



Bat Program

Program Purpose

Through hands on games and activities students will learn how bats live and how bats benefit ecosystems.

Length of Program

1 hour

Age

Grades 3rd-12th

Maximum Number of Participants

25

Objectives

After completion of all activities, students will be able to:

- List the different food sources consumed by bats
- Explain several bat adaptations
- Name several reasons why bats are beneficial and important to people
- Define and explain echolocation and how it is used by bats

Preparation

Before the class arrives:

- Locate the bat box in the curriculum room

Basic Outline

- I. Introduction (5 minutes)
- II. Bat quiz (5 minutes)
- III. Echolocation (5 minutes)
- IV. Bat Moth Game (10 minutes)
- V. Bat adaptations (15 minutes)
- VI. Human benefits (5 minutes)
- VII. Chiroptera differences (5 Minutes)
- VIII. Myths and folklore (5 Minutes)
- IX. Conclusion (5 Minutes)

Materials

Bat Skeleton
2 Blindfolds
4 Rattles
Bat skeleton diagram
Mega and Micro Bat Masks
Slinky
Bat Quiz
Little Brown Bats

Introduction

Introduce yourself to the class and explain that we will be talking about bats. Ask the students if they are afraid of bats and encourage students to share why they are afraid. Say that by the end of class you hope to have relieved some of their fears and helped them to better understand bats.

Bat Quiz

The bat quiz is a ten-question quiz of crazy questions intended to get the kids thinking about bats. The quiz should be read out loud asking for raised hands if they think the answer is true, and hands down if they think the answer is false. Hopefully they will ask questions to set up the rest of the class. The answers to the quiz should not be given until the myths and folklore section of the class. The quiz is included in the appendix and a laminated quiz can be found in the bat box.

Echolocation

This segment is intended to help students understand how bats find food. Carnivorous and insectivorous bats use echolocation to locate food. This process is much like the sonar that is used on submarines to find objects in the water. A bat makes a sound

like a beep. That sound is actually a sound wave that travels away from the bat like a wave in the lake when you drop a stone. The bat can make up to 500 beeps in one second. (Students will probably try this at this point and find they can't do more than two or three in a second). When these waves move outward they hit other things and bounce back. Bats have very sensitive ears and can hear these sounds bouncing back like an echo in a canyon. Bats are so good at using echoes that they can tell the difference between what is food and what is a predator or an obstruction by the shape the echo returns in.

The best example of how a bat uses echolocation is to get a volunteer from the audience to have them hold on to one end of a slinky. You will be holding the other end and both of you will drop to your knees to bring the slinky to the ground. Move about ten to fifteen feet apart and make a beep noise. When you make the noise send a single wave down the slinky and it will travel to the student and back to you. Every time you beep move closer and closer to the student making the beeps more rapid and more intense until you reach the student and pretend to eat them.

Bat Moth game

The bat moth game is intended to show students how echolocation works. Have the students make a circle and space themselves an arm length apart. Pick one student to be the bat. Put them in the center of the circle with a blindfold on. You will then pick one to four students to be the moth. Give each moth a rattle and the game begins. Every time the bat says beep the moths must shake their rattle. The moth may move but if the bat tags them they rejoin the circle and a new moth will enter the circle. When the group gets the hang of the game you can add

another bat to make things more challenging.

Bat Adaptations

This section is intended to explain a few of the unique body parts and behaviors bats have to survive. An explanation of these can be found in the attached appendix. Start by talking about one of the adaptations that you feel you have the best base of knowledge on. After the first adaptation the students will probably have other adaptations to add. This section is very free form allowing for the students to guide the class in the direction they are most interested in.

- Hanging up side down
- Fisherman bats
- Colonies
- Tail Scoop
- Bat babies
- Falling flight
- Vampire bat adaptations

Human Benefits

Humans all over the world benefit from bats and their nightly habits. In this section you will expose the students to a few of the benefits.

Ask the students who likes black pepper, chewing gum, Fig Newton's, bananas. Ask who has a grand parent or parent that has under-gone heart surgery. All of these things could not exist without bats.

- 75% of the black pepper grown in the world uses bat guano as a fertilizer.
- Gum trees, fig trees, peach trees, mango trees, avocado trees, date trees, cashew trees, and banana trees are all pollinated by bats like bees pollinate flowers.

- If they have a parent or grand parent who has had heart problems they were probably given an anticoagulant made from broken down vampire bat saliva. When a vampire bat makes a cut in its dinner its saliva keeps the cut from healing by thinning the blood. This technology has been adapted to make anticoagulants for use in humans to thin blood and make it easier for the heart to pump through clogged arteries.
- Bat guano was used as an ingredient in gun powder during the civil war
- Disperse seeds of fruit-bearing Trees
- Control insect populations

Chiroptera Differences

There are two main groups of bats:

Megachiroptera and Microchiroptera.

- Megachiroptera is one group found all over the world but mostly in Southeast Asia. Megachiroptera are identified by their big eyes and small ears and better than average vision. They do not use echolocation because they are fruit eaters so they depend on eyesight and their sense of smell for food.
- Microchiroptera are found all over the world also and are very common in the U.S. These bats have large ears and small eyes with unusual skin folds around their nose to aid with echolocation. They can see but do not depend on vision for food collection.

For this part of the class a pair of bat masks are included in the list of items. You can get two volunteers from the kids to wear the masks that illustrate the differences between the two groups of bats. The masks are made of paper and have rubberbands in the back to hold on to the kid's head.

Additional information and the bat masks are included in the appendix in the back.

Myths and Folklore

In this section you can go over the answers to the quiz and ask the kids if they know any other things about bats and talk about the truth involved with each myth that comes up. The answers to the quiz are included on the quiz sheet.

Conclusion

This section is here to wrap up all of the discussion and the final questions from the group.

References

- Tuttle, Merlin D. (1988)
America's Neighborhood Bats.
University Of Texas Press, Austin, TX.
- Greenaway, Frank. (1991)
Amazing Bats. Alfred A. Knopf, Inc., New York, NY.
- Shea, George. (1977)
Bats. EMC Corporation, St. Paul, MN.
- Bat Conservation International. (1991)
Educators Activity Book About Bats. Bat Conservation International. Austin, TX.
- Hill, John & Smith, James. (1984)
Bats, A Natural History. University Of Texas Press, Austin, TX.

Bat Quiz

#1. Bats Are Mice With wings.

False-Bats are more closely related to humans than mice.

#2. Bats are dirty and carry lots of diseases.

False-Bats clean themselves and other bats daily like your cat would.

#3. The world's largest bats have a wingspan of nearly seven feet.

True-Flying foxes have a wingspan that can reach nearly seven feet.

#4. Vampire bats are huge bloodsucking bats that are all over the world.

False-Vampire bats are small bats that live only in South America. They don't suck blood-they lick it up after making a cut with their teeth.

#5. The world's smallest bat is the size of a bumblebee and weighs less than a penny.

True-The Bumblebee bat of Southeast Asia is the size of a

Bumblebee and weighs less than a penny.

#6. All bats are carnivores.

False-A large group of bats, known as megachiroptera live on fruit and pollen. Most of the bats in the U.S. are insectivores.

#7. Bats fly around your head and get tangled in you hair.

False-Bats may come in for a closer look but are far too smart to get tangled in your hair.

#8. Some bats are cannibals.

True-Cannibal bats of Australia eat other smaller bats.

#9. Bats account for nearly 25% of all mammals.

True-There are nearly 1000 different species of bats in the world.

#10 Bats are blind

False-Bats see, but most don't depend on vision for food

Bat Adaptations

Here are some of the basic adaptations that bats have developed to help them survive.

Hanging up side down. Bats have adapted to hang upside down to avoid predators and to help conserve heat. Bats can do this because they have a tendon in their feet that requires them to have the foot closed. This makes it possible for bats to hang up side down from small cracks in rocks or trees and hibernate for around six months without exerting any energy. A bat foot is more like our hand in how it functions. Our hand requires us to exert energy to close the hand and make a fist. A bat foot does the opposite: it requires energy exertion to open the foot, allowing the bat to hang up-side down while fully asleep.

Colonies

When you find a bat in a cave or some other location it is probably not alone. The bats of Bracken Cave in Texas may number up to 25 million. These bats all share this very close living space for a very good reason: Heat. All of these bodies create a lot of heat and keep the cave a little warmer. As many as 200 bats can be found clinging to one square foot of rock. The nursery at Bracken Cave may have up to four million babies in it at one time. How does a bat mother find her baby? Bats have an excellent sense of smell and hearing so they can easily identify their babies by their sound and smell in a group of four million.

Tail Scoop

A bat's wing membrane spreads all the way to its tail allowing for extra lift and ease of flight. The tail membrane has two other very important functions. First, it enables the bat to fly through the air and

catch large amounts of bugs by making a cup with the membrane. It works like a bug net, sweeping an area to catch as many bugs as possible. This very effective method allows bats to catch around 600 gnat-sized insects an hour. The second important function is a baby seat. If a bat mother needs to transport her baby she will put it in the tail scoop and carry it with her.

Falling Flight

Bats are like jets they need a runway to take off. Jets have engines that propel them forward and bats have gravity to propel them down. Bats fall a little way to pick up speed and then take off before they hit the ground. If they are on the ground most of them can't take off. They will crawl with their legs and the claws on their thumbs to a higher position (on a tree or building) and fall into flight.

Fisherman Bat Adaptations

The fisherman bat has adapted to go fishing for its food. It does this using echolocation and hook like extensions on its feet. The bat sends out sounds like any other carnivorous bat but instead of finding bugs it is looking for small waves in the water. These waves tell the bat that a small minnow is at the top of the water feeding. The bat swoops down dragging its hooks in the water and catches the fish.

Vampire Bat Adaptations

There are three species of vampire bats in the world: the common vampire, the hairy-legged vampire and the white-winged vampire. All of the vampires feed on the blood of mammals but they will also feed on the blood of birds.

Vampires have very pronounced upper incisor and canine teeth but the rest of their teeth are much smaller than the average bat. These teeth are razor sharp and are used to

make a cut in their prey so they can lap up the blood. Vampires have a strong anticoagulant in their saliva that stops the blood from forming a scab, and keeps the blood flowing freely. The most common place to make a cut is around the eyes, lips, ears, feet, fingers, base of the tail, and anus.

After feeding, the bat is too heavy to fly after having consumed two to three ounces of blood. The vampire bat will crawl away from its prey to a safe place to wait for digestion. The vampire bats kidneys are very quick and will process most of the water out of the blood, making the bat urinate. After urinating, the bat can fly away. The prey will bleed for a long time sometimes days and babies will occasionally bleed to death because the anticoagulant will not allow the wound to heal.

Because vampire bats eat blood, they are more likely than any other bat to carry rabies. Vampire bat wounds are also easily infected, because the wound does not heal, leaving the prey susceptible to infection. These infections can spread and eventually kill the prey.

Delayed Conception (advanced topic)

Bats live half to two thirds of their life in hibernation. Bats do not have enough time to mate and carry young to term in the short time they are awake. To over-come this problem, bats delay their conception.

Unlike most animals who mate early in the spring bats mate in late fall. The female stores the sperm in her uterus and actually feeds the sperm through her cells. About two months before the end of hibernation, the sperm is released to the egg and conception occurs. This allows the female to be ready for birth at about the same time she is ready to come out of hibernation.

This way, the baby is given the maximum amount of time to grow and develop into an adult before it must hibernate.

Bat Babies

To give the babies the best chance at survival, bats have adapted to being very developed when they are born. The average baby bat is about one-fourth to two-thirds the weight of its mother. This means that if your mom weighs 100 pounds, you would have weighed 33 pounds when you were born. Some bats, like the red bat, have twins.

Rabies

A common myth about bats is that they all have rabies. Bats can carry rabies but are not very likely to do so. One tenth of one percent of bats are infected with rabies. This is less than dogs, cats, skunks, raccoons, and even cows. The reason people get rabies from bats is because we are curious when we see a bat on the ground, and we pick it up. Bats who on the ground are usually sick. That doesn't always mean they have rabies, but they would not normally let a human get close to them. You should assume that any bat or wild animal that lets you get close may be sick. Some bats on the ground are healthy but can't seem to fly away. The reason for that is some bats need to fall a little before they can fly. Planes need a runway to get speed to take off. Bats don't have engines so they get their speed from a fall.

If a bat bites you, you should bring the bat and yourself to a doctor. The doctor will have the bat tested for rabies and if it does have rabies you can be cured by a series of shots.