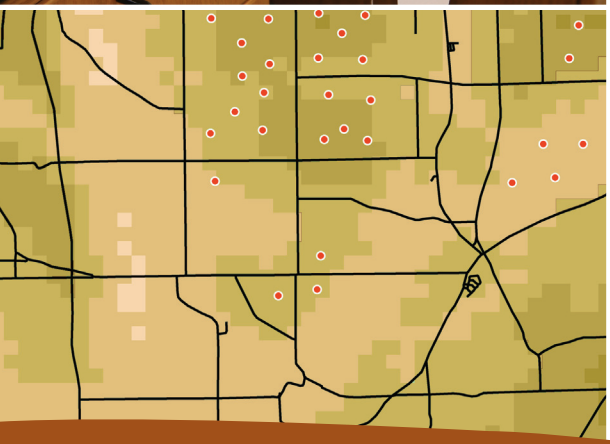
WindWise Education

Transforming the Energy of Wind into Powerful Minds



A Curriculum for Grades 6-12

www.WindWiseEducation.org

WindWise Education was developed with funding from the New York State Energy Research & Development Authority.

CAN WE REDUCE RISK TO BATS?

LESSON 12

KEY CONCEPT

Students will analyze bat behaviors and propose a wind farm operational plan that could reduce the risk of bat mortality.

TIME REQUIRED

1 class period

GRADES

6 – 8
9 – 12

SUBJECTS

Living Environments
Technology

windwise education
www.WindWiseEducation.org

BACKGROUND

A wind developer must determine when it will operate the turbines in order to generate enough electricity to maximize profitability while doing what is necessary to protect the environment. Whether the turbines are turned on or off can influence the level of bat mortality at a wind farm. In this lesson, students will learn about the behaviors of different bat species and create a schedule of when the turbines can be turned on and off to reduce the potential for bat mortality.

OBJECTIVES

At the end of the lesson, students will

- Understand the behavior of different bat species
- Explore the relationship between technology and nature

METHOD

Students will work in small groups to learn about the behaviors of different bat species near a wind farm. Based on these data, students will design a dispatch schedule for a wind farm that lowers the risk of bat mortality. Each group will present its dispatch schedule to the class for discussion of the pros and cons.

MATERIALS

You will need one set of the following materials for each group:

- ❑ Worksheet for each student*
- ❑ Information packets for each team (bat fact sheets, bat mortality data)*

*included with activity

GETTING READY

Prepare copies of the worksheets, reading passage, and information packets for all of the students.

ACTIVITY

Step 1: Beginning Questions for Students

If students have not studied wind energy before, begin the class by asking students what they know about wind energy and how wind turbines affect wildlife. Ask some specific questions about bat behaviors to get students thinking about how bats may be impacted by wind farms.

- When do bats fly?
- Where do bats live?
- What do bats eat?
- Where do bats go in the winter?
- What can happen when bats fly in the area of a wind turbine?

Provide students with the reading passage and career profile either before the lesson or for homework.

Step 2: Creating a Dispatch Schedule

Have students split into groups of four. Present this scenario to each team:

> *Last year, the Eco3Wind Company installed a 360 MW (megawatt) wind farm with 120 turbines. Each turbine has a maximum capacity of 3 MW. Recently, the Bat Protection Coalition, a local citizens group, has expressed concern about the impact of the wind farm on local bat populations. In response to these concerns, the company is looking for ways to reduce the likelihood of bat mortality on its wind farm. The company has hired a bat biologist to identify which bat species are present on or near the wind farm.*
>
> *Your team has been asked to examine the data collected by the bat ecologist and recommend a schedule of when to turn the turbines on and off. This schedule, called a dispatch schedule, will be designed to reduce the risk of bat mortality while also generating enough power to make the company profitable. Your proposal should include an explanation of which bat species your team has prioritized (if any) and how your schedule will help protect them.*

Provide students with the worksheet. Each student in the group will select one bat species to read about and complete the corresponding column of the table. When the table is complete, have each team discuss the behaviors of all 4 bats and determine which bats they will prioritize (if any). Using the species information, have students design a schedule of when they would recommend turning the turbines on and off.

Step 3: Wrap Up
After every team has completed their dispatch schedule, have a class discussion to compare results. To make comparisons easier, results can be summarized in a table.

Use some of the following questions to generate a discussion about the exercise:

- Were there any significant similarities or differences among the dispatch schedules?
- Did any of the groups prioritize 1 or 2 bat species over the others and, if so, why?
- Which dispatch schedule appears to provide the best protection for bats and why?

VOCABULARY

Barotrauma – Trauma caused by rapid or extreme changes in air pressure; in the case of bats, barotrauma results in death.

Cut-In Speed – The minimum wind speed at which the wind turbine will generate usable power. For most turbines, this is typically between 7 and 10 mph.

Dispatch Schedule – The "brains" of the wind turbine that collects data (such as wind speed) and tells the turbine when to turn on and off.

Echolocation – A system of making high-frequency sounds to determine the direction and distance of objects.

Endangered Species – A species in danger of extinction throughout all or a significant portion of its range.

Hibernate – To spend the winter in a dormant or torpid state.

Migrate – The movement of an animal from one location to another, often across very long distances, in search of food, water, and breeding opportunities and locations.

Start-Up Speed – The speed at which the rotor and blade assembly begins to rotate.

ECHOLOCATION

RELATED ACTIVITIES

- Lesson 10: How Does Energy Affect Wildlife?
- Lesson 11: What is Wind's Risk to Birds?

ADDITIONAL RESOURCES

CAN BATS AND WIND POWER GET ALONG?— www.sciencefriday.com/program/archives/200910022 —"Science Friday," National Public Radio. Broadcast on October 2, 2009.

BATS AND WIND ENERGY COOPERATIVE—www.batsandwind.org – This website provides links to studies related to bats and wind energy.

EFFECTIVENESS OF CHANGING WIND TURBINE CUT-IN SPEED TO REDUCE BAT FATALITIES AT WIND FACILITIES—www.batsandwind.org/pdf/Curtailment_2008_Final_Report.pdf – 2008 Annual Report.

STANDARDS

The Living Environment: Standard 1 (High School)
Key Idea 1:
The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing and creative process.

Major Understandings:
1.2a Inquiry involves asking questions and locating, interpreting, and processing information from a variety of sources.

1.2b Inquiry involves making judgments about the reliability of the source and relevance of information.

1.3a Scientific explanations are accepted when they are consistent with experimental and observational evidence and when they lead to accurate predictions.

1.3b All scientific explanations are tentative and subject to change or improvement. Each new bit of evidence can create more questions than it answers. This leads to increasingly better understanding of how things work in the living world.

Key Idea 3:
The observations made while testing proposed explanations, when analyzed using conventional and invented methods, provide new insights into natural phenomena.

Major Understandings:
3.5b Scientists use peer review to evaluate the results of scientific investigations and the explanations proposed by other scientists. They analyze the experimental procedures, examine the evidence, identify faulty reasoning, point out statements that go beyond the evidence, and suggest alternative explanations for the same observations.

Key Idea 7:
Human decisions and activities have had a profound impact on the physical and living environment.

Major Understandings:
7.2c Industrialization brings an increased demand for and use of energy and other resources including fossil and nuclear fuels. This usage can have positive and negative effects on humans and ecosystems.

7.3a Societies must decide on proposals which involve the introduction of new technologies. Individuals need to make decisions which will assess risks, costs, benefits, and trade-offs.

7.3b The decisions of one generation both provide and limit the range of possibilities open to the next generation.

Intermediate Level Science–Standard 4: Living Environment
Key Idea 7:
Human decisions and activities have had a profound impact on the physical and living environment.

Major Understandings:

7.1a A population consists of all individuals of a species that are found together at a given place and time. Populations living in one place form a community. The community and the physical factors with which it interacts compose an ecosystem.

7.1b Given adequate resources and no disease or predators, populations (including humans) increase. Lack of resources, habitat destruction, and other factors such as predation and climate limit the growth of certain populations in the ecosystem.

7.1c In all environments, organisms interact with one another in many ways. Relationships among organisms may be competitive, harmful, or beneficial. Some species have adapted to be dependent upon each other with the result that neither could survive without the other.

7.2a In ecosystems, balance is the result of interactions between community members and their environment.

7.2b The environment may be altered through the activities of organisms. Alterations are sometimes abrupt. Some species may replace others over time, resulting in longterm gradual changes (ecological succession).

7.2c Overpopulation by any species impacts the environment due to the increased use of resources. Human activities can bring about environmental degradation through resource acquisition, urban growth, land-use decisions, waste disposal, etc.

7.2d Since the Industrial Revolution, human activities have resulted in major pollution of air, water, and soil. Pollution has cumulative ecological effects such as acid rain, global warming, or ozone depletion. The survival of living things on our planet depends on the conservation and protection of Earth's resources.

EASTERN RED BAT

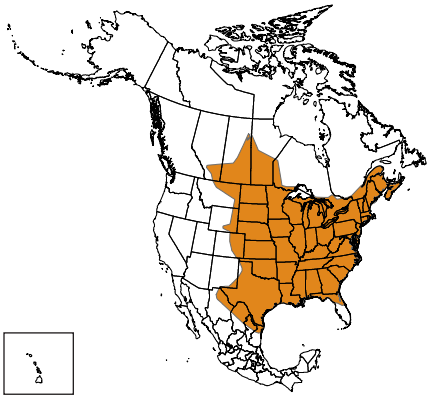
Lasiurus borealis (lay-zee-your-us bor-ee-al-is)

Photo © Merlin D. Tuttle

The eastern red bat has reddish-orange fur with a brownish-black tail and wing membranes. This bat lives or roosts in trees during the day. When hanging by one foot in trees, the bat will swing slightly, making it look like dead leaves or pine cones. This provides excellent camouflage from potential predators such as opossums.

The eastern red bat will often fly in a diving pattern to catch insects. They begin foraging about 1 to 2 hours after sunset and will focus their feeding within ½ mile of their day roosts. While foraging can occur throughout the night, activity appears to peak within the first 4 hours after sunset. They are often found feeding near lights, which attract insects, and along the edges of forests and clearings.

Range of Eastern Red Bat



The eastern red bat can fly up to 40 mph when on a straight, level course. These bats have been seen flying well above the tree canopy (30 m and higher), but when foraging, they are found at lower altitudes (15 to 30 m). As with most bats, they are less likely to fly at higher altitudes when wind speeds are above 6 to 8 m/sec.

These bats are typically solitary, but will come together in groups to mate and migrate. They mate in August and September and often give birth to twins. In the fall (September/October), these bats migrate in large groups over 900 miles to southern parts of their range until the following spring (May/June).

The life span of the eastern red bat is thought to be as long as 12 years. Eastern red bats are not considered threatened.

Sources:

- Bat Conservation International
- www.esf.edu/aec/adks/mammals/red_bat.htm
- Saunders, D. A. 1988. Adirondack Mammals. State University of New York, College of Environmental Science and Forestry. 216pp.
- Shump, K.A. Jr., and A.V. Shump. 1982. *Lasiurus borealis*. Mammalian Species, 183:1-6.
- William Caire, et al. Capture Heights and Times of *Lasiurus borealis* (Chiroptera: Vespertilionidae) in Southeastern Oklahoma

- Photo: Merlin D. Tuttle, Bat Conservation International, www.batcon.org
- Map data: National Atlas of the United States and Bat Conservation International

HOARY BAT

Lasiurus cinereus (lay-zee-your-us sa-near-ee-us)

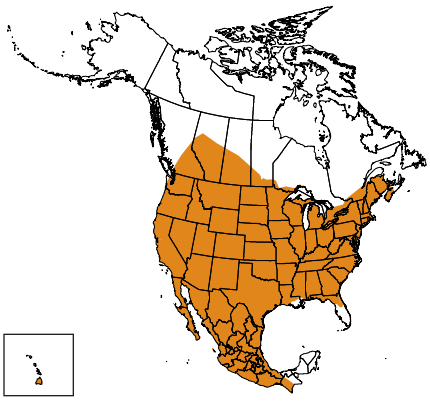
Photo © Merlin D. Tuttle

The hoary bat is often found roosting 10 to 15 feet above the ground in deciduous and coniferous woodlands.

Hoary bats typically begin feeding after dark and will feed all through the night until about an hour before sunrise. They are most active about five hours after sunset and forage as far as 24 miles from where they roost.

The hoary bat can reach speeds of 13 mph. They often forage near tree tops. These bats have been seen flying well above the tree canopy (30 meters and higher), but when foraging, they are found at lower altitudes (15 to 30 meters). Hoary bats feed on insects, especially moths. As with most bats, they are less likely to fly at higher altitudes when wind speeds are above 6 to 8 m/sec.

Range of Hoary Bat



These bats are solitary, but migrate in large groups and may even fly with groups of birds. During migrations, they can be found flying as early as sunset. Traveling over 900 miles, they reach Florida around October/November in the fall. They begin their return migration between February and May.

Due to their abundance, the hoary bat is not considered threatened.

Sources:

- Bat Conservation International
- Photo: Merlin D. Tuttle, Bat Conservation International, www.batcon.org
- Map data: National Atlas of the United States and Bat Conservation International

BIG BROWN BAT

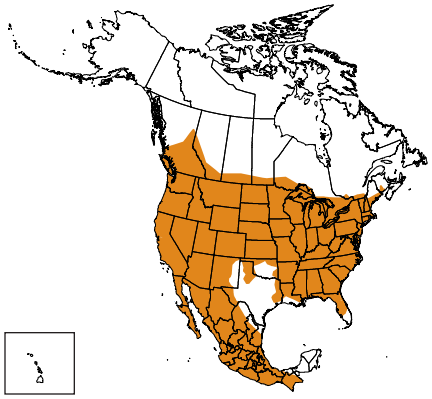
Eptesicus fuscus (ep-tess-a-cus fuss-cuss)

Photo © Merlin D. Tuttle

The big brown bat is very abundant and lives in a wide range of habitats, from forests to suburbs to agricultural areas. They live in large maternity colonies in buildings, barns, bridges, bat houses, and beneath loose bark or in small openings of trees.

These bats eat insects, especially small beetles. They typically forage between 0.6 and 1.2 miles from where they roost. The big brown bat typically starts foraging about 18 minutes after sundown, flies continuously while eating, and will spend about 90 minutes a night foraging. They have been observed to catch between 5 and 20 insects in a minute. The big brown bat prefers to forage along the edge of forests, over land or water, in clearings, and lake edges. They can eat the equivalent of their body weight in a single night.

Range of Big Brown Bat



The big brown bat migrates distances of less than 300 miles. They will typically hibernate in the winter, and the length of hibernation depends on the length of the winter.

The big brown bat typically flies at an altitude of 6 to 50 meters over forests and roadways. As with most bats, they are less likely to fly at higher altitudes when wind speeds are above 6 to 8 m/sec.

Due to their abundance and ability to live in more populated areas, this bat is not a threatened species.

Sources:

- Bat Conservation International
- Whitaker et al. 1977

- Photo: Merlin D. Tuttle, Bat Conservation International, www.batcon.org
- Map data: National Atlas of the United States and Bat Conservation International

INDIANA MYOTIS

Myotis sodalis (my-oh-tis so-dal-is)

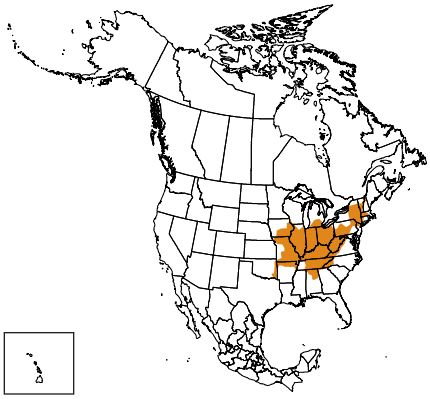
Photo © Merlin D. Tuttle

The Indiana myotis is a small gray bat that roosts in crevices or under the loose bark of trees during the summer. They tend to move regularly between roosts.

The Indiana myotis primarily eats insects and typically forages within a mile of the roost tree. These bats tend to be most active just after sunset, with their peak activity occurring within the first 2 hours following sunset. Indiana bats usually forage and fly within an air space from 2 to 30 m above ground level.

They migrate up to 500 miles between winter hibernacula and their summer roosts. They hibernate in caves during the winter, with the majority of them found in Indiana, Kentucky, and Missouri.

Range of Indiana Myotis



While no Indiana bat fatalities have been confirmed at active wind energy facilities, other *Myotis* species (*Myotis sp*) that exhibit similar life history characteristics and behaviors have been killed; therefore, there may be some risk associated with this species.

The Indiana myotis is a federally endangered bat. One of the contributing factors to the bat's decline could be a loss of adequate habitat. While caves where the Indiana myotis hibernates have been largely protected, the loss of forested areas where the bat roosts in the summer are not protected.

Sources:

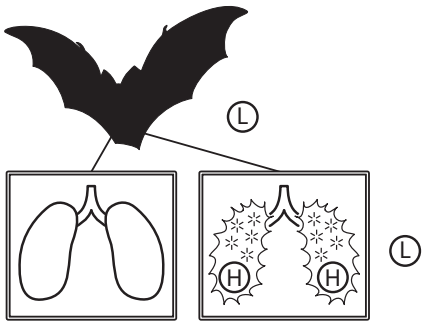
- Bat Conservation International
- http://www.batcon.org/index.php/all-about-bats/species-profiles.html
- http://animaldiversity.ummz.umich.edu/site/accounts/information/Lasiurus_cinereus.html
- Pandion Zephyr Duke Michigan Fatal Flaw Report
- Humphrey et al. 1977

- Photo: Merlin D. Tuttle, Bat Conservation International, www.batcon.org
- Map data: National Atlas of the United States and Bat Conservation International

READING PASSAGE: BATS AND WIND TURBINES

Bats sometimes have a bad reputation based on movie and Halloween images. Despite this, it is important to realize that bats are very helpful to people. The U.S. is home to 45 different species of bats; nearly all of which eat insects. Some bats can eat their weight in insects every night. Millions of bats eating insects every night is what you call great bug control! Just consider what life would be like without bats.

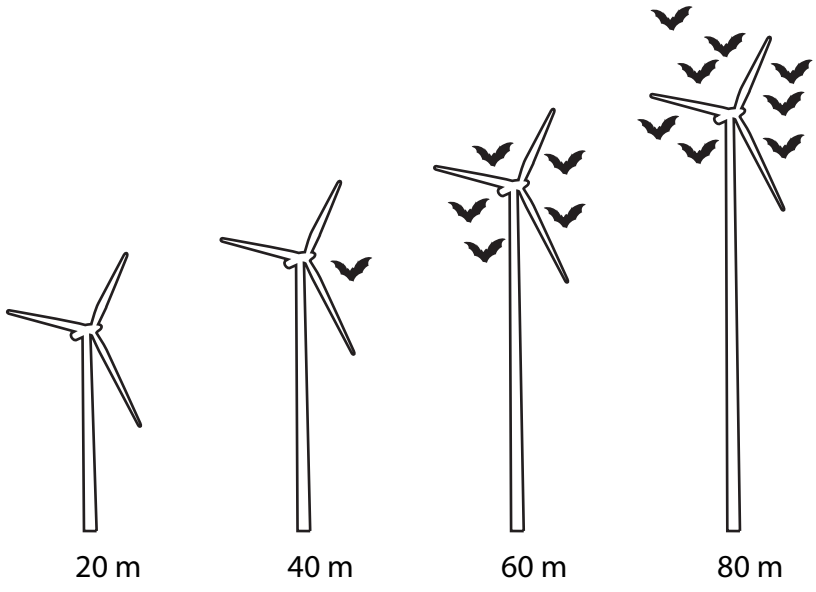
Bats are unique and interesting animals found to be living as long as 50 million years ago. Bats are the only mammals that fly. While many people think of bats as living or roosting in caves, many bats roost in trees, buildings, or even underneath the bark of trees. Bats use echolocation to navigate and find food, but they also have excellent vision. When colder weather arrives, some bats migrate to warmer areas while others hibernate. Bats can live a long life—in some cases more than 30 years—but they have a slow reproductive cycle in which they typically have only one baby or "pup" at a time. Four species of bats in the U.S. have been categorized as endangered; meaning there is a threat of extinction if their populations do not increase.



Barotrauma occurs when sudden pressure changes cause a bat's lungs to break. Moving turbine blades can cause such a drop in pressure, close to the rotor.

While researchers are learning more about bats every day, there are still many things we do not know about them. One of the great mysteries of bats is how they are impacted by wind turbines. Dead bats have been found near wind farms around the world. While in some cases the bat hit the turbine, many bats die from barotrauma, which is caused by extreme change in air pressure close to the moving wind turbine blades. Researchers have found that the majority of bat deaths occur in the summer and fall (June – September) during the migration season. Three bat species that roost in trees and make long-distance migrations tend to be killed more than any other species. These deaths often occur in the fall. As the height of wind turbine towers has increased, the mortality of bats has also increased.

Researchers face many challenges when trying to learn about and protect bats. It is difficult to count bats; thus, the actual population of each species is unknown. While there are some technologies available for detecting bats, we are still unable to determine the exact number of bats in a particular area. Researchers also have many questions about bats and their relationship with wind turbines. While they believe that the bats may be attracted to the areas with wind turbines, they are not sure why. Are the bats attracted to the clearings around wind turbines or are they considering the turbines as potential roosting sites since they often select the tallest trees? Or are they drawn to the insects?



While there are many unanswered questions, as researchers find more answers, wind farms will be better equipped to lower their impact on bat populations. Recently, researchers have found that bat mortality is higher on nights with low wind speeds. It is believed that bats are more likely to be flying when wind speeds are lower. Some experiments have been conducted where wind turbines were turned off until the wind speeds reached a higher threshold—called the cut-in speed. This has been found to be an effective mechanism for lowering fatality rates.

Sources

- USGS powerpoint presentation: www.mesc.usgs.gov/Products/Publications/22170/22170.pdf
- Bat Conservation International
- Barclay et al. 2007; Can. J. Zool. 85:381-387
- Arnett et al. 2008; J. Wild. Man. 72: 61-78
- Johnson 2005, Bat Res. News 46: 45-49
- Cryan and Brown 2007, Biol. Cons. 139: 1-11

CAREER PROFILE: ALLISON POE, BAT BIOLOGIST

I didn't grow up wanting to be a bat biologist—I didn't even know there was such a thing! After I completed a B.A. in psychology with a minor in sociology, I worked as a white water rafting guide in Colorado. It was there that I developed a deep appreciation for wildlife and decided to pursue a career in wildlife biology. I began by volunteering for a local environmental consulting firm where I joined a bat research trip, which was a creepy, scary, and very exciting experience. After we caught a few bats, I was hooked. Later I participated in a number of life-changing internships. I spent 5 months studying sea birds on a remote island in Alaska and helped with a Hawksbill sea turtle project and a bat project in Hawaii. I got my master's degree at the University of Western Ontario, where I focused on bats.

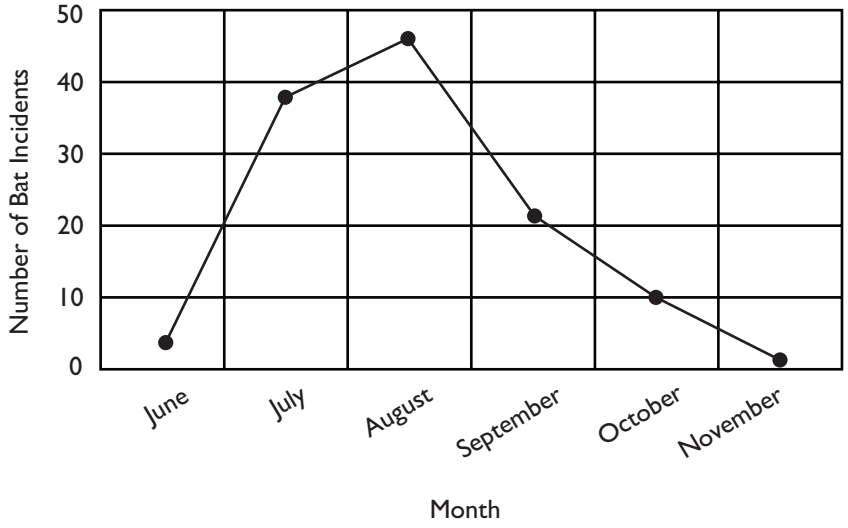
As a bat biologist, I do a variety of things, all pertaining to understanding bats and their biology and ecology. My focus is on the effects that wind farms have on bat populations. I use special acoustic bat detectors to survey areas where wind farms are proposed to assess the levels of bat activity and what species of bats are present in the area. I use computer software that allows me to see the recorded bat echolocation calls. This is called a spectrogram. Because different bat species sound different when they echolocate, I use the spectrogram to identify the species of bat that emitted the echolocation call. Bats are difficult to capture. By using this software, I do not need to see the bat up close to know what kind it is. With this information, we can show wind developers where the high risk areas are and help them make decisions that will minimize impacts to bats.

I really enjoy my work because of the variety. I get to go out in the field to potential wind farm sites and install bat monitoring equipment on meteorological towers, drive around at night looking for bats with acoustic bat detectors, and analyze echolocation call data in an effort to understand where the bats are and when they occur in an area. I work closely with other biologists and computer specialists to come up with new and improved methods to monitor bat activity. The work that I do is very rewarding and always keeps me on my toes.

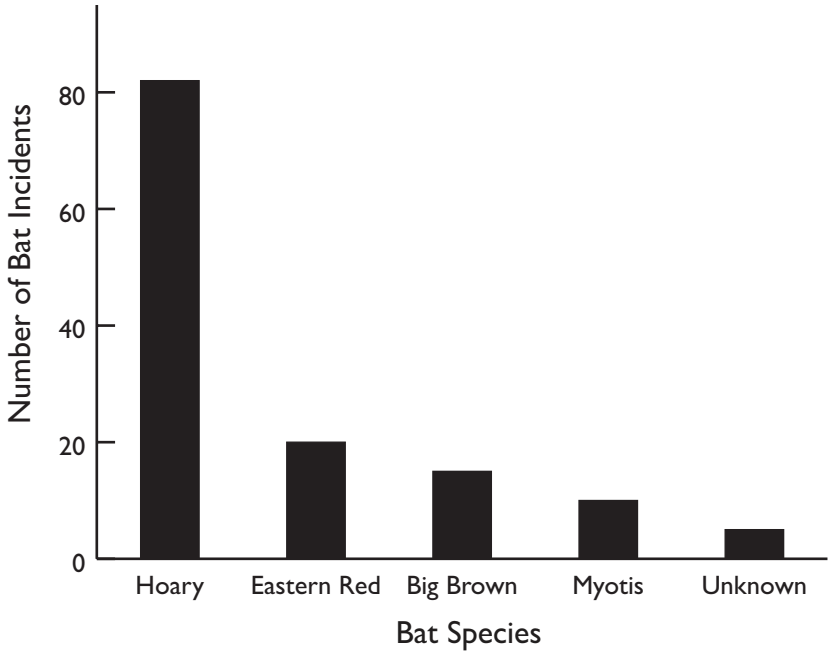
BAT MORTALITY DATA AT THE ECO3WIND FARM

The following are bat mortality data that the Eco3Wind Company has collected at its wind farm during the time of year when bats are present in the area.

Number of Bats Found (June 17th to November 15th)



Distribution of Bat Incidents by Species (June 17th to November 15th)



Name_____ Date_____ Class_____

WHAT DO WE KNOW ABOUT THE LOCAL BAT POPULATIONS?

Each team member will select one bat species, read the information packets (fact sheets on each species, range maps, tables, etc.), and complete the portion of the table that corresponds with his or her bat species. When the team's table is complete, discuss the questions below and begin creating your team's dispatch schedule.

	BAT SPECIES			
	Lasiurus borealis (Eastern Red Bat)	*Lasiurus cinereus* (Hoary Bat)	*Eptesicus fuscus* (Big Brown Bat)	*Myotis sodalis* (Indiana Bat)
Range: Does this species live in New York?				
Migration Does this species migrate?				
If so, what months are they probably present in NY?				
Flight Times What time of day do they fly?				
Habitat Where do the bats live and forage?				
Threatened or Endangered Species Is the species threatened or endangered?				
Wind Speeds At what wind speed does this species fly?				
Presence Has this bat species been found at this wind facility?				
Mortality Is this species known to die near wind turbines? If so, has it been found at this wind farm?				

Questions to Discuss With Group Members

1. Compare and contrast the 4 species. Identify the factors you think are most important.

2. Does the team want to prioritize any bat species? If yes, why?

Design the Dispatch Schedule

What is a dispatch schedule? It is the "brains" of the wind turbine. It collects data (such as wind speed) and tells the turbine when to turn on and off.

Determine the dispatch schedule specifications that your team would recommend for reducing potential bat mortality.

Consider the following questions when completing the table below:

- What times of day have the highest risk of bat mortality?
- At what wind speeds do the bats fly?
- Are there times of the year when the bats are more likely to be at risk?

	LOW RISK OF BAT MORTALITY *(when to turn the turbine ON)*	**HIGH RISK OF BAT MORTALITY** *(when to turn the turbine OFF)*
Time of Day		
Months		
Wind Speed		

WHAT DO WE KNOW ABOUT THE LOCAL BAT POPULATIONS?

	BAT SPECIES			
	Lasiurus borealis (Red Bat)	*Lasiurus cinereus (Hoary Bat)*	*Eptesicus fuscus (Big Brown Bat)*	*Myotis sodalis (Indiana Bat)*
Range: Does this species live in New York?	*Yes*	*Yes*	*Yes*	*Yes, part of New York*
Migration Does this species migrate?	*In the fall (September/ October), these bats migrate in large groups over 900 miles to southern parts of their range until the following spring (May/June).*	*Traveling over 900 miles, they reach Florida around October/November in the fall. They begin their return migration between February and May.*	*Migrates distances of less than 300 miles.They will typically hibernate in the winter, and the length of hibernation depends on the length of the winter.*	*They migrate up to 500 miles between winter hibernacula and their summer roosts. They hibernate in caves during the winter, with the majority of them in caves in Indiana, Kentucky, and Missouri.*
Flight Times What time of day do they fly?	*Begins foraging about 1 to 2 hours after sunset and will focus their feeding within ½ mile of their day roosts. While foraging can occur throughout the night, activity appears to peak within the first 4 hours after sunset.*	*Begin feeding after dark and will feed all through the night until about an hour before sunrise. They are most active about 5 hours after sunset and forage as far as 24 miles from where they roost.*	*Starts foraging about 18 minutes after sundown, flies continuously while eating, and will spend about 90 minutes a night foraging.*	*These bats tend to be most active just after sunset, with their peak activity occurring within the first 2 hours following sunset.*
Habitat Where do the bats live and forage?	*Lives or roosts in trees during the day. They are often found feeding near lights, which attract insects, and along the edges of forests and clearings When foraging, they are found at lower altitudes (15-30 m).*	*Roosting 10 to 15 feet above the ground in deciduous and coniferous woodlands. Have been seen flying well above the tree canopy (30 m and higher), but when foraging, they are found at lower altitudes (15-30 m).*	*Live in large maternity colonies in buildings, barns, bridges, bat houses, and beneath loose bark or in small openings of trees. Prefers to forage along the edge of forests, over land or water, in clearings, and lake edges.*	*Roosts in crevices or under the loose bark of trees during the summer. They tend to move regularly between roosts.*

Threatened or Endangered Species Is the species threatened or endangered?	*No*	*No*	*No*	*Endangered*
Wind Speeds At what wind speed does this species fly?	*They are less likely to fly at higher altitudes when wind speeds are above 6 to 8 m/sec.*	*They are less likely to fly at higher altitudes when wind speeds are above 6 to 8 m/sec.*	*They are less likely to fly at higher altitudes when wind speeds are above 6 to 8 m/sec.*	*Unknown*
Presence Has this bat species been found at this wind facility?	*Yes*	*Yes*	*Yes*	*No*
Mortality Is this species known to die near wind turbines? If so, has it been found at this wind farm?	*Yes, Yes*	*Yes, Yes*	*Yes, Yes*	

Questions to Discuss With Group Members

1. Compare and contrast the 4 species. Identify the factors you think are most important.
   Students may decide to focus on different factors depending upon how they view the information.

2. Does the team want to prioritize any bat species? If yes, why?
   Students may decide to focus on different species depending upon how they view the information.

Design the Dispatch Schedule

Consider the following questions when completing the table below:

Determine the Dispatch Schedule specifications that your team would recommend for reducing potential bat mortality.

The Dispatch Schedule will vary from student to student. Students should factor in which bats they are prioritizing, the time of day those species fly, the months they are living in the area and the wind speed that they are most likely to be flying in.

- What times of day have the highest risk of bat mortality?
  Bats are most at risk when they are foraging (after sunset and before dawn).

- At what wind speeds do the bats fly?
  They are less likely to fly at higher altitudes when wind speeds are above 6 to 8 m/sec.

- Are there times of the year when the bats are more likely to be at risk?
  The bats will be more at risk when they are living in the area of the wind farm. When the bats migrate away from the turbine, the risk will fall.