

Fins, Flippers & Flukes



Lab Program Curriculum Grades 3-5

Program Description

This 45–60 minute lab program will introduce students to a variety of marine mammal adaptations. During this program your students will participate in a brief discussion about mammal characteristics and the ocean conditions that make survival in this habitat challenging. Students and chaperones will then travel to four stations where they will explore materials such as whale teeth, a sea otter pelt and a blubber experiment. Participating in this program and using the enclosed activities will help your students meet ODE Science Content Standards and national Ocean Literacy Principles.

Chaperones will be asked to take an active role in the lab program, which is designed so that they read informational cards to the students in their group. It will also be the chaperone's responsibility to monitor the students' behavior during the lab program.

Before your visit:

- Make a **KWL chart**. Have the students write down what they **Know** about marine mammals and then have them write down **What** they want to know. Revisit this chart at the conclusion of your trip with what they **Learned**.
- Assign the activity **Measuring Marine Mammals** included in this packet. Using a bar graph, have your students graph the length of each animal.
- Have your students read **Finding Out About Marine Mammals** as an introduction to marine mammal characteristics and vocabulary. Use the accompanying worksheet to review this new vocabulary.
- Compare the living conditions of a marine mammal with those of a terrestrial mammal. Where do they sleep? How do they get their food? What do they eat? What environmental conditions must they be adapted to?

During your visit:

- Provide your students and chaperones with copies of the **Oregon Coast Aquarium Self Guided Materials**. A master copy of the pages needed to create this booklet can be found on the Teacher Resources page at the Aquarium website, www.aquarium.org

After your visit:

- Compare the feeding methods of toothed and baleen whales by completing the math activity, **Figuring Out Whales**.
- Ask you students to write a short story of the most interesting animal they found at the Aquarium. Have each student read their story to the class and have the class try to guess what the animal is.
- Lead the **Dilemmas** activity included in this packet to encourage students to think critically about what influence they have on the oceans and the animals that live there.



Fins, Flippers and Flukes addresses the following:

ODE Science Content Standards:

- 3.1** Structure and Function: Living and non-living things vary in their characteristics and properties.
- 3.3** Scientific Inquiry: Scientific inquiry is a process used to explore the natural world using evidence from observations and investigations.
- 4.1** Structure and Function: Living and non-living things can be classified by their characteristics and properties.
- 4.2** Interaction and change: Living and non-living things undergo changes that involve force and energy.
 - 4.2L.1** Describe the interactions of organisms and the environment where they live.
- 4.3** Scientific Inquiry: Scientific inquiry is a process of investigation through questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.
- 5.2** Interaction and Change: Force, energy, matter and organisms interact within living and non-living systems.
 - 5.2L.1** Explain the interdependence of plants, animals, and environment and how adaptation influences survival.

Ocean Literacy Principles:

Principle 5: The ocean supports a great diversity of life and ecosystems.

A: Ocean life ranges in size from the smallest virus to the largest animal that has lived on Earth, the blue whale.

C: Some major groups are found exclusively in the ocean. The diversity of major groups of organisms is much greater in the ocean than on land.

D: Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms (such as symbiosis, predator-prey dynamics and energy transfer) that do not occur on land.

Background Information

Mammals

Mammals come in all shapes and sizes, from the biggest whale to the tiniest vole. They all have certain characteristics in common, no matter what their size or shape.

All mammals:

- Are vertebrates (they have a backbone).
- Breathe air.
- Have hair or fur (Some whales lose their hair after they are born.)
- Are warm-blooded (They must eat enough food to produce energy to keep their body temperature constant.)
- Nurse their young with milk that the mother's body produces.

Most mammals:

- Give live birth. The only egg laying mammals are the spiny echidna and the platypus (both found in Australia).

Cetaceans (whales and dolphins) are marine mammals with streamlined bodies, which they propel forward with their strong flukes, or tails. These flukes are supported by cartilage rather than bone. Cetaceans breathe at the water's surface through blowholes—modified nostrils—located on top of their heads. Two kinds of whales seen off our coast are killer whales and gray whales.

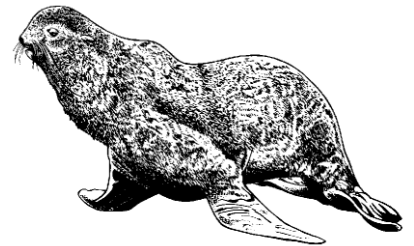


Pinnipeds are another group of mammals that includes seals, sea lions and walruses. Pinniped means “feather-footed”; their broad, paddlelike flippers are shaped like feathers. Two pinnipeds off our coast are California sea lions and harbor seals.

Staying Warm

Water draws heat away from the body 25 times faster than air. For example, a human swimming in 80 degree water will eventually get chilled, while the same person can remain comfortable in 80 degree air. One way that marine mammals compensate for this potential heat loss is that their bodies can produce and retain more internal heat.

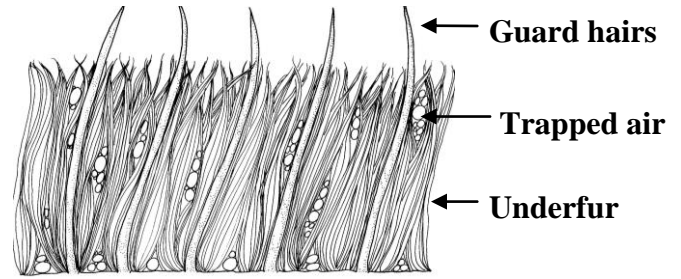
Pinnipeds and cetaceans rely on a thick layer of **blubber** to keep them warm. True seals have an especially thick blubber layer that is also used as an energy source during periods of fasting. During certain times of the year up to 50 percent of a marine mammal's body weight is blubber. A whale's blubber can be as thick as 20 inches in a bowheaded whale and make up 45 percent of their body weight! Whales also rely on their blubber for energy when food is scarce.



Sea otters are the only marine mammal that does not have a layer of blubber to keep them warm. Instead they rely on their **fur** for insulation. Sea otters have the densest fur of any

animal, with 500,000 to 1 million hairs per square inch on their bodies. Most people have about 100,000 (or less) hairs on their heads.

Sea otters spend a great deal of their time grooming using their mouth and paws to remove debris and keep their dense fur from matting. They will also blow air into their fur which becomes trapped between the hairs, creating an extra layer of insulation. A healthy otter with a clean coat will never feel the cold of the ocean water in which they spend all of their time.

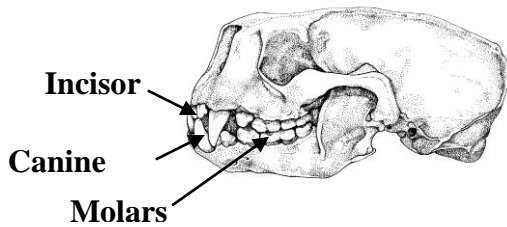


Sea otter fur

Feeding

Pinnipeds are opportunistic feeders. This means that they will eat just about anything edible and available. Most pinnipeds eat a variety of fish, shrimp and squid. Some will also eat marine birds, including penguins. While tooth structure in pinnipeds varies, most have sharp teeth that are designed for grasping prey and swallowing it whole. When capturing prey too large to swallow whole, they will tear it into smaller chunks that can be more easily ingested.

A sea otter must eat up to 25% of its body weight each day in order to satisfy its high metabolism. As a result, otters need to spend much of their time foraging and then resting from the effort. Individual sea otters show preferences for certain food items even though there are over 50 marine invertebrates that can make up their diet. An otter's menu includes crabs, clams, mussels, oysters, abalone, snails, shrimp, urchins, sea cucumbers, sea stars and octopuses.



only require a couple hard bites from an otter's crushing molars.

Most otter prey is hard shelled and methods for extracting the soft insides may vary among individuals. Some will use a rock or other tool, such as a discarded soda bottle, to crack open a shell. Others will simply smack two shelled victims together until the shells shatter. Some shells may

Vocabulary

- adaptation** (*A-dap-TAY-shun*): a characteristic, such as a body part, color pattern or behavior, that helps an organism survive in its environment
- baleen** (*bay-LEEN*): plates of fingernail-like material that hang from a baleen whale's upper gum, forming a mesh to trap the tiny animals the whale eats
- bioaccumulation**: a buildup of substances in organisms that gets more concentrated as it moves up the food chain
- blowhole**: the nostril of a whale
- blubber**: an insulating layer of fat just below the skin of most marine mammals
- carnivore** (*CAR-nih-vore*): an organism that feeds almost exclusively on other animals
- countershading**: a type of camouflage in which an animal's dark back grades into a light-colored underside. Seen from above, the dark backs of countershaded marine animals blend in with the water below. Seen from below, their pale sides and bellies blend in with the light coming from above.
- disruptive coloration**: a type of camouflage in which color patterns disguise an organism's shape. The black stripes and spots on a leopard shark, for example, are disruptive, disguising the shark's shape.
- dorsal fin** (*DOR-sul*): the fin on a fish's or whale's back
- echolocation** (*EH-koe-loe-CAY-shun*): a method of navigating and of locating objects in which an animal makes sound and determines locations from the timing and quality of the echo
- fin**: an appendage of an aquatic animal (fish or whale) used mainly to swim, steer or maintain balance
- flipper**: a broad, flat limb supported by bone and used for swimming
- fluke**: one of two horizontally flattened divisions of a whale's tail made of connective tissue, with no bone
- habitat**: the place where an organism lives; its home
- mammal**: a member of the class Mammalia (*ma-MAY-lee-ah*), a group of vertebrates that are warm-blooded, have hair and nurse their young. Sea otters, whales and humans are all mammals.
- marine mammal**: a mammal adapted to survive in a marine environment and dependent on it for food
- phytoplankton** (*FIE-toe-PLANK-tun*): photosynthesizing members of the plankton

plankton (*PLANK-tun*): organisms suspended in water that drift with the currents and swim only weakly or not at all

pod: a group of toothed whales; also called a herd or school

predator: a animal that kills and eats other animals

zooplankton (*ZOE-uh-PLANK-tun*): nonphotosynthesizing members of the plankton, mostly animals

Measuring Marine Mammals

Lesson at a Glance:

Students will measure the lengths of a group of marine mammals and compare each animal's size.

Oregon Content Standards:

SCIENCE

- **Third Grade:** 3.1 Structure and Function: Living and non-living things vary in their characteristics and properties.
- **Fourth Grade:** 4.1 Structure and Function: Living and non-living things can be classified by their characteristics and properties.
- **Fifth Grade:** 5.2L.1 Explain the interdependence of plants, animals, and environment, and how adaptation influences survival.

OTHER ADAPTABLE CONTENT AREAS

- Mathematics

Ocean Literacy: Essential Principles and Fundamental Concepts

5. THE OCEAN SUPPORTS A GREAT DIVERSITY OF LIFE AND ECOSYSTEMS.

- 5.a. Ocean life ranges in size from the smallest virus to the largest animal that has lived on Earth, the blue whale.

Materials:

- ❑ One 100-foot length of clothesline or rope
- ❑ Cable ties
- ❑ Single hole punch for each group
- ❑ Permanent marker for each group
- ❑ Measuring tape for each group
- ❑ Laminating materials (optional, but recommended)

Background information:

The lengths used for this activity come from a variety of resources and are currently accepted record lengths for these animals. If your students choose to pursue further research on these animals they may find resources with slightly different information.

In many groups of animals, one sex is different from the other; for instance, hens and roosters are different in size and plumage. This is called sexual dimorphism. With toothed whales (such as dolphins, porpoises and sperm whales), the males are typically larger. With baleen whales (such as gray and blue whales), the females are typically larger.

Here are the lengths of the animals included in this activity, plus some additional lengths (in *Italics*) that you may choose to add on your own. We have provided the lengths for males and females when that information was available.

Marine Mammals	Accepted maximum lengths
<i>Northern sea otter (female)</i>	4 feet
Northern sea otter (male)	5 feet
Harbor porpoise	5.5 feet
<i>California sea lion (female)</i>	5 feet
Harbor seal	6 feet
<i>Polar bear (female)</i>	6.5 feet
Pacific white-sided dolphin	7.5 feet
California sea lion (male)	8 feet
Polar bear (male)	8.5 feet
<i>Walrus (female)</i>	8.5 feet
Walrus (male)	10 feet
<i>Manatee</i>	10 feet
<i>Northern elephant seal (female)</i>	10 feet
Northern elephant seal (male)	14 feet
<i>Killer whale (female)</i>	23 feet
Killer whale (male)	26 feet
<i>Sperm whale (female)</i>	36 feet
<i>Gray whale (male)</i>	48 feet
Gray whale (female)	49 feet
Sperm whale (male)	65 feet
Blue whale	85 feet (average length, common)
<i>Blue whale</i>	110 feet (record length, very rare)

Activity:

1. Before class, cut out the pictures, laminate them (to prevent from tearing when attached to rope), and punch a hole near the top for the cable tie.
2. Divide students into as many groups as there are animals to measure out OR have your class make three of the same rope and then compare the measuring accuracy of each finished rope.
3. Explain to your students that these measurements are average lengths.

Group instructions:

1. Have students unravel their rope, preferably in a hallway or gymnasium.
2. Have students take turns using the measuring tape, marking the measurement and attaching the length cards with the cable ties.
3. Make sure that they tie the knot loops for their cable ties as they go. If they wait until all the marks are made, their final lengths on the rope won't be accurate, since they will have shortened the rope as they tie each knot.
4. Explain that they will begin to measure the length of each animal from the end of the rope. The end of the rope is every animal's tail and the mark on the rope (where the tag is hung) is the tip of the animal's face.



Conclusion:

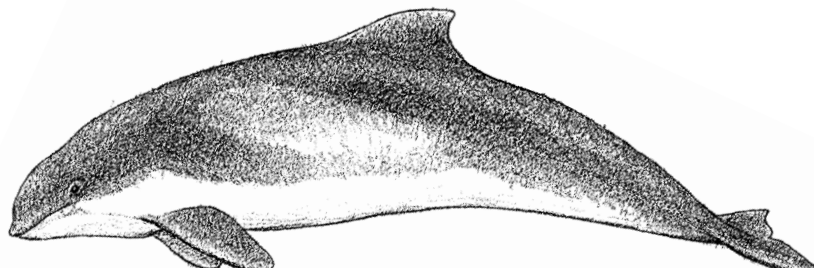
Have each group share their rope with the rest of the class, by having one student stand at each animal's tag as they hold up the rope.

Extension:

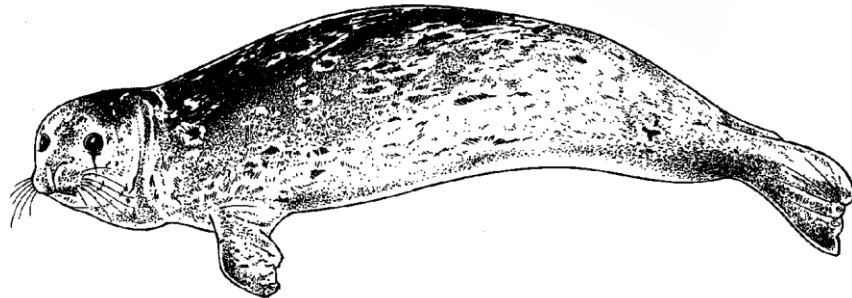
1. Have students convert the lengths in feet into inches, yards, meters, centimeters.
2. Add the shorter male and female lengths to the rope. Discuss sexual dimorphism.
3. Have students look up the lengths of other animals or things they are familiar with and add them to the rope. For example, find the length of a school bus or the average height of a fourth grader.
4. Have students use the library and the Internet to find the weights of the animals on their rope.
5. Have students calculate how many of each animal (nose to tail) it would take to reach one end of the hallway or gymnasium to the other.



Northern sea otter
5 feet

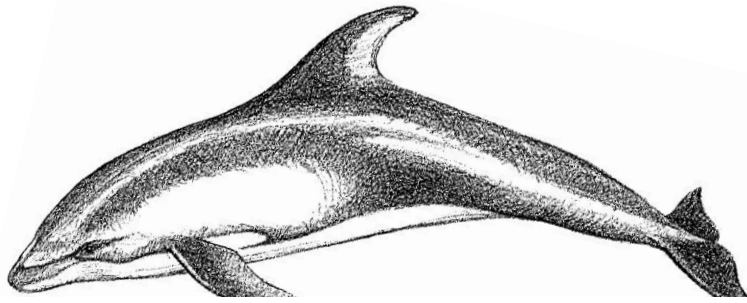


Harbor porpoise
5.5 feet

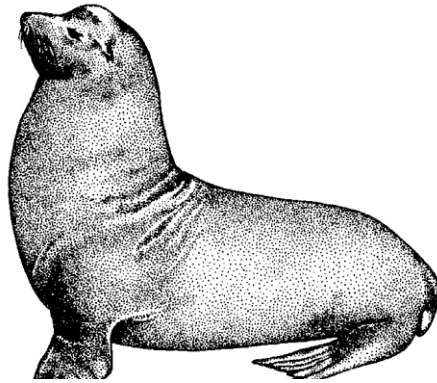


Harbor seal
6 feet

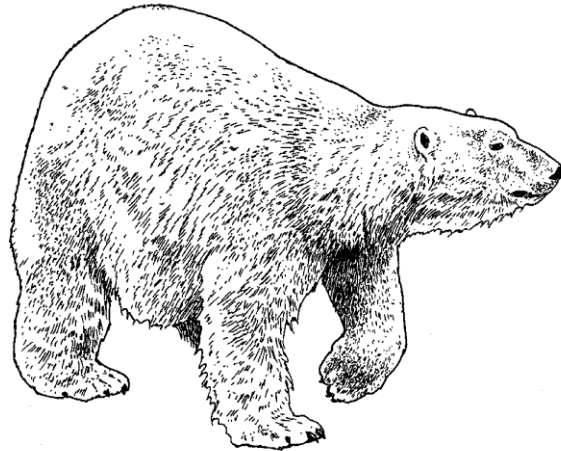




Pacific white-sided dolphin
7.5 feet

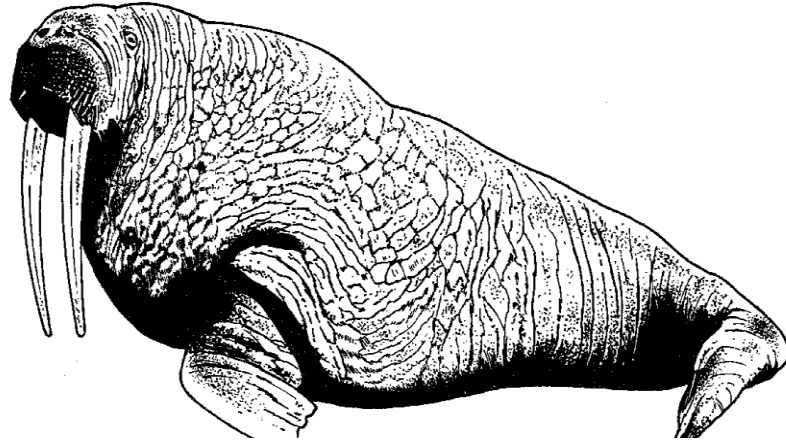


California sea lion
8 feet

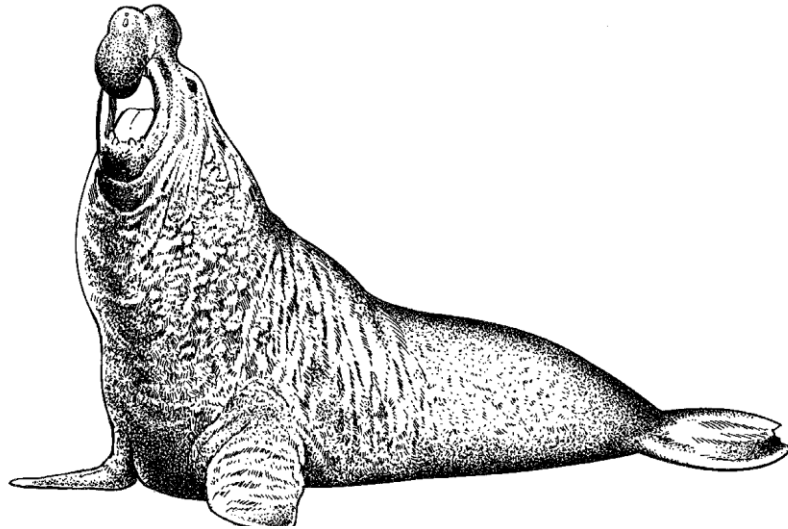


Polar bear
8.5 feet

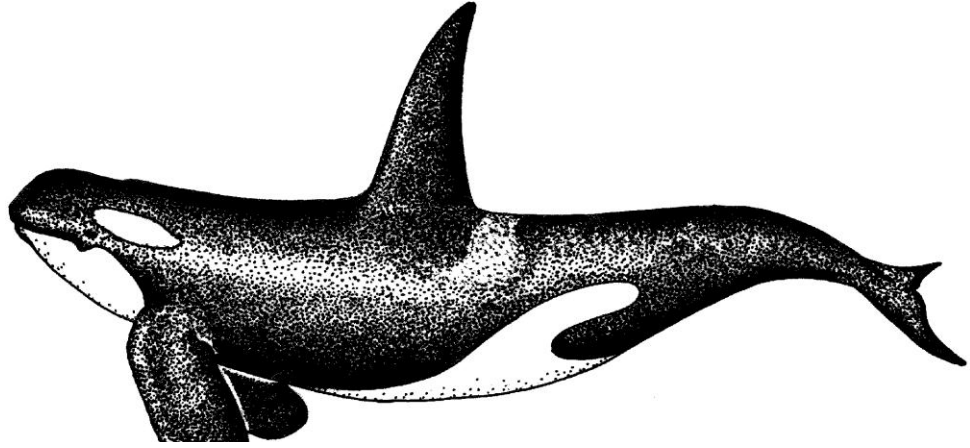




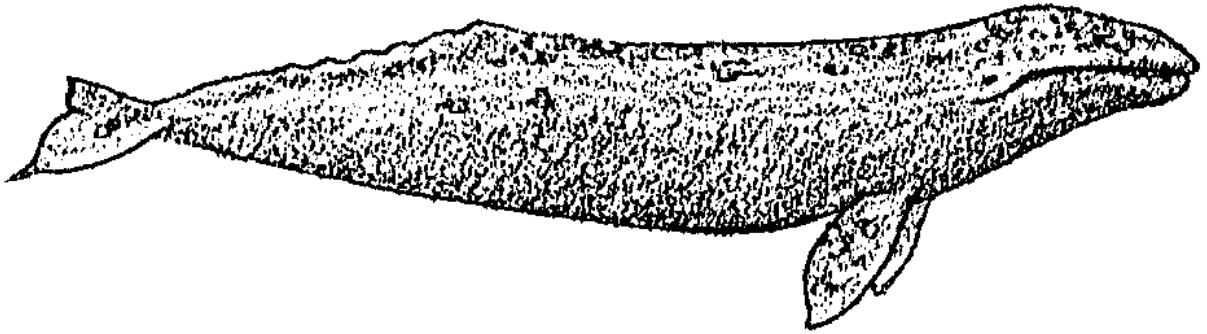
Walrus
10 feet



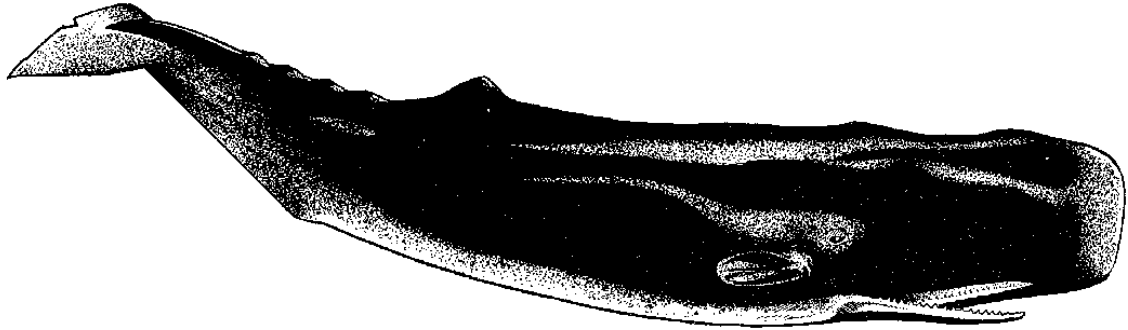
Northern Elephant Seal
14 feet



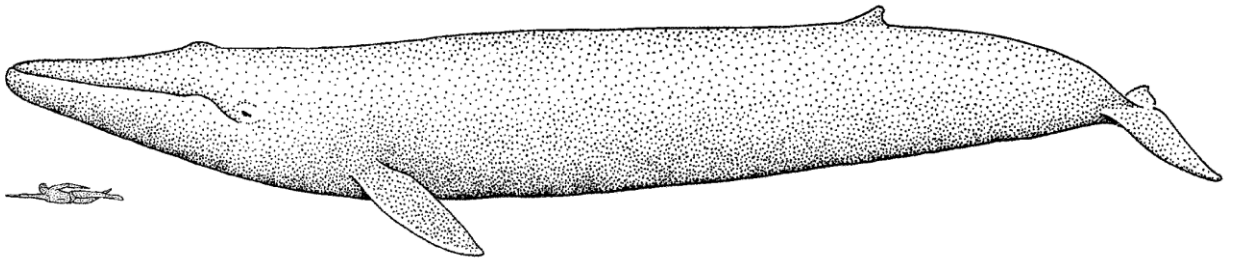
Killer whale (orca)
26 feet



Gray whale
49 feet



Sperm whale
65 feet



Blue whale
85 feet

Marine Mammal Words

Lesson at a Glance:

The purpose of this activity is to introduce your students to some of the information and vocabulary that they will hear in the marine mammal program at the Aquarium.

Oregon Content Standards:

SCIENCE

- **Third Grade:** 3.1 Structure and Function: Living and non-living things vary in their characteristics and properties.

OTHER CONTENT AREAS

Nonfiction reading and vocabulary

Ocean Literacy: Essential Principles and Fundamental Concepts

5. THE OCEAN SUPPORTS A GREAT DIVERSITY OF LIFE AND ECOSYSTEMS.

Materials:

- Finding Out About Marine Mammals text
- Marine Mammal Word Search
- Marine Mammal Words worksheet

Background Information:

Although marine mammals share the same basic characteristics as terrestrial mammals – warm blood, live birth, nurse their young, breath air and have hair, marine mammals are unique in many ways. First of all, they are adapted to survive in an ocean environment and depend on that environment for their food. Examples of marine mammals include seals, sea lions, sea otters, whales and even manatees and polar bears.

Special marine mammal adaptations include blubber or thick fur for warmth in the cold water, a nose or blowhole located near the top of its head, flippers, fins and flukes.

Activity:

1. Give each of your students a copy of the **Finding Out About Marine Mammals** text to read.
2. When they have finished reading, have your students write a list of the bold vocabulary words they've just read.
3. Give them the word search activity to help them become even more familiar with these words.
4. Use the fill-in-the-blank worksheets as a vocabulary test for your students before and/or after your visit to the Aquarium.

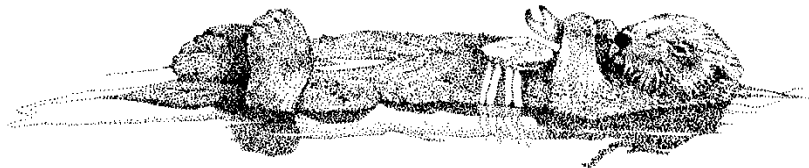
Finding Out About Marine Mammals

Just like land mammals, marine **mammals** are warm blooded, give live birth, nurse their young, breath air and have hair on their bodies at least at some stage of their lives. Marine mammals are different from land mammals because they depend on the ocean for their survival. The ocean can be a pretty tough place to live, especially for a mammal. You are a mammal – could you survive very long in the cold water off the coast of Oregon?

Marine mammals have body parts or behaviors called **adaptations** that help them survive in their environment. Most marine mammals have a thick layer of **blubber**, which helps insulate them in their cold ocean habitat. You would have to wear a special suit to stay warm enough to swim in the ocean for very long.

Another challenge faced by marine mammals is breathing. They don't have gills for taking oxygen out of the water like fish do. They have lungs like you, so they need to be able to come to the surface of the water to take each breath. Whales have an adaptation for breathing while they're swimming. Instead of having nostrils on the front of their face, they have one or two openings on the top of their heads called **blowholes**.

Finding food is also an important part of a marine mammal's survival. Most marine mammals are **carnivores** and eat only meat such as fish, clams, crab or other marine mammals. Some species, like seals, sea lions and toothed whales, have teeth designed for grabbing their food and swallowing it whole. Sea otters have teeth similar to yours and chew their food using their flat, crushing **molars**. Some marine mammals, like **baleen** whales, have no teeth at all. Instead, they have large plates of baleen that hang down from their upper jaw. They use their baleen to filter **plankton**, tiny plants and animals that drift throughout the ocean, from the water.



Sea otter



Marine mammals use flippers or flukes to help them move through the water. A **flipper** has a bone structure similar to that of your hand. Sea lions use their front flippers to swim through the water or shuffle along on land. Whales use their flippers for steering and stopping. They use their tail **flukes** in an up-and-down motion to propel themselves through the water. Toothed whales, such as dolphins, have a **dorsal fin** to help them stay straight as they swim through the water at speeds of up to 30 miles an hour! Dorsal means “back side,” which is exactly where the dorsal fin is found.



Sea lion

Marine mammals are an important part of the ocean **habitat**. These top predators feed on smaller animals and, by doing so, are helping to keep a balance in the ocean. Can you think of some ways that humans affect marine mammals in their habitat? Humans fish for some of the same species of fish that marine mammals eat. Marine mammals become injured or sick and sometimes die from many of the pollutants left in the ocean by people. What can you do to protect marine mammals and their habitat?

Marine Mammal Word Search

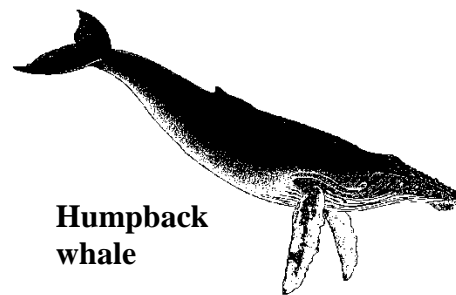
A	P	M	Y	H	S	R	E	P	P	I	L	F	B	Y
H	D	L	J	C	R	M	E	Q	R	F	A	Q	O	C
V	X	A	A	Q	J	L	X	T	E	H	S	G	P	F
F	R	H	P	N	S	F	Z	H	D	A	R	J	G	J
O	T	S	J	T	K	B	L	N	A	B	O	E	H	Z
Z	O	S	E	H	A	T	B	F	T	I	D	T	E	K
H	R	Q	R	L	S	T	O	I	O	T	M	V	V	H
C	U	S	E	R	O	V	I	N	R	A	C	I	F	B
A	X	E	B	H	C	H	W	O	S	T	P	L	T	S
S	N	P	B	K	I	G	W	U	N	R	X	L	T	H
R	F	L	U	K	E	S	A	O	G	S	A	S	H	O
S	N	S	L	A	M	M	A	M	L	W	H	L	V	P
L	O	L	B	O	M	W	U	N	B	B	A	C	O	X
J	L	V	I	S	I	C	Q	Z	I	Y	A	E	M	M

Find the following words in the puzzle above:

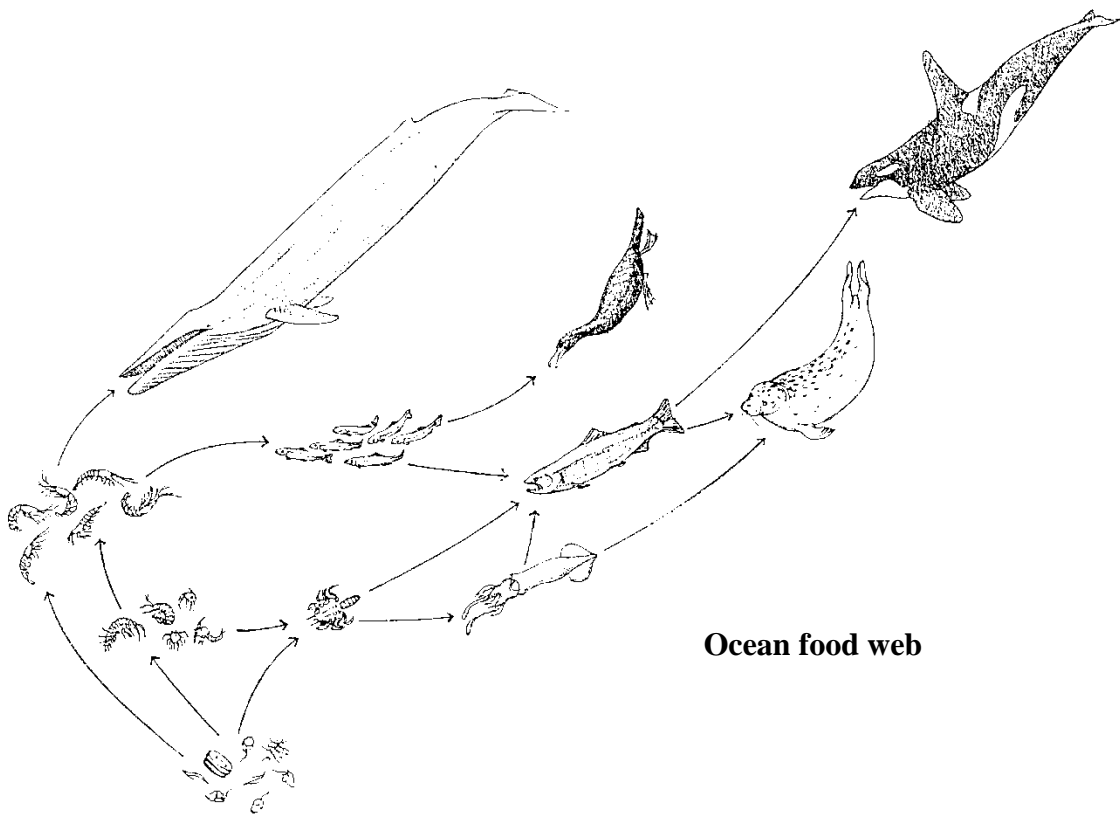
- adaptations
- baleen
- blowholes
- blubber
- carnivores
- dorsal fin
- flippers
- flukes
- habitat
- mammals
- molars
- plankton
- predators

Marine Mammal Words

1. Marine _____ are warm blooded, give live birth, nurse their young, breathe air and have hair on their bodies in at least some stage of their lives.
2. Animals such as marine mammals have body parts or behaviors called _____ that help them survive in their environment.
3. _____ are the tiny plants and animals that drift throughout the world's oceans with the help of the strong ocean currents.
4. Some species of whales have cone-shaped teeth for grabbing their food, while other species of whales have _____ in their mouth that helps them filter plankton from the water.
5. Most marine mammals are _____ and only eat meat such as fish, clams, crab or other marine mammals.
6. The fin found on the back of a toothed whale, such as a killer whale, is called a _____ fin.
7. Like humans, sea otters have flat teeth called _____ in their mouth, which help them chew their food.
8. Most marine mammals have a thick layer of _____, which helps insulate them in their cold ocean habitat.
9. Sea lions use their front _____ to swim through the water or shuffle along on land.



10. Whales use their flippers for steering and stopping. They use their tail _____ in an up-and-down motion to propel them through the water.
11. Instead of having nostrils on the front of their face, whales have one or two openings on the top of their heads called _____.
12. Marine mammals are an important part of their ocean _____.
13. Marine mammals are top _____ and feed on smaller animals, and by doing so are helping to keep a balance in the ocean.



Figuring Out Whales

Lesson at a glance:

Students use mathematical skills and problem solving to compare the size of a killer whale and a gray whale and to compare each shark's nutritional requirements to the students own.

Oregon Content Standards:

SCIENCE

- **Fourth Grade:** 4.2L.1 Describe the interactions of organisms and the environment where they live.
- **Fifth Grade:** 5.2L.1 Explain the interdependence of plants, animals, and environment, and how adaptation influences survival.

OTHER CONTENT AREAS

- Mathematics: measurement, weights, multiplication/division

Ocean Literacy: Essential Principles and Fundamental Concepts

5. THE OCEAN SUPPORTS A GREAT DIVERSITY OF LIFE AND ECOSYSTEMS.

Materials:

- Copies of **Figuring Out Whales worksheet**
- A bathroom scale
- A cloth measuring tape attached vertically to the wall
- Pencils
- Calculators
- Scratch paper
- Clipboards

Background:

All whales show some type of torpedo, or **streamlined**, body shape. This shape reduces drag and allows the whale to move through the water efficiently. Whales range in size from the Hector's dolphin, which measures only about four feet in length, to the blue whale, which measures about 100 feet in length. Whales can be divided into two groups, depending on what is in their mouths. Toothed whales—including dolphins, killer whales and sperm whales—have conical or spade-shaped teeth. Baleen whales—including humpback whales, blue whales and gray whales—have baleen plates hanging down from their upper jaws. Baleen whales have no teeth at all, instead they use their baleen to strain plankton and small fishes from the water.

Toothed whales are generally smaller than baleen whales, and adult male toothed whales are usually larger than females. Toothed whales have one blowhole on the top of their heads. They are social and travel in groups called pods. To feed, toothed whales use their interlocking teeth for grasping and tearing, rather than chewing. They swallow their food whole or in large chunks. Toothed whales that eat mostly squid usually have fewer teeth than those that eat mainly fish. The number of teeth differs for each species.



For example:

Sperm whale—18-25 large, conical teeth in each side of the lower jaw only. These fit into socket in the upper jaw. The upper jaw has teeth, but they almost never erupt through the gum.

Killer whale—10-12 large, conical teeth in each side of the upper and lower jaws.

Harbor porpoise—23-28 spade-shaped teeth on each side of the upper jaw and 22-26 in each side of the lower jaw.

Curvier's beaked whale—Males have a single pair of teeth in the lower jaw only. The female's teeth do not erupt through the gum.

Baleen whales are generally larger than toothed whales, and adult female baleen whales are usually larger than males. They have two blowholes on the top of their heads. Baleen whales are typically slower swimmers than toothed whales and are generally solitary. These whales strain seawater through their baleen plates. The baleen plates are arranged somewhat like teeth in a comb, hanging down from each side of the upper jaw. Inside the mouth, the bristles are intertwined to form a mat, or screen. Small planktonic animals such as krill, shrimp and larval fishes become trapped in these sieve-like plates.

Baleen is made from **keratin**, the same protein that makes up our hair and fingernails. It grows continuously, with the innermost layer of baleen fraying and wearing down by the movements of the whale's tongue. Some whales, such as the bowhead whale, have strips of baleen that can grow over 13 feet in length. The number of baleen plates in a whale's mouth varies with different species. For example:

Blue whale — 600 plates

Humpback whale — 700 plates

Gray whale — 320 plates

Right whale — 500 plates

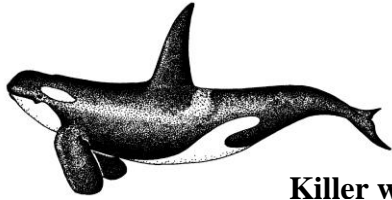
Activity:

1. Provide each student with a copy of the **Figuring Out Whales** worksheet.
2. Have students find a partner to help them measure their height using the cloth measuring tape on the wall. Students will record each others height on the appropriate worksheet.
3. Next, have the students take turns weighing themselves on the bathroom scale. Allow students to record their weight privately on their worksheet.
4. Students will complete their worksheet in class or as homework.

Extensions:

1. Have your students compare their heights to the lengths of one more different species of whale.
2. Have your students compare the amount of food eaten by a killer whale and a gray whale using a bar graph.
3. Have your students investigate how gray whales feed versus how blue whales feed.
4. Have your students investigate how killer whales feed versus how sperm whales feed.



**Killer whale**

Figuring Out Whales Worksheet

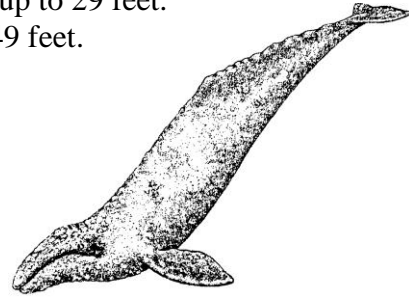
To learn more about the size and eating habits of killer whales and gray whales, complete the following math problems.

Important information:

- I weigh _____ pounds.
- I am _____ inches tall.
- A killer whale may reach a weight of 12,000 pounds and a length of up to 29 feet.
- A gray whale may reach a weight of 80,000 pounds and a length of 49 feet.

Reminders:

- There are 12 inches in a foot.
- There are 16 ounces in a pound.
- You may round your numbers to the nearest whole number.

**Gray whale**

Problems:

1. How many of you would it take to equal the weight of a killer whale?

$$\frac{\text{_____ pounds}}{\text{killer whale weight}} \div \frac{\text{_____ pounds}}{\text{your weight}} = \text{_____ of me equals}$$

the weight of a killer whale.

2. How many of you would it take to equal the weight of a gray whale?

$$\frac{\text{_____ pounds}}{\text{gray whale weight}} \div \frac{\text{_____ pounds}}{\text{your weight}} = \text{_____ of me equals}$$

the weight of a gray whale.

3. How many killer whales would it take to equal the weight of a gray whale?

$$\frac{\text{_____ pounds}}{\text{gray whale weight}} \div \frac{\text{_____ pounds}}{\text{killer whale weight}} = \text{_____ killer whales}$$

equals the weight of a gray whale.

4. How many of your body lengths would it take to equal the length of a gray whale?
First, convert the whale's length in feet to inches:

$$\frac{\text{_____ feet}}{\text{gray whale length}} \times 12 \text{ inches} = \frac{\text{_____ inches}}{\text{gray whale length}}$$

$$\frac{\text{_____ inches}}{\text{gray whale length}} \div \frac{\text{_____ inches}}{\text{your height}} = \text{_____ of me equals the}$$

length of a gray whale.

5. How many of your body lengths would it take to equal the length of a killer whale?

$$\frac{\text{killer whale length}}{\text{killer whale length}} \text{ feet} \times 12 = \frac{\text{killer whale length}}{\text{killer whale length}} \text{ inches}$$

$$\frac{\text{killer whale length}}{\text{killer whale length}} \text{ inches} \div \frac{\text{your height}}{\text{your height}} \text{ inches} = \text{_____} \text{ of me equals the length of a gray whale.}$$

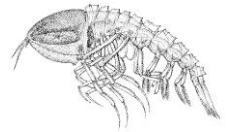
6. A gray whale eats about 268,000 pounds of amphipods each month during April-October when it is at its Arctic feeding ground. In a month with 30 days, approximately how many pounds of amphipods would a gray whale consume in one day?

$$\frac{\text{amphipods eaten in a month}}{\text{days in a month}} \text{ pounds} \times \frac{\text{hours}}{\text{hours}} = \frac{\text{pounds a day}}{\text{daily amphipod weight}}$$

If the average weight of an amphipod is 0.004 ounces, how many amphipods might a gray whale eat in a day?

$$\frac{\text{total amphipod weight per day}}{\text{total amphipod weight}} \text{ pounds} \times 16 = \frac{\text{total amphipod weight}}{\text{total amphipod weight}} \text{ ounces}$$

$$\frac{\text{total amphipod weight}}{\text{total amphipod weight}} \text{ ounces} \div \frac{\text{weight of one amphipod}}{\text{weight of one amphipod}} = \text{_____} \text{ amphipods}$$



Amphipod

7. If the average weight of a quarter-pound hamburger is 4 ounces, how many quarter-pound hamburgers would you have to consume in a day to eat as much as a gray whale?

$$\frac{\text{amphipod weight per day}}{\text{hamburger weight}} \text{ ounces} \div \frac{\text{hamburger weight}}{\text{hamburger weight}} \text{ ounces} = \text{_____} \text{ hamburgers}$$

8. A 12,000-pound killer whale can eat as much as 14,000 pounds of herring per month. In a month with 30 days, approximately how many pounds of herring would a killer whale eat each day?

$$\frac{\text{pounds of herring}}{\text{pounds of herring}} \text{ pounds} \div 30 \text{ days} = \text{_____} \text{ pounds per day}$$

If the average weight of a herring is 3.2 ounces, how many herring might a killer whale eat in a day?

$$\frac{\text{total herring weight per day}}{\text{total herring weight}} \text{ pounds} \times 16 = \frac{\text{total herring weight}}{\text{total herring weight}} \text{ ounces}$$

$$\frac{\text{total herring weight}}{\text{total herring weight}} \text{ ounces} \div \frac{\text{weight of one herring}}{\text{weight of one herring}} \text{ ounces} = \text{_____} \text{ herring}$$



Herring

9. If the average weight of a quarter-pound hamburger is 4 ounces, how many quarter-pound hamburgers would you have to consume in a day to eat as much as a killer whale?

$$\frac{\text{_____}}{\text{daily herring weight}} \text{ pounds} \times 16 = \frac{\text{_____}}{\text{daily herring weight}} \text{ ounces.}$$

$$\frac{\text{_____}}{\text{daily herring weight}} \text{ ounces} \div \frac{\text{_____}}{\text{weight of one hamburger}} \text{ ounces} = \text{_____} \text{ hamburgers.}$$

Marine Mammal Dilemmas

Lesson at a glance:

This lesson is designed to give students an opportunity to examine their own values and beliefs related to the environment and to practice discussing environmental issues without placing judgments.

Common Curriculum Goals and Benchmarks:

SOCIAL SCIENCE

- **Third Grade:** SS.03.CG.03 Identify ways that people can participate in their communities and the responsibilities of participation.
- **Third Grade:** SS.03.SA.03 Identify and compare different ways of looking at an event, issue, or problem
- **Third Grade:** SS.03.SA.04 Identify how people or other living things might be affected by an event, issue, or problem.
- **Third Grade:** SS.03.SA.05 Identify possible options or responses; then make a choice or express an opinion.
- **Fourth and Fifth Grade:** SS.05.GE.07 Understand how physical environments are affected by human activities.
- **Fourth and Fifth Grade:** SS.05.GE.07.01 Understand how and why people alter the physical environment
- **Fourth and Fifth Grade:** SS.05.GE.07.02 Describe how human activity can impact the environment.
- **Fourth and Fifth Grade:** SS.05.SA.03 Identify and study two or more points of view of an event, issue, or problem.
- **Fourth and Fifth Grade:** SS.05.SA.04 Identify characteristics of an event, issue, or problem, suggesting possible causes and results.

Ocean Literacy: Essential Principles and Fundamental Concepts

6. THE OCEAN AND HUMANS ARE INEXTRICABLY INTERCONNECTED.

- 5.e. Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollution (point source, non-point source, and noise pollution) and physical modifications (changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean.

Materials:

- Dilemma cards

Background information:

Discussing environmental ethics can be difficult. There are many sides to every issue, and often the feelings for one position or another are strong. In presenting this activity to students, stress the importance of not placing judgment, and listening to perspectives other than their own. Understanding all sides can provide a bigger picture of the issues.

It is not the intent of this activity to prescribe right and wrong answers for the students.

Activity:

1. Divide students into groups of four or five.
2. Give each group a dilemma card and have one member read the dilemma and the choices of answers to the rest of their group.
3. Each student in the group should decide on their own what their response would be. Then have each group discuss their choices among themselves. Each student should be able to defend their reasoning.

Summary:

1. Discuss each dilemma as a class. Be sure to remind your students that there are several sides to any issue and usually there isn't only one right answer.
2. Stress the importance of gaining a clear understanding of all positions.
3. Ask the students whether or not it would have helped them make their dilemma choices if they had known more about the issue.
4. Ask them if they think that most people are aware of these issues.
5. What can they do to help more people become aware of human impact on the marine environment?
6. Encourage students to find out more about the issues brought up in their dilemmas. Knowing more will allow them to make more informed decisions.

Extensions:

1. Have students research other issues related to marine mammals discuss them as a class.
2. Discuss how other marine wildlife may also be affected by marine debris, water pollution, commercial fishing, eco-tourism or possible release from a captive situation such as an aquarium.

1.

You just cleaned your basement. On a dusty back shelf you discovered 10 cans of old paint and some very old pesticides and weed killers that you can't use.

What will you do with them?



2.

You are walking on the shore with a friend who is visiting you from the Midwest. Your friend sees a purple sea star she thinks is very beautiful. She tells you she wants to go into the tidepool and get it to take it home.

What do you do?



3.

You are an expert salmon angler. You always know where the BIG ones are. You're standing on the side of a stream where you know the salmon run. On the far side of the stream you see a pool you just know has the BIG one in it, but to get there you must cross the stream. You know this is probably an area with salmon redds (nests), but no one from the Department of Fish and Wildlife is around and you're expected to come home with a fish for dinner.

What do you do?



4.

You were fishing at a secluded lake and caught seven fish this morning. Now, its afternoon and the fishing as been great! You have caught five fish in one hour, all of which are on your string in the water and are bigger than this morning's fish. The law allows you to possess 10 fish per day.

What should you do?



5.

You are on a fieldtrip to the Newport bay front. Although you know it's not a good idea to feed the wildlife, some of your friends are tossing pieces of their tunafish sandwiches to the sea lions.

What should you do?



6.

You're on a charter boat with your family during your summer vacation. Your grandfather, a grumpy, stubborn man, is a heavy smoker and keeps throwing his plastic cigar butts over the side.

What should you do?



4.

- a. Continue to fish and keep all the fish.
- b. Let the smallest fish you caught this afternoon go free and keep the big ones to stay within your limit.
- c. Quit fishing and go for a hike.
- d. Continue to fish but release them.
- e. Other

5.

- a. Tell them that feeding the sea lions can harm the animals and ask them to stop.
- b. Report their behavior to an authority on the dock.
- c. Ask the teacher to ask them to stop.
- d. Ignore them.
- e. Other

6.

- a. Yell at him, call him an idiot and ask him if he hasn't heard of the MARPOL Protocol, the law prohibiting the dumping of all plastic wastes from ships at sea.
- b. Ask the captain for a can, give it to your grandfather and politely ask him to use it for his cigar butts.
- c. Do nothing.
- d. Tell your parents to tell your grandfather to quit smoking.
- e. Other

1.

- a. You know it's illegal, but you simply hide them in your garbage can with your other household waste and have it taken to the county landfill.
- b. Leave them in your basement.
- c. Call the county to find out where to dispose of them safely.
- d. Other

2.

- a. You notice that there are many sea stars and you think it won't hurt anything to take just one.
- b. Offer to pull it off the rock and suggest you play Frisbee with it.
- c. Explain that this animal won't be able to survive if she takes it home and suggest that she watch it here and then leave it in its habitat.
- d. Yell at her and ask her how she would feel if someone picked her up and threw her out in the ocean.
- e. Other

3.

- a. Go to the nearest house and ask to borrow their boat, knowing you'll be in the doghouse if you don't come home with fresh fish.
- b. Put on your best lure, cast as close to the pool as possible and hope for the best.
- c. Carefully walk through the stream.
- d. Go to the fish market for fish for dinner.
- e. Other

1.

There are getting to be too many sea lions near your town. Their pups are starving. Sea lions eat fish – but fishermen need fish too. The sea lions rest on the beach – but people want to sit on the beach too.

What should the people in your town do?



2.

You are on a fishing boat with a friend's family. When the fishing net is hauled in, some of it is torn. Your friend's father cuts the torn part out and throws it overboard. Just then you see some dolphins swimming toward the boat.

What should you do?



3.

You are out on the beach with your friend and you find a seal pup. No one else is around.

What should you do?



4.

You work at an oceanarium that might be able to return a whale to the wild. Here are some facts to consider:

- You have been treating the whale for a possibly contagious disease. The disease seems to be gone.
- The whale has begun to feed on its own, but you don't know if it will be able to find food in the wild.
- It has not been with others of its own species for most of its life.
- Whales swim with their own pods but you don't know if its pod can be found or if they will accept it.
- This species of whale is not endangered.

Make your decision based on what is best for this whale and for whales in the wild. What should you



2.

- a. Move quickly and try to pull the net out of the water.
- b. Tell your friend's father that it is against the law to throw plastics overboard. Tell him also that marine mammals die from getting tangled in nets.
- c. Try to scare the dolphins away.
- d. Don't say anything but report him to the Coast Guard when you get to the dock.
- e. Do nothing
- f. Other

1.

- a. Take some of the sea lions to live in another place. This would mean fewer sea lions near your town. (Keep in mind that the ones you move might not live or they might come back.)
- b. Let nature take its course and let the sea lions starve.
- c. Catch the pups and let your local aquarium take care of them, if they can. When the pups are older, set them free.
- d. Hire a biologist to determine the actual effect of the sea lions on the fishing industry
- e. Let licensed hunters control the sea lion population.
- f. Other

4.

- a. Go ahead and release it and hope it will socialize and feed on its own. You hope to use radio-tracking equipment to follow its progress in the wild.
- b. Since your whale seems healthy, capture other whales in an ocean pen. Introduce your whale to them. If your whale hunts and eats on its own and gets along with the other whales, then release it
- c. Keep the whale in the oceanarium for educational purposes and for study since you can not prove it is healthy.
- d. Other

3.

- a. Take it home and care for it in your bathtub.
- b. Leave the pup alone. Call the State Police and tell them the pup is on the beach. Stay to keep people away from it until they arrive.
- c. Pet the pup, although you know it's against the law. Then return it to the water.
- d. Do nothing
- e. Other

5.

You are the owner of a large factory. The water that your factory drains into the river nearby is polluted, but it is within legal limits. Fish and marine mammals in your area are getting sick from the pollution. Some are dying. The equipment to reduce the pollution. Some are dying. The equipment to reduce the pollution is expensive. If you buy it, you can't give your employees raises this year.

What should you do?



6.

You are the owner of a small aquarium. You are going out of business because not enough people are coming to see your exhibits. Your seals are healthy but old. Other aquariums might not want to adopt them, and you might not be able to get permits to turn them loose. You are not sure if they can live in the wild after 25 years in your aquarium. These seals are not an endangered species.

What should you do?



7.

You are a researcher on a small tropical island. The people of this island hunt dolphins for food. They travel in canoes and use spears to kill the dolphins. Each year a small number of dolphins is injured but not captured. Some of these injured animals may not survive.

What should you do?



8.

You are a humpback whale photographer. You always know where you can find the whales. You are out in your boat and see a mother humpback whale and her calf. To get the photograph you want, you must be at least 20 feet from the pair. You know this is against the law, but no one from the government is around. Your magazine has to have the photo.

What should you do?



6.

- a. Ask other aquariums if they can take the seals. Keep at it until someone says yes, or until you run out of possibilities.
- b. Ask an animal rights group to try to force the government to let you release the seals.
- c. Load the seals in your truck and release them without the permits. Deal with the law later.
- d. End the seals' lives.
- e. Other

5.

- a. Since you are within legal limits, wait a while to see if the cost of the equipment will go down.
- b. Do nothing.
- c. Store the water until the laws change or until you have extra money to spend on the equipment.
- d. Add the equipment, because you know that the chemicals will work up the food chain and affect even more animals. Your employees may be unhappy, but everyone will lead healthier lives.
- e. Other

8.

- a. Stop your engine and hope that the whales will come closer so that you can get your photograph.
- b. Keep following the whales at a legal distance and hope you get your picture. (Keep in mind that you may be tiring the calf.)
- c. Chase them down and take your picture.
- d. Forget taking a picture of this pair of whales. Look for another photo opportunity, even though you feel sure you'll never get one as good as this.
- e. Other

7.

- a. Give the people motor boats to increase their speed. This might improve their aim.
- b. Give them guns to reduce the suffering on the part of the dolphins. This will also increase their hunting efficiency.
- c. Do nothing. This tradition has gone on for hundreds of years and hasn't seemed to hurt the dolphin population.
- d. Bring in another food source so the people don't have to eat dolphins.
- e. Other