Measuring Up to a Little Brown Myotis

How do you measure up to a little brown myotis? Fill in the chart below to find out!

	Little Brown Myotis	You
Kind of Animal	Mammal	
Wingspan (arm span)	Average 10.5 inches	
Number of Fingers	4 fingers and 1 thumb	
Weight	7-14 grams, about as much as 2 crayons	
Heart Beats per Minute Resting	Less than 100	
		Sit down, count heart beats for 15 seconds, multiply by 4.
Heart Beats per Minute Active	As many as 900	
		Do jumping jacks for 1 minute, count heat beats for 15 seconds, multiply by 4.
Wing Beats (Arm beats) per Second	12	
		Count number of arm flaps for 10 seconds and divide by 10.
Food Eaten in One Day	8.5 grams to 16.8 grams = 1.2 times weight	
		1.2 times your weight
Lifespan	One of the longest lived mammals for its size: average 10 years, but can live as long as 30 years or more	



FAT BAT HABITAT

Objective: Students will describe the food habits of the little brown bat and limiting factors related to foraging.

Method: Students pretend to be little brown bats that must forage to stay alive.

Background: The majority of bat species, including Idaho's 14 species, are insectivorous. Throughout their lifetimes, bats encounter certain hazards or obstacles. There are limiting factors.

Limiting factors fall into two basic categories: natural and human-caused. Disease, freezing temperatures and predators are examples of natural limiting factors. Vandalism, cave disturbance and improper pesticide use are examples of human-caused limiting factors.

The average adult little brown bat can consume up to 600 mosquitoes per hour and up to one-third its body weight during one nightly feeding. This figure may be affected by a number of limiting factors.

This activity is designed to stimulate students thinking about the amount of food the average Idaho bat needs to consume each night and the limiting factors that might impact that process.

Materials:

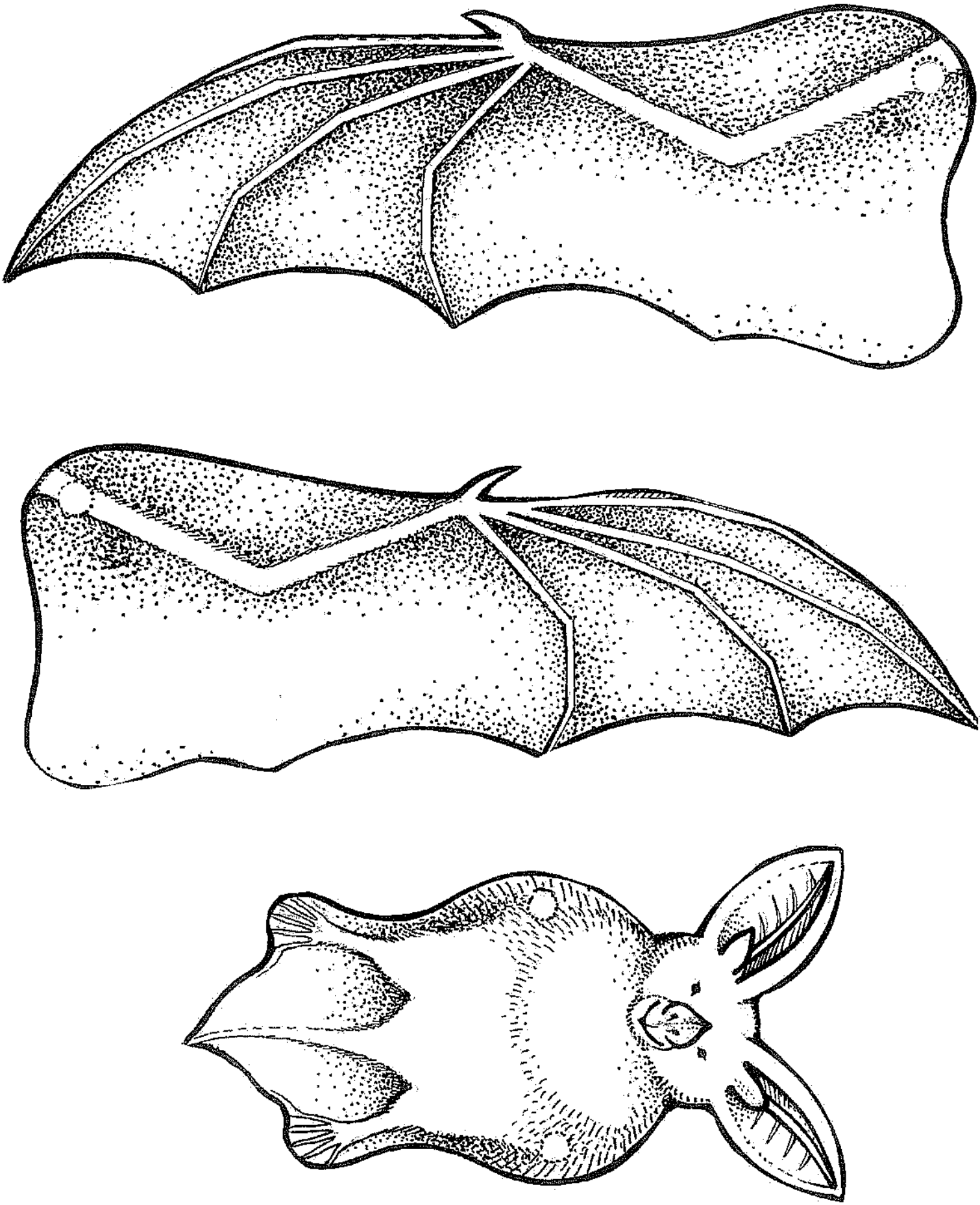
Open area or classroom
Food tokens (mosquito cards) 20 white, five green and two blue tokens per student
One envelope or paper bag per student (stomach)

Procedure:

1. Explain to students that they will be representing bats foraging for insects at night.
2. Give each child an envelope (stomach). Scatter the mosquito tokens in the open area. Have students line up along the edge of the open area. The edge will represent the location of the colony. Tell students that bats emerge at dusk. When you say it's getting darker and tell them to go, they may "emerge" and begin collecting mosquito tokens. Tokens should be placed in their stomachs.
3. Allow time for each student to gather approximately 30 insects (approximately 1 minute.)
4. Have students count how many mosquitoes they ate. Are there still some left? Would this be true in real life? (yes) Discuss how bats reduce the mosquito population, but if they ate all of them, they wouldn't have enough to eat the next night. Also discuss what would happen if we didn't have bats to eat mosquitoes.
5. Next have students subtract tokens according to the chart below. Review limiting factors.
6. Students need at least 20 white tokens to survive. Why did some bats survive and others did not? What limiting factors might have led to the death of bats? Classify them as natural or human caused.

White	Food (Mosquito Cards)	
Green	natural limiting factors	lose one white token
Blue	human caused limiting factors	lose two white tokens

MASTER FOR FAT BAT HABITAT



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Hands-on Activity: Echolocation in Action!

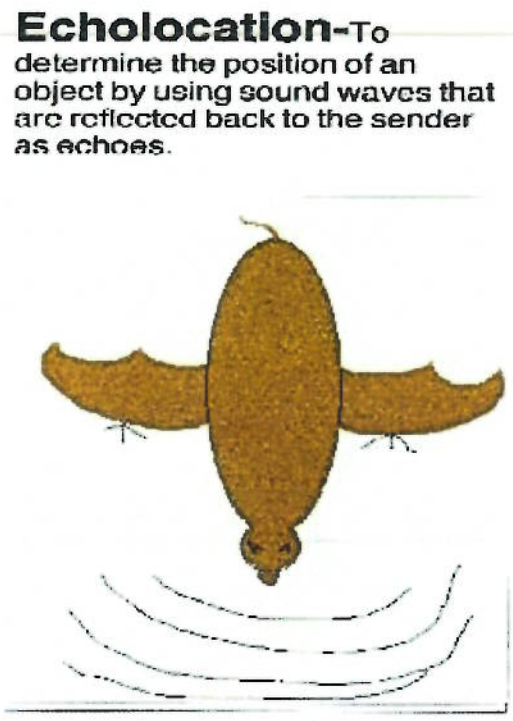
Contributed by: Integrated Teaching and Learning Program, College of Engineering, University of Colorado Boulder

Quick Look

Grade Level: 4 (3-5)
Time Required: 30 minutes
Expendable Cost/Group: US $1.00
Group Size: 2
Activity Dependency: None
Subject Areas: Physical Science

Summary

In this activity, students will experience echolocation themselves. They actually try echolocation by wearing blindfolds while another student makes snapping noises in front of, behind, or to the side of them.
This engineering curriculum meets Next Generation Science Standards (NGSS).



Students experience echolocation

Engineering Connection

We need to know where things are, and many times we need to be able to "see" something even when it's dark outside or something is far away and obstructed by the ocean or clouds. Engineers have learned from nature how to use sound and radio waves to locate objects. This is called SONAR (SOund wave Navigation And Ranging) and RADAR (RAdio wave navigation And Ranging).

Learning Objectives

After this activity, students should be able to:

- Explain the basics of echolocation.
- Explain that engineers developed SONAR based on natural echolocation.

Educational Standards

- NGSS: Next Generation Science Standards - Science
- Common Core State Standards - Math
- International Technology and Engineering Educators Association - Technology
- State Standards

Materials List

Each group needs:

- 1 blindfold
- Clipboard or hardcover book
- 2 pencils
- Variety of crayons
- 2 copies of the Echolocation Worksheet
- 2 copies of the Echolocation Bar Graph Worksheet

Worksheets and Attachments

Echolocation Worksheet (doc)
Echolocation Worksheet (pdf)
Echolocation Bar Graph Worksheet (doc)
Echolocation Bar Graph Worksheet (pdf)

Visit [www.teachengineering.org/activities/view/cub_soundandlight_lesson4_activity1] to print or download.

Pre-Req Knowledge

Definitions of longitudinal and transverse waves (Lesson 1), wavelength and amplitude (Lesson 2), Frequency (Lesson 3), Sound Waves (Lesson 4).

Introduction/Motivation

We have been talking about sound waves and how animals and engineers use sound waves to "see" underwater or in the dark. Who remembers what it is called when animals do this? (Answer: echolocation) That's right — *echolocation*! Engineers developed a technology based on the natural echolocation that animals use. It works pretty much the same way, but we call it something different. Who remembers what it is called? (Answer: SONAR) Terrific! *SONAR* is a great example of how engineers can learn from the world around us and use ideas from nature to create new ways to help people.

Today you are going to have a chance to try out echolocation for yourselves. We are going to break up into teams of two. Then, one person wears a blindfold and guesses where the sound is coming from as the other person makes snapping or clapping noises in front of them, behind them or to their side. It is a fun challenge to learn about echolocation. Are you ready to try it out? Let's get started!

Procedure

Background

Sound travels in waves through the air to the ears. Depending on the location and intensity of the sound, the ear can usually locate the direction of the sound.

Animals — such as bats, whales and dolphins — use sound to see by emitting sounds that echo off other objects and then return to their ears. Depending on how long it takes the sound to reach their ears and the direction it comes from, these animals can determine the location of the object.

Engineers have mimicked this natural echolocation in Sonar and Radar, which work basically the same way as echolocation in animals.

In this activity, students will try to determine the location of nine sounds made from various locations in front of, behind or to the side of them. Try to spread students out as much as possible so that each team can focus on their own clapping or snapping noises without being distracted by other teams. Conducting this activity outside or in the school gym is an excellent idea.

Before the Activity

- Copy the attached worksheets (each student needs one Echolocation Bar Graph Worksheet and one Echolocation Worksheet).
- Make enough blindfolds (large bandanas or strips of fabric) so that each group of two students has one blindfold.

With the Students

1. Go over the activity Introduction.
2. Break the students into groups of two.
3. For each team, have one student sit in a chair and the other stand nearby with the Echolocation Worksheet.
4. Have students gently blindfold their partner so that they are unable to see. Remind them not to peek!
5. Have the non-blindfolded student snap or clap their fingers while the other student guesses the location from where the snap came.
6. Students should record their partner's response on the Echolocation Worksheet after each snap/clap.
7. Have students follow the Echolocation Worksheet for all nine snaps or claps, and record all responses on the sheet. Students should put a check mark if their partner guessed correctly and an X if they guessed incorrectly.
8. Ask students to write down the number of times they guessed correctly for each location (side, behind or in front).
9. Have students switch places and repeat the procedures. Once both students have guessed, have them give each other their worksheets, so they can use them to create their own bar graphs.

10. Help students color in their Echolocation Bar Graph Worksheet with the number of times that they guessed correctly for each location.
11. Talk as a class about the results! Discuss why some locations may be harder to guess than others. (Be aware that noise from other teams will likely be a contributing factor to erroneous guesses.)

Assessment

Pre-Activity Assessment

Who Remembers?: Ask students to raise their hands and share one thing they remember from the lesson. Once students have shared, they must leave their hands down.

Activity Embedded Assessment

Teacher Observation: Walk around while students are completing the activity and assist them as needed. Talk with students about how challenging or simple it is to locate the sounds. Remind students that some animals are great at echolocation, and engineers mimic (in Sonar) this natural animal response.

Post-Activity Assessment

Results Analysis: Have several students share their bar graphs (if you have time, you can make one giant bar graph for the entire class). Talk about the results, and discuss why some locations were perhaps harder to guess than others. Encourage students to think about why noise from other teams may have made it harder to guess the location of the snaps or claps.

Investigating Questions

- How does Sonar work? Do a class project to learn more about how engineers developed and use Sonar.
- How does ultrasound work? Research new developments (such as 4D ultrasounds) in imaging technology for ultrasounds.

Safety Issues

To ensure groups do not trip over and bump into one another, conduct this activity in an area with plenty of space.

Remind students to stay seated while blindfolded.

Troubleshooting Tips

Some students may not feel comfortable being blindfolded; if this is the case, allow them to complete the experiment with their eyes closed.

Activity Extensions

In a quiet place with few obstructions to trip over, allow the students to wear a blindfold (or close their eyes) and try walking around. They can try making noises, like clicking, or snapping their fingers. See if they can tell when they are close to a wall, another person, or a door. Several non-blindfolded students and/or adults should monitor the group to ensure no accidents occur.

Activity Scaling

For upper grades, have students analyze the data using a graphing tool like Excel®. Students can plot actual location of the snap versus real location and then find the percent of correct responses.

For lower grades, the activity should still be appropriate, although students may need more support and guidance.

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Name: _____ Date: _____

Echolocation in Action! Activity – Echolocation Worksheet

Recorder (team partner): _____

Location	Actual Guess	Right?	Wrong?
Front			
Behind			
Side			
Side			
Behind			
Front			
Front			
Behind			
Side			

Number of times the "front" guess was right: _____

Number of times the "side" guess was right: _____

Number of times the "behind" guess was right: _____

Name: _____ Date: _____

Echolocation in Action! Activity – Echolocation Bar Graph Worksheet

Number of times the "front" guess was right: _____
Number of times the "side" guess was right: _____
Number of times the "behind" guess was right: _____

Color in the bar graph below with the number of times each guess was right. If the answer is 0, leave that group blank.

3			
2			
1			
	Front	Side	Behind

Which location had the most correct guesses? (If it was a tie, you can write both locations). _____

Which location had the least correct guesses? _____

What are your ideas about why some locations were easier or harder to guess?

_____

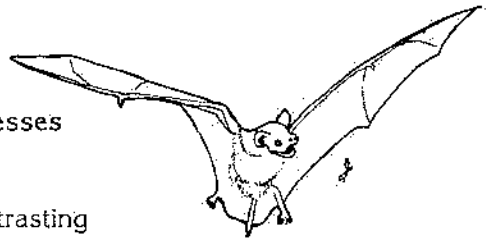
_____

Sensational Ears

Topic Area
Echolocation

Introductory Statement
In this simulation activity, students will attempt to catch a moving object using only their sense of hearing.

Science
Life science
adaptations



Math/Science Processes
Observing
Predicting
Comparing and contrasting
Generalizing
Communicating

Materials
For each group:
lid from paper box (see *Management*)
marble

For each student:
bat ears
a 5-ounce paper cup

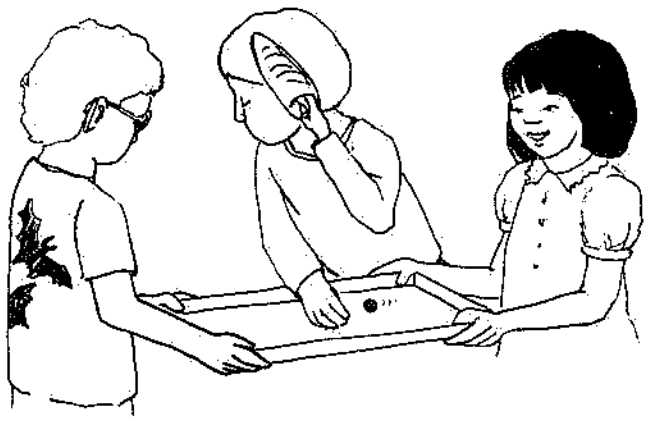
Key Question
How can an insect-eating bat catch its prey using only its sense of hearing?

Background Information
Insect-eating bats locate their prey utilizing echolocation. They emit sounds from their mouths and noses. These sounds bounce back as echoes. The bats' sensitive hearing allows them to hear variations in pitch which help them locate their prey. Echolocation enables the bats to figure the speed and direction the insects are flying. Some bats which use echolocation also have other body adaptations which enable them to use their wings and tail to scoop up insects and place them into their mouths while flying.

In this simulation, the students cannot use echoes to locate a moving object; they can, however, use the actual sounds made as an object moves to attempt to locate it while they have their eyes closed.

Management
1. Copy-paper box lids, cardboard trays, or other shallow boxes are suitable for use in this activity.
2. The students should not be able to see the marble roll in this activity. Blindfolds interfere with the student's hearing and the bat-ear placement. It is easiest just to ask the student who is designated the "bat" to close his or her eyes.
3. Students in small groups of three or four will be assigned jobs and the jobs will be rotated after each turn. The "bat" (with eyes closed) will attempt to catch the marble as it is rolled gently across the bottom of the box lid. The two other students will be assigned as "movers." They should each take one end of the box lid and gently raise and lower the ends to make the marble roll. In groups of four, the fourth person will be the observer to check that the rules are followed for snatching the marble.
4. It must be emphasized that the "bat" must quickly snatch at the marble and use only the fingers and thumb of one hand (not the palm of the hand or the arm) when attempting to catch the marble.
5. Allow about 15-20 minutes to complete this activity.
6. Bat ears are most effective and durable if copied on card stock or tag. Prior to the activity students should cut out the front and back of the ear. The front and back part of the ear should be glued around the perimeter leaving an opening where indicated.
7. Prior to the activity, the teacher should gather the box lids, marbles, and duplicate the bat ears for each student.

Procedure
1. Ask the *Key Question:* How can an insect-eating bat catch its prey using only its sense of hearing?
2. Direct students to think about whether it would be hard to catch something they could not see. Show them a box lid and marble. Roll the marble in the box lid and ask students if they can hear it. Tell them that the person chosen to be the "bat" will have to close his or her eyes so the marble cannot be seen. Demonstrate how to use the bat ears by sliding the hand into the ear like a mitt. The hand will cup the back of their ear. Because the student will have to rely upon the sense of hearing, "bat ears" supported by the cupped hand will help to funnel the sound.



3. Distribute the box lid, marbles, and bat ears to each group.

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4. Have students choose jobs.
5. Without closing their eyes, let students practice catching the marbles by snatching them with their thumbs and fingers.
6. After the practice period, instruct students who are the "bats" to first put on their bat ears. You may want to help them decide which hand to use for catching the marble. They probably will have greater dexterity using their dominant hand.
7. Instruct the "movers" to gently tip the box lid allowing the marble to roll. After the "bat" catches the marble, rotate jobs until all students have had an opportunity to catch the marble.
8. After the discussion, ask students to write on the front of their bat ears (lines are provided) how if felt to catch the marble using only their sense of hearing.

Discussion

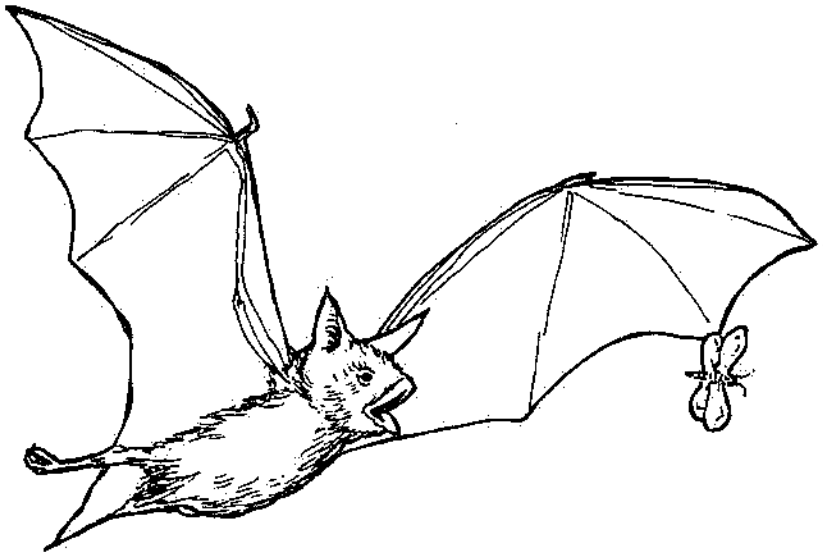
1. Was it as easy for you to catch the marble with your eyes closed as when you could see it? Explain.
2. Did anyone develop a strategy to help you find the marble while you had your eyes closed? What was the strategy?
3. What do you know about the physical characteristics of bats that use echolocation? [they have large ears]
4. How do the large ears help them locate their food?
5. Explain in your own words how bats use echolocation.

Extensions

1. Use hard round candy instead of marbles and the "bats" can eat their food.
2. Cover ears, close eyes, and let students attempt to catch the marble.
3. Research and draw ear and head shapes of bats that use echolocation as the means of catching their prey.

Major Conceptual Components

- Bats live in diverse habitats where their unique structures allow them to meet their basic needs.
- Bats have unique structures which allow them to meet their basic needs.
- Bats have unusual facial characteristics such as nose leaves, enormous ears, and intricate faces which allow them to find and eat their food.
- Some bats use sound to help them communicate and navigate.



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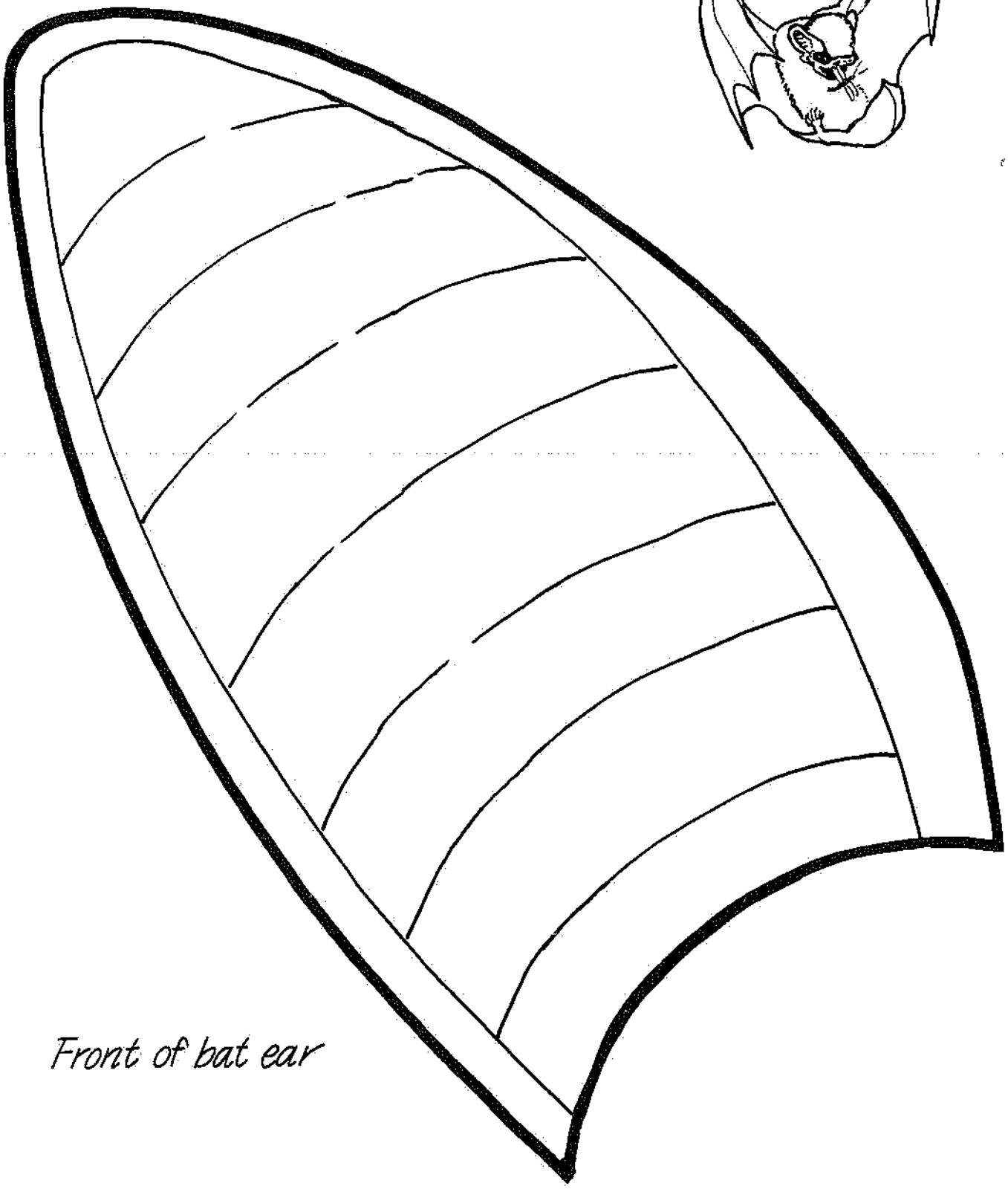
SENSATIONAL EARS



Front of bat ear

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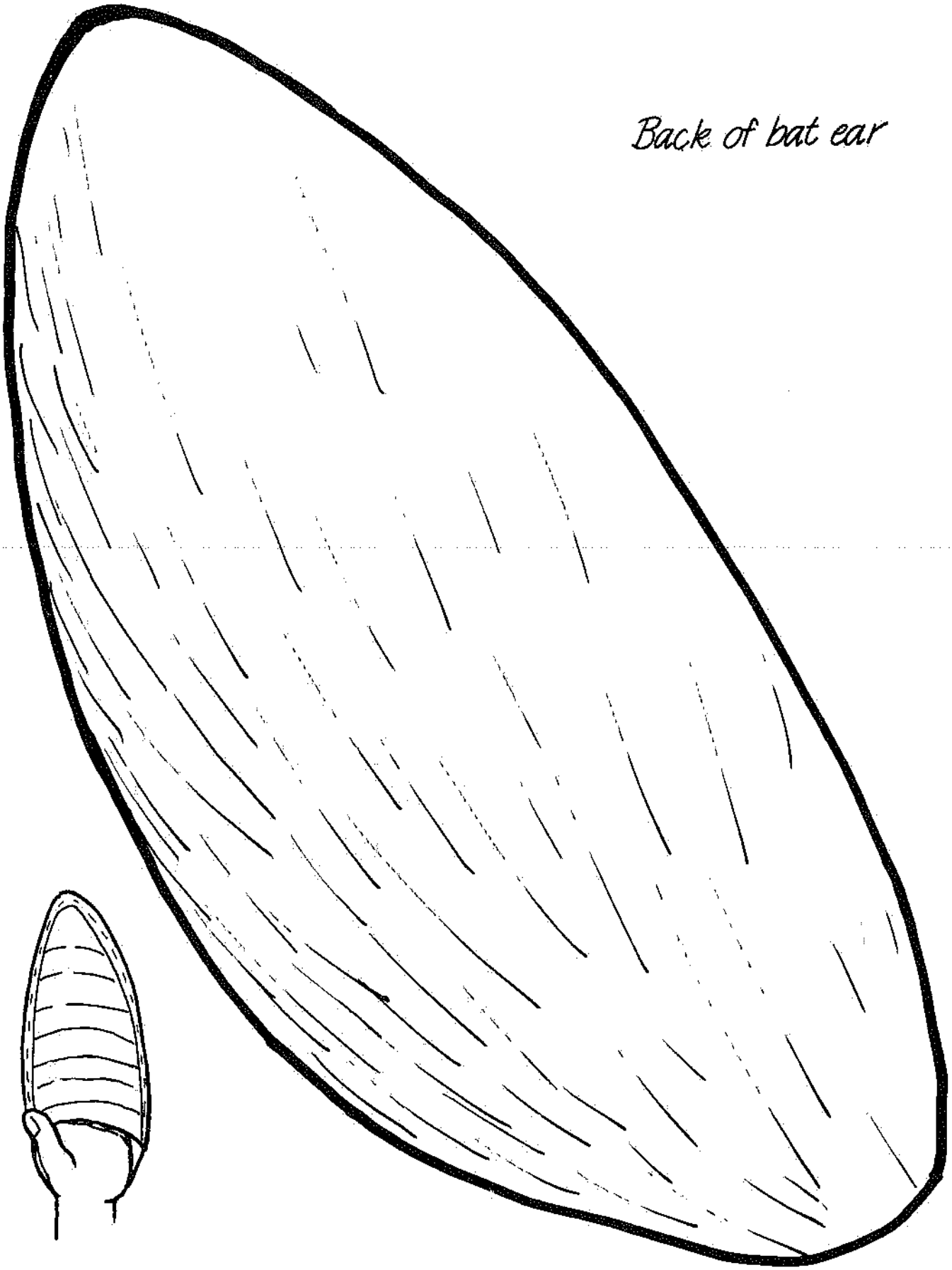

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WILDLIFE WORKSHEET

Cinquain and Paint a Bat

A cinquain is a 5 lined poem, which follows the format below. It does not have to rhyme!

	Sample:
Title (2 syllables)	*Salmon*
Description of title (4 syllables)	*Anadromous*
Description of action (6 syllables)	*Migrate to the ocean*
Description of feeling (8 syllables)	*Powerful native of Idaho*
Rename title (2 syllables)	*Chinook*

Directions:

- On the lines below, write a cinquain poem about a bat. Be sure your poem has 5 lines and follows the correct number of syllables.
- Trade poems with a partner to edit spelling and number of syllables.
- Follow the directions in the box to make a hand-print bat. Write your final draft neatly on your art work.

Line 1: Title _____

Line 2: Description of title _____

Line 3: Description of action _____

Line 4: Description of feeling _____

Line 5: Rename title _____

Directions for making a hand-print bat

1. To form the bat's wings, paint both hands black or brown, leaving your thumbs clean. Print, overlapping slightly in the center to form the body.
2. Make two feet and two ears, using black or brown fingerprints.
3. Fingerprint two white eyes.
4. When dry, outline the bat's ears and feet and give it some claws and small black pupils in its eyes. Draw in thumbs on upper wings.

**Modified from Hand-Print Animal Art: A Kids Can Series by Carolyn Carreiro*