



Respect: Bats Lesson

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Overview

The theme for this week is respect. We embrace each other's differences so that we may enrich the well-being of everyone. There are a lot of harmful myths about bats, but the truth is that they provide crucial environmental services, from pest control to pollination, and their survival is threatened by multiple stressors. As environmental stewards, it is our duty to dispel rumors and spread scientific knowledge about bats to the general public.

Learning Objectives

- YCC precipitants will disprove popular myths about bats.
- YCC precipitants will have a general understanding of basic information about bats.

Materials Needed

- Blank pieces of paper
- Coloring pencils/pens/markers
- Writing utensils (pens, pencils)
- Scissors
- Big Brown Bat Factsheet
- Eastern Red Bat Factsheet
- Hoary Bat Factsheet
- Northern Long-Eared Bat Factsheet
- Little Brown Bat Factsheet

General Outline

1. General Facts

- Discussion*
- Flying*
- Diet*
- Echolocation*
- Habitats*
- Winter Survival*
- Ecosystem Services*
- Threats*

2. Bats in National Parks

- Learning from Bats*
- Managing Bats in Parks*

3. Activity

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Background (for park employee benefit)

Over 50 species of bats live in NPS parks, and MONO has 5 species within its borders. It is not easy to talk about all bats as a single group, as species vary from size, diet, habitat, and winter habits. However, bats are not often covered with a positive light in popular media, and it's important to appreciate the species for the environmental services they provide.

Procedure

1. General Facts

a. Discussion

- i. Tell YCC precipitants: together, let's come up with a list of things you know about bats. (Share some yourself if they can't come up with a significant list). Examples: ¹
 1. Bats use echolocation, a unique biological sonar system, to navigate and hunt fast-flying insects in total darkness
 - a. Bats have perfectly fine vision!
 2. Bats are the second largest group of mammals, after rodents, but are not closely related to mice.
 3. There are over 1,300 species of bats worldwide.
 4. They live to 10-15 years in the wild.

b. Flying

- i. They are the only mammals capable of true and sustained flight. Others, like the flying squirrel, glide instead of fly.
- ii. They are in the order *Chiroptera* (Kir-op-tera), meaning "hand wing". Their forelimbs form webbed wings.²
- iii. Unlike birds, bats can't launch themselves into the air from the ground, as their wings don't produce enough lift and very few species can walk. Sleeping upside down allows them to launch themselves to fly!
- iv. Video: [How Bats Fly](#)³

c. Diet

- i. Bats are known to eat insects, fruit, nectar, fish, amphibians, reptiles, birds, small mammals, and even other bats.⁴ Despite myths, only 3 out of +1,300 species of bats drink blood, and they are all in Latin America.
- ii. Most bats are nocturnal, but some are active during the day. This impacts what they eat, and what preys on them. The Samoan flying fox, for

¹ BCI. "Bats Are: Cool!"

² *ibid.*

³ Clark, J. & Bryant, C. (2016) "How Bats Fly."

⁴ BCI. "Bats Are: Cool!"

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example, forages during the day because their echolocation is not as refined as other bats.

d. *Echolocation*⁵

- i. Bats produce ultrasound, soundwaves at frequencies above human hearing (we can't hear them). These bounce off objects nearby, and then return to the bats' ears, which are finely tuned to recognize their own unique calls.
- ii. Bats change their calls for different purposes, such as searching, feeding, and social calls, and each bat species has its own unique call pattern.
- iii. Video: [Echolocation](#)⁶

e. *Habitats*

- i. Bats are everywhere except the regions surrounding the poles. Indonesia has the highest number of bat species, with at least 219 species.⁷
- ii. Bats rest in varied places, like trees, slopes, caves, and near open water.⁸
 1. Roost: space where bats rest safe from predators during the day. By resting in caves, large trees with full branches, or bridges, they are hidden away and difficult to see by predators. Hanging upside down also allows for a quick escape if predators do find them, and they can hear any disturbance in their roost with their refined ears. Bats are incredibly agile and can escape flying predators.
 2. Hibernacula: where bats hibernate in the winter, like caves. Like for roosts and maternity colonies, bats look for high spaces that are out of reach from ground predators like snakes, raccoons, and cats.
 3. Maternity colony: huddling mothers create a safe and warm space to raise their young. The combined body heat increases the area's warmth, an important factor for the young. Huddling also helps protect the young from falling, as they may lose grip on them. Fallen pups can be captured by ground predators.

f. *Winter Survival*⁹

- i. Migration: moving between summer and winter habitats in search of food sources, for spaces ideal to hibernate, or spaces ideal to raise their young.
- ii. Torpor: mental and physical state of inactivity that some mammals experience in extremely cold temperatures. It is an extreme reduction in metabolic rate, heart rate, and respiratory rate to survive periods of time

⁵ NPS. (2016) "All About Bats: Echolocation."

⁶ Adetunji, O. (2016) "Echolocation."

⁷ BCI. "Bats Are: Everywhere."

⁸ NPS. (2016) "All About Bats: Where Bats Live."

⁹ NPS. (2016) "All About Bats: Hibernate or Migrate."

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without food. Bats can enter torpor for a few hours, or hibernate in torpor for months. In torpor, unconscious biological functions continue to occur.

g. *Ecosystem Services*¹⁰

- i. Support cave communities: cave-dwelling bats support the complex and unique cave ecosystems that house a diverse number of creatures by providing crucial nutrients in their guano (manure).
- ii. Pest control: insect-eating bats (insectivorous) provide a natural form of pest control, which reduces crop damages and the use of pesticides.
- iii. Pollinators: nectar-eating bat species help plants pollinate and disperse their seeds, like the blue agave. Bats add value to the agricultural industry.
- iv. Seed dispersal: fruit-eating bats help plants distribute seeds.
- v. Prey: hawks, owls, weasels, and raccoons prey on bats to survive.

h. *Threats*

- i. Bats are exceptionally vulnerable to extinction because of widespread habitat loss and disease pressure. It is also important to note that, in relation to their size, they are among the slowest reproducing mammals.
- ii. The International Union for the Conservation of Nature (IUCN) lists almost a third of the 1,296 bat species assessed as threatened or data deficient. 24 are Critically Endangered, 53 species are Endangered, and 104 species are Vulnerable.¹¹
- iii. Thoughtless tourism: bats use caves for crucial activities, like raising their pups or hibernating. If disturbed, bats can burn through the energy they need to survive the winter, and scared moms may abandon their pups.¹²
- iv. White-nose syndrome: disease caused by fungus, displayed as a powdery white substance around the bat's muzzle and wings (namesake). It affects cave-dwelling bats, and since its discovery in 2006, it has spread to more than half of the U.S. and has killed millions of bats, nearing 100% mortality rate in some colonies.¹³
- v. Wind turbines: have a damaging effect on 21 bat species in the U.S., particularly migratory, tree-roosting species.¹⁴ Bats hit low-pressure pockets, are blasted around, and thrown to the ground.

¹⁰ NPS. (2016) "All About Bats: Benefits of Bats."

¹¹ BCI. "Bats Are: Threatened."

¹² *ibid.*

¹³ NPS. (2016) "Threats to Bats: White-Nose Syndrome."

¹⁴ NPS. (2016) "Threats to Bats: Wind Energy."

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- vi. Habitat loss: a reduction of available natural spaces and resources crucial to a species' survival. Many factors can cause this, such as:¹⁵
 - 1. Destruction: removal of habitat due to deforestation, human development, wetland draining, and land-use change (agriculture).
 - 2. Fragmentation: division of land due to roads, farms, cities, etc. Most impactful for migrating species, as their traditional travel paths are disturbed, reducing food and shelter availability.
 - 3. Degradation: reduction of livable spaces due to pesticide use, light pollution, water contamination, invasive species, etc.¹⁶
- vii. Climate change: the rapid, unpredictable, and unusual nature of changes in seasonal weather patterns are becoming more frequent and intense:¹⁷
 - 1. Heat waves/droughts cause overheating and reduce food access.
 - 2. Uncontrollable wildfires, driven by droughts, can destroy habitats.
 - 3. Intense storms and heavy rains can flood habitats and kill colonies.
 - 4. Early snows can block cave entrances and prolonged freezing temperatures may cause bats to freeze to death during hibernation.

2. Bats in National Parks

a. *Learning from Bats*

- i. Over 50 unique species of bats live in National Parks. Data guides researchers and wildlife managers in protection efforts.
- ii. Given their small size, nocturnal habits, and protected habitats, bats can be hard to study. Researchers use special techniques to study bats:¹⁸
 - 1. Mist nets: virtually invisible loose mesh strung up between poles at dusk to catch bats. Species and weight are noted, samples are taken, and a band ring is placed on the bat to identify the individual if recaptured to track its movements and life history. It is then released.
 - 2. Acoustic surveys: recording the echolocations with special microphones and recording devices to identify the species present in the park, as each species has a unique set of sounds. Some parks have permanent monitoring stations to track activity year-round.
 - 3. Field surveys: using infrared cameras in places they likely live in to record population numbers and species present.

¹⁵ NPS. (2016) "Threats to Bats: Habitat Loss."

¹⁶ BCI. "Bats Are: Threatened."

¹⁷ NPS. (2016) "Threats to Bats: Climate Change."

¹⁸ NPS. (2018) "All About Bats: Studying Bats."

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4. Radio transmitters: attaching temporary radio transmitters to a bat's back to learn about the places that they go to rest, hibernate, or raise their young to better manage and protect their habitats.
- b. *Managing Bats in Parks*
 - i. NPS-wide: wildlife managers have many strategies to keep bats healthy and their habitats safe, including:¹⁹
 1. Closed caves: many National Park caves are closed to visitors by federal laws. Managers may also need to close caves year-round or seasonally to protect the organisms.
 2. Bat-friendly cave and mine entrances: install gates to allow free passage for bats but keep larger mammals (like humans) out.
 3. Outreach and education: interpretive programs, informational displays, and special events to educate the ~300 million annual visitors about the importance of bats and how we can help them.
 4. Preventing spread and impacts of white-nose syndrome: the disease has killed millions of bats since 2006. NPS has helped slow the spread of the disease by regulating access to caves and mines, cleaning or restricting use of clothing and gear between caves, and funding over 158 projects in 78 parks since 2013.
3. **Activity**
 - a. Tell YCC precipitants: "MONO has 5 unique species of bats:²⁰ Big brown bat, Eastern red bat, Hoary bat, Northern long-eared bat, and Little brown bat. Each species has its unique needs and challenges, but they all share the same cultural stigma and unfounded fear."
 - b. Divide YCC precipitants into 5 teams, based around a species of bats. Tell them: "Imagine you are the head of public relations for MONO. You want to prepare a Public Service Announcement (PSA) campaign for bat week at the end of October, and you want to highlight the 5 species of bats MONO has. You want to focus on educating the public on the importance of bats for our environment, and generally make the public appreciate bats more. With what you learned today, the information on the factsheets, and some web-searching, make a quick sketch of a poster about your team's bat! Feel free to cut up the picture included in the fact sheet. You have 10 minutes."
 - c. Once they are done, give them a minute or two to share their group's public service poster with the group.

¹⁹ NPS. (2016) "Protecting Bats in Parks."

²⁰ NPS. "Information on Species in National Parks."

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Big Brown Bat Factsheet²¹

- Habitat: deciduous forests, suburban areas, and agricultural areas.
- Roost: in tree cavities and in man-made structures.
- Diet: crop and forest pests like beetles, stink bugs, and moths.
- Winter: they hibernate in their roosting sites.
- Threat: human activities, like logging and habitat modification, have been forced to move out of their forest habitats and closer to human structures.
- Fun fact: their life expectancy is 19 years.



²¹ BCI. "Species Profile: Eptesicus fuscus"

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Eastern Red Bat Factsheet²²

- Habitat: deciduous or evergreen trees, and trees on the edge of the forest.
- Roost: solitary species; mothers prefer to roost alone.
- Diet: mosquitoes, moths, beetles, cicadas, flies, and other flying insects.
- Winter: migrate along the Atlantic seaboard.
- Threat: they hibernate in leaf litter, so they may die from winter controlled burnings.
- Fun fact: one of the only bats that can birth twins, and they can have 3-5 young in a litter.



²² BCI. "Species Profile: Lasiurus borealis"

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Hoary Bat Factsheet²³

- Habitat: trees on the edge of forests, dense forests, open wooded glades, and shade trees in urban spaces.
- Roost: top of trees on the edge of forests. They are a solitary species.
- Diet: moths, flies, beetles, wasps, grasshoppers, termites, and dragonflies.
- Winter: migrate to subtropical and tropical areas.
- Threat: 76,000 – 152,000 of Hoary bats die annually from wind turbine collisions.
- Fun fact: found in all 50 states and are the only native land mammal and only bat species in Hawai'i.



²³ BCI. "Species Profile: Lasiurus cinereus"

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Northern Long-Eared Bat Factsheet²⁴

- Habitat: dense forest stands.
- Roost: caves and crevices in live or dead trees. Maternity colonies are 30 - 60 bats big.
- Diet: moths, flies, leafhoppers, caddisflies, and beetles.
- Winter: hibernate in caves and mines.
- Threat: up to 98 percent of populations cross the country have been impacted by the white-nose syndrome.
- Fun Fact: sometimes only their nose and ears are visible when they hibernate.



²⁴ BCI. "Species Profile: *Myotis septentrionalis*"

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Little Brown Bat Factsheet²⁵

- Habitat: swamp lands.
- Roost: manmade structures and crevices in trees near water.
- Diet: wasps, moths, beetles, crane flies, mosquitoes, and caddisflies.
- Winter: they hibernate in caves and mines, 4 - 6 months.
- Threat: heavily impacted by white-nose syndrome.
- Fun fact: individual bats catch ~1,200 insects in 1 hour during peak feeding time.



²⁵ BCI. "Species Profile: *Myotis lucifugus*"

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