

BATS: NEED NECTAR, WILL TRAVEL

Students play the role of nectar feeding bats on their annual migration and try to avoid the different hazards that hinder their progress.

SCIENCE STANDARDS CORRELATION
SC03-S4C3-01&04,
SC04-S4C4-02,
SC03S4C3-05, SC03-S3C1-01&02, SC05-S3C-02

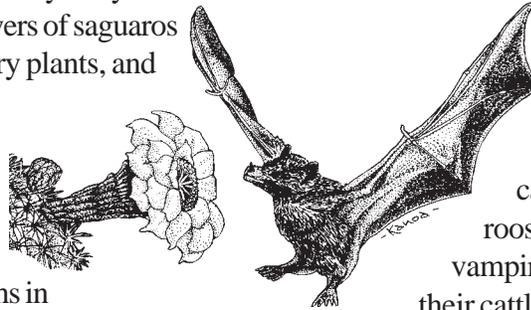
OBJECTIVES

Students should:

- Describe the annual migration of long-nosed bats including key elements such as: where the bats roost, where they spend the winter, and what they eat.
- List different threats to long-nosed bats throughout their annual migration.
- Describe what might happen to the plants that depend on bats for pollination if the bats are eliminated, and describe what could happen to long-nosed bats if their host plants are eliminated.

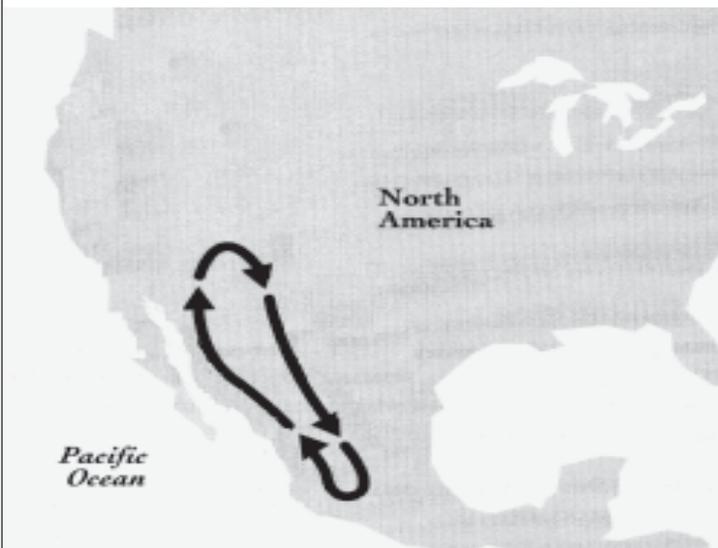
BACKGROUND

Lesser long-nosed bats are important pollinators of desert plants in the southwest United States and northwest Mexico. In nightly feeding forays that may carry them sixty miles, they visit flowers of saguaros and other tall cacti, century plants, and tree morning glories to drink their nectar. They follow the flowering seasons of these plants along a “nectar corridor,” spending the winter months in the warmer climates of Mexico, mating, and moving north with the spring to summer birthing grounds in northern Mexico and Arizona. To migrate each year, long-nosed bats follow a loop as long as 3,200 miles through deserts, mountains, and tropical dry forests. Their pollination services are essential to the reproduction of their food plants. Research has shown that in years when they arrive too early or too late for their plants’ flowering cycles, seed production declines significantly. The bats also eat some of the fruit of these plants, spreading seeds as they fly and helping the next generation of plants to grow.



The long-nosed bats’ lengthy international migrations expose them to diverse hazards. They do not hibernate in the winter as do their more temperate relatives, but instead huddle in protective caves or rock overhangs for warmth. Ranchers in Mexico have dynamited many of these caves to eliminate the roosting sites of the vampire bats that damage their cattle. In the U.S., many old mines that serve as bat roosts have been dynamited or sealed to prevent human injury. In both cases, important long-nosed bat roosts are destroyed, and the bats have fewer safe places to roost, exposing them to the cold or to the easy reach of predators.

Agricultural chemical use also affects long-nosed bat populations. Herbicides directly kill the bats’ food plants. Other threats are from human removal of food plants. In Mexico, local people harvest millions of wild agaves (century plants) to produce mescal, reducing availability of this flower resource at important times in the long-nosed bats’ annual migration. And farming and development on both sides of the border eliminate desert habitat essential to the bats’ survival. For these reasons, long-nosed bats are now listed as an Endangered Species by the U.S. Fish and Wildlife Service. In Mexico, they are listed for special protection by the Mexican Secretariat of Environment, Natural Resources, and Fisheries.



LONG-NOSED BAT MIGRATION

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MATERIALS

· player name cards (see master sheet page 23) For 25 students, copy and distribute the name cards in the following proportions: (adjust the numbers in similar proportions for more or less students.)

- 7 adult bats
- 7 baby bats
- 1 snake
- 3 owls
- 1 bobcat
- 2 developers clearing land
- 2 people dynamiting a cave
- 2 mescal-makers harvesting agaves

· 200 cotton balls to represent energy obtained from the flowers visited

- 3 lengths of thin rope or heavy twine, 12 m (40 feet) long
- 6 lengths of thin rope or heavy twine, 4.5m (15 feet) long
- a large playing field or gymnasium

VOCABULARY

Endangered
Migrate
Pollination
Pollinator

GETTING READY

- 1) Make enough player name cards for your group using the master sheet. You may want to copy the cards on cardstock and attach them to a string loop so students can wear them around their necks.
- 2) Gather materials and set up the playing field as depicted in the “Game Set-up” drawing (page 21) ahead of time.
 - Lay out the 12 m ropes in loops to form the winter roosts and the summer birthing roosts on opposite ends of the playing field. Lay another 12 m rope between them to form the U.S./ Mexico border.
 - Take the 4.5m ropes and loop them in circles to form temporary roosting caves.
 - Scatter the cotton balls throughout the entire playing field, avoiding roosts.

SETTING THE STAGE

You may want to do this activity in two parts, discussing bats and bat facts one day and playing the game the next.

- 1) Start your students thinking about bats by testing their “Bat IQ.” Have them take out a pencil and piece of paper and list a row of numbers from 1-10. Ask them to mark T next to each number if they think the answer is true or F if false.
- 2) Briefly discuss the answers using information from *Answers to Test Your Bat IQ* (next page.) Introduce the students to long-nosed bat migration patterns by sketching a map of northwest Mexico and the southwest U.S. on the board.
- 3) Ask the students, “Where is it warmer in the winter, south in Mexico or north into Arizona?” (south in Mexico.) “If you were an animal that

drank nectar, in which of these places would you want to be in the winter? Why?” (Mexico. It is warmer, and flowers can bloom.) “Where do you think the bats that drink saguaro and agave nectar go in the winter?” (Mexico.)

- 4) Explain that in our area, nectar-feeding bats called lesser long-nosed bats migrate from Arizona to Mexico and back again depending on the season. Draw out their migratory route on the board, explaining where they find food, have babies, and roost along the way.
- 5) Ask the students if they can think of any possible dangers these bats may face along the way. Tell them you are going to play a game about the long-nosed bat migration. Then take them outside to outline the rules and play the game.

QUESTIONS TO TEST YOUR BAT IQ

(ADAPTED FROM *BAT CONSERVATION INTERNATIONAL. SEE RESOURCES LIST.*)

1. Bats swoop down and become caught in people’s hair.
2. Bats are the only kind of mammals that can fly.
3. Bats are flying mice.
4. Bats are blind.
5. Most bats are dirty and carry rabies.
6. If you see a bat on the ground during the day it might be sick.
7. Bats produce several litters a year, just like mice.
8. A single bat can catch 600 mosquitoes in just one hour.
9. Some bats feed on blood.
10. In the Sonoran Desert region, nectar-feeding bats are important pollinators for the saguaro and organ pipe cactus.

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ANSWERS TO TEST YOUR BAT IQ

1. F. Insect-eating bats dart about swiftly when they fly, and sometimes they come quite close to people. Their echolocation can detect objects the thickness of a human hair from 1 inch away and they would not choose to run into your hair! Bats are very coordinated fliers and can bank and turn fast enough to avoid your head.
2. T. Bats are the only mammals that can really fly (flying squirrels actually glide.) Some can hover like hummingbirds while feeding on nectar.
3. F. Bats may look like mice with wings, but they are not rodents.
4. F. All bats can see quite well. Insect-eating bats depend on their echolocation to find their food, and fruit and nectar eaters use their sense of smell, but all can see well.
5. F. Bats are clean animals and groom themselves several times a day, like cats. They can get rabies, like dogs, cats, skunks and foxes, but very few bats have rabies. When a bat gets rabies, it tends to go away and hide instead of becoming aggressive.
6. T. Healthy bats retreat to caves, abandoned mines, rock crevices, trees, attics, and other areas for safety during the day. A bat on the ground may be sick. It is important to never pick up any sick wild animal...it may bite in self-defense.
7. F. Bats have a low reproductive rate and only have one baby a year. For this reason, if a bat population is disrupted by natural or human causes, it takes a long time for it to recover.
8. T. Insect-eating bats are highly successful hunters and are useful pest-removers. The 20 million Mexican free-tailed bats in Bracken Cave, Texas, eat **250 tons of insects every night!**
9. T. Vampire bats are the only species that feed on blood. They are common in Central and South America and draw blood mostly from livestock.
10. T. In our region, the Mexican long-tongued bat and lesser long-nosed bat are two nectar-feeders that pollinate these plants.

PLAYING THE GAME

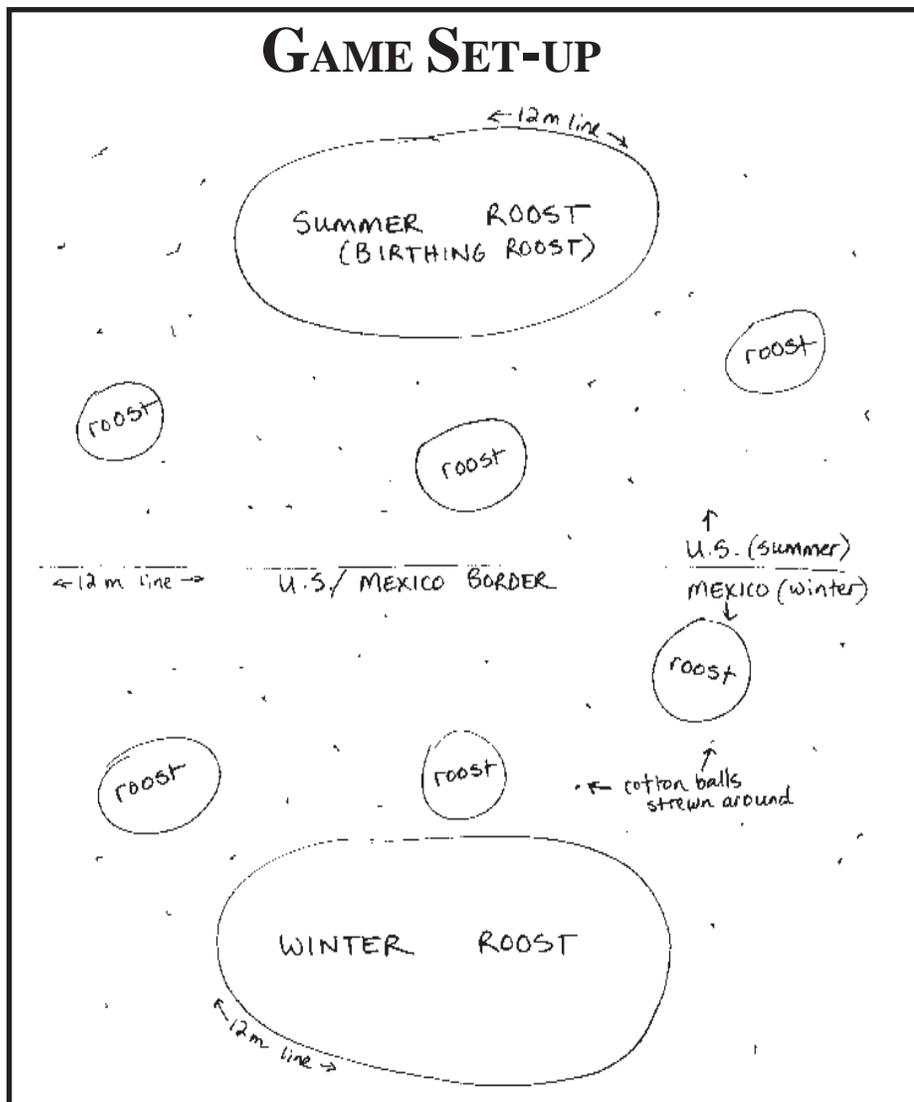
- 1) Take students to playing field or gymnasium and explain what each zone represents. Tell them that the winter roosts, summer birthing roosts, and temporary roosting caves are all “safety zones” where bats can rest unharmed.
- 2) Randomly distribute the role name cards in roughly the same proportions as highlighted above. Discuss the roles of each player as outlined in *Role Rules* (see page 21.)
- 3) Discuss the game rules as enumerated in *Game Rules* (see page 21), pointing out the different sites as you explain their functions.
- 4) Start the game on the winter grounds, telling them it is early spring and time to start migrating north. Let them play for a minute or so then give the warning “One more minute before summer begins. When I say summer, you must move into the United States!”
- 5) Give the signal for the season change. Have the adult bats join the baby bats and gather “nectar.” If any bats linger too long in the summer birthing roost, remind them that as fall advances, they need to go out and eat. Wait a minute then give the signal again, this time calling the bats south for the winter.
- 6) When they arrive at the winter feeding grounds, count how many cotton balls each bat got. Ask the predators and human-caused hazards how many bats they tagged. See who survived. Switch roles and play the game again. Play a few rounds, allowing students to switch roles after each one.
- 7) Stop the game and bring them together to discuss it. Ask questions like:
 - What’s it like being a bat? Is it difficult to survive your migrations?
 - Is it easy or hard to be a predator of a bat when they have their caves to roost in? What about when their caves are gone?
 - Did the mescal-makers affect the bats?
 - Did the developers affect the bats?
- 8) Switch role cards again, this time asking the developers, mescal-makers, and cave-dynamiters to sit out this round.
- 9) Play the round and call the students back together. Ask the same questions as above, asking if the absence of developers, mescal-makers, and cave-dynamiters had any effect on the bats. Return to the class and discuss the potential for survival for nectar-feeding bats in the future.

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DISCUSSION

- 1) Ask the students to think about the hazards that affect nectar-feeding bats with questions such as:
 - What kinds of threats do bats face on their migration? (predation, lack of safe roosts, reduction of food plants)
 - What do they think will happen to the bats if their plants continue to disappear? (They will have less food to eat on their journey, and their populations could drop.)
 - What will happen to the plants if their pollinators disappear? (The plants may not get pollinated and will not produce enough seeds to keep new generations growing.)
 - What will happen if bat roosts continue to disappear? (Again, their populations could drop.)

- 2) Do the students think there is any way to help the bats continue to make their migrations? Tell the students that one of the nectar feeding bats in our area, the lesser long-nosed bat, is now considered an Endangered species. This is making people work harder to protect it.
- 3) Explain that there is cause for hope. As people learn more about the importance of migratory pollinators like bats, they are working to save their corridors and important feeding/resting sites. In national monuments and state land in Arizona, for example, old mines that used to be dynamited or barricaded to keep people out are now covered with “bat gates” that allow bats to enter and use these roosts. In Mexico, local people are working to teach farmers to protect bat roosts and food plants. It’s not too late to help protect these valuable pollinators and fascinating animals.



GAME RULES:

- The game begins in the winter roost. Baby bats wait in the summer birthing roosts for adults to reach them before they join the game.
- Each bat must visit at least five flowers (gather five cotton balls) in its flight to survive. They can go to the roosts/safety zones to be safe, but they must move with the seasons to gather their food. In winter and into spring, they are in Mexico. In summer they are in the United States. Explain that they must be in the correct site depending on the seasons, and that you will warn them when the seasons are changing, i.e. “One more minute before summer begins. When I say summer, you must move into the United States!”
- Predators and human-caused hazards must wait outside the safety zones.
- If any of the baby bats is untagged by adult bats in the summer birthing grounds, it cannot fly when the season changes (they are eliminated.)
- All of the predators or other hazards must tag the bats gently (no tackling!). After receiving the cotton balls from the bats, the predators should drop them back out on the playing field to ensure a constant flow of flowers, but the developers and mescal-makers should keep theirs to show the effects of plant loss.

ROLE RULES:

- 1) **Adult bats** must “fly” from the winter grounds to the summer breeding grounds and back according to the seasons, visiting flowers (gathering cotton balls) as they go. They need to tag one baby bat in the summer breeding grounds to bring it back to the winter site with them. They must return to the winter grounds with five cotton balls, representing five successful visits to flowers for nectar, to have survived the annual migration. (The cotton balls represent energy obtained from flower nectar for migration.)
- 2) **Baby bats** must “fly” from the summer breeding grounds, once tagged by an adult bat, to reach the winter grounds. They need to collect 3 cotton balls, either from the adult who tags them or from the ground, to show they survived the annual migration.
- 3) **Owls and bobcats** can tag (gently!) adult and baby bats *outside* the safety zones (roost caves, winter grounds, or summer breeding grounds.) The bats must give them 1 cotton ball if they have any.
- 4) **Snakes** can tag adult and baby bats *within* the safety zones (snakes are able to climb up into the nooks and crannies that other predators may not be able to reach) and the bats must give 1 cotton ball to them as well.
- 5) **Developers clearing land** can gently tag bats *outside* their safety zones on both sides of the border and also receive 1 cotton ball.
- 6) **People dynamiting caves** can remove the safety zone roosts by scrunching the twine together only when no bats are currently in the roosts.
- 7) **Mescal-makers harvesting agaves** can tag the bats on the Mexico side only, and the bats must give them 1 cotton ball.

EXTENSION

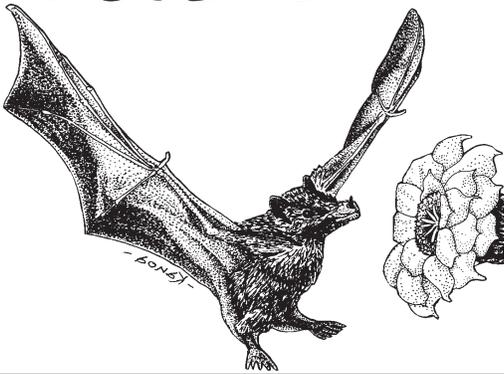
Have your students observe migratory behavior in their own backyard, schoolyard, or neighborhood park by monitoring a portion of the chosen area that contains a food or water resource. This could be a fruiting or flowering tree or shrub, a bird bath, bird-feeder, swimming pool, etc. Encourage the students to keep a wildlife journal where they can record birds, insects, or mammals that visit the area. Have them record activity for regular periods throughout a season (fall or spring would be better than winter, but winter migrants are interesting to watch here as well) and if their animal(s) of choice is (are) feeding, drinking, traveling through, or mating/nesting. They can use field guides to select their animal or you can prepare a list of local birds, insects, or mammals

that would be appropriate to investigate. Give your students some basic guidelines for taking observational data, and then encourage them to write up a season-end report that summarizes the activity of their animal, the plants that it visited, and the purpose of the visits (feeding or shelter, etc.)

The students can do further research on migratory pollinators. They can get involved in monitoring migratory pollinators that move through their region throughout the year. For more information, contact *Journey North Signs of Spring Everywhere* (see resources list p. 2.) See also “Migratory Pollinator Conservation” on the Arizona-Sonora Desert Museum website <http://www.desertmuseum.org>.

PLAYER NAME CARDS MASTER SHEET

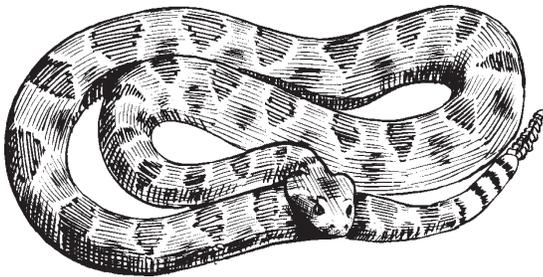
ADULT BAT



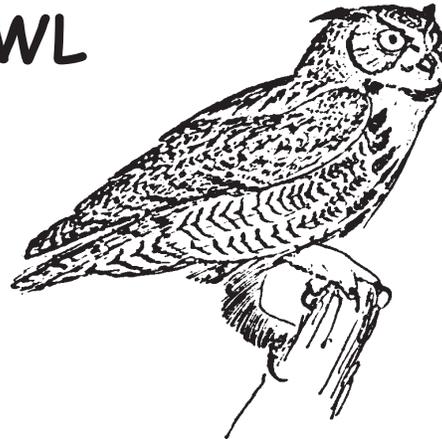
BABY BAT



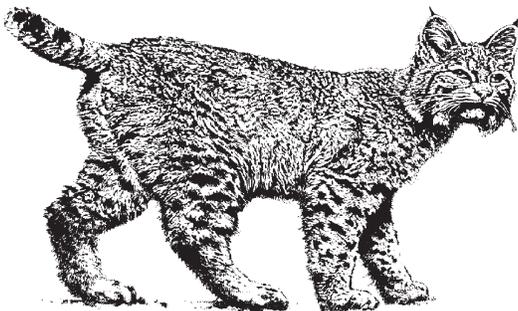
SNAKE



OWL



BOBCAT



**DEVELOPER CLEARING
LAND FOR FARMS
AND HOUSES**



**PERSON DYNAMITING A
CAVE**



**MESCAL-MAKER
HARVESTING
WILD AGAVES**

