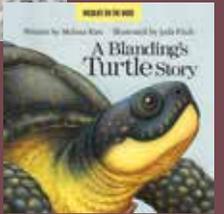
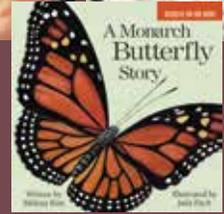
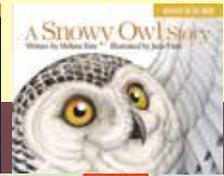
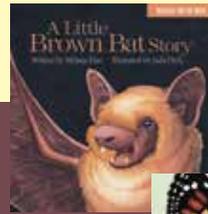


WILDLIFE ON THE MOVE

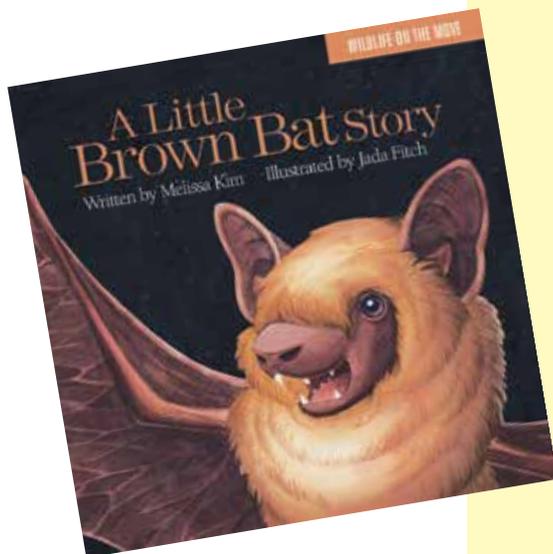
Teaching Guides



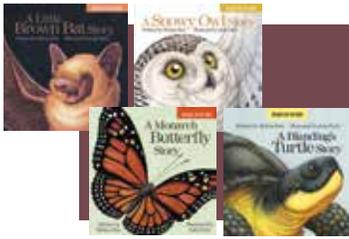
A Maine Audubon/Islandport Press Partnership

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Reproducibles



Introduction

ABOUT MAINE AUDUBON

Maine Audubon is building a community of people who understand that when Maine's wildlife thrives, Maine thrives. Since 1843, we have been connecting people to nature through a science-based approach to conservation, education, and advocacy. The largest Maine-based wildlife conservation organization, Maine Audubon has eight wildlife sanctuaries, 10,000 members, and serves over 50,000 people annually.

We work with children, adults, families, and educators to foster environmental literacy and stewardship through science-based and experiential education programs.

ABOUT WILDLIFE ON THE MOVE

"Wildlife On the Move" started with a great story. In January 2014, a Snowy Owl got stuck in an abandoned building in downtown Portland, Maine, and Maine Audubon staff were called on to assist. Both on scene that day and in the days following, we saw a fantastic opportunity in this front page story to explain basic wildlife ecology, why animals venture far from home, and what positive human intervention looks like. Our friends at Islandport Press agreed, and together we set to work developing a series of books that would help introduce and expand upon these important themes for families and classrooms in Maine and beyond. Not only did the trapped Snowy Owl get a happy ending, but we hope that her and other stories will live on to benefit and inspire generations of young naturalists and conservationists to come.

Why these species? The species chosen for the Wildlife on the Move project are iconic, charismatic, and most importantly, representative of the challenges facing Maine's wildlife. Even students who have never seen a Snowy Owl, for example, are able to relate to the experience of living in Maine. Though the story of each species is unique, they explore similar themes of animal movement, human interactions with wildlife, animal adaptations, seasonal changes, and habitat requirements.

Why this format? The Wildlife on the Move books are written for preschool-aged children through second graders, with simple prose supported by a strong foundation of scientifically accurate content and illustrations. This allows educators, aided by these curriculum guides, to dig deeper into the underlying scientific concepts and to challenge older students to take on a greater load of the cognitive work. The

smaller board books allow students of all ages to explore the books at their own pace and practice reading skills, while the large teacher editions allow for large group reading and discussion while inviting further interaction with the detailed illustrations.

HOW TO USE THIS GUIDE

Like the books in the Wildlife on the Move series, these companion teaching guides can be used in multiple ways. It is certainly possible to choose a standalone unit or lesson from one teaching guide, or to use them to provide context and background information to inform your own usage of the Wildlife on the Move books.

However, we hope that your interactions with this book series will go deeper than that. Taken as a whole, the Wildlife on the Move series provides an opportunity to explore multiple themes related to ecology, geography, and stewardship throughout each season and from multiple angles. This seasonal focus also provides an excellent starting point for incorporating outdoor exploration and field work into your teaching. You'll find tips for that in this guide, too.

Finally, we are proud to have put together a set of books that truly speak to a wide range of ages—from preschool to second grade. If you have the opportunity to work with multiple age groups, we hope you'll take advantage of this by spiraling back to the Wildlife on the Move books as your students grow. Not only will they be glad to revisit these familiar stories, but you'll be prepared to help them delve deeper into the ecological themes contained within the books.

Acknowledgments Maine Audubon and the Wildlife On The Move project have benefitted from many partners and collaborators. These guides include contributions from teachers at Portland Public Schools and Opportunity Alliance, and were funded by the Jane B. Cook 1992 Charitable Trust and Edward H. Daveis Benevolent Fund. We especially thank Melissa Kim at Islandport Press for her tireless support.

In each guide, you'll find these sections:

Background information This section will give you the context and background knowledge necessary to teach these books confidently! It's certainly not necessary to have all of the answers, but knowing where to look for more information is important. If this section doesn't answer all of your (or your students') questions, the resources listed at the end of the guide should point you in the right direction.

Discussion Questions Part of what makes these books work for a wide range of ages is their careful balance between scientific accuracy and conciseness. This gives educators the opportunity to highlight certain ideas and themes in the books by asking well-chosen open-ended questions before, during, and after a read aloud. This section contains examples and ideas for all three.

Lessons and Activities We've provided a range of lessons and activities in each guide organized around several themes and guiding questions. Though each works as a standalone, we think that they work best when bundled. This allows you to explore a topic in different ways, address multiple learning styles, and incorporate other subjects.

Standards Addressed For the purpose of these teaching guides, we've chosen to focus on the Next Generation Science Standards (NGSS). The reason for this is twofold; first, while many of the lessons and activities in this guide integrate multiple subject areas, we believe that it is their accurate and accessible science content that sets the Wildlife on the Move books apart.

Secondly, the NGSS align with Common Core State Standards for Math and English Language Arts. These Common Core connections are listed for each NGSS performance expectation and accessible on the NGSS website.

We have also taken the Maine Early Learning Developmental Standards into account for those educators working with preschoolers. You'll find a list of the science standards most relevant to this guide in the Appendix.

Objectives The importance of firsthand observation and hands-on, sensory experiences in nature cannot be overstated, especially for young children. Throughout this guide, you will notice that many of the lesson

objectives reflect that by going beyond knowledge and skills to include experiences and actions.

Extensions Each lesson includes extension options and ideas for incorporating other subjects, specialties, and areas of your classroom. These are just a starting point—consider working with other teachers at your school or parents to fully integrate Wildlife on the Move themes into other areas.

Take Learning Outside Research has shown that students are happier, healthier, and more engaged when they are given opportunities to play, learn, and explore outside. Authentic experiences in nature support students' learning, but also their social, emotional, and physical growth and development.

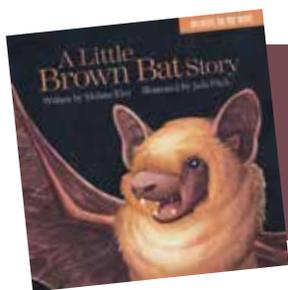
Focusing on the seasonal themes of each Wildlife on the Move book can be a great springboard for taking your students outside, and many of these lessons include outdoor exploration and observation components. Consider allowing extra time outdoors for students to explore and play on their own, too. Unstructured time in nature often leads to unexpected teachable moments and gives your students a chance to relate to you—and each other—in new and positive ways.

Take Action The final part of this section describes ways that you and your students can take meaningful action to help wildlife. We know that time and resources vary from school to school and we have included projects that vary accordingly. Maine Audubon is committed to helping schools take action, so let us know if we can be of help.

Appendix In this section are the following resources:

- Maine Early Learning and Development Standards
- Book lists, including children's books, teacher resources, and classroom-friendly field guides
- Songs and fingerplays
- Reproducibles, including graphic organizers and graphics used in lessons

Access online resources at maineaudubon.org/WOTM.



Background Information

BATS OF MAINE

Common Name	Scientific Name	Winter Survival Strategy	Habitat	Conservation Status*
Big Brown Bat	<i>Eptesicus fuscus</i>	Hibernate	Varies, often deciduous forest	
Little Brown Bat	<i>Myotis lucifugus</i>	Hibernate	Varies, often near water and built environments	Endangered (MESA)
Northern Long-eared Bat	<i>Myotis septentrionalis</i>	Hibernate	Thick forests	Endangered (MESA) Threatened (ESA)
Eastern Small-footed Bat	<i>Myotis leibii</i>	Hibernate	Heavily forested and mountainous areas	
Tri-colored Bat	<i>Perimyotis subflavus</i>	Hibernate	Forest edges and agricultural areas	
Hoary Bat	<i>Lasiurus cinereus</i>	Migrate	Forest edges, not attracted to built environments	
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	Migrate	Coniferous and mixed forest, preferably old growth	
Eastern Red Bat	<i>Lasiurus borealis</i>	Migrate	Near urban areas, streams, and fields	

*MESA: Maine Endangered Species Act;
ESA: United States Endangered Species Act

WHAT MAKES BATS SPECIAL?

There are 1,300 different species of bats found worldwide on every continent except Antarctica. This makes bats the second-largest group of mammals (rodents are the first). Bats range in size from the 6" wingspan of Kitti's Hog-nosed Bat (often called the bumblebee bat) to the 5' wingspan of the Golden-crowned Flying Fox. Bats feed on nectar, insects, seeds, fruit, fish, amphibians, reptiles, small mammals and birds, and blood.

Nearly all bats are nocturnal, or active at night. They can see, but mostly rely on their excellent hearing to find food and navigate in the dark. In a process called echolocation, bats emit sound waves that are ultrasonic (too high in frequency for humans to hear). When those sound waves reach a solid object, they bounce back towards the bat. By listening for these echoes, the bat can "see" the object. Many bats have large ears or specialized ear shapes, which is thought to help with echolocation.

Bats are the only mammals that can truly fly. A bat's wing contains the same basic bone types as a human's hand, including four elongated fingers and a short thumb on the leading edge of the wing. Although they are excellent fliers, bats cannot achieve the same powerful burst that allows a bird to take off from a perching position. Instead, bats must start off hanging by their feet and free fall to gain momentum before beginning to fly.

LITTLE BROWN BAT LIFE HISTORY

Diet Little Brown Bats, like all bats that are found in Maine, are insectivores. They feed on a variety of flying insects, including mosquitoes, moths, mayflies, caddisflies, and midges. Many of these insects are aquatic for part of their life cycle, so Little Brown Bats are often found roosting near water and foraging over it.

Habitat Little Brown Bats are found in a variety of habitats and are widespread across the country. They prefer to forage near bodies of water and commonly roost in manmade structures.

As with most small mammals, temperature is an important variable in the life of a Little Brown Bat. When temperatures are low, they conserve energy by entering torpor, a state in which metabolic rates and body temperature are reduced. Depending on the temperature, time of day, and season, bats will use one of several roost types when not foraging:

- Day roosts must be sheltered from predators and preferably dark or dim. These are often in or near buildings, although hollow trees or other natural crevices may be used. With the exception of nurseries, bats roost alone or in small groups during the day and are often torpid.
- Night roosts are small spaces where many bats will crowd together for warmth after feeding. Use of night roosts varies depending on evening temperatures and the availability of prey. If the night is warm and insects are abundant, bats may not need to roost during the night.
- Hibernacula are the places where bats congregate to hibernate and are typically caves or abandoned mines. To be a suitable site, a hibernaculum must remain above freezing and must have high humidity levels during the winter. Bats in Maine typically hibernate from early September until early to mid-May. There are three known hibernacula in Maine, although it is possible that bats may be hibernating in other locations as well.

Hibernation Little Brown Bats belong to one of only three groups of mammals in Maine that truly hibernate: resident bat species, jumping mice, and woodchucks. True hibernation is marked by a significant reduction in an animal's body temperature and metabolic rate for an extended period of time. These animals do not typically wake up during the winter and to do so is energetically costly, which is why White-nose Syndrome (WNS) is so problematic for bats (see more on WNS below).

Other animals do conserve energy in the winter by becoming less active, and this may range from periods of dormancy during especially cold weather to the "light hibernation" of Black Bears. These animals typically awaken to eat, eliminate waste, and in the case of bears, give birth.

Reproduction Little Brown Bats mate before hibernating, although ovulation and fertilization do not occur until females emerge from hibernation in the spring. Females then gather by the hundreds or thousands to give birth and care for pups. These nursery roosts are chosen for their warmer temperatures, which help the pups to grow faster. Bats typically give birth to a single pup, which reaches adult size and begins flying after approximately three weeks.

Attics and other warm building spaces are often chosen as nursery roosts, which can become problematic as female bats may abandon their young if disturbed. When possible, building maintenance or bat exclusion projects should be delayed until late summer after young can fly on their own.

CONSERVATION STATUS

Little Brown Bats used to be one of the most common bats in North America, but White-nose Syndrome (WNS) has caused a large drop in their numbers in recent years and they are now listed as endangered in the state of Maine. White-nose Syndrome is a fungal disease that affects bats and is particularly problematic for species that hibernate. It spreads easily among bats that are gathered in shared hibernacula and causes bats to arouse during hibernation. This costs them vital energy reserves and often leads to starvation. It was first documented in New York in 2006/2007, spread to Maine by 2011, and has killed more than one million bats in the Northeast since then.

The fungus originated in Europe and was brought to North America accidentally. Before its introduction to the U.S. no mass die-offs were associated with the fungus, possibly because European bats have co-evolved with the fungus and are therefore less vulnerable.

Although the rate at which bats are succumbing to WNS seems to be plateauing, their slow reproductive rates mean that recovery will take time as well.

GLOSSARY

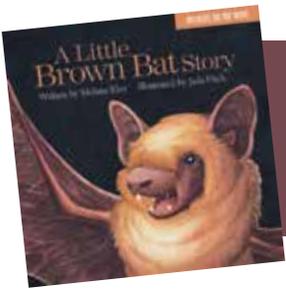
Nocturnal - active at night

Diurnal - active during the day

Crepuscular - active at dawn and dusk

Echolocation - the use of reflected sound for navigation

Hibernacula - overwintering locations used by an animal that hibernates



Discussion Questions

Before Reading

- What do you already know about bats? What do you predict the bat in the story will do?
- How do you feel about bats?
- Have you ever seen a bat? When and where did you see it?

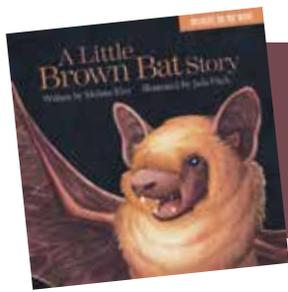
During

- What animals do you see in the pictures? Which ones are awake at night? During the day?
- What are the people doing in the pictures?

After Reading

- Why would people want to help bats?
- What can people do to help bats?





Lessons & Activities

Unit I: Bat Adaptations

GUIDING QUESTIONS

What do bats need to survive?

How are they adapted to fly and catch food?

NGSS Performance Expectations

K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive.

K-ESS2-1. Use and share observations of local weather conditions to describe patterns over time.

K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to fit their needs.

K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.

2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats.

Comparing Bats and People

Objectives: Students will compare and contrast people and bats and be able to describe several characteristics of mammals that people and bats share

Materials: images of bats (see appendix), Venn diagram printable (see appendix), chart paper, markers

Procedure:

1. Create a Venn diagram comparing humans and bats. Begin by allowing students to share ideas based on their own knowledge or observation of bat pictures.
2. Finish the comparison by sharing a few facts about bats (if these ideas haven't come up already) and letting students decide if they apply to humans or not:
 - a. Bats have fur/hair on their bodies.
 - b. Bats are warm-blooded and can create their own body heat.
 - c. Bats nurse their young.
 - d. Bats are nocturnal.
 - e. Some bats hibernate.

3. Use another color marker to highlight a-c on the list above, which should all be in the “bats and people” section of the Venn diagram. Explain that bats and people have these characteristics in common because they are both mammals. What other animals are also mammals? (Note: some mammals, such as whales, elephants, and naked mole rats have evolved to have little to no fur or hair, but they do still nurse their young).

Extension: Give students a list or pictures of other animals and challenge them to sort them into “mammals” and “not mammals” categories.

Echolocation Explorations

Objectives: Students will explore echoes and how bats use echolocation to hunt and navigate

Materials: blindfold, access to a solid wall, watch that ticks, hardcover book, two cardboard tubes

Procedure:

1. Bats use sound to find their way in the dark, so begin with a hearing challenge. Gather students together in a circle and ask them to close their eyes. Walk around the circle and explain that when you clap your hands, they should point to where they think you are, then open their eyes to see if they are right. How often do they pick the right direction? What happens if you move farther away, or clap more quietly? Try having the students push their ears forward by cupping their hands behind their ears, which should catch sounds and make it easier to hear.
2. Since most prey animals (and objects like trees or buildings) won't make noise to help a bat detect them, bats make the noise and then listen for the sound to return as an echo. Have students stand in front of a brick or other solid wall and clap or bounce a ball. Can they hear an echo?
3. Set up an echolocation demonstration by placing two long cardboard tubes in a V shape. Place a ticking watch in the opening of one tube to represent the bat making sounds and listen at the opening of the other. Without something for the sound to bounce off of at the center of the V, you shouldn't be able to hear anything. Place something solid, like a hardcover book, at the center and try again. Can you hear the watch tick?

Extension: “Bat and Moth” is a classic tag game that lets kids try their hand at using sound to find their way. Have the group stand in a large circle and select two students to start in the middle. Blindfold one and explain that they are the bat and must find the moth using only sound. The moth can see and move around in the circle to try to avoid the bat. Whenever the bat says “bat,” the moth must answer “moth,” just as an echo would bounce off of a real moth. The people standing on the outside of the circle are there to help keep the bat safe. If the bat gets too close to the edge, they can clap to alert the bat or gently guide the bat away from the edge. When the bat tags the moth (or gives up) the game is over and new bats and moths can be selected.

Bat Hunting

Objectives: Students will practice catching “insects” the way that bats do, and will know that bats fly erratically because of the way they hunt.

Materials: bubbles

Procedure:

1. Show students a video of a bat catching insects (see online resources section). How does it catch the insect? (scoops it into its mouth with its wing and tail).
2. Find a space where you can spread out, and set the scene as the students prepare to hunt like bats (describe the setting sun, have them stretch their wings, etc.). Explain that the bubbles are flying insects and that to catch them, they need to scoop it towards their mouths using their wings (forearms) or tail (ankles).
3. Let the group hunt for a while, then come back together to debrief. Was it easy or hard? Were they able to fly in a straight line or did they need to zig-zag? Some people think that bats fly erratically because they are blind, but it is actually because they are chasing insects.

Extension: Although the bats that live in Maine are insectivores, there are bats in other parts of the world that eat everything from nectar and seeds to fish and fruit! Have students research some of these other bat species and compare them to the Little Brown Bat.

Bat Pup Match-up

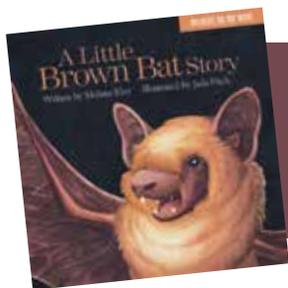
Objectives: Students will practice finding each other by sound, comparing that experience with how mother bats find their pups when returning to a nursery roost

Materials: two matching sets of sound shakers made from film canisters or other small, opaque containers filled with a variety of materials (beans, gravel, sand, rice, etc.)

Procedure:

1. Begin by describing the early life of a Little Brown Bat: Females have one pup at a time and do so in nursery roosts that they share with hundreds or even thousands of other mother/pup pairs. When the adults are out foraging during the night, the pups huddle together for warmth. The mothers and pups know each other’s voice and call out to find one another at the end of the night.
2. Divide the class into two equal groups. Explain that one half will be the adult bats and the other will be the pups. Have the adults “fly” to one side of an open room while the pups gather close together, and give each bat one of the shakers.
3. On your signal, have the adults fly back to the pups. All bats should shake their shakers and listen closely to find their match. Pairs that have found each other should sit down together so that it’s clear who is still looking for their partner.
4. Once everyone has found their match, have them carefully open the shakers to make sure they were correct! What made it hard to find their partner? What helped them to find the right person?

Extension: Continue to explore the way bats grow and the interactions between bats and their young through dramatic play. Young bats must be cared for until they can fly on their own, then must learn to fly and hunt. Give students opportunities to act these situations out, or bat puppets or stuffed animals to use in doing so. You could also have students write creatively from the perspective of a bat.



Lessons & Activities

Unit II: Bat Habitat

GUIDING QUESTIONS

**What makes a good bat habitat?
Where do bats go in the winter?**

NGSS Performance Expectations

K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive.

K-ESS2-1. Use and share observations of local weather conditions to describe patterns over time.

K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to fit their needs.

K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.

2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats.

Roosting Bats

Objectives: Students will be able to describe why and where bats roost upside down and will practice looking for potential roosting sites in natural and built environments

Materials: clothespins, black and brown construction paper, double-sided tape, paper with a small rectangular hole cut out, bat template (see appendix), drawing implements

Procedure:

1. Look at some of the illustrations in *A Little Brown Bat Story* that show the bat roosting. Where does it roost? (in trees and a cave). How does it hang? (upside down). Does it stand out or is it camouflaged? (camouflaged). Is it alone or with other bats? (both, depending on the timing).
2. Explain that bats roost in different locations depending of the time of day and year. Guide the group in pretending to be bats:
 - a. During the day, they roost alone in well hidden places (trees, buildings, under rocks, in wood piles). Have the students spread out and sleep during the day.

- b. As the sun sets and night falls, they can wake up and fly around, pretending to catch bugs. After hunting for a little while, the bats start to get cold! Gather the group together in a huddle and explain that bats look for night roosts where they can get close together to warm up.
 - c. Now that they're warm, they can hunt for a few more minutes before finding a daytime roost again.
 - d. When night falls this time, it is time to hibernate! Lead the bats to a cave where they can hibernate (hibernacula) and have them slow down to a hibernating state by taking deep breaths and staying very still and calm.
3. Bring the group back together and give each student a clothespin. Let them open and close it a few times. The spring mechanism is similar to bats' feet - it only takes energy to open, so they can hang upside down without needing to use their muscles to hold on. When they need to fly (or make a quick getaway), they can let go and use the downward momentum to start flying.
4. Have each student cut a bat shape out of construction paper and tape it to the clothespin, making sure that the feet align with the clipping end.
5. Lastly, have each student draw a type of roost site for their bat. The hole cut out in the paper is where their bat can clip on. If it's a hibernacula or night roost, encourage them to draw additional bats. Let students share their work with the larger group. Which roosts are natural? Are some bats roosting in built environments?

Extension: Walk through an outdoor area and look for potential roosting sites for bats. If there aren't a lot of trees, are there places near buildings where they could roost? Look at eaves, loose shingles, etc. Let the students take turns hiding and finding the clothespin bats in potential roosting sites (or anywhere they can reach to clip them!). Where can they be camouflaged best? If desired, introduce a few brightly colored bats to the mix. Can they be hidden as easily? Why are real bats not brightly colored?

Temperature Studies

Objectives: Students will perform an experiment to determine how color can influence temperature, and apply their findings to bat house design

Materials: construction paper in various colors (including black and white), small pieces of cardboard, thermometers

Procedure:

Introduction:

1. Explain that bats in Maine prefer warm roosting sites, especially when raising pups. Warmer temperatures help the bats conserve energy, and the pups grow faster in warmer environments. Therefore, since some colors reflect heat and others absorb heat, it is important to choose the color of a bat house wisely!
2. What scientific tool is used to measure temperature? (a thermometer). Show or review with students how to read a thermometer. Ask students to predict which color (of the choices available) will absorb the most heat and record their predictions.

Experiment:

1. Tape a thermometer in the center of each piece of cardboard and center a piece of construction paper on top. Tape around the edges so that the paper doesn't blow away. Leave one thermometer uncovered on cardboard as a control. Place each thermometer setup in full sun and take an initial reading.
2. Return after an hour or so and take new readings. Record your findings in a chart and compare. Which color heated up the most? Which colors did not heat up as much? Was anything surprising?

Conclusion:

1. Based on the results of the experiment, what color(s) would be best for a bat house in Maine? Have the students design a bat house.

Extension: Put the plans students created to use by painting a bat house to be installed on school grounds. You could also conduct a similar experiment to determine the best location for a bat house.

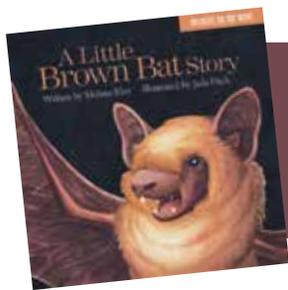
Bats in the Food Chain

Objectives: Students will explore how pesticide use can affect bats

Materials: insect cards (see appendix). Make enough copies so that you have enough for about 10 insects/student and draw a black dot on 1/4 to 1/3 of the cards.

Procedure:

1. Begin with a short discussion about people and insect pests. How does the bat in *A Little Brown Bat Story* help people? (by eating mosquitoes and insects that eat or damage crops). What are some other ways that people deal with insect pests? (bug spray, pesticides, etc.).
2. Explain that in this game, you own an apple orchard and the students are bats that live near the orchard. What will the bats eat? (insects). Spread the insect cards out (picture side up) around a common area and explain that each night, the bats will fly around to collect five insect cards before returning to their roost (seat).
3. Play one practice round. Then, after the students have foraged a second time, ask them to flip over their insect cards. Explain that although the bats were helping to eat some of the insects, you decided to use pesticides to protect your apples, too. Cards that have a black dot on the back were contaminated with pesticides. Have students count how many contaminated insects they have eaten:
 - a. 0-1 = healthy bat; b. 2-3 = sick; c. 4-5 = dead
4. Have any dead bats turn in their insect cards to be shuffled and redistributed. Healthy and sick bats should keep their cards and continue to count the total number of contaminated insects as you play several more rounds. Any dead bats can help with setting up the cards, etc.
5. Pause the game for a brief discussion. What is happening to the bat population? (declining). What is happening to the insect population? (increasing). Since you, as the orchard owner, don't want all your apples eaten by insects, what could you do? Remind students that using more pesticides is one option. If students say that you should stop using pesticides, point out that the diminished bat population won't eat many of your pests and challenge them to think of ways you could attract bats.
6. Play one last round without the contaminated insect cards. Explain that the bat houses you installed around your orchard attracted new bats and have all the students participate again.



Lessons & Activities

Unit III: People and Bats

GUIDING QUESTIONS

How can people help bats?

How can bats help people?

NGSS Performance Expectations

K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive.

K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to fit their needs.

K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.

K-ESS3-3. Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.

2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats.

K-2-ETS1-1. Ask questions, make observations, and gather information about a new situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

How Many is 1,000?

Objectives: Students will work together to create a visual representation of the 1,000 mosquitoes a bat can eat in an hour while practicing cooperation, counting, and math skills.

Materials: Chart paper, 25 to 50 copies of the stamping template (see appendix) cut in half, rubber stamps or markers, glue sticks

Procedure:

1. Begin by reviewing the fact that a Little Brown Bat can eat 1,000 mosquitoes in an hour. Explain that you will be working together to stamp or draw 1,000 insects so that everyone can visualize just how many that is.
2. Show one of the stamping templates and, together, count the squares (10). Then, count by tens as you create a pile of ten templates (100). If you count by 100s, how many piles would you need to make 1,000? (10).
3. Have the students work in small groups or independently to fill the templates by stamping or drawing insects in each of the ten boxes. Once a template is full, they can add it to the chart paper (try to group finished templates in rows of ten, if possible).
4. Once all templates are full, take a moment to appreciate just how many insects there are. You may wish to hang the completed poster(s) in a public area so others can do the same!

Extension: In order to eat 1,000 insects in an hour, a bat would have to consume 16-17 per minute. Using a stopwatch or a clock with a seconds hand, challenge your students to do some of the following tasks in a minute: say the word “mosquito” sixteen times, pick up sixteen plastic bugs with tweezers, etc.

Bat Attitude Survey

Objectives: Students will survey their peers and communities to find out how people feel about bats, and will practice representing and reporting their findings using graphs.

Materials: copies of the sample survey (see appendix), clipboards, writing utensils, chart paper

Procedure:

1. Begin with a large group discussion. What are some animals that most people like? Are there some animals that people tend not to like or tend to be afraid of? Sometimes people are less likely to help animals that they are afraid of. For example, people who are afraid of spiders might squish them instead of letting them go outside. Therefore, in order to help bats, it would be helpful to know how the people in the school and community feel about them.
2. You can use the sample survey (see appendix) or work together to create your own by brainstorming a list of words—good and bad—that people might use to describe bats.
3. Help students administer the survey to other students and teachers at school. If possible, you may also wish to have them survey family members.
4. Compile the results into bar graphs, then discuss the results. Which words were most commonly used to describe bats? Were they positive or negative descriptions? What might help people feel differently?

Extension: Visit the “Take Action” section for some ways you can help give bats a PR boost. Afterwards, you may wish to repeat the survey. Did anything change?

Bat Posters

Objectives: Students will create posters that use visual art and persuasive language to highlight the ways that bats help people

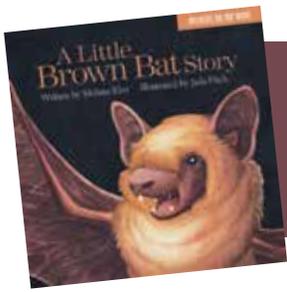
Materials: posterboard, writing and drawing implements, books or other information about bats

Procedure:

1. If people need to learn more about bats in order to care about or want to protect them, what are some things they should know? Use a mind map to brainstorm specific messages that might help convince people that bats are worth helping. For example, if you start with the idea that bats help people, or bats are interesting, what facts could be used as evidence?
2. Have students work individually or in small groups to create posters that illustrate one or more of the messages from the class brainstorm in step 1.
3. Hang the posters in a public space!

Extension: Consider widening the scope of this project beyond Maine. How do bats in different parts of the world help with seed dispersal and pollination? What are some interesting facts about other species of bats?





Take Action

Restore Bat Habitat

Work with your school and community to create and preserve potential roosting sites for bats by leaving standing dead trees (snags), allowing bats to use loose shingles, eaves, or outbuildings, and putting up bat houses.

Public Relations for Bats!

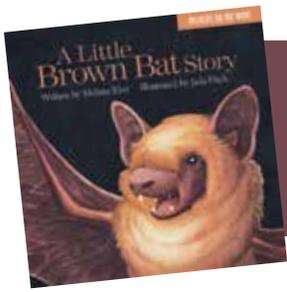
Bats often have an unfair reputation and your work to counteract that doesn't have to end with the Bat Posters lesson in Unit 3. Have your students brainstorm other ways to help people learn about bats. They may want to create flyers, film a PSA, or even host a bat education event for the community.

What to do if there's a BAT IN YOUR HOUSE

A stray bat that has found its way into your home is often a young bat that has recently begun foraging on its own. Help it safely outside by doing the following:

1. First, isolate the bat in a darkened room and leave a door or window open to the outside. The bat should eventually find its way out on its own. Let an adult check to see if the bat has left.
2. If for some reason the bat cannot get out on its own, you may need to capture and release it. Make sure to wear thick leather gloves and wait for the bat to land. Carefully cover it with a cardboard box and slide another piece of cardboard underneath. Visit Bat Conservation International for more information on how and when to release it: <http://www.batcon.org/resources/for-specific-issues/bats-in-buildings/removing-a-single-bat>.
3. Bats do not seek contact with people and are unlikely to bite unless handled. However, they can be a vector for rabies. If you are bitten by a bat, or if a bat comes into contact with a young child or pet, you will need to capture the bat so it can be tested for rabies. Contact your local animal control office for further instructions and seek medical attention immediately.





Take Learning Outside

To extend your study of bats and their habitat to the outdoors, try some of these ideas:

Fall

- Many animals, including bats, are preparing to hibernate or migrate. Look for squirrels caching acorns, birds feeding on seeds and fruit, etc. What insects are still active?

Winter

- What animals can you observe that are still active in the winter? How are other animals surviving?
- Even without bats out and about, winter nights can be busy as owls court and nest. Listen for their calls at night, and try looking for evidence of them during the day.

Spring

- Bats emerge from hibernation when temperatures rise. Keep an eye out for active insects, which means food for newly active bats!
- Aquatic insects make up a big part of the Little Brown Bat's diet. Spring and summer are great times to visit a pond or stream to scoop for the larval forms of many of these insects. Don't forget to look for tadpoles and frogs, too!

Summer

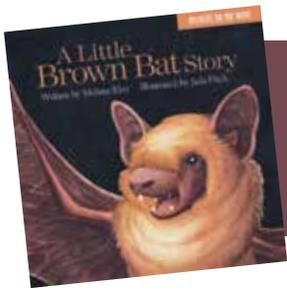
- Take advantage of relaxed summer bedtimes to observe nature at night. What animal behaviors do you notice as the sun sets?

The BENEFITS

The benefits of taking your students outside are multi-fold. Getting students moving and exploring in different settings offers physical benefits and gives them a chance to recharge. Connecting what you do outside with what happens in the classroom provides opportunities for students to excel and engage in different ways. Perhaps most importantly, it also provides a framework of shared experiences from which you can all work. Young children learn best from firsthand experience, but may not have ever looked under a fallen log or followed a bee from flower to flower.

These benefits are magnified if you make outdoor learning a regular habit. Going outside and, if possible, visiting the same location throughout the year will highlight seasonal changes and spark lines of questioning that link to bigger ecological concepts. For example, hibernation and migration make much more sense if you've noticed insects and flowering plants getting scarcer and felt temperatures getting colder throughout the fall. Furthermore, as you and your students become more comfortable with the routines and expectations associated with outdoor learning, it will get easier and you'll be better able to take advantage of teachable moments as they arise.

The ideas here are only a starting point. At Maine Audubon, we want all educators to feel confident and supported in creating these types of experiences for their students. We provide this support through classroom visits that can serve to introduce content, field trips and field studies at our sanctuaries or local parks, curricular coaching, teacher workshops, and rentable materials through our Educator Resource Center. Visit maineaudubon.org for more information.



Appendix

Maine Early Learning and Development Standards

Earth Science:

- Demonstrates, through observation and investigation, an understanding that human action impacts the earth (i.e., use of resources and recycling, the process from cutting trees to recycling paper)

Life Science:

- Uses senses to observe and describe properties of familiar plants and animals
- Uses vocabulary for naming plants and animals moving beyond generic labels (e.g. “bug”) to names of specific creatures (e.g. “ant,” “beetle”) and uses symbols or icons to identify where they see such creatures
- Develops plans, based on observations and guided inquiry, to care for plants and animals in the classroom and surrounding area
- Observes and describes animals in his/her immediate environment to learn what they need to live
- Uses nature journals, tally sheets and resource materials, with support, to summarize observations (e.g., make connections between the types and numbers of birds coming to a feeder in summer or winter by counting and categorizing)
- Listens to accounts and discusses pictures found in fictional or non-fictional books or media to enhance vocabulary and concept knowledge of living things and their environments
- Identifies problems affecting the lives of plants and animals (including themselves) and generates possible solutions
- With teacher support, creates drawings or models for possible solutions
- Compares tools or solutions and reflects on what works well
- Designs and creates materials to change the behavior or incidence of creatures (e.g. bird feeders, butterfly gardens) in places

Book Lists: Children’s Books

Nocturnal Animals

- *Daylight Starlight Wildlife* by Wendell Minor: beautiful illustrations that pair diurnal animals with their nocturnal counterparts
- *Flashlight* by Lizi Boyd: this wordless book features the nighttime explorations of a child armed with a flashlight. Readers will delight in looking closely to see what is (and isn’t) illuminated by the flashlight’s beam.
- *Forest Bright, Forest Night* by Jennifer Ward: begin with either day or night, but take note of which animal is awake and which is sleeping. Halfway through, you flip the book over and the roles reverse!
- *Where are the Night Animals?* by Mary Ann Fraser: a look at eight nocturnal animals, with details about how and why they are active at night

Bats

- *Baby Bat’s Lullaby* by Jacquelyn Mitchard: A mother bat lovingly soothes her pup to sleep with rich, poetic descriptions that will challenge students to analyze the figurative language
- *Bats at the Library* by Brian Lies: a thoroughly silly account of bats frolics at a public library after dark. A great tool for winning over anyone who persists in thinking bats are gross or scary.
- *Bats: Biggest! Littlest!* by Sandra Markle: detailed text and photographs that explore different bat adaptations
- *Bat Loves the Night* by Nicola Davies: lyrical but scientifically sound text paired with lovely illustrations
- *Bats: Night Fliers* by Besty Maestro: A higher-level introduction to bats of the world
- *Beautiful Bats* by Linda Glaser: simple text and clear illustrations detailing how Little Brown Bats hunt and fly
- *Good Night, Bat! Good Morning, Squirrel!* by Paul Meisel: another silly tale of friendship mostly recounted in notes that bat and squirrel leave to each other when they find themselves sharing a home

- *Eyewitness Juniors #13: Amazing Bats*: two-page spreads with photos and information around topics like “Seeing in the Dark,” “The Nursery,” and “Bat Snacks.” Provides a good chance to practice using nonfiction text features
- *Shadows of Night: The Hidden World of the Little Brown Bat* by Barbara Bash: includes lots of great detail about young bats growing up, and an excellent illustration of a bat hunting by scooping up insects with its wings
- *Stellaluna* by Janell Cannon: the classic tale of a fruit bat adopted by a family of birds. Highlights some of the differences between bats and birds with a sweet message about friendship overcoming those differences
- *Zippering, Zapping, Zooming Bats* by Ann Earle: a comprehensive look at bats, including pages that touch on bat anatomy, life history, and how people interact with bats

Book Lists: Field Guides

- *Stokes Beginner’s Guide to Bats*: photographic guide to 45 North American species. Each entry includes information about diet, habitat, feeding patterns, and more
- *Bats of the World: a Golden Guide*: illustrations paired with narrative entries, along with a detailed introduction with lots of valuable background information

Adult Resources

- *Balanced and Barefoot: How Unrestricted Outdoor Play Makes for Strong, Confident, and Capable Children* by Angela Hanscom: written by a pediatric occupational therapist (and founder of TimberNook), an easily accessible description of the developmental benefits of outdoor play. A good one to recommend to parents
- *Nature Preschools and Forest Kindergartens: The Handbook for Outdoor Learning* by David Sobel: engaging accounts from existing programs along with guidance on everything from curriculum development to risk assessment
- *Hug a Tree and Other Things to Do Outdoors with Young Children* by Robert Rockwell, Elizabeth Sherwood, and Robert Williams: a classic compilation of outdoor activities for young children
- *Project Seasons: Hands-on Activities for Discovering the Wonders of the Natural World* by Deborah Parrella: a compendium of seasonal activities

Songs and Fingerplays

I Love the Nighttime (to the tune of “You Are My Sunshine”)
 I am a bat and
 I love the nighttime
 That is when I fly around
 I am nocturnal
 I love the nighttime
 I’m a bat, the night is when I’m found

Bats are Sleeping (to the tune of “Frere Jacques”)
 Bats are sleeping, bats are sleeping
 Upside down, upside down
 Waiting for the setting sun, waiting for the night to come
 Then they’ll fly around, then they’ll fly around

Bats are resting, bats are resting
 Upside down, upside down
 Waiting until they feel warm, waiting for the bugs to swarm
 Then they’ll fly around, then they’ll fly around

Little Bat (to the tune of “Twinkle, Twinkle”)
 Flutter, flutter, little bat
 How I wonder where you’re at
 Swooping through the darkest night
 You find your way without a light
 Flutter, flutter, little bat
 How I wonder where you’re at.

INSECT CARDS: CODLING MOTH



INSECT CARDS: TARNISHED PLANT BUG



MAINE BATS

Big Brown Bat

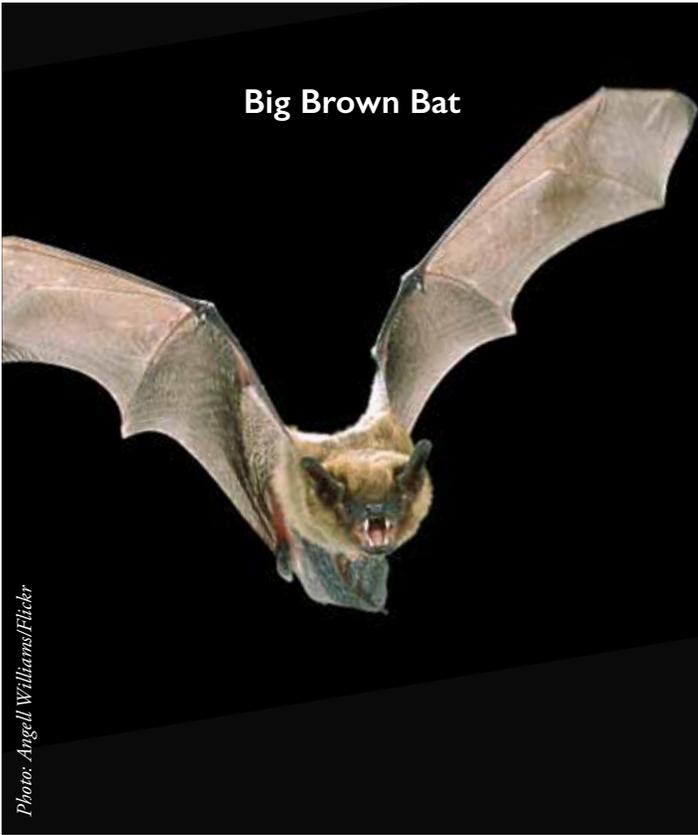


Photo: Angel Williams/Flicker

Eastern Small-footed Bat

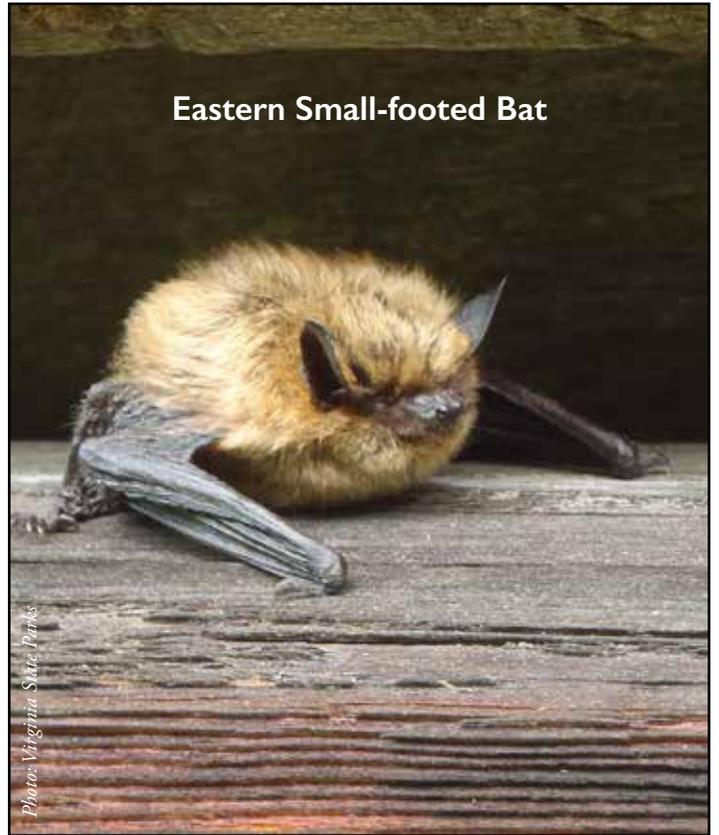


Photo: Virginia State Parks

Little Brown Bat

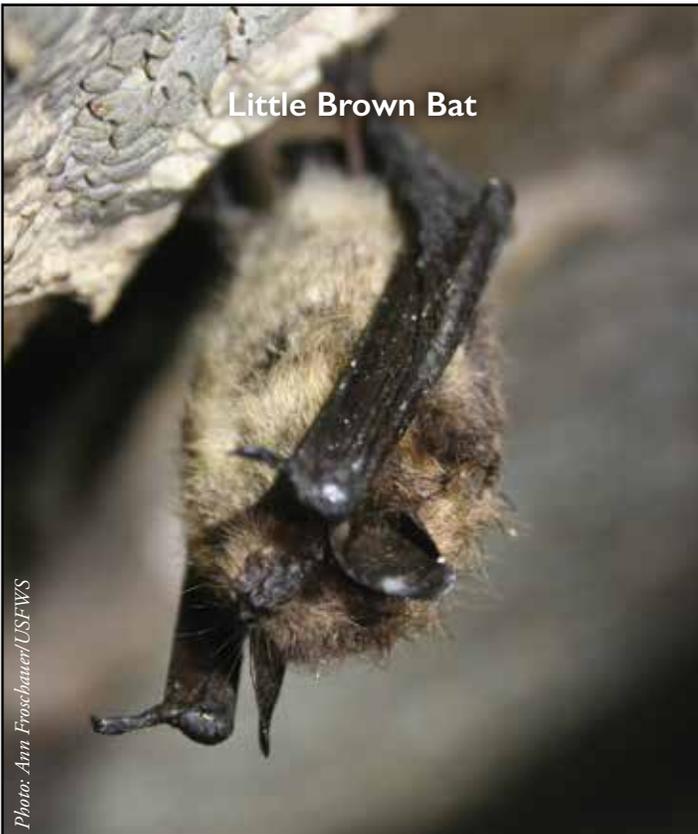


Photo: Ann Froschauer/USFWS

Northern Long-eared Bat



Photo: USFWS

MAINE BATS

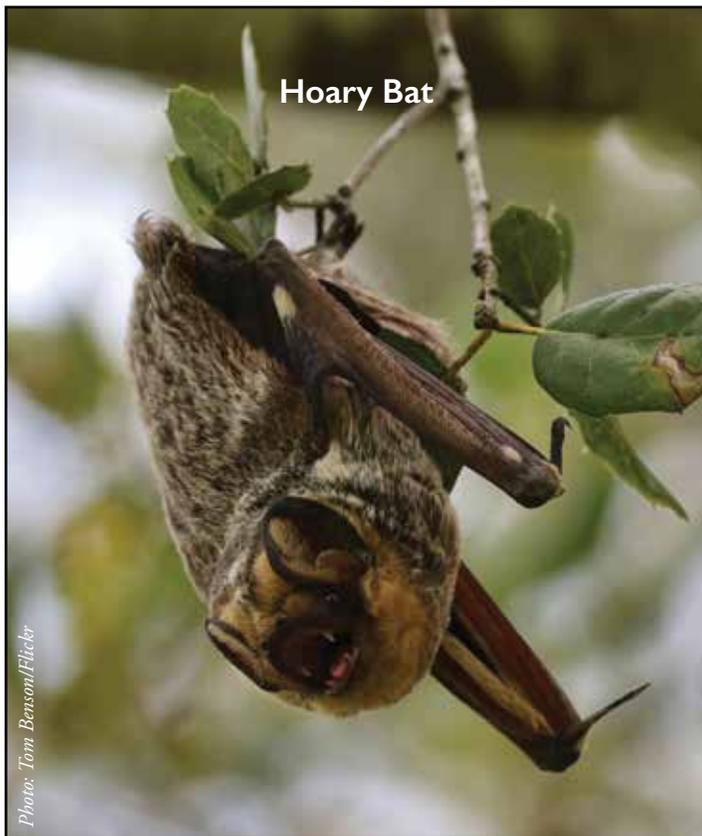
Tri-colored Bat



Eastern Red Bat



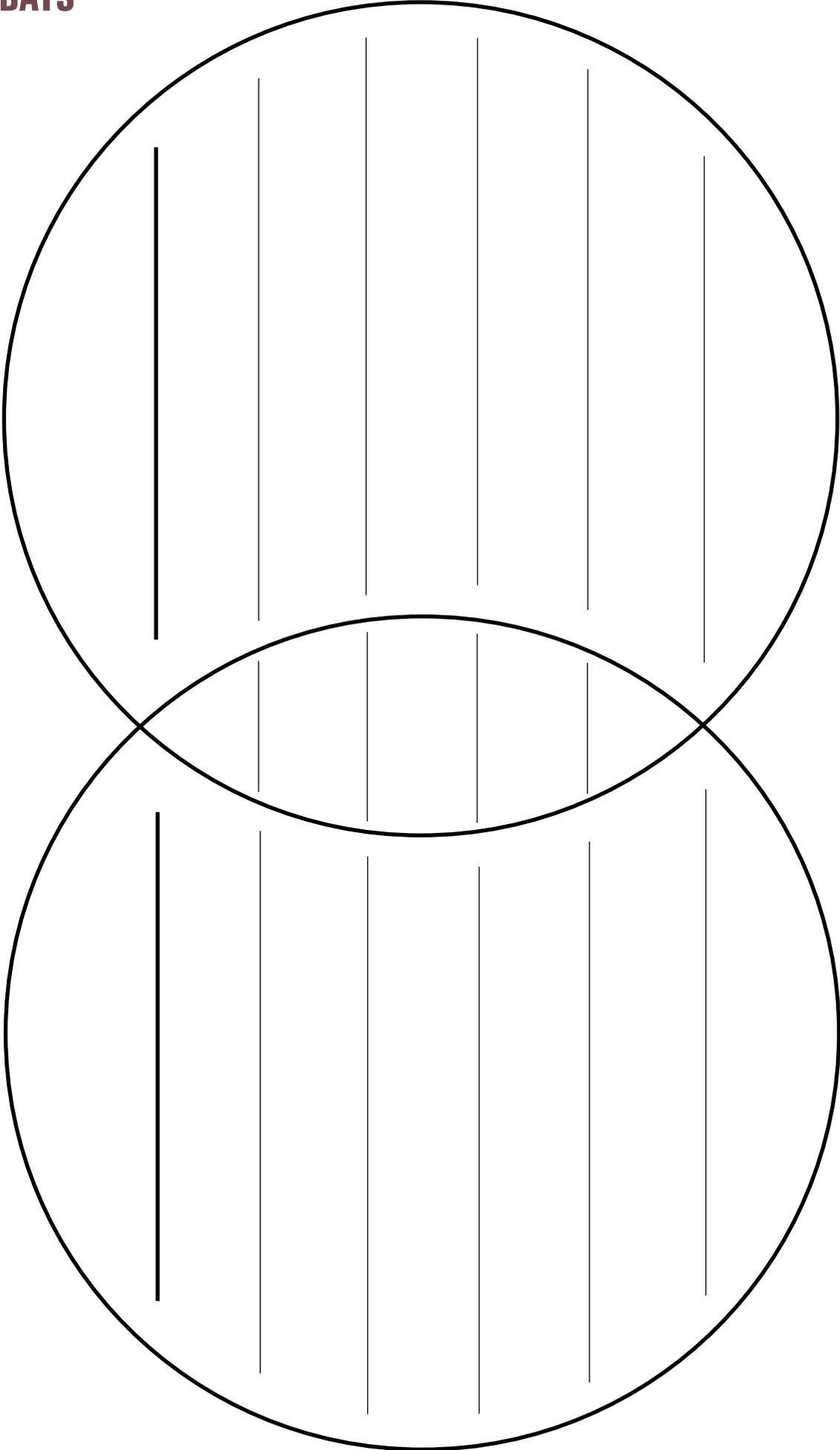
Hoary Bat



Silver-haired Bat



**COMPARING BATS
AND PEOPLE**



STAMPING TEMPLATES

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BAT TEMPLATE



SAMPLE BAT ATTITUDE SURVEY



help people?

hurt people?

neither?

cool

gross

interesting

scary

