

INVESTIGATING BAT ADAPTATIONS

1

Summary:

Students investigate adaptations that increase a bat's chance of finding food and surviving in a particular habitat.

Grade Level:

3-6

Time:

two activity periods

Subject:

science

Skills:

observation, comparison, hypothesizing

Learning Objectives:

Students will be able to:

- ✓ List several different foods that bats eat.
- ✓ Describe anatomical features that lend themselves to particular bat diets.
- ✓ Analyze bat features to accurately predict their diets.

Materials:

- ✓ Bats Adapt for Food cards (one set of six cards for each group)
- ✓ Bat Food Clues at the end of the lesson, paper for students to write answers

Background

Did you ever stop to think what the world would be like if all animals suddenly tried to eat just one kind of food? What if they all decided to eat just grass? The answer is simple. They soon would run out of grass and starve to death. Because animals eat a wide variety of foods, they compete less, allowing many different species of animals to live in the same habitat and maintain healthy ecosystems.

Most of the world's bats eat insects, and in areas with cold winters, that is all they eat. Many tropical bats eat fruit and nectar, and a few are carnivores that eat other animals, including rats and mice, small birds, frogs, lizards, or even fish. Only three out of more than 1,000 species of bats drink blood.

Each species of bat is adapted for the food it eats. Some bats specialize in eating just one or a few kinds of food, but others are generalists that eat a wide variety of foods. Long-nosed bats have noses of varied lengths and widths that match the sizes and shapes of the flowers from which they drink nectar. Carollia fruit bats are adapted to feeding almost entirely on small

piper fruits, but some flying foxes are generalists that eat many sizes and kinds of fruit as well as nectar.

Some bats that catch insects have adaptations for hunting certain kinds of prey or for capturing them in certain places. Free-tailed bats are like little jet airplanes, using their long, narrow wings and far-reaching echolocation (sonar systems) for chasing moths high up in the sky. California leaf-nosed bats are more like helicopters, relying on short, broad wings to snatch crickets and other insects from plants or the ground. They can use their extra-large eyes and ears to find insects without even using echolocation. Big brown bats have especially strong jaws and teeth for chewing hard beetles. Pipistrelles have tiny teeth for eating gnats and mosquitoes, and gray myotis have large feet for catching mayflies as they hatch from a pond's surface.

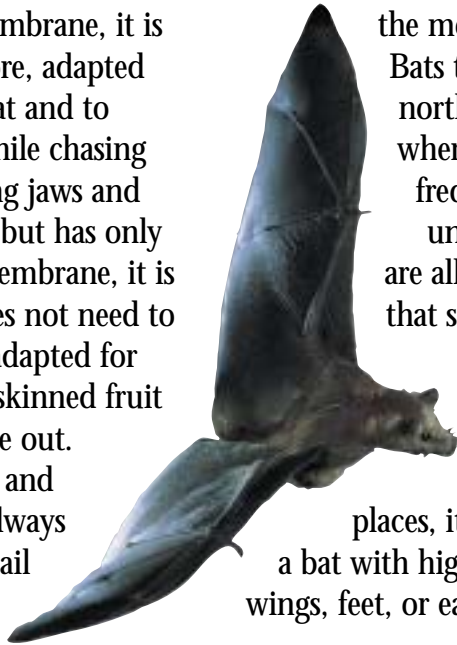
Most experienced bat scientists can guess what a bat eats by looking closely at its adaptations. Long, narrow wings or large tail membranes are usually adaptations for catching insects, but if the bat also has huge feet and claws, it probably eats fish.



Just having large, but not overly large, feet would indicate a bat that catches insects from pond surfaces. If a bat is large and has strong jaws, long canine teeth, and a large tail membrane, it is probably a carnivore, adapted both to eating meat and to turning quickly while chasing prey. If it has strong jaws and long canine teeth, but has only a very small tail membrane, it is a fruit bat that does not need to chase prey, but is adapted for biting into tough-skinned fruit to squeeze the juice out. Both insect-eating and meat-eating bats always have long tails or tail membranes, but meat-eaters are the largest and have the strongest jaws.

Special adaptations allow bats to find and eat certain kinds of food with little or no competition from other species. This is very successful as long as their unique food type is abundant, but such specialization is risky, because the kinds of prey, fruit, or flowers a bat eats might die out, leaving the bat to starve. Animals that eat a variety of foods can switch types if one disappears, but they cannot compete well with specialized animals for any one food. Most

specialists, such as the huge-footed fishing bats, or long-nosed nectar bats, live only in tropical areas where climates and food sources are the most predictable.



Bats that live in northern climates, where changes are frequent and unpredictable, are all insect-eaters that seldom

specialize on any one insect type. In these places, it is rare to find a bat with highly specialized wings, feet, or ears.

fact cards among its members so that every student can become an expert on one of the bat eating habits. (Two students can share a single card in groups having more than six students.)

3. Ask students to take out a piece of paper and number it from one to twelve down the left-hand side. Ask questions by reading the “Bat Food Clues” to the class one at a time.
4. Give each group a minute or two to discuss each given clue, and decide what type of bat it is (for example, insect-eating, fruit-eating, etc.).
5. After all Bat Food Clues are given and students have written their answers, go back through the ‘ Bat Food Clues’ and lead the class in discussing the answers. Bonus questions after each Bat Food Clue can be used to stimulate additional discussion. Each group’s expert on each feeding type can be called upon to help lead discussions.

Preparation

Make enough copies of the Bats Adapt for Food cards to distribute one complete set to each group. You may want to laminate the cards for durability.

Procedure

1. Divide your class into groups of six or more students each.
2. Distribute one complete set of Food Cards to each group. Tell the group to divide the



Extensions

- ✓ Challenge students to investigate other animals that have food habits similar to bats. For example, some birds snatch insects out of the air, while others pick them from foliage. *How do the habits and habitats of these birds compare with those of bats? What about fruit-eating birds? Nectar-eating birds? Fish-eating birds? Are there any other animals that eat blood?* Students can present their results in poster or report format.
- ✓ There have been many other bats featured on stamps from all countries and many other backyard wildlife species featured on U.S. stamps. See how many you can find to start your collection. Visit the American Philatelic Society's website, www.stamps.org/kids/kid_StampFun.htm, for more information on these stamps, stamp collecting, and National Stamp Collecting Month (October, 2002).

Assessment

- ✓ Have students write letters to advertisers they select, explaining why they think a bat would make the perfect mascot for their product. Students could apply their knowledge of bat characteristics and make their own connections to products. For example, bats can fold their wings around them to protect them from the elements, so they'd make a great mascot for umbrellas or raincoats. Or bats could advertise insect repellent since they eat mosquitoes. Or maybe aircraft manufacturers, since bats use radar. Sports teams? Night vision goggles?
- ✓ Have students create a Halloween card with a bat on it to mail to their grandparents or friends. Inside, they could include a "Did You Know?" section listing interesting facts they learned about bats.



Excerpted with permission from "Discover Bats!" a multi-media activity guide by Bat Conservation International, Copyright © 1998.



TEACHER REFERENCE SHEET

ACTIVITY

1

BAT FOOD CLUES

1. WHO AM I?

Clue: My toes and claws are exceptionally long, and the sides of my toes and claws are flat.

Bonus Questions:

What is the advantage of having long toes and claws? What is the advantage of having flattened toes and claws?

Answers:

1. I am a fish-eating bat. Can reach into water without submerging body. To glide easily through water.

2. WHO AM I?

Clue: My legs are extra strong and my kidneys work quickly so I can eliminate water as fast as I eat.

Bonus Questions:

How do fast-working kidneys help a blood-eating bat? What is the advantage of extra strong legs?

Answers:

2. I am a blood-eating bat. To get rid of the water, so the bat won't be too heavy to fly. To walk on the ground while stalking large prey or to jump away quickly if the prey wakes.

3. WHO AM I?

Clue: I am a large, strong bat with large ears and broad wings.

Bonus Questions:

Why does a carnivorous bat need big ears? What is the advantage of having broad wings?

Answers:

3. I am a meat-eating bat. To listen to and find prey. To better lift heavy prey.

4. WHO AM I?

Clue: I fly fast over quiet water, searching for tiny moving objects. My fur is oily.

Bonus Questions:

What is the advantage of flying over calm water? What is the advantage of oily fur?

Answers:

4. I am a fish-eating bat. To easily detect tiny fin tips using echolocation. To shed water, keep bat fur dry, and avoid getting cold.

5. WHO AM I?

Clue: My short, broad wings and my large tail membrane allow me to dart in and out of branches.

Bonus Questions:

What is the advantage of being able to dart in and out of branches? What is the advantage of being able to catch insects on the ground or in bushes?

Answers:

5. I am an insect-eating bat that catches prey on the ground or on plants. To avoid obstacles and catch prey. To avoid competing for food with other bats that feed in the open.

6. WHO AM I?

Clue: I have sharp teeth and strong jaws that can cut or crush big meals, I also have a big tail membrane.

Bonus Questions:

What is the advantage of having sharp teeth and strong jaws? What is the advantage of a big tail membrane?

Answers:

6. I am a meat-eating bat. To quickly kill and cut up large prey and break bones. To maneuver better when chasing prey.



TEACHER REFERENCE SHEET

ACTIVITY

1

BAT FOOD CLUES

7. WHO AM I?

Clue: My teeth are small, except for my front teeth, which are sharp and can cut like a razor. My nose can detect heat.

Bonus Questions:

Why are razor-sharp teeth important? What is the advantage of a heat-sensitive nose?

Answers:

7. I am a blood-eating bat. To make quick, painless cuts. To find areas on prey that are rich in blood.

8. WHO AM I?

Clue: I have sophisticated echolocation abilities; long, narrow wings; and small ears.

Bonus Questions:

Why do bats have echolocation as well as good eyesight? What advantages do long, narrow wings have?

Answers:

8. I am an insect-eating bat that catches prey in the air. To pursue prey on the darkest nights and to roost in deep, dark caves where they are safe from predators. To chase fast-flying insects and travel far.

9. WHO AM I?

Clue: I can smell my food from a long way off and I don't have to echolocate.

Bonus Questions:

Why do many of these bats not need to echolocate? Why is a good sense of smell important?

Answers:

9. I am a fruit-eating bat. They don't live in caves and echolocate isn't necessary for finding fruit. To smell ripe fruits, because color can't be seen in the dark.

10. WHO AM I?

Clue: My tongue is long and my wings allow me to hover.

Bonus Questions:

Why does this bat need to hover in flight? What is the value of a long tongue?

Answers:

10. I am a nectar-eating bat. To visit flowers rapidly without landing, therefore staying safe from predators. To reach deep in to flowers and lap up nectar.

11. WHO AM I?

Clue: My teeth are flat and my jaws are strong so I can squeeze juice from my food.

Bonus Questions:

Why does this bat discard as much pulp as possible? What is the advantage of having flat teeth?

Answers:

11. I am a fruit-eating bat. To get the most nutritious part of the fruit without carrying extra weight. To squeeze out juice without cutting up the pulp.

12. WHO AM I?

Clue: My nose is long and narrow and my teeth are very small.

Bonus Questions:

What is the advantage of small teeth? What is the advantage of a long, narrow nose?

Answers:

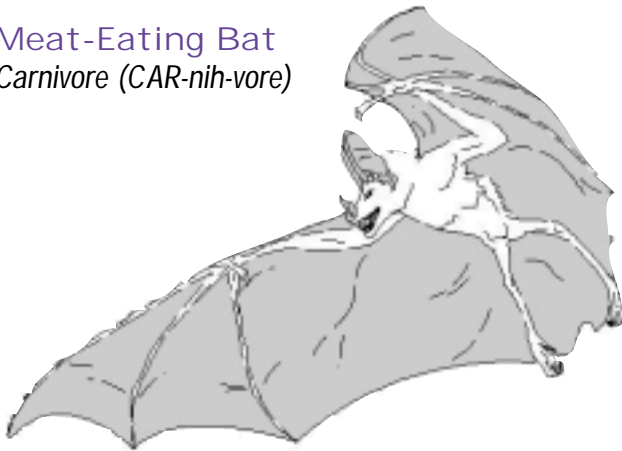
12. I am a nectar-eating bat. Nectar doesn't need to be chewed, so heavy teeth aren't needed. To reach deep into long, narrow flowers.



ACTIVITY
WORKSHEET 1

BATS ADAPT FOR FOOD CARDS

Meat-Eating Bat
Carnivore (CAR-nih-vore)



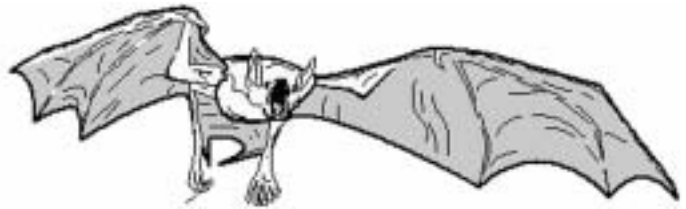
Body: Large size for capturing and carrying off other animals.

Head: Strong jaws for killing prey; large ears help identify and locate a mouse's footsteps or the call of a frog.

Wings: Broad, with up to three-foot wingspan; large tail membrane for maneuvering rapidly.

Teeth: Sharp molars and long canines for chopping flesh and crushing bones.

Fish-Eating Bat
Piscivore (PISK-kah-vore)



Body: Larger than average size; long legs and enormous feet; long, sharp, hooked claws; toes flat for knifing through water; oily fur that sheds water to keep dry.

Head: Strong jaws for killing and chewing fish; special echolocation ability to detect ripples or fins on water surface.

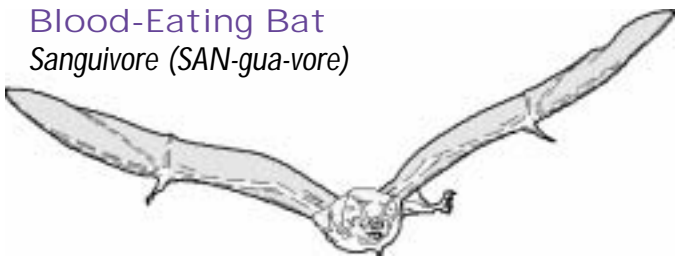
Wings: Narrow and long for flying fast over water.

Teeth: Sharp (similar to insectivores), for chopping and grinding fish.



BATS ADAPT FOR FOOD CARDS

Blood-Eating Bat Sanguivore (SAN-gua-vore)



Body: Strong legs for walking on ground or climbing on prey and for jumping into flight when full of blood.

Head: Heat-sensitive nose helps find blood vessels closest to prey's skin surface; short pug muzzle makes biting easier.

Wings: Broad and short; strong enough to carry heavy food loads with a full stomach.

Teeth: Tiny molars; incisors forming large, razor-sharp blades for slicing prey's skin; grooved tongue for lapping blood; special saliva keeps blood from clotting so bat can keep drinking.

Special: Kidneys allow bat to urinate as fast as it eats to lighten the load before flying home

Insect-Eating Bat Insectivore (in-SECK-tih-vore)



Body: Many body shapes, all small.

Head: Many kinds of faces and ears that aid echolocation and hearing while hunting for insects.

Wings: Insectivores that catch insects on the ground or on plants (gleaning insectivores) have broad, short wings and large tail membranes for darting in and out of branches or hovering close to the ground. Insectivores that chase insects in the air while flying (aerial insectivores) have longer, narrower wings and often have smaller ears for streamlining; some use their tail membrane to help catch prey.

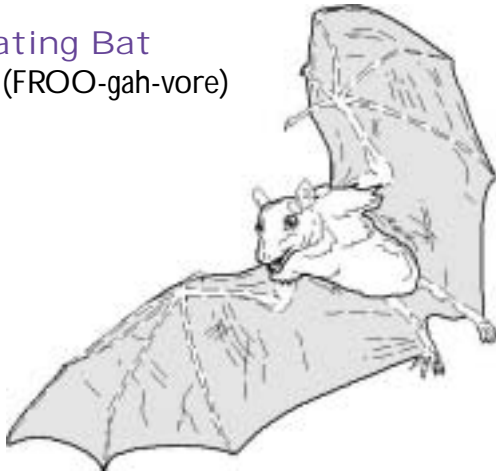
Teeth: Sharp, for grinding and chopping tough insect bodies.



ACTIVITY
WORKSHEET 1

BATS ADAPT FOR FOOD CARDS

Fruit-Eating Bat
Frugivore (FROO-gah-vore)



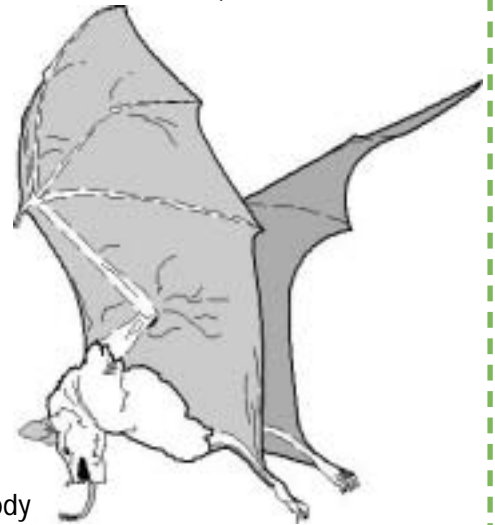
Body: Often large with bright colors; most have no tail and little or no tail membrane.

Head: Medium to short snouts; keen nose for smelling ripe fruit; strong jaws for biting fruit; large eyes with excellent vision; many don't echolocate.

Wings: Wide and short for carrying heavy fruits; small tail membrane.

Teeth: Wide, flat grinding teeth and strong jaws for crushing fruit-separates juice and spits out pulp; some have grooved teeth to more easily collect juice.

Nectar-Eating Bat
Nectarivore (NECT-ter-ah-vore)



Body: Small body

Head: Long, slender snout fits perfectly into flowers; long, delicate jaw; grooved lower lip and rough, scaly tongue to catch nectar; excellent vision; and sense of smell.

Wings: Short and wide with long wingtips for hovering above flowers.

Teeth: Small; not used much for chewing due to liquid diet.