Beaver Adaptations

Students will discover the impressive physical and behavioral adaptations that help beavers survive in their unique aquatic environment.

Grade Level : 4th grade

Phenomena:
What adaptations do beavers have that help them survive in their environment.

Objectives:
- Students will be able to define physical and behavioral adaptation and be able to state the difference.
- Students will be able to identify two or more physical and behavioral adaptations that help beavers survive in their environment.

Materials:
- Beaver skull & skin (Attachment A)
- Beaver track
- Cardboard cutout teeth
- Canoe paddle
- Swim fins
- Gloves with sticky palms
- Coat
- Kickboard
- WD40 can
- Deodorant stick
- Goggles
- Earphones

Time Considerations
Preparations: 20 minutes
Activity 1: 10 minutes
Activity 2: 30 minutes
Activity 3: 10 minutes
Conclusion: 10 minutes

Related Activities:
Beaver Dam Site

www.NevadaOutdoorSchool.org

Next Generation Science Standards

4-LSI-1 Construct an argument that plants and animals have internal and external structures that function to promote survival, growth, behavior, and reproduction.

Science and Engineering Practices (SEP):
Engaging in argument from evidence.

Disciplinary Core Ideas:
Structure and Function

Cross Cutting Concepts:
Systems and system models

Excellence in Environmental Education Guidelines

- **Strand 2.2-The Living Environment (B): Learners understand that plants and animals have different characteristics and that many of the characteristics are inherited.**

Background

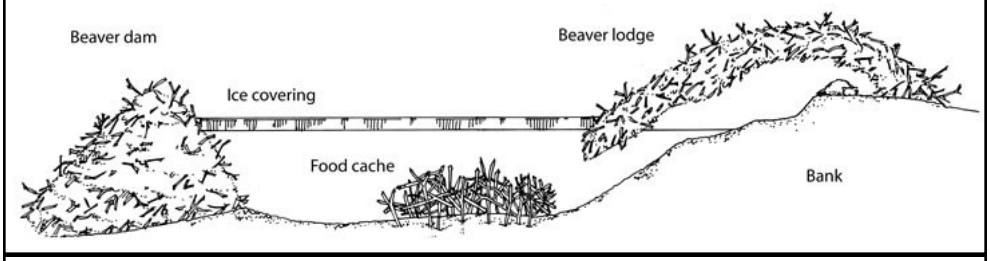
Beavers (*Castor canadensis*) are the largest rodents in North America. Adult beavers weigh about forty pounds and average about three feet long from tip of nose to tip of tail.

You can find beavers located anywhere from fast flowing rivers, slow streams, lakes, ponds, and marshes to roadside ditches. Beavers live in lodges built in river and lake banks, or in free-standing dams directly in a body of water. Both types of homes are built in waterways that maintain a constant level year round.

In places where water is moving quickly, beavers will act as engineers and use tree trunks, sticks, mud, stones, and plant parts to build a dam. Beaver dams will flood the area and create a pond that maintains a constant water level. The sound of rushing water acts as an environmental trigger and stimulates the beaver to build a dam. This is why you will only see beaver dams in areas with running water.

Beavers need this constant water level in order to provide protection from predators, to maintain an underwater entrance to their lodges, and to supply a place for their food caches. The pond must also be deep enough that the water doesn't freeze through during the winter months. This provides a livable (even if cold!) space for beavers all year long.

Beaver lodges are built with the same materials used to build dams. The walls in beavers dams can be up to 4 ft thick insulating their home keeping it warm during the winter months. The lodges will have many underwater entrances that lead to a large chamber built above the water level. Beavers live in colonies consisting of one breeding couple, and their kits (adolescent beavers.) Kits (born in a litter between one and eight, on average four to a litter) will live with their parents until they are two years old. At two, beavers are driven out of their home to find a new colony, or to establish their own.



A diagram of a beaver's dam and lodge in the winter.

Each colony may have multiple dams and lodges, however during the winter, beavers will usually consolidate to one living quarter to conserve heat.

It is a commonly held belief that beavers build ponds to provide

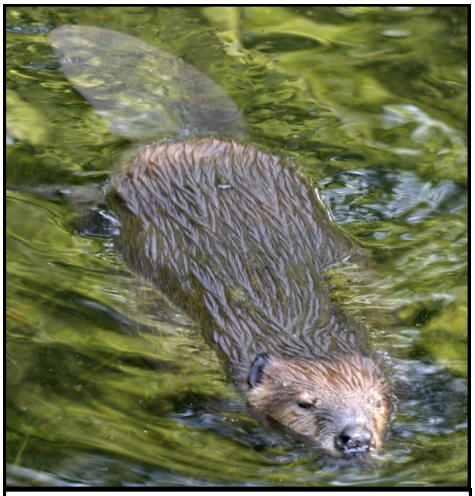

A beaver dam.

them with access to their food of choice: fish. This however, is a misconception. Beavers do not eat fish, but are herbivores who feed on aquatic plants and the leaves, inner bark, and twigs of nearby deciduous trees. These remarkable animals are able to eat more than three pounds of food in one meal! During the winter months, beavers will snack on the bark of trees that were gathered in fall. Those trees are stored in food caches anchored by mud to the bottom of the beaver's pond.

Have you ever heard the saying "busy as a beaver"? This term was coined due to the beaver's work ethic. They don't stop! Beavers will continue to work on their dens and dams even during the winter. Sometimes you will see evidence of a beaver cut four feet or higher above the ground! These unusual tree stumps are created during the winter when beavers can only access the trees above the snow packs multiple feet above ground.

How is it beavers are able to thrive in such industrial and wet environments? Beavers have an array of behavioral and physical adaptations that help them to survive in their unique aquatic environment.

Adaptations are specialized characteristics that organisms have developed to help them better survive in their en-


Beavers have adaptations that help them survive in cold water conditions.

vironment. There are two types of adaptations: physical and behavioral. Physical adaptations are physical features an organism is born with that help it to survive in its environment. For example, human's are born with an opposable thumb. This is a physical adaptation that allows humans to have greater agility with their hands. Behavioral adaptations are specialized behaviors an organism does that help it to survive in its environment. For example, humans use their thumbs to write or eat. An opposable thumb is a physical adaptation, the use of the thumb to do everyday tasks is a behavioral adaptation.

Preparations

Compile beaver dress up materials. If you do not have access to


Beavers have physical as well as behavioral adaptations.

a beaver skull and/or skin, print photos (Attachment A) to show to students.

Study the beaver dress up teachers pages 5-8 in order to familiarize yourself with the props and the adaptations they represent.

Place beaver dress up props in a pile, and have students sit in a half circle around the objects facing the instructor.

Doing the Activity

Activity 1: Introduction

Have students untie their shoelaces. (If students don't have laced shoes, have them partner with a friend for the exercise)

Ask students to tuck and hold their thumbs in the palm of their hand (the hand signal for the letter "b" in sign language).
Tell students to tie their shoelaces without moving their thumbs from this position.

Ask students why this is so difficult? Why do you think we're doing this?

Explain that over time primates have changed in order to accomplish complicated tasks (such as tying shoes) by forming the opposable thumb. These are called adaptations.

Tell students that an adaptation is a change that takes place so the animal can better survive in their environment.

Tell students there are two types of adaptations: physical and behavioral. Ask them if they think they know the difference?

Explain that a physical adaptation is a physical trait that an animal is born with to help it survive. An example would be the opposable thumb.

Explain that a behavioral adaptations is a specialized behavior that an animal has in order to better survive in its environment. An example would be the actual use of the opposable thumb to complete complex tasks.

Activity 2: Beaver Trivia

Divide students up into groups and give each group a whiteboard. Ask students the trivia questions (Tab 13).

Students will discuss their group answer and write it on their whiteboards. Groups will receive a point for every correct answer.

Activity 3: Beaver Dress Up

Ask for one student volunteer to act as our beaver for the following activity. (Let the student know they will be dressed up as a beaver before they volunteer themselves)

Have each student choose one prop from the pile.

Once a student has chosen a prop, have them share their hypothesis as to what the item could represent with their classmates.

Ask what adaptation each prop is representing as you call each student to dress up the volunteer beaver.

Beaver dress up activity.

Continue until the beaver has been dressed in all the props.

As you undress the beaver volunteer ask students to repeat as a group what adaptations the props represent.

Ask students to turn to their neighbor and explain what “adaptation” means. Have them give two examples of adaptations that beavers have.

Have students share ideas with the class.

Conclusion

Ask students what one adaptation is that humans have. Have them share with the class.

Assess students on their ability to correctly match the beaver adaptation with the prop.

Assessment

Assess students based on their responses to the conclusion questions.

- Have students watch the Disney busy beaver video (http://www.youtube.com/watch?v=PAI3ATQLNu4) and identify three beaver behaviors that were accurately portrayed, and three beaver behaviors that were inaccurate.

Extensions

- Divide students into groups and have each group put together a two minute scene that illustrates one physical and one behavioral adaptation of a beaver. Have each group perform their scene, while students in the audience write what the adaptations were being preformed.

Planet Adapto!

- Let students create their own adapted alien. Give students time to draw and write a story about their alien and why it is superbly adapted to their planet: Adapto. You can describe the planet to students (low oxygen levels, no water, sunlight for only 2 hours a day, etc.) or let students create their own planet’s environment.

Field Trip Opportunity

- Visit a local area where beavers are active.
- Allow students to explore the area and look for clues of beaver activity (tracks, dams, ponds, drag trails, scent mounds, stumps, etc.)

Vocabulary

Adaptation: a characteristic that has developed over time, which helps an organism to survive in its environment.

Behavior: to do and say things in a particular way.

Behavioral Adaptation: a specialized behavior an organism does, which helps it to survive in its environment.

Characteristics: a typical quality or feature.

Environment: all the things that influence your life, such as the area where you live, your family, and the things that happen to you.

Habitat: the place and natural conditions in which a plant or an animal lives.

Herbivore: an animal that eats plants.

Inherited: a particular characteristic that is passed down to you.

Opposable Thumb: the only digit on the human hand that can move in a different direction than the other digits. The thumb can be moved around to touch the other fingers, giving humans the ability to grasp anything from pencils to tree branches.

Physical Adaptation: a physical characteristic that an organism is born with, which helps it survive in its environment.

Sources

- Fyon, Andy. "Beaver Scent Mound." Photo. *Andy's Northern Ontario Wildflowers Burwash Wildlife* 2003. 9 Dec. 2008. <http://www.ontariowildflower.com/wildlife_animals.htm>
- Hicker, Rolf. "Cute Beaver." Photo. *Canada-Photos.com* 2008. 9 Dec. 2008 <http://www.canada-photos.com/cute-beaver-54-pictures.htm>
- Holser, Ginger. "Swimming Beaver." Photo. *Washington Department of Fish and Wildlife: Living with Wildlife* 2008. 5 Dec. 2008 <http://wdfw.wa.gov/wlm/living/beavers.htm>.
- Kalman, Bobbie, and Jacqueline Langille. What is a Rodent?. New York: Crabtree Publishing Company, 2000.
- Kelsey, Elin. Nature's Children: Beavers. Danbury, CN: Grolier Educational Corporation, 1986.
- Link, Russell. "Beavers." Living with Wildlife. 2008. Washington Department of Fish and Wildlife. 5 Dec. 2008 <http://wdfw.wa.gov/wlm/living/beavers.htm>
- National Park Service, Utah. "Amazing Beaver Adaptations." Canyon Country Outdoor Education: Fourth Grade Curriculum. 2006. 13 Sept. 2008 <http://www.nps.gov/cany/forteachers/upload/FourthGrade_All.pdf>.
- Outdoor Learning Center, Upham Woods. "Beaver Ecology." 2003. Wisconsin 4-H Youth Development. 13 Sept. 2008 <http://4h.uwex.edu/uphamwoods/programs/documents/BeaverEcologyLessonPlan.pdf>.
- Rees, Jenifer. "Beaver Lodges and Bank Dens." Drawing. *Washington Department of Fish and Wildlife: Living with Wildlife* 2008. 5 Dec. 2008 <http://wdfw.wa.gov/wlm/living/beavers.htm>.
- School of Conservation, New Jersey. "Beaver Ecology." Montclair State University. 13 Sept. 2008 <http://csam.montclair.edu/njsoc/sessions/beaverecology.pdf>.
- Siegmund, Walter. "Beaver Dam." Photo. *Wikipedia Commons* 25 May 2008. 5 Dec. 2008 < http://commons.wikimedia.org/wiki/Image:BeaverDam_8409.jpg>.

Teacher's Page

Beaver Dress Up

Castor gland: Deodorant stick
Physical Adaptation: This is a scent gland located on a beavers abdomen close to the tail. The gland contains castoreum.
Behavioral Adaptation: Beaver will build mounds of mud, called scent mounds, with their paws and then spray castoreum on the mounds from their castor gland. This is used to attract mates as well as to mark their territory.

Oil gland: WD40 can
Physical Adaptation: Beavers have a waterproofing oil gland located at the base of their tail.
Behavioral Adaptation: Beavers will spread the waterproofing oil through their fur. This helps to keep them dry and warm.

Fur: Heavy coat and furry vest
Physical Adaptation: Beavers coats have two layers: an outer layer of long "guard" hairs, and an inner layer of soft, thick, shorter fur. This double layered coat helps to keep the beaver warm.

Fat layer: Kickboard
Physical Adaptation: helps to insulate the beaver while swimming through below freezing water and winter conditions.

Teacher's Page

Internal Flaps (Nose, Ear, Mouth): clothespin, and earphones
Physical Adaptation: Beavers have muscles in their ears and noses that can seal while the beaver is diving or swimming underwater. This enables the beaver to swim without being bothered by water. Beavers also have a special membrane behind their teeth. Because of this membrane beavers can swim with a log in their mouth without swallowing any water!

Nictitating membrane: Goggles
Physical Adaptation: Beavers have a clear third eyelid that they can close but still see through while swimming underwater. Beaver's eyes are also located near the top of their head so that they can see while swimming near the surface of the water.

Lungs: Have the volunteer hold their breath for as long as possible
Physical Adaptation: Beavers can hold their breath for ten to fifteen minutes at a time! This is because beavers lungs can remove 75% of oxygen in air (compared to humans' 15%). They can also tolerate higher levels of carbon dioxide in their blood.

Teacher's Page

Beaver paw prints.

Hind Foot Double Claw: Pocket Comb
Physical Adaptation: On the fourth toenail of each hind foot beavers have a double claw. The claws can open and close like a tiny pair of pliers.
Behavioral Adaptation: Beavers use this toe-nail like a comb. They will use it during grooming to untangle their fur, comb out unwanted twigs and mud, and to spread waterproofing oils through their fur.

Webbed hind feet: Swim flippers
Physical Adaptation: Beaver's hind feet are webbed. The webbed hind feet will push against the water as the beaver swims helping them to be quick and strong swimmers.

Front feet: Gloves with sticky dot palms and fake fingernails
Physical Adaptations: The beaver's front feet have rough pads on the in-side, and long claws for fingernails.
Behavioral Adaptation: Beavers will use their roughly padded front paws for gripping. Sometimes even for pushing heavier logs to their pond. Their long claws will be used for digging. Some-times if a beaver has to travel far to find trees they will dig canals to float the trees back to the pond.

Teacher's Page

Teeth: Cardboard cut out
Physical Adaptation: Beaver's teeth, like all rodents continue to grow their whole lives. In order to keep them a manageable length, beavers must constantly be gnawing and chewing. When chewing, beavers are also helping keep their teeth sharp. The lighter colored layer on the inside of the beaver's teeth is made of dentine, a softer material than the darker orange colored coating on the outside of the teeth. This harder outside layer is made of enamel. The beaver's lower jaw will work against the dentine layer on the inside of the teeth wearing it down and creating a sharp point for cutting.
Behavioral Adaptation: Beavers have strong jaw muscles paired with their teeth allowing them to cut down more than 200 trees a year! Beavers will use their teeth to cut down trees and branches to use for building and for food.

Tail: Canoe paddle
Physical Adaptation: Beavers tails are thick and wide. During the winter months beaver's tails will enlarge up to three times their normal thickness storing fat as an energy supply. Beaver's tails also play an important role in helping the beaver balance as it cuts down a tree (like a kickstand on a bike.)
Behavioral Adaptations: Beavers use their tail like a rudder to steer them through the water while swimming. They will also slap their tail against the water as a warning signal when predators or danger is near.
Myth: Beaver's tails are not used to pat down mud. They will use their nose and/or paws to help smear and move mud around.

ATTACHMENT A

ATTACHMENT A

Beaver Song

Beavers one, Beavers all
Let’s all do the Beaver call!
Beavers two, Beavers three
Let’s all climb the Beaver tree!
(make motion like climbing a tree)
Beavers Four, Beavers Five,
Let's all do the Beaver Jive!
(do hand jive motions)
Beavers Six, Beavers Seven,
Let's all go to Beaver heaven!
(do hand prayer, close eyes, and sway)
Beavers Eight, Beavers Nine,
STOP! - - It's Beaver Time!
(Do crazy dance and Nah, Nah, Na-nah singing of Hammer Time song)

Beaver Quiz

1. Beavers are A. Monogamous (one mate for life) B. Polygamous (many mates) C. Have a new mate each year

2. Beavers are A. Rodents B. Canines C. Marsupials

3. A beaver's favorite food is A. Bark B. Lily Pads C. Berries

4. A beaver's claws are A. All webbed B. All clawed C. Webbed and Clawed

5. Beavers can swim under water for A. Up to 5 minutes B. Up to 15 minutes C. Up to 1 hour

6. Beavers slap their tail on the water A. To find a mate B. To warn others about danger C. When playing

7. The oil beavers use to keep dry is also A. Used in perfume B. Smells very bad C. Beavers don't secrete oil

8. The beaver population is A. At an all time high B. Has remained steady since the 19th century C. Was close to extinction in the 19th century.

9. To fell a tree 3-4 feet wide, beavers need A. 1 hour B. 1 night C. 1 week

10. Beavers control where a tree falls by A. Chewing on it in a certain place B. Knocking it down with their tail C. They can't control where it falls

11. Beavers are A. Nocturnal B. Diurnal C. Crepuscular

12. Beavers are A. Carnivores B. Herbivores C. Omnivores

13. Beaver's biggest enemies are A. Humans B. Snakes C. Mountain lions

14. Young beavers leave their homes at A. 5 years B. 2 years C. Never

15. Beavers **do not** use their tails for A. A rudder when moving trees through the water B. To warn other beavers of danger C. To smooth mud on their lodges

16. When beavers swim underwater, their eyes are A. Closed B. Open C. Closed with special eyelids.