials in bold are provided by SMILE)

*Station A*

3-6 Tuning Forks (preferably of different sizes)  
2 Shallow pans of water  
Paper Towel

**Ziploc bags**  
Permanent Marker  
Paper Towels  
**Packing Tape**

*Station B*

Ice  
2 Dishpans  
**Rubber gloves** (too big for students)  
**Gloves made of assorted materials** (e.g. rubber, cotton, wool)  
Stopwatches  
Thermometers  
**1 Can of solid vegetable shortening** (e.g. Crisco)

*Station C*

**Dry parsley**  
Dishpans with water  
**Straws**  
**Plastic pocket combs**  
**Ziploc bags**  
**Tongs**  
Paper Towels  
**Styrofoam cups**  
Scrap paper  
Scales (optional)

Materials provided are enough to support 20 students

Handouts/Transparencies:

**Station Set-Up Instructions**  
**Student Booklet**  
**Answer Booklet**

Pre-Class Set Up & Introduction

1. The activities below (A, B, C) are intended to be organized as 3 separate stations around the classroom in which students will rotate between. Before the class begins, set up the materials using the Station Set-Up Instructions. Mark each station by taping the labels (attached to the instructions) to the table/desk.
2. As a class, brainstorm different species of whale that the students may be aware of. Ask the students if they can tell you the ocean(s) each species is found in. Use the table on the next page to help.
3. Provide students with a copy of the Student Booklet. This booklet provides instructions for the experiments at each station, as well as questions for the students to work through. Inform them they will be working in groups as they rotate around each station. Divide the class into 3 groups (6 groups for a large class size) and assign each group a starting station. Have each group spend at least 10 minutes at each station before they move to the next.

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Whale Species	Arctic Ocean	North Atlantic	North Pacific	South Pacific	Southern Ocean
Beluga	✓				
Bowhead	✓				
Blue		✓			✓
Fin		✓			✓
Gray			✓		
Humpback		✓	✓	✓	✓
Minke		✓	✓		✓
Narwhal	✓				
Orca (killer)	✓	✓	✓	✓	✓
Right		✓	✓		✓
Sei		✓	✓	✓	✓
Sperm		✓	✓	✓	✓

*Locations of common whale species*

### Wrap Up

1. Assign each group a station to report back on. Each group should assign a spokesperson to come to the front of the class and explain their findings from that station. Let the other groups comment or ask questions on those findings.
2. Briefly discuss with the class the underlying concepts of each station:

#### Station A

- Why is sound an effective way for whales to communicate and navigate?
- How might whales find their way around in a dark ocean?
- What is echolocation?
- How might human-induced sounds in the ocean impact whales?

#### Station B

- The ability of blubber to help conserve body heat
- Blubber is also an energy store
- Blubber is more suited to marine mammals that live in deeper waters. During diving, blubber does not compress under pressure unlike fur - air spaces and therefore insulation remains intact at depth

#### Station C

- Did one feeding strategy work well for all groups overall?
- Did different students prefer different methods?
- What other adaptations would whales need to aid these different strategies?

### Extensions:

1. Have the students play the echolocation game. This is similar to Marco Polo:

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- Students form a circle
  - Blindfold a volunteer “dolphin” and steer them to the center
  - Choose five students to be “fish”
  - When the dolphin calls out “Dolphin!” the fish must respond with “Fish!”
  - Dolphin moves around the circle trying to tag the fish by following the sounds of their voices. When a fish is tagged, they must then sit outside the circle.
  - After a few minutes, call a time out. In the ocean, dolphins sometimes hunt together in pods. Add a few more blindfolded dolphins to see if hunting gets easier.
2. Have the students assess the effectiveness of blubber gloves, using varying amounts of vegetable shortening in each glove. Simply smothering hands directly with vegetable shortening can also be an additional experiment, although lots of hand soap is required for clean up!
3. Have each group create a research poster on baleen verses toothed whales. The poster should compare and contrast baleen whales with toothed whales, highlighting other adaptations in addition to feeding strategies. Students could use specific species as examples.

Vocabulary:

**Baleen**

Also known as whalebone (although it is not made of bone), these are flat, flexible plates with frayed edges, looking like combs of thick hair. Made of keratin, the same substance as hair, some whales use these combs for filter feeding.

**Baleen Whale (Mysticetes)**

Whales that have plates of whalebone in the mouth for straining plankton from the water. They include the rorquals, humpback, right whales and gray whale

**Blubber**

A thick layer of vascularized fat found under the skin of many marine mammals

**Cetacean**

An order of marine mammals that comprises whales, dolphins and porpoises. They have a streamlined hairless body, no hind limbs, a horizontal tail fin, and a blowhole on top of the head for breathing

**Copepod**

A large class of small aquatic crustaceans, many of which occur in plankton

**Krill**

A small shrimp-like planktonic crustacean of the open seas. It is eaten by a number of larger animals, notably the baleen whales

**Pinniped**

An order of carnivorous aquatic mammals, comprising seals, sea lions and walrus. They are distinguished by their flipper-like limbs.

**Toothed Whale (Odontocetes)**

A predatory whale having teeth rather than baleen plates. Toothed whales include sperm whales, orca, beaked whales, narwhals, dolphins and porpoises.

**Zooplankton**

Animal plankton (primary consumer) that drift in the ocean currents; different types

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are found at all depths from the surface down to the deepest depths.