

Marine Mammal Adaptations



Photo by Lori Polasek, Alaska SeaLife Center

Teacher Guide

Recommended for Grades 1-4



Distance Learning



Alaska Academic Standards

Science A12, A13, A14a, B4
Language Arts C2a; Arts C4, C5;

National Academic Standards

The following National Academic Standards for grades K-4 are addressed within this program:

Science as inquiry

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Life science

- The characteristics of organisms
- Life cycles of organisms
- Organisms and environments

Physical science

- Properties of objects and materials

Objectives

Through this Distance Learning session your students will be able to:

- Define the word adaptation.
- List several marine mammals and their characteristics.
- Describe some marine mammals that are specific to Alaskan waters.
- Explain how their adaptations make them well suited for their habitats.
- Use the scientific method to experience and explain the function of blubber.

Background Information

Marine mammals are animals that breathe air through lungs, are warm-blooded, have hair (at sometime during their life), give birth to live young and suckle their young. Marine mammals also get all or most of their food from the ocean.

Marine mammals are a diverse group thought to have evolved from terrestrial ancestors to aquatic life through a number of unique physical adaptations. There are four groups of marine mammals including: cetaceans (whales, dolphins, and porpoises), pinnipeds (seals, sea lions and walrus), fissipeds (sea otter and polar bear), and sirenians (manatees and dugongs). This session will focus on the adaptations which allow pinnipeds and fissipeds to survive cold, Alaskan waters.

1. Pinnipeds - Pinniped means “fin footed” mammals. This is because they have four (4) flippers instead of arms and legs. Pinnipeds include seals, sea lions and walruses.



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2. Fissipeds – Fissiped stands for “split footed” mammals. The sea otter is considered a fissiped. It has front paws which can grab fish and other creatures, similar to the human hand. The polar bear is another fissiped.

All mammals:

1. Give live birth.
2. Nurse their young.
3. Breathe air.
4. Are warm-blooded.
5. Have hair.

Marine mammals:

1. Can hold their breath for long periods of time.
2. Have a hydrodynamic shape.
3. (Most) have blubber.
4. Have flippers for swimming.
5. Utilize water from food.

Some of the adaptations marine mammals have include:

Deep Diving

- These animals use oxygen more efficiently. They fill their lungs and exchange 90% of their air in each breath, have high blood volume, and their blood chemistry allows greater oxygen retention (the high red blood cell count and increased myoglobin make their muscle tissue and blood dark red).
- They have high tolerance to lactic acid and carbon dioxide. Their muscles can work anaerobically (without oxygen) while they hold their breath.
- They can tolerate tremendous atmospheric pressure at great depths. Lungs and ribs are collapsible, air spaces are minimized, and nitrogen absorption is limited.

Swimming

- Drag is reduced by hydrodynamic body forms.
- Appendages are modified for maximal propulsion and minimal drag.

Thermoregulation

- A large body with small surface to volume ratio reduces heat loss. Blubber or thick underfur is used as insulation.
- A complex circulatory system in extremities is used to conserve and dissipate heat.
- Young pinnipeds and cetaceans grow fast on milk with 40%-50% fat compared to 3% fat in human milk.

Water Conservation

- Most marine mammals rarely drink fresh water; instead they utilize water present in food, breathed air and blubber.
- They have specialized kidneys which produce urine that is saltier than sea water.

Sensory

- These animals have well developed whiskers for sensing.
- Marine mammals communicate underwater with sound, and many species use sound to locate prey.



How do marine mammals use these adaptations to survive?

Their ocean environment is very wet and cold. Therefore we know that marine mammals use their special adaptations to help them survive.

How do Marine mammals eat?

- They have teeth that allow them to eat foods found in their habitats. Walrus use their tusks for protection and pulling themselves up on large pieces of ice.
- Most predators have eyes on the front of the head to help them catch their food.
- Otters use rocks as tools to break open their food.

How do they stay warm?

- Otters have a thick undercoat of up to one million hairs per square inch.
- Seals, sea lions and walruses use blubber to stay warm because their fur is not very thick or warm.
- Marine mammals eat lots of calories. A large Steller sea lion needs about 30,000 calories a day to be healthy while humans need about 2,500 calories.

How do they swim?

- They have flippers that allow them to steer and propel themselves through the water. Sea lions use front flippers for propulsion and rear flippers for steering while seals use their front flippers for steering and their rear flippers for propulsion.
- Hydrodynamic body shape helps the animals to cut down on drag.
- A clear, nictitating membrane acts similarly to a diver's goggles to keep water out of their eyes.



Pre Session Activities/Cross Curriculum Ideas

Blubber Gloves: Introducing the Scientific Method

To introduce the idea and function of blubber to your students you may want to make a pair of “blubber gloves”.

Blubber gloves are made from two Ziploc bags filled with shortening (such as Crisco), sealed and duct taped together to make a “glove” or mitt.

How to use your blubber gloves

Materials

- One or two watertight plastic storage tubs (small to medium sized)
- Iced or VERY cold water (enough to fill tubs nearly full)
- Blubber gloves
- *Stopwatch (optional)*
- *Science thermometers (optional)*

Setup

Fill plastic tub(s) with ice and water about $\frac{3}{4}$ full.

Procedures

Follow the scientific method:

Observations- Have students place one hand in the cold water. Have them describe the feeling of the cold water.

Hypothesis- Before the student puts the blubber glove hand into the same water ask them to predict how it will feel? Will it feel the same as the hand without the glove?

Testing- Students should place both hands in the water simultaneously. One of the student’s hands will be wearing the glove and the other will be bare. Remind students not to allow water inside the blubber glove or the effect is diminished. Instruct the students to describe the differences in temperature between hands.

Results/Conclusions- Ask students how the two hands compared. Why do they think there was a difference? Relate this to animals with and without blubber. Name some animals and have students decide if they have blubber or not.

Optional Activities

You may wish to repeat this activity with some variations.

- Use a stopwatch to illustrate the difference in time the blubber glove hand can spend in the icy water.
- Put one science thermometer in an empty Ziploc bag and place one thermometer in the blubber glove bag. Record temperatures of both after 5, 10, and 15 minutes. Graph results for a visual representation of the variances.

Session Materials

Which is Which?

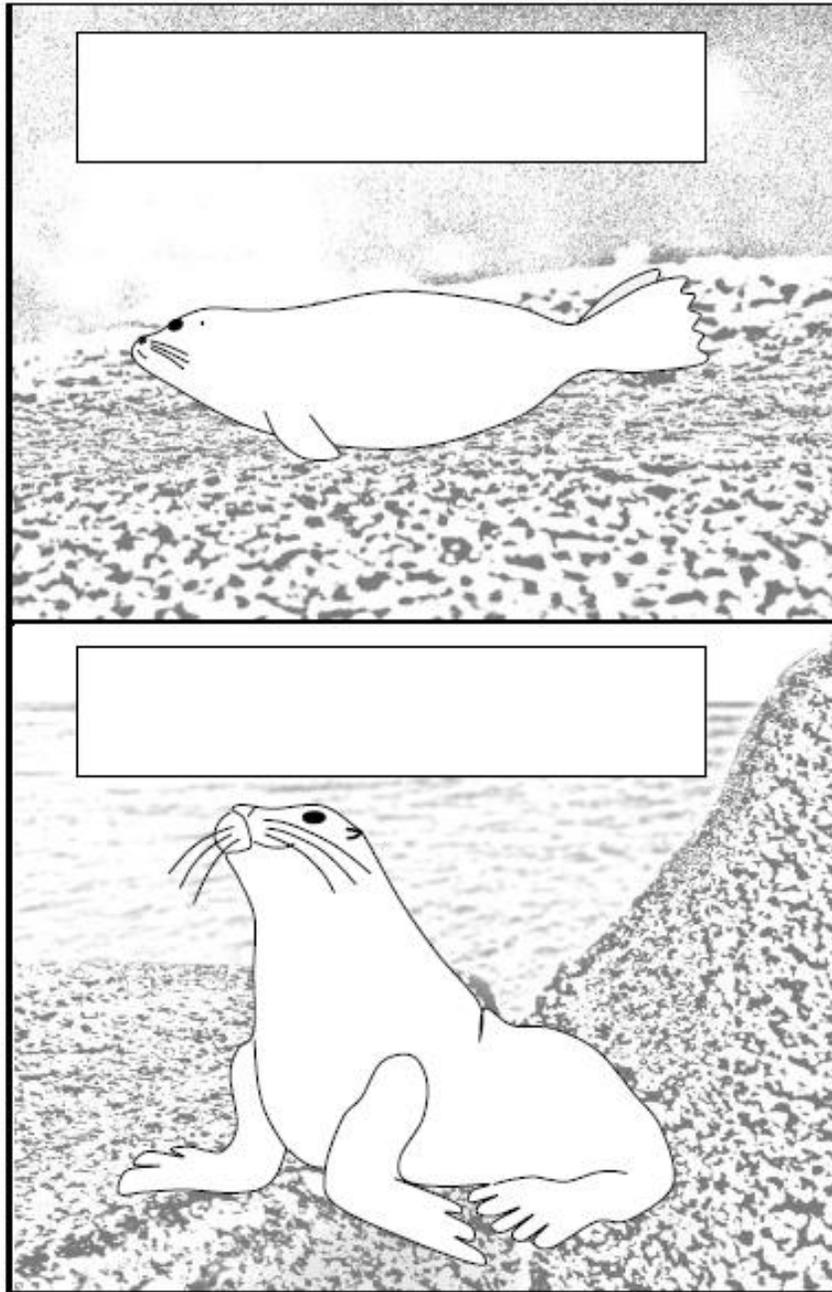
At the Alaska SeaLife Center we have harbor seals and Steller sea lions. Both have flippers, big eyes, long whiskers, and a long, torpedo-shaped body. So how do we know which one is which? Observe these animals at the SeaLife Center, and then match the adaptations to the correct animal.

a.
short
front
flippers

b.
long front
flippers

c.
can stand up
on all fours

d.
pushes with
its back
flippers



e.
has ear flaps

f.
has only
ear holes

g.
eats more

h.
has thick
blubber

After the program, you can color the animals and their habitats.
What else might they have in their habitats?

Clay harbor seal instructions

Make a Clay Harbor Seal!

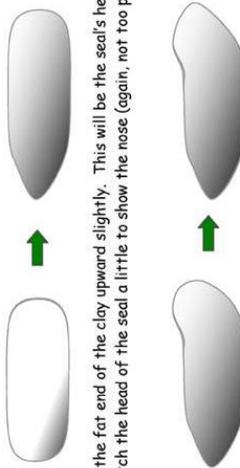
Materials

1. Large piece of mottled black/white clay
2. Small piece of black clay
3. Card

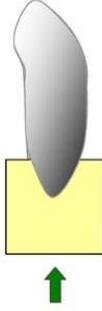


Instructions

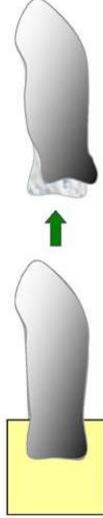
1. Roll the mottled black/white clay piece into a ball.
2. Now roll the ball into a short, fat log. (Not too skinny! Harbor seals have lots of blubber.) Sharpen one end of the log like a pencil, but not too pointy.
3. Bend the fat end of the clay upward slightly. This will be the seal's head. Stretch the head of the seal a little to show the nose (again, not too pointy).



4. Holding the card straight up & down, slide it into the tail of your seal, about as far as your thumb nail.



5. Pinch the clay against the card, then peel it away to create the rear flippers.



6. Pinch a little clay along the sides of the seal to create the front flippers.



7. Using your black clay, add two eyes and a nose on your seal's face.



8. Use the corner of the card to draw in whiskers, a mouth, and ear holes (seals do not have ear flaps, they just have little holes). You can also draw claws on the flippers.



Your harbor seal is complete! Save it in its baggie to protect it from harm.

Teachers/Parents:

This is Sculpey™ clay – bake it at 275° for about 20 minutes to harden.

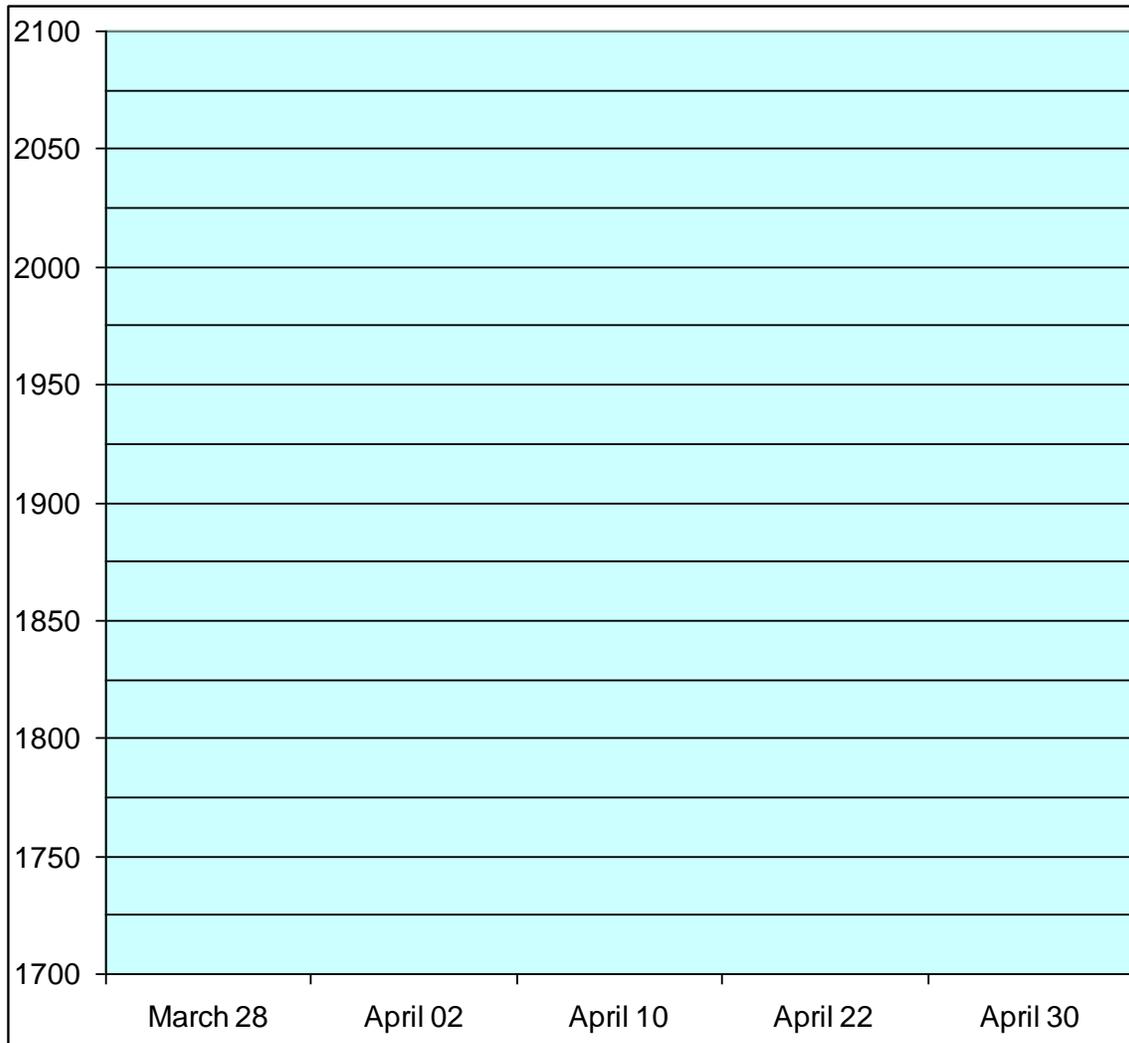


Post Session Activities/Cross Curriculum Ideas

Mathematics-

Woody's weight changes throughout the year. In late spring he averages a weight gain of between 2 and 10 kg per day. Plot his increasing weights on the graph over time.

- | |
|--------------------------|
| 1. March 28: 1744 pounds |
| 2. April 2: 1775 pounds |
| 3. April 10: 1845 pounds |
| 4. April 22: 2000 pounds |
| 5. April 30: 2040 pounds |



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Food for Thought

Do you think humans can gain that much weight in such a short time period? Why or why not? Discuss this with your classmates.

1. Woody the sea lion loves to eat. If Woody eats just one fish every day for an entire week how many fish has he eaten?
2. Sea otters need to stay very clean if they are to keep warm. If a sea otter cleans himself 3 minutes one day and 4 the next how many minutes has he spent cleaning?
3. If a sea otter cleans himself everyday of the week but one how many days has he spent cleaning himself?
4. A 2,000 pound male Steller sea lion is _____times bigger than a 500 pound female Steller sea lion and _____times bigger than a 250 pound harbor seal.
5. Woody eats 10 fish one day, 6 the next and 8 the third. How many fish did he average for those three days?
6. If a sea otter spends 10 minutes cleaning itself once an hour, how many minutes are spent cleaning after 9 hours?

Social Studies-

Many marine mammals live in very cold environments. Have students find cold locations on a map. Students can then find information about the specific cold climates. Ask them to find out how people live in these environments. Where do they live? What do they eat? What language do they speak? How do they make money? What do they do for fun? Do they have any special customs or traditions?

Some example places include:

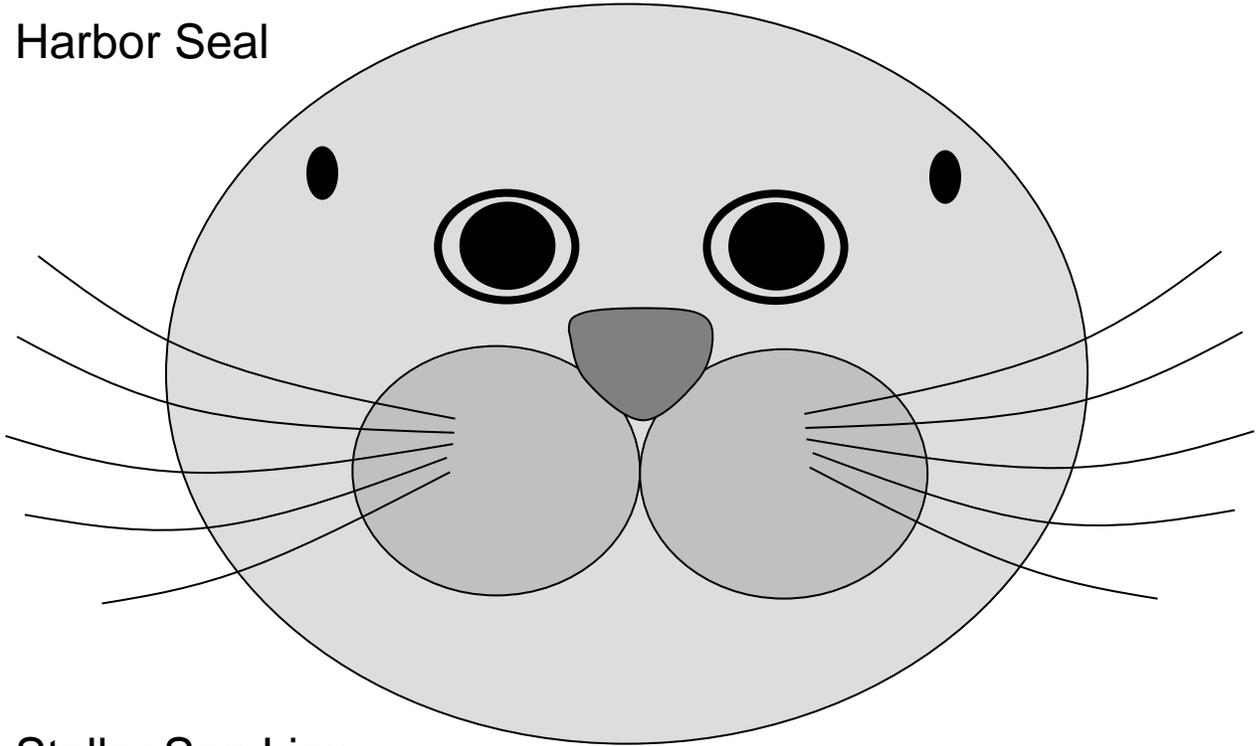
- Northern Russia
- Northern Canada
- Greenland
- Finland
- Sweden
- Norway

Art-

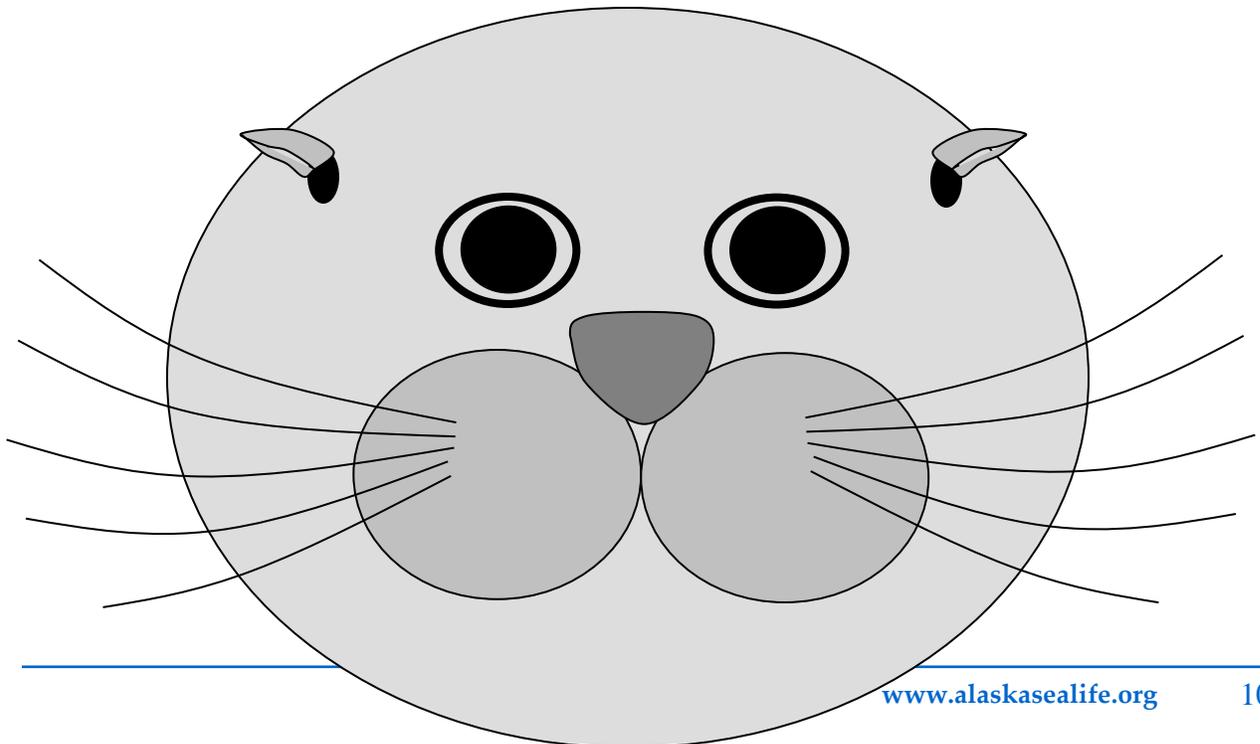
Wonderful Whiskers

Marine mammals use their stiff whiskers like hands underwater to help them find prey. Make masks with your class with stiff whiskers used for feeling in the dark. To help these last longer use foam pieces instead of paper. To make puppets attach the faces to paper bags.

Harbor Seal



Steller Sea Lion

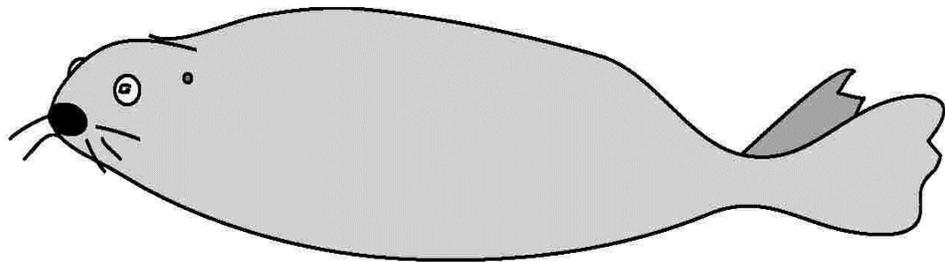


Fabulous Flippers

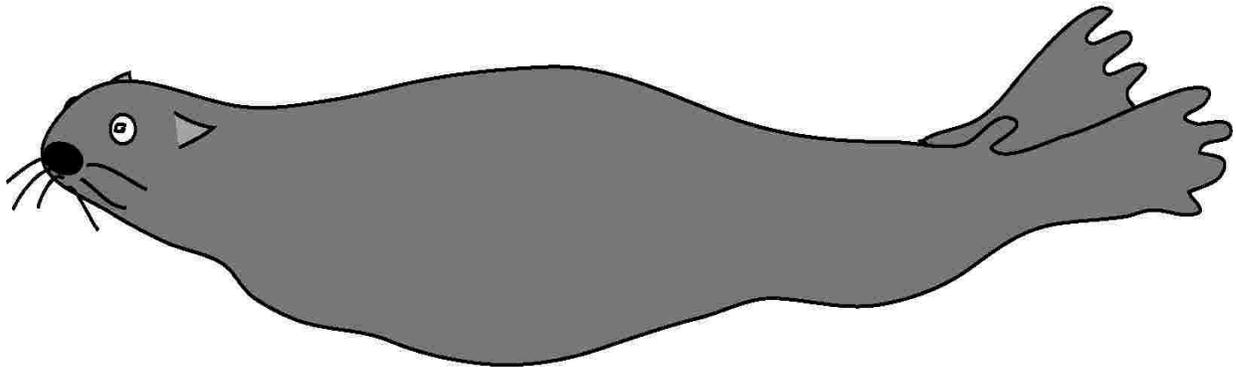
Steller Sea Lions and Harbor Seals

Finish drawing the front flippers on the harbor seal and Steller sea lion to show how they are different.

Harbor seal



Steller sea lion



Language Arts-
Vocabulary Virtuoso

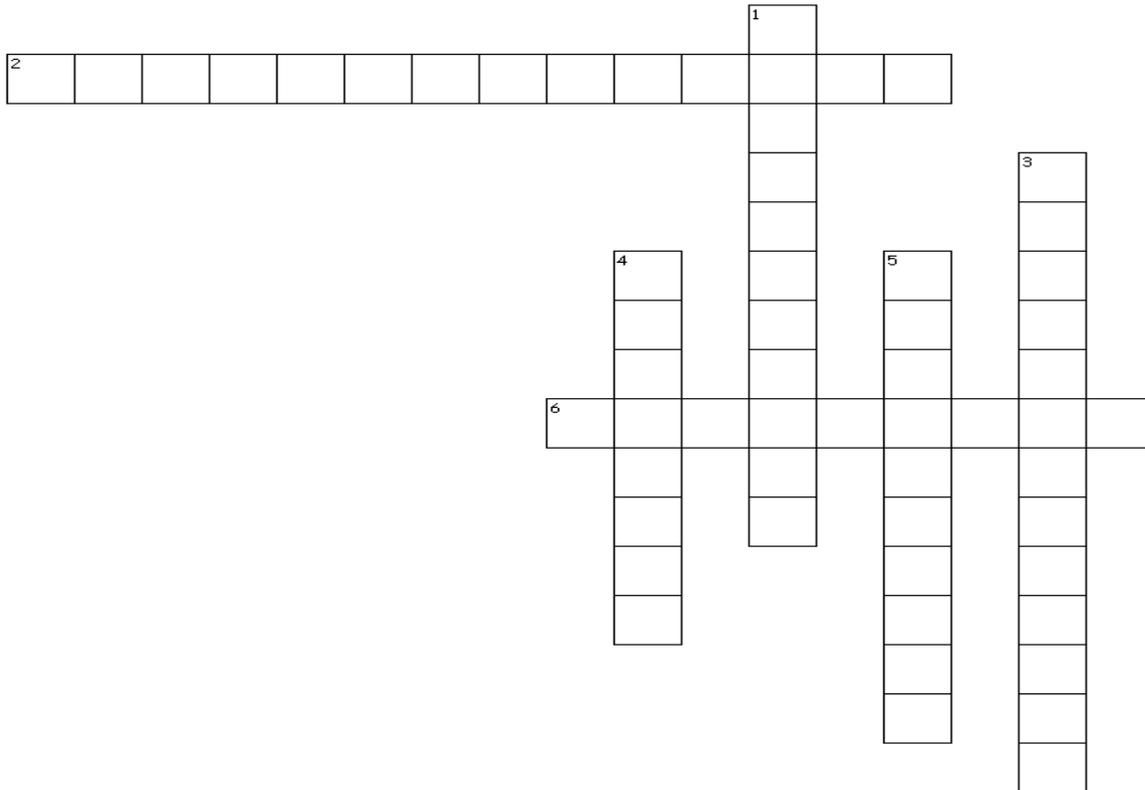
Fill in the blanks in this marine mammal glossary:

1. An _____ is something an animal has that allows it to survive in its environment.
2. Harbor seals and Steller sea lions use a thick layer of fat called _____ to help them stay warm in the cold Alaskan water. Another marine mammal, the _____, has an especially thick undercoat of fur which traps air to help it stay warm.
3. A _____ body shape, like a torpedo, helps sea mammals to move through the water quickly and efficiently.
4. All mammals give birth to live young, nurse their young, _____, are warm-blooded, and have _____ at some point in their lives.
5. Seals have ears that are located _____, and seal lions have external ears.





Marine Mammal Adaptations Criss-Cross



Across

- 2. This animal can turn its rear flippers forward and walk on all fours.
- 6. Does not have much blubber, but instead has hollow hairs that trap air around its body to keep it warm in the frigid water.

Down

- 1. Traveling in groups called pods, these large marine mammals can use teamwork to catch their prey.
- 3. Feeds using baleen to strain tiny plankton from the water.
- 4. Flat molar teeth allow this marine mammal to crack down on mussels, clams and other crustaceans.
- 5. The front flippers are primarily used for steering, and the rear flippers are alternately used for propulsion.

Word Bank

Polar Bear, Steller Sea Lion, Humpback Whale, Sea Otter, Killer Whale, Harbor Seal.

Writing Wrangler

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Give your students' creative side a chance to shine while tackling these marine mammal writing exercises!

- Write about how it feels to be cold. What do you do when you go outside and it is cold? How do you stay warm? How is that different from what these animals do to stay warm?
- Write a short story about Woody, a male Steller sea lion at the Alaska SeaLife Center. Please include the following words:
 - Fish
 - Flippers
 - Whiskers
 - Cold
 - Blubber

Additional Resources

Books

- Bonner, Nigel. 1995. *Polar Regions*. Thomson Learning, New York.
- Boyle, Doe. 1995. *Otter on His Own: The Story of a Sea Otter*. Soundprints, Norwalk, CT.
- Siska, Heather Smith. 1980. *People of the Ice. How the Inuit Lived*. Firefly, Buffalo, New York.
- Tracqui, Valerie. 1994. *The Polar Bear. Master of the Ice*. Charelsbridge Publishing, Watertown, MA.
- Walker-Hodge, Judith. 1999. *Seals, Sea Lions, and Walruses (Animals of the Oceans)*. Barron's Educational Series, Hauppauge, NY.
- Wexo, John Bonnett. 2001. *Seals & Sea Lions (Zoobooks)*. Wildlife Education, Poway, CA.
- Wynne, Kate. 1997. *Guide to Marine Mammals of Alaska*. Alaska Sea Grant, Fairbanks.
- Yolen, Jane. 1998. *Welcome to the Ice House*. G.P. Putnam's Sons, New York.

Internet Sites

<http://www.enchantedlearning.com/themes/ocean.shtml>

This is a perennial favorite among teachers.

<http://whale.wheelock.edu>

An active site about whales that is worth exploring.



Answer Keys

Math Madness

1. 7
2. 7
3. 6
4. 4, 8
5. 8
6. 90 minutes or 1 and ½ hours

Vocabulary Virtuoso

1. adaptation
2. blubber, sea otter
3. hydrodynamic
4. breathe air, hair/fur
5. internally

Marine Mammal Criss-Cross

1. killer whale
2. Steller sea lion
3. humpback whale
4. sea otter
5. harbor seal
6. polar bear

Harbor Seals vs. Steller Sea Lions (session materials)

Harbor Seals

Steller Sea Lions

Steller Sea Lions