Going Batty Adaptations Lessons

NATIONAL WILDLIFE REFUGE SYSTEM

Going Batty

Season:
All

Objectives:
Students will be able to...

- Define echolocation and determine the importance of echolocation to bats and other animals that depend on it.

- Determine the similarities and differences between the anatomy of bats and similar species.

- Determine the different types of foods bats eat by discovering their special adaptations and abilities.

Key Concepts:

- Echolocation
- Frequencies
- Anatomy
- True-flying
- Homologous Structures
- Insectivorous
- Adaptations

Summary of Activities

This binder includes a variety of activities and background information related to bats and their adaptations. The trunk also contains supporting materials for the activities in this binder as well as extra materials to use for additional activities at your own leisure. Feel free to use the lessons in this binder and materials in the trunk how it best fits your goals and needs.

Please be respectful with the artifacts and items. Always use extra care when handling the two bat skeletons found in the trunk.

Table of Contents (Binder)

State (SEEd) Standards

Kindergarten

Standard K.2, Living Things And Their Surroundings

Standard K.2.2, Obtain, evaluate, and communicate information about patterns in the relationships between the needs of different living things and the places they live.

First Grade

Standard 1.2, The Needs of Living Things And Their Offspring

Standard 1.2.2, Construct an explanation by observing patterns of external features of living things that survive in different locations.

Standard 1.3, Light And Sound

Standard 1.3.1, Plan and carry out an investigation to show the cause-and-effect relationship between sound and vibrating matter.

Second Grade

Standard 2.2, Living Things And Their Habitats

Standard 2.2.4, Design a solution to a human problem by mimicking the structure and function of plants and animals and how they use their external parts to help them survive, grow, and meet their needs.

Third Grade

Standard 3.2, Effects Of Traits On Survival

Standard 3.2.3, Construct an explanation that the environment can affect the traits of an organism.

Standard 3.2.4, Construct an explanation showing how variations in traits and behaviors can affect the ability of an individual to survive and reproduce.

Fourth Grade

Standard 4.1, Organisms Functioning In Their Environment

Standard 4.1.1, Construct an explanation from evidence that plants and animals have internal and external structures that function to support survival.

Fifth Grade

Standard 5.3, Cycling Of Matter In Ecosystems

Standard 5.3.2, Obtain, evaluate, and communicate information that animals obtain energy and matter from the food they eat.

Going Batty Trunk Materials List

Activity Books/Manuals

- Going Batty Lesson Plans & Handouts Binder
- Orange Activity Folder
- Discover Bats Activity Book
- The Bat House Builder's Guidebook
- Educator's Activity Book About Bats

Books

- Zoobooks: Bats (2)
- Vampire Bats and Other Creatures of the Night
- Bats: Swift Shadows in the Twilight
- What is a Bat?
- The Bat
- Bats: For Kids
- Bats and Other Animals of the Night
- Beautiful Bats
- The Secrets of Animal Flight
- Stellaluna
- Misunderstood: Bats
- Bats of the World
- Bats of the United States (16)

Miscellaneous Items

- Bat Skeleton (2)
- Box of 10 Red Bandanas and Fabric Bat Outline
- Laminated Flip Chart: "Year in the Life of a Little Brown Bat"
- Paper Bat Craft
- Bat Puppet
- DVD: Bat Talk
- DVD: The Secret World of Bats
- Bat Anatomy Poster
- Bat Anatomy Cards
- Bat Adaptation Food Cards
- Bat Food Clue Cards
- Bats: True or False Poster
- Bats: True of False Poster Laminated Cards
- Bats Poster

What is a Bat?

Background Information

Bats are the only **true-flying mammal** found in the world. While some mammals, such as the flying squirrel, have a membrane allowing them to glide short distances, bats are able to take real flight similar to birds and insects.

The bones within a bats wing resemble the finger bones found on a human hand. These are sometimes called **homologous structures** as both humans and bats have the same common ancestor, but our limbs are adapted to do different things even though they resemble one another.

There are over 1,400 species of bats found worldwide making bats the most diverse group of mammals besides rodents. Bat species can range from the large flying foxes with wing spans up to six feet long to bumblebee bats which weigh less than a penny. Bats can be found within nearly every region of the world except for extreme desert and polar regions.

Most types of bats are **nocturnal** meaning they are active at night. During the night, bats prey on a variety of flying insects including mosquitoes, moths, crickets, beetles, and more. Bats also eat a variety of other foods, depending on the species, including fruit, leaves, nectar, fish, and other bats.

Many bats use **echolocation** to detect and locate their prey at night when it is harder to see. Bats are known for their sensitive vision which can make their sense of sight limited.

Many bats are highly social and live in large colonies. During the wintertime, when many bats are **hibernating**, bats will roost in large colonies in quiet, undisturbed places such as empty buildings, caves, and trees. Some species of bats will actually **migrate** during the winter months rather than hibernating depending on the species and habitat they prefer.

Bats Found in Utah

Big Free-tailed Bat

Mexican Free-tailed Bat

Allen's Big-eared Bat

Canyon Bat

Little Brown Bat

Silver-haired Bat

Western Red Bat

Big Brown Bat

Bats Found in Utah

Fringed Myotis

Long-eared Myotis

Spotted Bat

Western Small-footed Myotis

California Myotis

Long-legged Myotis

Hoary Bat

Townsend's Big-eared Bat

Bats & Moths Game

Time:
20 minutes

Season:
All

Objectives:
Students will be able to...

- Define echolocation and determine the importance of echolocation to bats and other animals that depend on it.

Key Concepts:

- Echolocation
- Frequencies

Summary

Bats depend on their use of echolocation to accurately locate the insects and prey they are hunting at night. Echolocation also help bats to be more aware of surrounding obstacles such as trees and human-made structures that could potentially make hunting more difficult.

In this activity, students will discover how echolocation works and test their own abilities as a bat or moth. Students will also learn just how much bats depend on echolocation and why these different forms of communication and navigation are important to different types of animals.

Materials Included

- Box of 10 Red Bandanas and Fabric Bat Outline

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Bat Echolocation

Background Information

Echolocation is the process by which animals emit calls, at various sound frequencies, and listen for echoes of their call to return after rebounding off of the objects around them. Depending on the type of animal, echolocation can be used to locate prey, communicate with other animals, or navigate when it is difficult to see.

About 70% of all bat species use echolocation. However, bats are not the only animal that uses echolocation. Whales, dolphins, oilbirds, and shrews all use echolocation for various reasons.

When thinking about bats, specifically, echolocation is primarily used to detect prey when hunting. The high frequency sounds that bats emit during echolocation help to determine the shape and size of the objects around them. In fact, using echolocation, a bat is able to detect an object the width of a human hair.

Because bat echolocation is emitted at various **frequencies**, ranging somewhere between 9kHz to 200kHz, most of the sound's bats emit cannot be heard by the human ear. To put this into perspective, humans can only hear from about 15 kHz to 20kHz. However, if humans were able to hear bats, the sound of echolocation is about the same volume as a smoke alarm demonstrating how powerful echolocation can be.

Echolocation serves as an important hunting device for bats because bats can eat up to 50% of their body weight in just one night. Depending on where a bat chooses to forage for food, the volume of echolocation sounds can vary. In areas with a lot of open space, bats will emit louder and more powerful sounds to detect the locations of insects in wider spaces. This differs from bats that hunt in areas with more trees and surroundings. These bats will emit quieter and less powerful sounds in order to home in more accurately on the location of the insects they are hunting.

Bats & Moths Game

Instructions

1. Find a flat, open area to start the game with plenty of extra space, and have students form a standing circle with everyone facing inwards.

2. Choose one volunteer to be the bat and another volunteer to be the moth. Have both volunteers enter the middle of the circle.

3. Share with students that the object of the game is for the bat to catch the moth while flying. Because the bat is flying at "night," they will need to use echolocation to find the moth. Blindfold the student who is playing as the bat when ready.

4. Demonstrate echolocation to the students by having the student playing as the moth respond "moth" every time the student playing as the bat says "bat".

5. Explain to everyone else that they will all get a chance to play the next rounds, but their role for this first round is the keep the student playing as the bat safe by keeping them in the circle since they are blindfolded.

6. Once all students understand the rules, start the first round of the game. If the bat has a hard time catching the moth, have the students make the circle smaller or add more moths. If it is too easy, expand the circle.

7. Once the student playing as the bat has caught the student playing as the moth, choose a new bat and new moths to play again.

8. For the next round, add another bat and some obstacles. The obstacles can be student volunteers that are stationary "trees" or "buildings." Every time the bat says "bat" the obstacle will also respond along with the moth by saying "tree" or "building."

9. Continue playing until everyone has had a chance to be a bat or moth.

Reflection Questions

1. Ask students to describe why echolocation was so important in this activity.
2. Ask students if calling out frequently made it easier or harder to find the moths and how this changed when obstacles were added.

Bat Anatomy Poster Activity

Time:
10 minutes

Season:
All

Objectives:
Students will be able to...

- Determine the similarities and differences between the anatomy of bats and similar species.

Key Concepts:

- Anatomy
- True-flying
- Homologous Structures

Summary

The anatomy of bats is extremely unique compared to other common mammals and animals that can fly. All of the features that make up a bat help bats to achieve true flight.

In this activity, students will discover some of the similarities and differences bats have with humans and other mammals regarding their anatomy and the structure of their bones.

Materials Included

- Bat Anatomy Poster
- Bat Anatomy Cards

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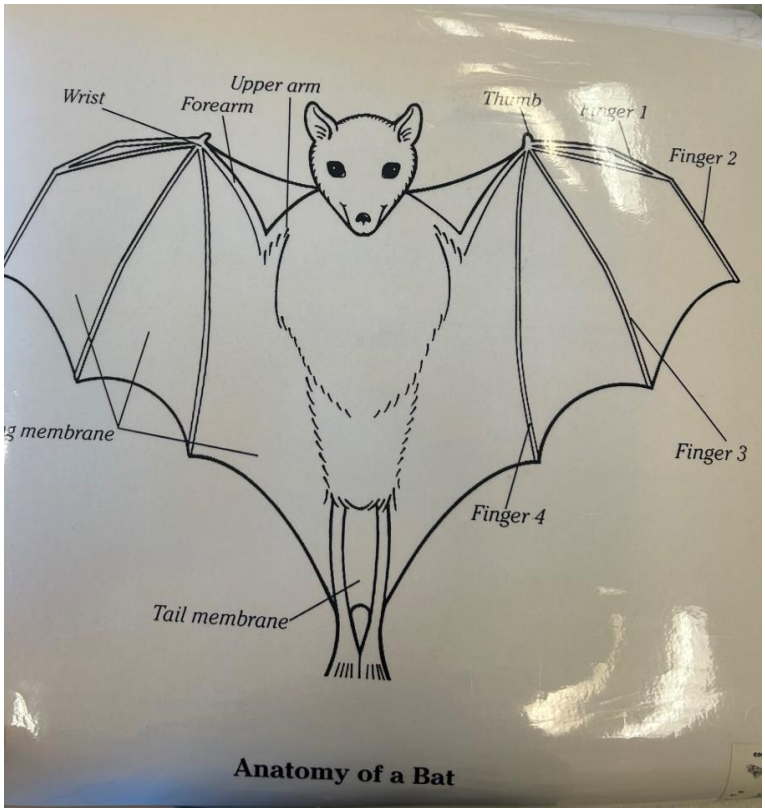


Anatomy of a Bat

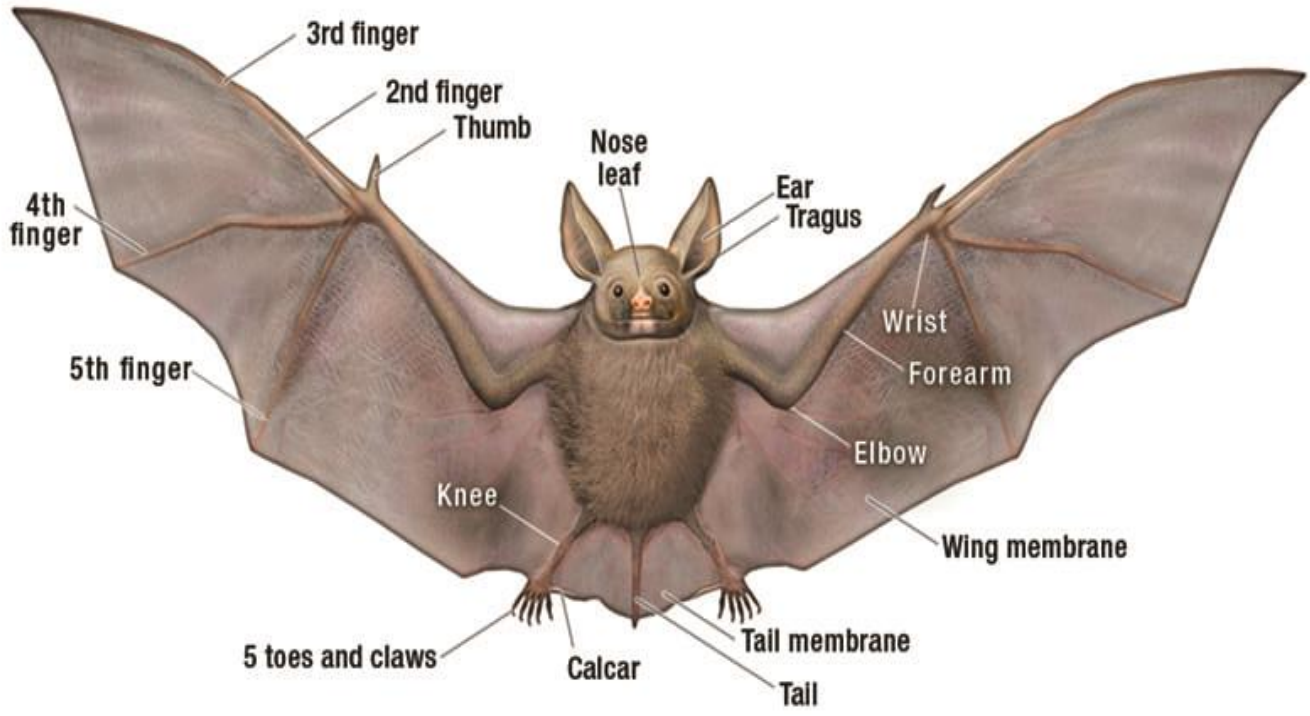
Background Information

The **anatomy** of a bat is very unique compared to other related species. This is largely due to that fact that bats are the only **true-flying** mammal species.

Similar to many other mammal species, bats also have bones that resemble a human hand. Even though bats have wings, the bones that hold their wings together have evolved from the same common ancestor as humans and many other mammals. These similar bones are called **homologous structures.** However, even though there is a common ancestor, the limbs still serve different purposes for each different animal.

While bats do share fingers, thumbs, and wrists with humans, their wing and tail membranes set them apart from other mammal species. These webbed membranes give bats the ability to take true flight.

In addition to this, while bird bones are hollow, allowing them to take flight due in part to their light weight, bat bones are solid just like other mammal species. However, even with solid bones, the heaviest bats only weigh up to about 3 pounds. This lightweight framework gives bats the extra push to be able to take true flight.



Bat Anatomy Poster Activity

Instructions

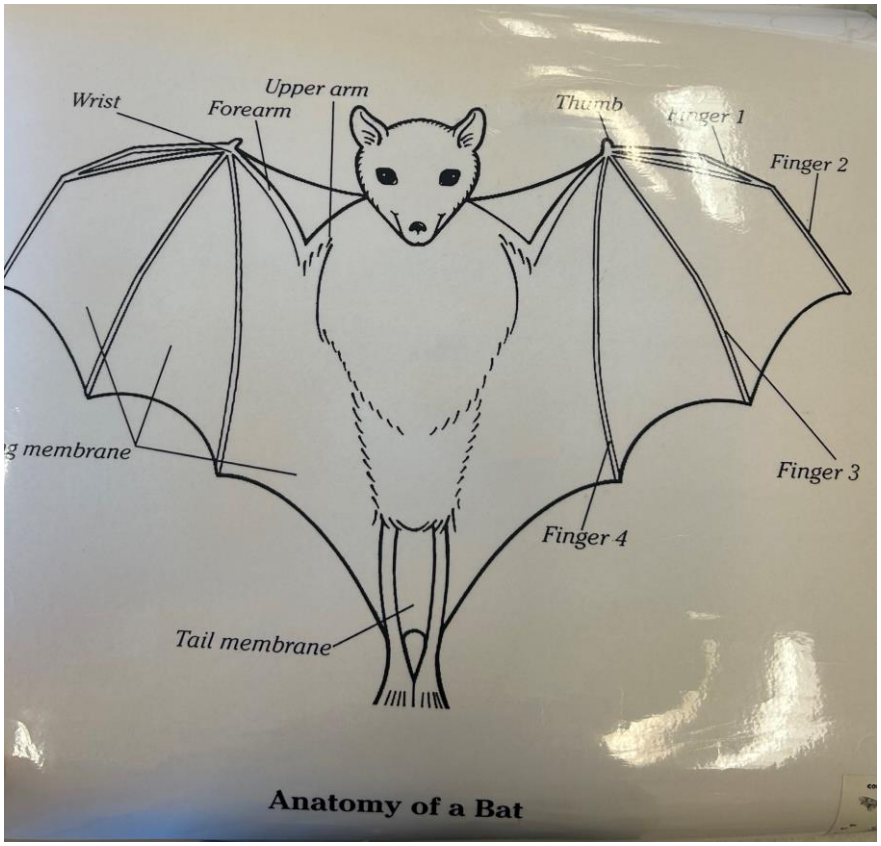
1. Find a space to hang the “Bat Anatomy Poster” where all students are able to see.

2. Discuss with students that bats are mammals and that some of the features on their bodies are shared with other mammals and some are different. Ask students what might be similar between this poster of a bat and humans.

3. Ask for volunteers to place one of the “Bat Anatomy Cards” on the poster one-by-one.

4. After each card has been placed, discuss with students why they think this is the right spot for that feature and if they think that feature is shared with other similar species.

5. Define homologous structures and ask students if they can name other animals that might also share the same common ancestor with bats and humans. (This could include cats and whales which also have the same bones as humans and bats).



Specialized Bat Diets Activity

Time:
20 minutes

Season:
All

Objectives:
Students will be able to...

- Determine the different types of foods bats eat by discovering their special adaptations and abilities.

Key Concepts:

- Insectivorous
- Adaptations

Summary

While many bats eat insects, there are also a large variety of species that eat other specialized foods. These bats have special adaptations that allow them to hunt and find these specialized food sources easier.

In this activity, students will learn about the many different types of foods that bats eat while also discovering some of the special adaptation's bats have that allow them to successfully hunt for their meals.

Materials Included

- Bat Adaptation Food Cards
- Bat Food Clue Cards

Bat Food & Specialized Diet

Background Information

With so many different species of bats found throughout the world in various habitats and ecosystems, bats have a wide range of specialized diets. While 70% of the bats found around the world are **insectivorous**, there are a large number of species that prefer to eat other types of food as well.

In the temperate regions of North America, all but three species of bats feed exclusively on insects. Insect-eating bats are essential to all ecosystems as one bat can eat greater than 600 insects in just one hour. Many insect-eating bats are found in temperate regions of the planet where seasonal changes take place.

Many of the world's larger bat species, including flying foxes, feed on fruit, seeds, and pollen from flowers. These larger bat species are typically found within the subtropical regions of the world such as Africa, Australia, and Southeast Asia.

There are also specialized fish-eating bats that are only found on the islands and rocky coastlines of the Gulf of Mexico. However, these are not the only bats that eat larger forms of prey, there are some species of bats that are known to eat fish, frogs, rodents, and even other bats.

Probably the most infamous bat found throughout the world is Latin America's three species of vampire bats. Vampire bats are the only species of bats that do feed off of the blood of other animals. However, they often choose to feed off of different forms of livestock, such as cattle, due to the abundance of cattle found within the vampire bat's native habitat.

Specialized Bat Diets Activity

Instructions

1. Set out the Bat Adaptation Food Cards at the front of the classroom or in an open space.

2. Pass out the Bat Food Clue Cards to students. Depending on the number of students in the class, you may want to have students form groups or partners.

3. Discuss with students that not all bats eat just mosquitos and insects. Bats eat a variety of different types of foods. Using the context clues on their cards, students must determine what type of food the bat species they have eats.

4. After letting the students discuss their ideas and think, have volunteers come to the front of the classroom to place their bat with the correct type of food that bat eats.

5. One-by-one, discuss the different adaptations bats have that allow them to eat a certain type of food and how those adaptations are important to those specific bat species for activities other than just eating.

Reflection Questions

1. What adaptations are important to bats and their chosen diets?

2. Besides adaptations, are there other factors that play a role in a bats diet? (Habitat)

3. If you were a bat, is there a certain diet that you would choose? Why is that?

Bat Hibernation & Migration

Background Information

Hibernation is the condition or period of an animal or plant spending the winter in a dormant state. It is also defined as an extended period of time where a plant or animal remains inactive. The process of hibernation involves a reduction in an animal or plant's metabolic rate, heart rate, and respiratory rate. This allows for the animal or plant to survive long periods without eating.

For bats specifically, during hibernation their heart rate can drop to about 10 beats per minute allowing them to take a breath every few minutes. Their body temperature also drops to near freezing depending on the location they chose to hibernate. Furthermore, their daily bodily functions slow down to much slower rates reducing the cost of energy by nearly 98%.

Depending on the species of bat, some will hibernate up to six months of the year in order to make sure their food resources, typically insects, are readily available when coming out of hibernation. Many bats will choose to hibernate in places such as caves, unused buildings, trees, and rock crevices. When bats hibernate together in large groups they are sometimes referred to as colonies or **hibernacula**.

While many species of bats hibernate, a large number of bats also **migrate** during the winter months. This is similar to annual bird migration which takes place every year. Many migratory bat species prefer to roost in trees as they migrate south for the winter months. Typically, this migration takes place as the number of insects start to disappear.

One example of a migrating Utah bat is the hoary bat. During the fall season, hoary bats will gather, by the hundreds, along the southern coastlines and in northern Mexico after making their journey south for the winter.

Bat Conservation

Background Information

In the past, bats have often been villainized making them one of the most important misunderstood creatures on the planet. Without bats, significant and costly crop damage would take place on a large scale. With that said, bats eat enough insects and pest species to save more than $1 billion per year in the United States corn industry alone.

Bats play essential roles in **pest control, pollination, and seed dispersal**. Without bats, many of the plants and crops that make up familiar ecosystems would struggle.

Even though bats are essential to the world's plants and crops, bat populations are steadily declining throughout the world. Human activity and habitat loss play a large role in the decline in bat populations, but so does **white-nose syndrome** which is a fungal disease impacting hibernating bats. More than 5 million bats have died due to the disease since its discovery in 2006.

Although bat populations are declining, **conservation** efforts are underway and have brought much of the important awareness to the public about the importance of these animals.

Furthermore, research treatments are underway to help bats fight the fungal disease and more than 15 bat species are now listed under the Endangered Species Act.

There are many ways that we can help bats near our own homes. Here is a list of some of the easy ways humans can help bats:

1. Turn off unnecessary lights and watch for bats.
2. Promote natural habitat near your own home.
3. Feed hungry bats by minimizing the use of pesticides in your yard.
4. Provide shelter by installing a bat box.
5. Avoid disturbing bats during hibernation.
6. Remove unwanted bats humanely.

Reflection

Ask Students...

1. In your opinion, which bat adaptation is the most important to their survival? Why do you think that is?

2. Why are bats so important? What is their role in the food chain and what do they do for the environment?

3. What are some ways we can protect bats near our own homes?

4. If you could be any type of bat, what special adaptation would you have and why?