

Bat Women of Panama

A film by Tom Fitz

Classroom Discussion Guide Elementary Version (K-5)



Film Overview

“Bat Women of Panama” showcases a small group of female scientists who use reason, technology, and even creativity to reveal the many mysteries of Central America's amazing bats. Set on the small island of Barro Colorado, this nine-minute film follows five research biologists through wet tropical forests as they encounter a variety of bat species with surprising physical and behavioral adaptations. Stunning scenes, fascinating biological wonders, and the playful wit of the film narrator will keep students engaged as they learn about one of nature’s most misunderstood creatures.

The Barro Colorado National Monument is a premiere biological research station administered by the Smithsonian Tropical Research Institute. This former rainforest hilltop was converted to an island by the flooding of the Panama Canal and draws hundreds of scientists from around the world annually. Among the many biological wonders of Barro Colorado is its rich diversity of bats. Through the study of these fascinating creatures and their interactions with other animal and plants species, we get a glimpse into the complexity of life in tropical rainforests.

Teachers can use this guide to supplement study of the Sunshine State Standards in the areas of life science and the practice of science, specifically on ideas such as *interdependence, diversity and evolution of living organisms, the practice of science, and the characteristics of scientific knowledge.*

Key Terminology

Be sure that students are comfortable with these terms either before the film, or as part of discussion after the film. If the students are doing writing prompts, these terms can be provided as a "word bank" to help guide their writing.

adaptation, amphibians, birds, carnivore, competition, echolocation, evolution, fish, food chain, fossil, herbivore, invertebrate, mammal, natural selection, nocturnal, parasite, reptiles, species, tropical wet forest, vertebrate

National Standards Correlations

Discussion Guide Element	Unifying concepts and processes	Science as inquiry	Life science	Earth and space science	Science and technology	Science in personal and social perspectives	History and nature of science
Discussion Question #1	•	•	•				
Discussion Question #2			•			•	
Discussion Question #3		•	•				
Discussion Question #4	•		•				•
Activity: Build a Bat House	•		•		•		•
Activity: Classification	•	•	•	•			

Sunshine State Standards Correlations

Discussion Guide Element	K	1	2	3	4	5
Discussion Question #1	SC.K.N.1.2, SC.K.N.1.5	SC.1.N.1.1	SC.2.N.1.1	SC.3.N.1.1	SC.4.N.1.1, SC.4.N.1.8, SC.4.L.16.3	SC.5.N.1.1, SC.5.N.1.3, SC.5.N.2.2
Discussion Question #2	SC.K.L.14.3	SC.1.L.16.1	SC.2.L.17.2		SC.4.L.16.2, SC.4.L.16.3, SC.4.L.17.4	SC.5.L.17.1
Discussion Question #3	SC.K.N.1.2, SC.K.L.14.3	SC.1.N.1.1, SC.1.L.14.1	SC.2.N.1.1, SC.2.N.1.5	SC.3.N.1.1, SC.3.N.1.6, SC.3.N.1.7	SC.4.N.1.6	SC.5.N.1.6, SC.5.N.2.1
Discussion Question #4	SC.K.L.14.2, SC.K.L.14.3	SC.1.L.17.1		SC.3.L.15.1	SC.4.N.2.1, SC.4.L.17.2	SC.5.L.14.2
Activity: Build a Bat House	SC.K.L.14.3	SC.1.L.14.1, SC.1.L.17.1	SC.2.L.17.1		SC.4.L.17.1	
Activity: Classification	SC.K.L.14.3	SC.1.L.14.1, SC.1.L.14.3, SC.1.E.6.1	SC.2.E.6.1	SC.3.N.1.4, SC.3.L.15.1	SC.4.N.2.1	SC.5.L.14.2, SC.5.E.7.3

Discussion Questions/Writing Prompts

Use the following questions as springboards—either to stimulate a classroom discussion or as writing prompts. Either way, the goal is to foster discussion on the level of synthesis and analysis. Below each question, you will find possible areas of discussion to guide the teacher.

1. The bat scientists use speakers that play frog mating calls. Then, they observe what the bats do. What specific bat behavior are they studying? What must the scientists do to make sure that their results make sense?

- Be sure to remind students that scientists run experiments when they have a question about the natural world.
- Point out that scientists often use creativity in designing these experiments.
- Help students surmise that the specific bat behavior in this experiment is feeding—more specifically, how bats are able to locate frogs using hearing and echolocation.
- Prompt students to consider what can be learned from observing the bats in this experiment. For example, ask them what the scientists could change about the sound (volume, frequency, frog species, timing) in order to observe changes in behavior.
- Discuss the concepts of repeated trials and replication. Students should understand that repeated experimental trials are critical to producing reliable results. Also ensure understanding of replication—if other scientists can and do replicate the same experiment, this is vital in verifying the scientific process.



2. There are 72 different kinds of bats on Barro Colorado island. That is more than the number of species in Europe! How can so many types of bats live on such a small island? Why are there so many bat species here? Are bats helpful to the island?

- *Remind students that the film features many types of bats. They saw insect-eating bats, fish-eating bats, fruit-eating bats, and meat-eating bats.*
 - *Ask students to consider what the bat population would be like if every bat on the island only ate figs. Discuss the fact the total population of bats would be limited by how many figs are available. Then ask if more bats could live on the island if another type of bat arrived that only eats fish. Lead the discussion in this way to illustrate the role of specialization (diversity) on population sizes.*
 - *Ask students what would happen if a plant disease that causes fig trees to die were to spread throughout the island. Would the fig-eating bats start eating fish or frogs or would some of them starve or be forced to find a new home?*
 - *Ask students to consider behavioral and physical adaptations of bats that allow them to survive. Ask what characteristics would help a bat echolocate (large ears), eat frogs (strong jaws), or catch fish (long sharp claws on feet).*
 - *The bats help the figs as well, by dispersing their seeds.*
3. An observation is what you see, hear, feel, smell or taste. Name some observations made about bats in the film. Then, name the idea that might follow each observation. In other words, what might scientists conclude from each observation?

- *Observation: The fringe-lipped bat only eats male frogs.*
Inference: Fringe-lipped bats find their prey by hearing male frogs singing loudly to female frogs.
- *Observation: When the bats were hung upside down, they became calmer.*
Inference: Bats are more comfortable when they hang upside down.
- *Observation: When male bats spray a mixture of body fluids from a sac on their wings, females fly toward and around them. Inference: The male uses the mixture and its scent to attract females for mating.*



4. Compare and contrast bats and humans. Do bats harm or help humans?

- *Both bats and humans are mammals. Bats are the only mammals that can fly. Both humans and bats have live young and the young drink milk from the mother. Bat pups learn to fly at about four months old.*
- *Both bats and humans are very social creatures that live in colonies. The life span of bats is anywhere from four to thirty years.*
- *Bats are nocturnal. Most humans are active during the day.*
- *Both bats and humans have the same basic needs - water, food, air, space.*
- *Both bats and humans have teeth and chew their food. Both bats and humans rely on other organisms as food sources for energy; neither can make their own food.*
- *Bats use their wings like hands. Their wings have thumbs and wrists, similar to a human arm.*
- *Bats help humans in the following ways: eating lots of insects that might kill crops (less pesticide use), dispersing seeds, helping plants to grow (bananas, avocados, peaches, vanilla bean).*

Suggested Activities for Further Study

1. Build a Bat House

- ❖ Construct bat houses as a class activity! There are many do-it-yourself bat house instruction guides online. Try the plans at Bat Conservation International (www.batcon.org) or the US Fish and Wildlife Service (www.fws.gov/southeast/ea/Fun_Facts/pubback2.pdf).
- ❖ Discuss "space" as one of the basic necessities of plants and animals, including humans. Bats need space for shelter, space for foraging to seek food, and territory to build and protect a family.
- ❖ If there are appropriate spots around the schoolyard for a bat shelter, plan to put up bat houses at the beginning of the school year and visit them at the end of the school year, if and when bats have moved in. You might also make the bat houses for students to take home. If possible, place bat houses in different types of locations so that comparisons on bat utilization and site characteristics can be made.
- ❖ For **younger grades**, record all evidence of activity at the bat box. Are there any signs of animal and/or bat presence? For **upper grades**, discuss some seasonal factors in Florida that might determine whether or not bats will migrate and/or hibernate (food availability, variation in rainfall).



2. Barro Colorado in the Classroom - A Classification Activity

DAY ONE - BRING BARRO COLORADO ALIVE!

- ❖ Using either a corner of the classroom, a bulletin board, or even part of the hallway, delineate or create an island using poster board, felt, or other materials available. Either do this together as a class or prep before students arrive.
- ❖ Next, split the class into small groups of 2-4 students each. Split the list "Common Animal Species of Barro Colorado" (below) accordingly, giving each group an equal number of species to work with. Either give students their species written down on cards, or have them write them down on paper.
- ❖ Discuss the genus species (scientific) name. In order to incorporate **standard SC.3.N.1.4**, discuss the reasons why scientists use the genus species names to communicate and study organisms.

DAY TWO - RESEARCH AND CREATE ANIMALS

- ❖ Either take students to the library, or provide them with adequate, age-appropriate research materials. Each group should be able to find some information about the animals on their list.

- ❖ Populate your island. If resources allow, as students find pictures of the animals, print them out or color-copy them and place them in and around your "island." Or have students draw pictures. *(If prep time allows, teachers can create cards of the animals beforehand to have students decorate, stitch, paint, etc. - whatever time and resources allow!)*

DAY THREE - OBSERVATION AND CLASSIFICATION

- ❖ For **younger students**, discuss/review the five senses. Point out that only seeing, hearing, and possibly touch in some cases is realistic in the classroom. For **older students**, introduce/discuss review the science of classification. Introduce the term "taxonomy."
- ❖ Using as many senses as possible have students make observations about their animals. **Younger students** should write or talk about simple observations, **older students** should begin to classify animals into groups by behavior and physical characteristics, and **upper level students** should compare and contrast specific structures (i.e. organs).
- ❖ **Grades 3 and above** should classify animals into the following categories: vertebrates, invertebrates, mammals, birds, reptiles, amphibians, fish, insects, those which lay eggs, those having live births
- ❖ Make tags out of card stock with classification labels. Younger students will have things like "has hair or fur," "forward-facing eyes," "has loud, screeching call." Older students may either have tags listing behaviors or characteristics like "live births," or actual classifications like "vertebrate - mammal" or "vertebrate - fish." Students should place tags right over the animals on the island.

DAY FOUR - ADD THE ENVIRONMENT

- ❖ As a whole group, brainstorm a list of non-living factors that affect the critters of Barro Colorado Island. Students might come up with air temperature, wind, air pressure, rocks, soil, and water. Discuss which are found on the Earth's surface (**SC.1.E.6.1 and SC.2.E.6.1**) and which create weather (**SC.5.E.7.3**).
- ❖ As a final activity, have students create the non-living environmental components using materials in the classroom - cotton ball clouds, crumpled brown-bag rocks, etc. and add them to Barro Colorado Island.



Common Animal Species of Barro Colorado

Agouti	<i>Dasyprocta punctata</i>	Green Iguana	<i>Iguana iguana</i>
American Kestrel	<i>Cerncalo Americano</i>	Howler Monkey	<i>Alouatta palliata</i>
Baird's Tapir	<i>Tapirus bairdii</i>	Least Shrew	<i>Cryptotis parva</i>
Big-eared bat	<i>Ateles fusciceps</i>	Mosquitofish	<i>Gambusia nicaraguensis</i>
Bridled Anole	<i>Norops frenatus</i>	Ocelot	<i>Leopardus pardalis</i>
Bulldog Bat	<i>Noctilio leporinus</i>	Peacock bass	<i>Cichla ocellaris</i>
Caiman	<i>Caiman crocodilus</i>	Pygmy Kingfisher	<i>Chloroceryle aenea</i>
Capybara	<i>Hydrochaeris hydrochaeris</i>	Red-tailed Squirrel	<i>Sciurus granatensis</i>
Chuck-will's-widow	<i>Caprimulgus carolinensis</i>	Round-eared Bat	<i>Lophostoma silvicolium</i>
Climbing Rat	<i>Tylomys panamensis</i>	Silver-tipped Myotis	<i>Myotis albescens</i>
Collared Peccary	<i>Tayassu tajacu</i>	Spider Monkey	<i>Ateles geoffroyi</i>
Common Boa	<i>Boa constrictor imperator</i>	Tent-making Bat	<i>Uroderma bilobatum</i>
Common forest toad	<i>Bufo typhonius</i>	Three-toed Sloth	<i>Bradypus variegatus</i>
Crested Caracara	<i>Caracara cheriway</i>	Toucan	<i>Ramphastos swainsonii</i>
Dart-poison frog	<i>Dendrobates auratus</i>	Tropical Screech Owl	<i>Megascops choliba</i>
Dung Beetle	<i>Canthidium</i>	White-headed Capuchin	<i>Cebus capucinus</i>
Elegant Mosquito	<i>Sabethes cyanaea</i>	White-lipped Mud Turtle	<i>Kinosternon leucostomum</i>
False Vampire Bat	<i>Vampyrum spectrum</i>	White-nosed Coati	<i>Nasua narica</i>
Fringe-lipped bat	<i>Trachops cirrhosus</i>	Wood Turtle	<i>Rhinoclemmys annulata</i>
Golden Silk Spider	<i>Nephila clavipes</i>	Wrinkle-faced Bat	<i>Centurio senex</i>