BC Bat Edu-Kit

Activity Guide

Little Brown Myotis by Cory Olson

Bats

T'ənt̓anwiya

September 2020 Okanagan Edition

Welcome to the

BC Bat Edu-Kit Activity Guide

2020 Okanagan Edition

This education kit was made possible thanks to the following partners:
Bat Education & Ecological Protection Society
BC Community Bat Program
BC Government
En'owkin Centre
Kelowna Museum Society
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In acknowledgement and honouring the traditional and unceeded territory of the Okanagan Syilx First Peoples.

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Many of the activities included here were borrowed and adapted from other bat conservation groups. We would like to thank them for sharing. These include but are not limited to Alberta Community Bat Program, Bat Conservation International, Bat Week.org, BC Community Bat Program, Bat Education and Ecological Protection Society, Burke Mountain Naturalists, and NatureKids BC.

We would also like to thank all the photographers who are credited throughout the activity guide who gave us permission to use their photos.

We couldn't have done it without you!

SPREAD THE WORD
The BC Bat Edu-Kit Okanagan Edition is a two year project. We welcome feedback and contributions. Okanagan Nation Alliance and Westbank First Nations are in the midst of contributing additional content.

Other non-profit organizations in BC are welcomed to use and copy this educational resource. We only ask that you give credit to the original developing team. Please contact us so we can share the Publisher version if you wish to add or edit content. Please note there are certain limitations to adapting it, such as it is limited to non-profit use due to some copyright content and photos.

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Introduction

This BC Bat Edu-Kit is intended to be used in either a classroom or a non-formal classroom setting. Bats have an important role in our ecosystems. The myths, misconceptions and sometimes anxiety that bats invoke result in a mystique that is hard to reconcile to these beautiful and essential creatures. Opportunities to introduce bats in such a way that understanding and empathy leads to stewardship.

According to studies, children's academic performance in science, math, English and social sciences increase when they have hands-on experiences with nature and the outdoors. These experiences also foster a sense of responsibility to their surroundings.

We hope that after applying some of these activities in the classroom, educators and students will learn that;

- Bats are interesting.
- Bats are important.
- Bats are threatened.
- Bats need us - you can help.

The activities and resources we have gathered will hopefully make it easier for more bat heroes to arm themselves in order to protect and celebrate these amazing creatures.

The BC Bat Edu-Kit consists of;

1. This Activity Guide
2. BC Bat Edu-Kit Craft Binder
3. Tote with bat props
4. Data stick with digital files of activity guide, crafts binder, and bat PowerPoint presentation.

BC BAT EDU-KIT LENDER

This kit is being managed by:

Contact Name: _____

Organization: _____

Contact Phone Number: _____

Contact Email: _____

How to use the BC Bat Edu-Kit

This edu-kit is designed for schools and community groups. It may be used as a full and in-depth study of bats in BC or as a supplemental resource within another curriculum. The aim is to engage students in the study of BC bats, relevant to our local ecosystems.

1. When you sign-out the BC Bat Edu-Kit, first review the 'Materials Checklist' on page 10 and ensure all the contents are present. Note anything that is missing or damaged and report it to your lender.

When you finish with the BC Bat Edu-Kit, please review the 'Materials Checklist' again and ensure all the contents are returned. Please notify your lender if anything was damaged or is missing.

2. Consider your audience and possible BC curriculum links:

Table. A snapshot of the BC Curriculum as it relates to bats.

Grade	Big ideas	Core competencies	How bats relate to the BC curriculum.
K	Plants and animals have observable features. Daily and seasonal changes affect all living things. Diversity of our community.	Demonstrate the ability to question and predict. Understand local First People culture as it relates to Okanagan bats and ecology.	Bats are mammals. Bats are nocturnal. In summer, bats of BC are active. In winter bats of BC either hibernate or migrate south to warm climates. There are 15 different species of bats in BC.
1	Living things have features and behaviours that help them survive in their environment. Recognize and respect the diversity of individuals and care for the local environment.	Our rights, roles, and responsibilities are important for building a strong community.	Bats are only mammals that can fly. Nocturnal – and hunt with echolocation, and also have good eyesight. Bats are important.
2	Living things have life cycles adapted to their environment. Water is essential to all living things, and it cycles through the environment. Canada is made up of many diverse regions and communities. Local actions have global consequences, and global actions have local consequences.	Processing and analyzing data and information. Communicate findings and relate to others perspectives through comparisons. Identify simple patterns and connections and environmental consequences of actions. Express and reflect on personal experiences of place. First Peoples knowledge	Lifecycle of bats. Bats need water to survive. Bats drink while they fly. Bats need clean open waterbodies to drink from. Bats need our help. We can help bats.
3	Living things are diverse, can be grouped, and interact in their ecosystems.	Scientific Investigation process including ethical responsibilities, digital technology, First Nations perspectives and make observations in the local environment. Process and analyze information, evaluate and show patterns and trends. Use collaborative approaches to care for community. Display innovative and new or refined ideas when problem solving. Communicate findings and decisions or value judgment's collaboratively.	Bats are in Order Chiroptera (not Rodentia). Bats in BC are microchiropterans. (Not megachiropterans which are the fruit bats that we don't have in BC). List the 15 species of bats that we have in BC. Study how they are similar to each other or different. Each of the bats live and interact within their ecosystem. Each use different habitats (i.e. forests, grasslands, etc.).
4	All living things sense and respond to their environment.	As above. Sensing and responding: — humans — other animals — plants biomes as large regions with similar environmental features	Bats have good vision. Female bats use sense of smell and sense of hearing to locate their pups in a maternity roost. Bats use highly developed sense of hearing to hunt insects at night. They use sensory system similar to sonar, called echolocation.

Table (continued). A snapshot of the BC Curriculum as it relates to bats.

Grade	Big ideas		How bats relate to the BC curriculum.
5	Multicellular organisms have organ systems that enable them to survive and interact within their environment.	As above. Demonstrate a sustained curiosity about a scientific topic or problem of personal interest. Through scientific inquiry, decide which variable should be changed and measured for a fair test. Identifying potential risks and possible sources of error. Suggest improvements to their investigation methods. Identify some of the assumptions in secondary sources. Communicate ideas, explanations, and processes in a variety of ways. Express and reflect on personal, shared, or others' experiences of place. Basic structures and functions of body systems: — digestive — musculo-skeletal — respiratory — circulatory. First Peoples concepts of interconnectedness in the environment, the nature of sustainable practices around BC's resources.	Skeletal system of bat wings. Their hands and arms are their wings. Bats have specialized circulatory and digestive systems adapted to be able to hibernate. Their heart rate drops dramatically. They do not eat for several months. Their metabolic rate drops significantly.
6	Multicellular organisms rely on internal systems to survive, reproduce, and interact with their environment.	With support, plan appropriate investigations to answer their questions or solve problems they have identified . Experience and interpret the local environment Contribute to care for self, others, and community through personal or collaborative approaches	Compare basic structures and functions of body systems; excretory, reproductive, hormonal, nervous
7	Evolution by natural selection provides an explanation for the diversity and survival of living things.	Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal interest. Identify a question or problem to solve through scientific inquiry, formulate hypotheses and predictions. Observe, measure, and record data (qualitative and quantitative), using equipment, including digital technologies, with accuracy and precision. Ensure that safety and ethical guidelines are followed in their investigations. Processing, analyzing, evaluating, and applying and communicating findings from investigations.	Evolution of bats, the only flying mammals on earth. Over 1,200 species of bats on Earth. At least 15 species in BC. Learn about each of these species and how they are specialized to their habitat, diet, and where they get water to drink.
8	Analyzing data by determining averages is one way to make sense of large data sets and enables us to compare and interpret.	Use tools or technology to explore and create patterns and relationships, and test conjectures. Develop, demonstrate, and apply mathematical understanding through play, inquiry and problem solving. Connect math concepts to each other and to other areas and personal interests.	Bat Survey data patterns processed, analyzed and interpreted to explain health of an ecosystem. (missing activity).
9	The biosphere, geosphere, hydrosphere are interconnected, as matter cycles and energy flows through them.	Observe, experience and interpret the local environment. Seek and analyze patterns, trends, and connections in data, including describing relationships between variables and identifying inconsistencies. Construct, analyze and interpret graphs, models. Analyze cause-and-effect relationships.	Researchers are finding that bats transport nutrients from lowland water ecosystems to upland forests or drylands. This is because bats hunt insects near waterbodies then fly back to their roosts where they defecate. Bat guano is very rich in nutrients.

Table (continued). A snapshot of the BC Curriculum as it relates to bats.

Grade	Big ideas		How bats relate to the BC curriculum.
10	Energy is conserved, and its transformation can affect living things and the environment.	Local and global impacts of energy transformations from technologies. Seek and analyze patterns, trends, and connections in data, including describing relationships between variables and identifying inconsistencies. Contribute to care for self, others, community, and world through individual or collaborative approaches.	Bats in the food web. Impact of technologies such as wind farms on bat populations.
11	Complex roles and relationships contribute to diversity of ecosystems. Changing ecosystems are maintained by natural processes. Human practices affect the sustainability of ecosystems. Humans can play a role in stewardship and restoration of ecosystems. Scientific processes and knowledge inform our decisions and impact our daily lives.	Process and analyze data and information to understand the benefits of ecosystem services.	Bats in the food web. Bats are found in many different ecosystems in BC and use different habitats. Human use and development of land has impacted habitat that bats need to survive. Bats are in trouble. We can help bats.
12	Living sustainably supports the well-being of self, community, and Earth. Biodiversity is dependent on the complex interactions and processes between biotic and abiotic factors. Climate change impacts biodiversity and ecosystem health. All members of a species have common characteristics that evolve over time. Human actions affect the quality of water and its ability to sustain life. Living sustainably supports the well-being of self, community, and Earth.	Assess risks and address ethical, cultural, and or environmental issues associated with proposed methods of projects. Communicate scientific ideas and information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions, and representations.	Bats hunt an immense number of insects, including some that are considered pests in the agricultural and forestry industries. Studies have shown bats save billions of dollars in pesticides. Bats need a diverse number of arthropod species and are part of complex interactions and processes. Climate change already impacting bats. Extreme heat waves in the Okanagan has meant mortality of bat colonies that live in bat boxes. Studies underway.

3. Consider the bat species that live in your region and introduce your students to the species that they might encounter in natural areas nearby.

Table. Bat species found in each region of British Columbia.

	Scientific Name	Status	BC Ministry of Environment Region									
			Vancouver Island	Lower Mainland	Sunshine Coast	Thompson	Kootenay	Cariboo	Skeena	Omineca	Okanagan	Peace
Spotted Bat	*Euderma maculatum*	SC[1]; Blue (BC)				x		x			x	
Pallid Bat	*Antrozous pallidus*	T[1]; Red (BC)									x	
Townsend's Big-eared Bat	*Corynorhinus townsendii*	Blue (BC)	x	x	x	x	x	x			x	
Hoary Bat	*Lasiurus cinereus*	Not at risk	x	x	x	x	x	x	x	x	x	x
Eastern Red Bat	*Lasiurus borealis*	Red (BC)					?				x	x
Silver-haired Bat	*Lasionycteris noctivagans*	Not at risk	x	x	x	x	x	x	x	x	x	x
Big Brown Bat	*Eptesicus fuscus*	Not at risk	x	x	x	x	x	x	x	x	x	x
Yuma Myotis	*Myotis yumanensis*	Not at risk	x	x	x	x	x	x	x		x	
Californian Myotis	*Myotis californicus*	Not at risk	x	x	x	x	x	x	x		x	
Western Small-footed Myotis	*Myotis ciliolabrum*	Blue (BC)				x	x	x			x	
Northern Myotis	*Myotis septentrionalis*	E[1]; Blue (BC)					x	x	x	x		x
Long-legged Myotis	*Myotis volans*	Not at risk	x	x	x	x	x	x	x	x	x	x
Little Brown Myotis	*Myotis lucifugus*	E[1]	x	x	x	x	x	x	x	x	x	x
Fringed Myotis	*Myotis thysanodes*	Blue (BC)	?	?	?	x	x	x			x	
Long-eared Myotis[2]	*Myotis evotis*	Not at risk	x	x	x	x	x	x	x	x	x	x
Canyon bat	*Parastrellus hesperus*										(x)[3]	
Mexican Free-tailed Bat	*Tadarida brasiliensis*		(x)[3]	(x)[3]	(x)[3]							

[1] COSEWIC Status (federal): E = Endangered, T = Threatened, SC = Special Concern, [2] Long-eared Myotis (*Myotis evotis*) includes the species formally known an Keen's Myotis because genetic evidence indicates these are the same species. [3] Acoustic records only; currently considered Accidental in BC.

Modified from: Craig, V. J., and S. L. Holroyd. 2004. Bat Conservation Strategy for BC and Alberta. Draft. Prepared for BC Ministry of Water, Land and Air Protection. 112 pp.

4. Learn about the role of bats in the Syilx Okanagan culture as part of the living ecosystem and the nsyilxcₐn guidance of tmix^{w} – a sacred responsibility to protect all living things. Okanagan Nation Alliance, Westbank First Nations, and the En'owkin Centre are in the midst of contributing additional content.

5. Connect students with natural areas nearby, in order for them to experience and understand the importance of protecting bat habitat.

6. If possible, try to choose at least one activity from each of the 4 sections in this activity guide so that students learn that;

- Bats are interesting.
- Bats are important.
- Bats are threatened.
- Bats need our help.

Lesson Planning Ideas

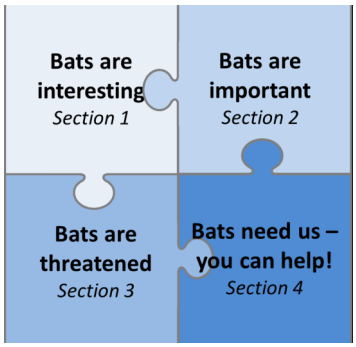
There are a number of ways to approach delivery of the bat activities in this guidebook. We have tried to layout the activities as simply as possible. These activities can be used individually or grouped together to make a full lesson plan.

Jigsaw Method

The jigsaw teaching strategy is a way of organizing student group work that helps students collaborate and rely on one another. This is effective for accomplishing multiple tasks at once and giving students a greater sense of individual responsibility.

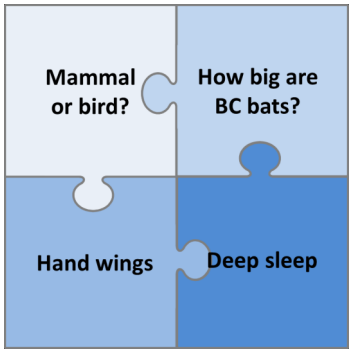
The classroom has 4 stations, each with a different bat activity.
Students are divided into four groups. Each group goes to a different station.
Where appropriate, each student within the group is assigned a specific role or task.
As the group works, students contribute their role/task to the group's overall efforts.
When the activity is completed or the time is up, the students move as a group to the next station.

Option 1. Teachers choose an activity from each section of the Guidebook. For example, an activity from section 1 (Bats are interesting), an activity from section 2 (Bats are important), etc. Then divide the class into the four stations, each doing one activity. Rotate after 15 to 20 minutes until all the groups have visited all four stations.



Option 2. Teachers divide the guidebook into 4 different days, each covering a section of the Guidebook. For example, one day is 'bats are interesting' and several activities from that section are covered, another day is 'bats are important', third day is 'bats are threatened', and last day is 'bats need our help'.

Day 1: bats are interesting:



Introducing Sections with the Bat Slideshow

If you choose option 2 above, then you could use the PowerPoint presentation included in this package to introduce each section. The slideshow is organized around those 4 key messages (bats are interesting, bats are important, bats are in trouble, bats need our help). Each section in the slideshow is approximately 15-20 minutes long.

Activities within each of the sections would be a great way to augment the information within the PowerPoint presentation. Whether your group is project based or inquiry-based learning we hope you find the resources easy to use and a way to enrich your students and your lessons.

Checklist of Materials in Edu-Kit

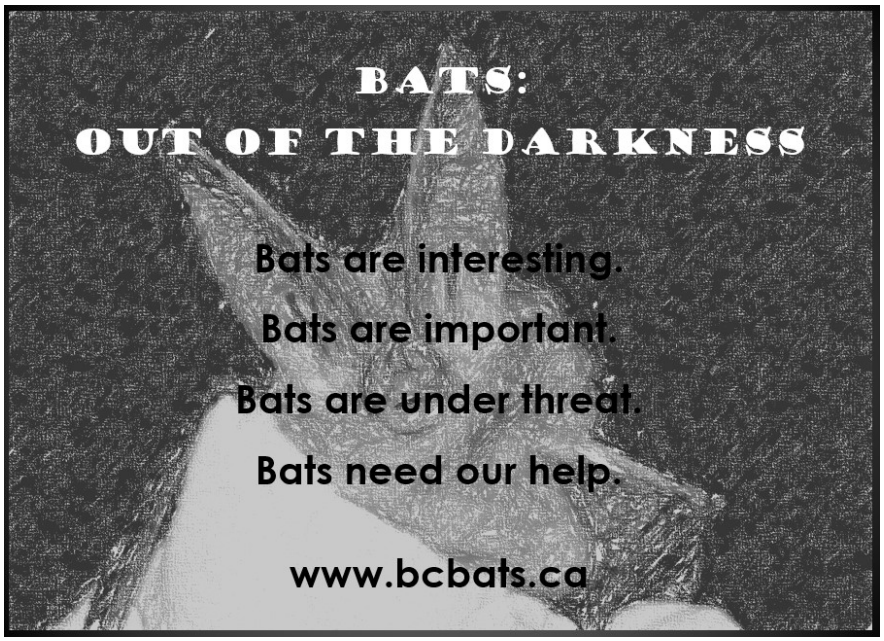
Item	Present at time of signing out	Present at time of returning	Notes
Black storage bag			
BC Bat Edu-Kit Activity Guide Binder			
BC Bat Edu-Kit Crafts Binder			
Data stick with BC Bat Edu-Kit Activity Guide			
Bats of the Pacific Northwest laminated poster			
MythBusters bat fact laminated cards (7)			
Puppet—Small black bat finger puppet (Folkmanis)			
Puppet—Large Brown Bat puppet (Folkmanis) - Note that Brown bat is not this big in real life.			
Bat model—Townsend's Big-eared Bat (Safari Ltd).			
Bat model—Brown Bat (Safari Ltd.)			
'Batty For Bats' black bandana (www.fundanabandanas.com)			
Bat skull—Little Brown Bat			
Small container with bat guano			
Cookie tray with image of forelimb bone anatomy + bag with magnets of bones			
NatureKids BC bat ID cards laminated (8)			
Black plate in shape of bat (with photo of South American Sword-nosed Bat)			
Laminated sheet of photos and habitat of bats (8 large and 7 letter-sized)			
Slinky			
Bat silhouettes with weights (6)			
Taxidermy bats (from Royal BC Museum)	To be added in Year 2		
Bat detector & Instructions			
Find my bat twin cards (16)			
Bird or mammal cards (8)			
Safety First animals: dog, deer, bear, bat			
Eco-Locate me cards (34)			
What's for dinner cards (20)			
Live or Die cards (18)			
Migration Station , map and ruler			
Stopwatch			
Thermometer			
Habitat Bag: empty water bottle, toy house, 6 toy insects, toy tree, mining tool, 16 lami-			

Materials in Edu-Kit Checklist (continued)

Item	Present at time of signing out	Present at time of returning	Notes
Bat costume:			
* fur vest			
* wings			
* 2 black gloves			
* bat ears head piece			
Books:			
Stella Luna + laminated Stella Luna storyline cards (20) + Crafts and Activities sheets (Master copies to be photocopied)			
Bats of British Columbia	Waiting on new publication		
How Names Were Given; Legend in Kou-Skelowh We are the People; A Trilogy of Okanagan Legends	To be added in Year 2		
Where do bats go for Christmas by Darlene Hartford			
Benji Bat Wears Glasses by Darlene Hartford			
Carla the Clumsy Bat by Darlene Hartford			
Baby Bats Don't Hatch From Eggs by Darlene Hartford			

BATS ARE INTERESTING

BC Bats Slideshow



Age: Grades K—12

Subjects: science

Duration: 15—20 minutes per section. There are 4 sections.

Group size: small to whole school gymnasium presentation.

Setting: Indoors

Objectives

Students will be able to;

1. Learn about bat characteristics that make them interesting.
2. Learn about bat biology.
3. Learn about bat habitat.
4. Learn about why bats are in trouble.
5. Get some ideas about how to help bats.

Method

Students listen to a hands-on interactive slideshow presented by the educator, or in higher grades, students study and then present the slideshow to the class.

Background

This presentation was adapted from the BC Community Bat Program for the BC Bat Edu-kit.

Materials

BC Bat Edu-Kit PowerPoint Presentation
Bat skeleton
Small bat finger puppet
Bat skull to show teeth
Taxidermies of small and large BC bats
Bat guano
Bat costume (fur vest, wings, ears)
Slinky (for echolocation)
30cm ruler
Cdn quarter
5 Cdn loonies

Procedure

This slideshow can be used by educators, schoolteachers, club leaders, or home-schooling parents to present to students in grades K to 5. It can also be used in higher grades for students to study and then present to the entire class.

How to use the PowerPoint presentation:

1. Get familiar with the PowerPoint presentation. Make sure to read thru the 'notes' pages as these can be used as speaking notes.
2. Decide if you want to do all 4 sections of the slide presentation or only choose a few. Also decide if you want to break it up into 4 different days, or all at once.
3. Print out the notes page and have it ready for when you do your presentation.
4. You have the option of either using some of the props included in the BC Bat Edu-Kit during the slideshow or not. If you choose to use them, then have them ready.
5. Do the slide show and follow the 'notes' page.

The slide show is divided into 4 sections:

Bats are interesting.
Bats are important.
Bats are threatened.
Bats need us - you can help.

SECTION 1: BATS ARE INTERESTING

Nocturnal
Mammals (warm-blooded, have fur, give birth to live young that suckle milk)
Bats are the only mammal that can fly
Wing anatomy *(Prop: bat skeleton)*
Life cycle of bats in BC
There are 15 species of bats in BC
Props: taxidermy bat if have one, or life-size model of bat
Smallest and biggest *(Props: 30cm ruler, Cdn quarter, 5 Cdn loonies)*
Habitat: Where do bats live? What do they need to survive?
Water
Food – arthropods *(Props: bat skull with teeth)*
Hunt with sonar called echolocation *(Props: slinky)*
Spotted Bat. *(Props: if have bat costume, can do a review of bat characteristics at this point.*
Shelter – called roosts
Summer roosts (tree roosts, rock roosts, building roosts)
Winter roosts (Most bats hibernate, a couple of species migrate south and stay active all winter).

SECTION 2: BATS ARE IMPORTANT

Bats eat millions of insects that are considered pests to agriculture, forestry and humans.
Bats are part of biodiversity and our ecosystems. Food web example.
Bats aid in nutrient cycling *(Props: bat guano containers)*.
Bats in other part of the world are important pollinators, seed dispersers, and sources of medicinal value.
Bats are an integral part of our culture.

SECTION 3: BATS ARE THREATENED

7 out of the 15 species of bats of BC are listed as 'at risk'.

Reasons why bats in trouble.

SECTION 4: BATS NEED US - YOU CAN HELP

What to do if you see a bat? Safety first.
Leave bats alone, where safe to do so.
Protect and restore natural habitat.
Keep cats indoors or in a catio.
Help raise awareness about the importance of bats.
Lead a campaign to become a Bat-Friendly Community.
Help with evening bat counts.
Co-exist with bats where safe to do so.
Install a bat box if doing an eviction of bats from a building.
Learn more about bats (www.bcbats.ca and www.batcon.org).

Bat Touch and Feel Table

Age: Grades K— 12

Subjects: science

Duration: 15 minutes

Group size: max 30, 5 to 8 students at a time.

Setting: Indoors

By Bat Education and Ecological Protection Society

Objectives

Students will be able to;

1. See, touch and feel bat wing, mounted bat, fur, guano, and skull.

Method

Students will get to physically see and touch mounted bats, kind fur, model bats, guano and skull.

Background

Bats are amazing wild animals that very few of us ever get to see. Being nocturnal, they have eluded humans for millennia. However, bats are interesting creatures of the night being the only mammal able to fly. They are also an important part of the wildlife fauna in British Columbia as they are predators of many insect pests. Unfortunately, bats are in trouble due to many environmental and human-caused factors. There are many things we can do to help bats but first lets get to know them.

Materials—*found in BC Bat Edu-Kit contents*

bat guano

bat skull
bat puppet/model
mounted bat

Procedure

Set up a portable table with a tablecloth. To the table add the bat wing, mounted bat, fur, guano, and skull. Explain to the students that in a couple of minutes everyone will get a chance to come to the table to see the items. Explain what they are going to see and touch. Reiterate the skull is not to be picked up; only very gently touched as it is very fragile. Reinforce that wild bats **should not** be touched as we are never sure if they are a carrier or a vector of diseases.

Bat Guano

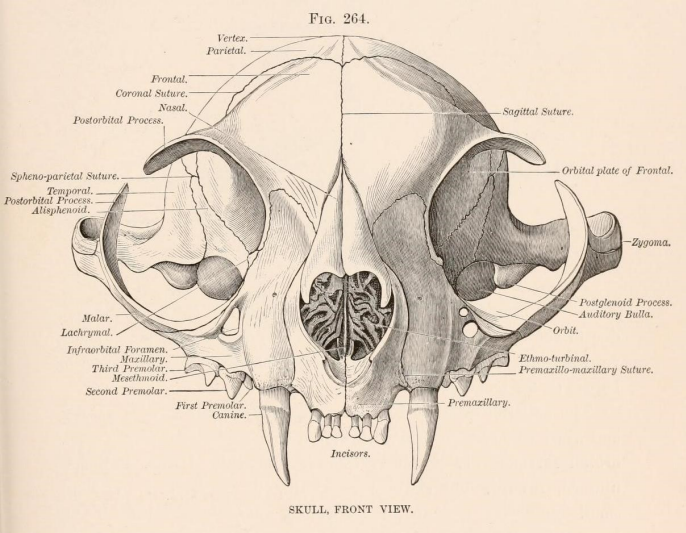
The scat or poop from a bat. All of the Okanagan bats are insectivores. One of the richest natural fertilizers to be used in agriculture and has been used since ancient times to promote plant growth and a good harvest. It contains healthy microorganisms and elements such as nitrogen and phosphorus that work to detoxify the soil. Phosphorous also helps crops flower and nitrogen helps promote stalk and shoot growth.

Do not handle guano with bare hands as it could contain histoplasmosis fungus (causing a lung infection).

Guano has ecological and economic value.

⇒ Guano is ecologically important due to its role in dispersing nutrients. Cave ecosystems, in particular, are often wholly dependent on bats to provide nutrients via their guano, which supports bacteria, fungi, invertebrates, and vertebrates.

⇒ A recent scientific paper on the economic value of bats to agriculture estimated that bats provided nontoxic pest-control services totaling $3.7 billion to $53 billion per year. This study did not even consider what the indirect costs of "replacing" bats with pesticides would be in terms of potential health and pollution threats from greater levels of toxins in the environment.



Bat skull

"Our study sought to address a major question about the evolution of diversity in the bat skull: What explains the large number of differences that we see in skull shape?" said Santana. "We found that echolocation is a major — and ancient — contributor to skull shape. Diet is also important, but generally more recent."

the cranium has many functions, such as feeding, respiration and protecting the brain
The lower jaw is largely just involved in feeding

Bat models

Bats are able to flap their wings using their powerful chest muscles, which are attached to a central raised bone on the breastbone called a keel. A bat's arms, legs, and greatly elongated fingers provide the frame for the wings. However, the whole body is well adapted for flying.

Touch and Feel Table cue cards. Note that one side is the questions, and the other page has the answers. Print double-sided and then cut them out. ***Found in BC Bat Edu-Kit contents***

Bat Guano (or bat poop)

1. Can you see the shiny bits in the pellets? What do you think these might be?
2. Bat guano is an excellent natural fertilizer and is high in nitrogen. What can fertilizer be used for?
3. Bat guano is an important part of ecosystems. Why do you think this is? Hint: Bats eat insects near a water body and then fly away and poop them out in the forest or in a cave where they live.

Bat Skull

Have a close look at the teeth.

1. Do bat teeth look like those of a beaver?

2. Can you guess what the pointy sharp canines and molars would be used for?

Bat Fur

1. Bats can fly, but they are mammals. Do they have feathers or fur?
2. What colour are the bats of BC?
3. Can you describe what body parts have evolved into their wings?
4. Bats belong to the Order Chiroptera. Break this word up into 'chiro' and 'ptera' and try to figure out what these Latin and Greek words mean. Hint: Here are other words with those root parts; chiropractor, chirographic, chiromancy, pterodactyl, pterosaur, pteropods.

Bat Guano (or bat poop)

1. Bats eat insects and chew them into tiny bits. You are seeing the shiny wings and exoskeletons of insects that were eaten by the bat.
2. Bat guano is an excellent natural fertilizer that is used by farmers and gardeners.
3. Bats bring rich nutrients from aquatic ecosystems to upland ecosystems. It's all part of how ecosystems are connected to each other. Nutrients are cycled from one ecosystem to another.

Bat Skull

Have a close look at the bats teeth.

1. No. Beavers have two big front teeth for gnawing wood. Beavers belong to the Order Rodentia. Bats cannot gnaw on wood or buildings.

2. The bats of BC eat insects and arachnids. They are insectivorous and need their sharp pointy teeth to crush the hard shells (exoskeletons) of beetles and other insects. Bats belong to the Order Chiroptera.

Bat Fur

1. Bats have fur. They are the only mammals that can truly fly.

2. The different bat species of BC are brown, black, blonde, reddish, or grizzled in colour.

3. Their arms have become their wings. Bats have elongated finger bones to provide the frame of the wing. The wings extend all the way down to their ankles. The tail of some bat species is also part of the wing. Bats are able to flap their wings using their powerful chest muscles.

4. 'Chiro' is Latin for hand and 'ptera' is Greek for wing. So, 'hand-wing'.

Bats Out of the Darkness

Age: Grades K– 12

Subjects: science, language arts, social studies

Duration: 15 minutes

Group size: small to large

Setting: Indoors or outdoors

Hoary Bat

Objectives

Students will be able to;
1. Define nocturnal and diurnal,
2. Understand that bats are nocturnal,
3. Understand that we should not be afraid of bats. They are interesting and important.
4. Bust the myths that surround bats.

Method

Students will list some animals that are nocturnal versus diurnal, and play a game to dispel myths about bats.

Background

Don't believe everything you hear about bats. Bats have gotten a bad rap, despite the fact that they positively impact our lives every day. Misconceptions about bats can lead to devastating results in bat conservation efforts.

Bats are often misunderstood, but they are fascinating creatures. Bats are nocturnal which means they sleep during the day and come out to play when the sun goes down. We don't often see them. Humans and the many other creature we see and like are diurnal, which means that like us, they are active during the day and sleep at night.

Electricity was not invented until 1879. This means that for millennia before that, humans only had the moon and fire to light the night. Since bats are only active in the dark, they have been a mystery to people for a long time.

There are many myths that make bats out to be scary blood-sucking creatures. It is this type of public attitude that has contributed to the general decline of bat populations around the world, and to the fact that many of the bat species in BC are listed as vulnerable or threatened (red- and blue-listed). As people continue to exterminate bats from their houses, actively kill bats when they come across them, or inadvertently destroy bat roost sites, bats as a whole will remain threatened.

Technology has now allowed scientist to study bats, and they are finding that bats are interesting and very important.

Materials

Paper
Pencil
Print out 'MythBusters' cards; ***found in BC Bat Edu-Kit contents***

Procedure

Explain what nocturnal and diurnal means. What is different about the day versus the night? What animals can you think of that are active at night versus day. Have students write down or draw some of them.

Explain what a myth is. A myth is a traditional story, especially one concerning the early history of a people or explaining some natural or social phenomenon, and typically involving supernatural beings or events.

Explain that electricity was only invented in 1879. This means that for millennia before that, humans only had the moon and fire to light the night. Since bats are only active in the dark, they have been a mystery to people for a long time.

Many stories were told to try to explain bats, some of them were scary. For example, many people view bats as being ugly, scary, nasty little creatures who are harmful blood-sucking pests.

Get students to play 'MythBusters'. Print out the two following pages, cut them out, and see if students think the statements are true or false.

By learning the facts about bats, people can learn to appreciate bats. Maybe students can even become bat buddies and convince their family and friends that bats are interesting and important.

Some other myths:

Bats purposely fly into human hair
Bats may fly close to humans in order to catch insects. They have no interest in getting caught in your hair.

Most bats have rabies
Less than 1% of bats carry rabies.

Bats are dangerous
Bats are wild animals that prefer to keep to themselves.

Bats are dirty
Bats regularly groom themselves, when not hunting or sleeping, to keep their fur clean and free of parasites.

Bats are blind
Bats have excellent vision. Their eyes are adapted to see well in low light levels.

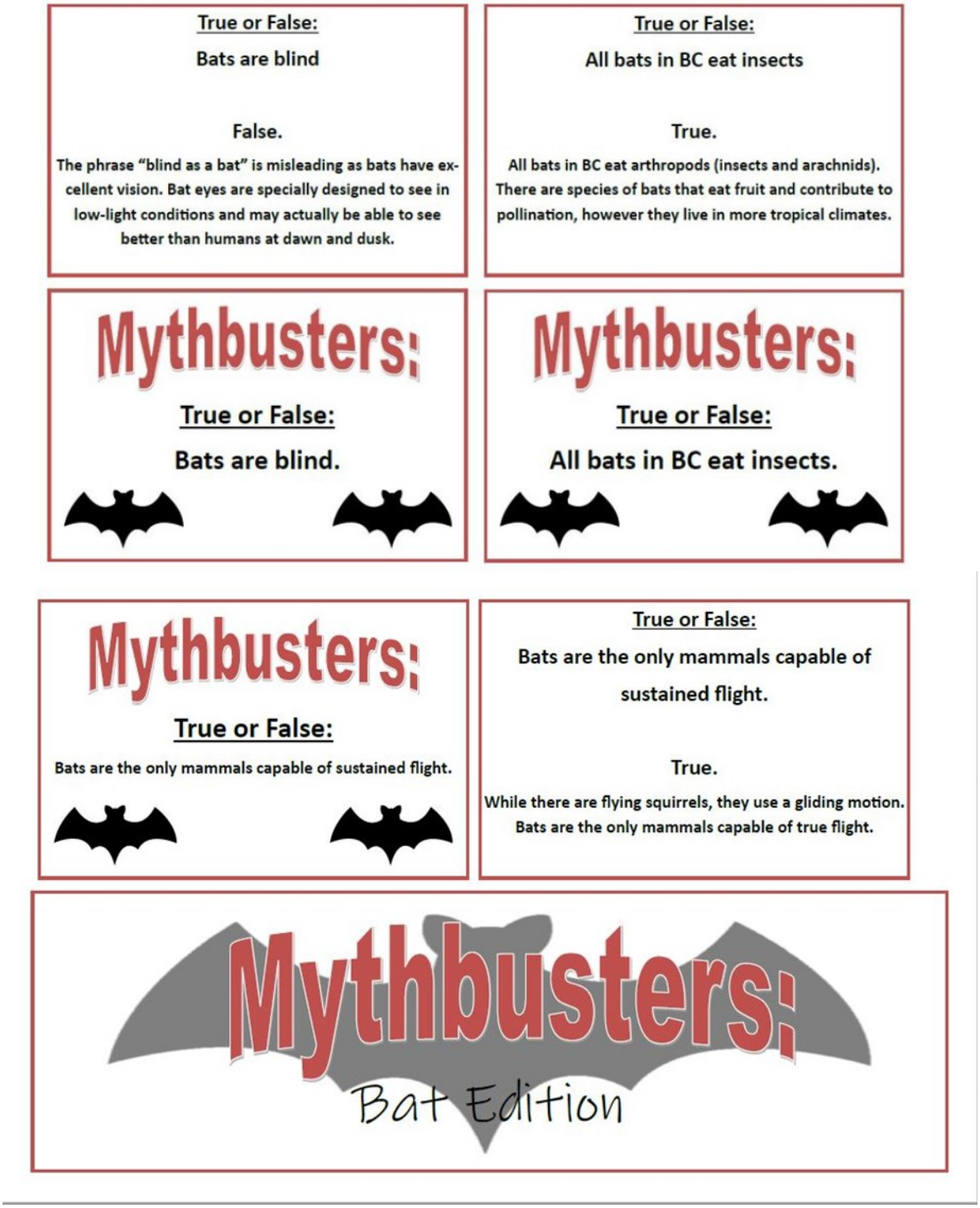
Bats feed on human blood
BC's bats don't feed on blood. Vampire bats, found in Central and South America, have been known to bite humans, but this is extremely rare. Vampire bats primarily consume blood from livestock, such as cattle. Their feeding habits do not kill their prey.

Bats are just flying rats
Bats are in a separate order from rodents. They belong to the order Chiroptera, which translates to 'hand wing.' It is the second largest order of mammals.

Bats are pests
The opposite is true! Bats are valuable mammals. They help control insect pests and, in other parts of the world, they also important pollinators and seed distributors.

Print , cut out, and see if students can figure out if statements are TRUE or FALSE.

Found in BC Bat Edu-Kit contents.



Print , cut out, and see if students can figure out if statements are TRUE or FALSE.

Found in BC Bat Edu-Kit contents.

True or False:

All bats have rabies

False.

While bats are a reservoir for rabies (which means they can carry the virus and pass it on without showing signs of the disease) less than 0.5% of bats test positive for rabies. Never handle bats and beware of bats that act oddly, like flying during the day.

True or False:

Bats are flying rats

False.

Bats are very distantly related to mice and are in a separate order, ***Chiroptera***, which translates to "hand wing". ***Chiroptera*** is the second largest order of mammals and there are over 1000 species of bats worldwide.

Mythbusters:

True or False:

All bats have rabies.


Mythbusters:

True or False:

Bats are flying rats.


True or False:

Bats can live for over 20 years.

True.

While the big brown bat has been shown to live up to 19 years in Canada, the little brown bat can live to over 39 years. Bats are unusual in that they have a surprisingly long life-span for such a small mammal.

True or False:

Bats account for a quarter of all mammal species.

True.

Chiroptera is the second largest order of mammals and there are over 1000 species of bats found worldwide.

Mythbusters:

True or False:

Bats can live for over 20 years.


Mythbusters:

True or False:

Bats account for a quarter of all mammal species.


Mammal or Bird?

Age: Grades K—4

Subjects: science

Duration: 15 minutes

Group size: small

Setting: Indoors

Objectives

Students will be able to;
1. understand that bats are mammals,
2. distinguish between mammals and birds.

Method

Students will classify different birds and mammals into their class.

Background

Bats are mammals but they can fly like birds. Mammals are warm-blooded vertebrate animals that are distinguished by the possession of hair or fur, the secretion of milk by females for the nourishment of the young, and (typically) give birth to live young.

Birds are warm-blooded vertebrate animals distinguished by the possession of feathers, wings, and a beak, the laying of eggs, and (typically) the ability to fly.

Materials—*found in BC Bat Edu-Kit contents*

Various photos of mammals such as Human, White-tailed Deer, Little Brown Bat, Townsend's Big-eared Bat. From Edu-kit: Townsend's Big-eared Bat models. Bat mount taxidermy (if available). Photo of baby bat and pup suckling.

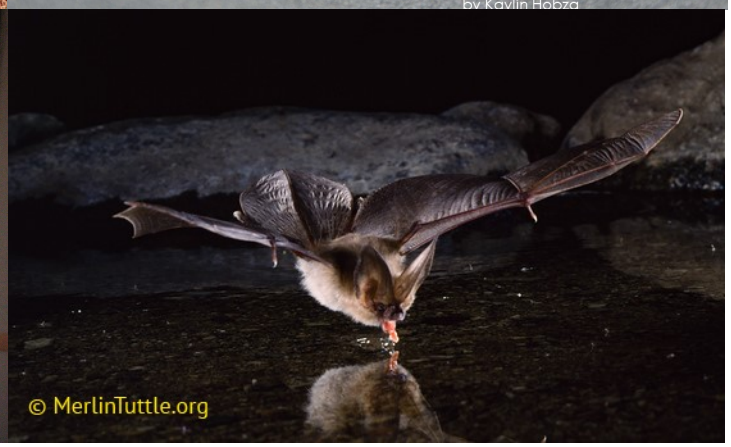
Various photos of birds such as Canada Goose, Black-capped Chickadee, hen, American Robin. If you have access to feathers and eggs, please add them.

Print and cut out the next page if you need some photos of birds and mammals.

Procedure

Lay out on a table the definition of Mammal and Bird. Have students figure out which animal is a mammal and which is a bird.

Print and cut out.



How Big Are BC Bats?

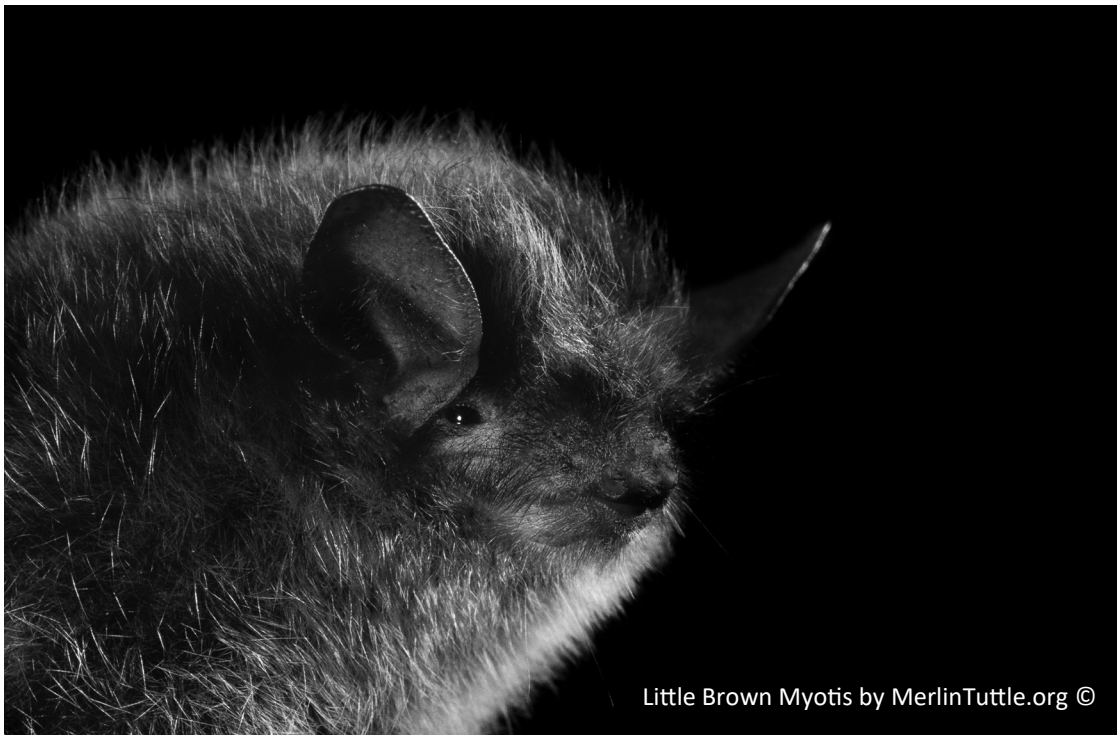
Age: Grades K—7

Subjects: science

Duration: 15 minutes

Group size: small

Setting: Indoors


Little Brown Myotis by MerlinTuttle.org ©

Objectives

Students will be able to;

1. understand that the bats of BC are small and weigh very little.

Method

Students will compare silhouettes and weights of different BC bats.

Background

The bats of BC are remarkably small and light! Being light-weight helps them be effective flyers. Bats are in the order Chiroptera which means 'hand-wing'. There are two suborders; 1. Microchiroptera or Mircobats, which are small and live world-wide, and 2. Megachiroptera or Megabats, which are large Old World fruit bats. In BC we have 15 different species of Microchiroptera and zero species of Megachiroptera.

Materials—*found in BC Bat Edu-Kit contents*

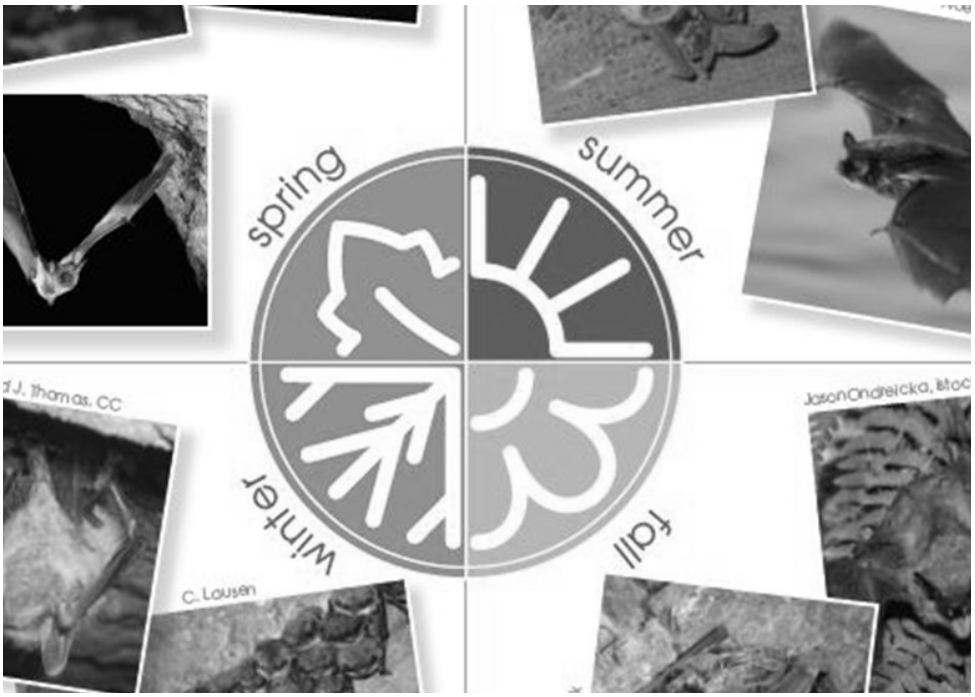
Silhouettes of bats with their weights represented by coins.

Procedure

Use the silhouettes of various BC bats with their weights represented by coins (weights from the Royal Canadian Mint) to help students understand just how little and light our bats are! Invite students to hold each bat and compare different bat weights and sizes.
You can use the table to figure out which bat is which.
Which bat is the biggest? Smallest?
Which bat is the heaviest? Lightest?

Species	Wingspan (inches)	Body Length (inches)	Weight (grams)	Coins to demonstrate weight
Spotted Bat	14	4-4.5	17-19.8	2 toonies and 2 pennies
Pallid Bat	15-16	2.75	14-25	2 toonies
Townsend's Big Eared Bat	11	4	7-12	1 toonie
Hoary Bat	15.5	5.1-5.7	26	3 toonies and 1 quarter
Eastern Red Bat	12	3.5-4.5	7-12	1 toonie
Silver-haired Bat	10.6-12.2	3.6-4.5	8-12	1 toonie and 1 penny
Big Brown Bat	12.8-13.8	4.3-5.1	17	2 toonies and 1 penny
Yuma myotis	9.4	1.5-1.9	6	1 loonie
Californian myotis			4.4	1 quarter
Western Small-footed myotis	9.4	3.1-3.9	4.9	1 quarter

Life Cycle of Bats Play Along



Age: Grades K, 1, 2

Subjects: science

Duration: 15 minutes

Group size: about 20

Setting: Indoors or outdoors

Objectives

Students will be able to;

1. understand the life cycle of a BC bat; winter, spring, summer, fall.
2. Explore that seasonal changes affect bats and they adapt to survive.

Method

Students will pretend do be bats and follow the teachers' instructions as to what happens to them in each season.

Background

The behaviour of bats in BC is intricately tied to the seasons. In winter, most of our bat species hibernate. In spring, they awaken, hunt for insects, and find their roosts. In summer, pups are born and they mature within a few months. In fall, bats hunt as they need to fatten up for winter hibernation. They leave their roosts and move around a lot at this time of year as they make their way to their winter hibernacula. Fall is also mating season.

Materials

'Lifecycle of bats in British Columbia' diagram.

Procedure

Show diagram of life cycle. Talk about each season briefly, then have the students play along pretending to be a bat and follow the leader – you. You can use the diagram to see what the bat does in each season.

WINTER: Form a circle. Tell the students that they are all bats. Ask them to lay down on ground and put their feet up, pretending to be roosting/ sleeping upside down. During hibernation they are deep in sleep.

SPRING: Spring is coming. You feel it's warming up. Start to shiver to warm up your body temperature from 5°C to 40°C (pretend it will take you 30 minutes to warm up). Your heart beat is beating faster (from 5 beats per minute to 100 beats per minute). Once awake, you stretch your wings, and clean your fur by licking (all upside down!). Then fly out of the cave.
Follow the leader (have the kids follow you). Hunt for insects like moths or beetles. Full belly.
Pretend you are looking for shelter like a maternity roost – perhaps a big tree, under the bark, in a rock crevice, a bat box, or the eaves or attic of a building.

SUMMER: Form a circle. Pretend you are nice a warm in roost. You are a female bat that is pregnant. It's now June, and you give birth to one pup. If you have students who do not want to be female bats in your group, they can pretend to be male bats roosting under the bark of tree. Mama Bats - Each night you leave your pup with a babysitter (another adult female), and you go hunting for insects.

Pretend come back to roost to your pup, and to sleep.

Pretend you are now the pup! Pup is clumsy. Pups born with eyes closed, ears are limp, no fur so you are naked like a baby. Can't fly. Tiny. Curl up with mom to drink breast milk.

Pup is now 3 weeks old. It has opened its eyes, ears are up, fur has grown in. Let's learn to fly. Off you go. Follow the leader again. The pup can't fly very well. Bump into tree. End up on floor. You have to climb up the tree to get enough height to be able to then turn around and use gravity to fly off. Fly again. Back to roost. Oh dear, pup is tired. And guess what? Pup just lost my baby bat tooth! (yes, baby bats lose their milk teeth and grow adult bat teeth when
ready to wean). Fall asleep.

FALL: Pup is now 3 or 4 months old and all grown up. A very good flier. Off you go to hunt for insects. Leave your maternity roost where you were born. Find other bat friends. Go explore and fatten up. (Pups don't mate until their second autumn).

WINTER: Nights are getting colder. Find a cave to hibernate in.

You have fattened up to 40% your spring weight. How much is 40%? Ask kids how much they weigh. So, for kids: if you weighed 50 lbs. in spring, you are now 70 lbs. Refer to table below.

You lower your body temperature from 40°C to 5°C.

You lower your heartbeat from 100 beats per minute to 5 beat per minute.

Now hibernating until spring.

Table. The average weight of a child at different ages and with 40% of weight added.

Age of child	Average weight (+/- 15 lbs.)	Weight plus 40%
5	40	56
6	47	66
7	50	70
8	57	80
9	65	91
10	72	101

Lifecycle of bats in British Columbia

spring

- Bats return to BC or wake up from hibernation
- Hungry and thirsty
- Females pregnant
- Find summer roost

summer

- Females gather in maternity roosts
- Pups are born
- Pups learn to fly in late summer
- Males usually roost by themselves

winter

- Hibernate (13 out of 15 BC species)
- Live in southern USA and Mexico (2 out of 15 species)

fall

- Leave the summer roost
- Mating
- Find hibernacula or migrate south

A Year in the Life of a Bat

By Paula Rodriguez de la Vega

Age: Grades K—5

Subjects: science, art

Duration: 15 minutes

Group size: 4 to 25 students

Setting: Indoors

Objectives

Students will be able to;
1. understand the life cycle of bats in BC.
2. understand that the behaviour of bats changes every season, depending on food source, water availability, and environmental (weather) factors.

Method

Students will cut, sort, and glue items to create the lifecycle of a bat.

Background

As temperatures drop into winter bats along with other animals must make a choice in order to survive; adapt to the environment (hibernation) or change to a different environment (migration). In this activity we concentrate on a life cycle that focuses on hibernation.

Materials

Provide each student with;
- a blank piece of construction paper,
- the seasons, foods and lifecycle cut outs,
- crayons and glue.

Procedure

Have the students glue the seasons in a circle on the blank piece of paper. Have students decide where each of the events and food items fit into a typical year of a female bat. The finished product should resemble the 'Lifecycle of bat in British Columbia' diagram of previous activity.

Questions:
Are there any reasons why bats would eat certain foods at different times of the year or act certain ways at different times of the year (examples: why do bats eat mosquitos in the spring and summer? Because that's typically when mosquitos and insects are alive, after the wet spring.

Why do bats migrate to a winter roost in the fall? Because the daylight is less and the temperatures are lower so that insects don't survive.

Why do bats hibernate in the winter? Because most of their natural food sources are not available so they go into hibernation in order to preserve energy and survive the winter. Water is frozen and there are very few, if any, insects to eat.

Why does a pregnant mother leave the winter hibernacula in the spring- why not just stay cozy and safe in there all year? Because they're hungry after winter hibernation and they need to find food and water and a warm roost to have their pups – a maternity roost.

A Year in the Life of a Bat

Cut, sort, and glue into the four seasons of the year.

Draw a picture of a bat in spring.

Draw a picture of a bat in summer.

Draw a picture of a bat in fall.

Draw a picture of a bat in winter.

Summer	Spring
Fall	Winter

Cut each sentence and glue it to the season it belongs to.

Bats return to BC or wake up from hibernation.

Females gather in maternity roosts.

Hibernate. (13 out of 15 BC species)

Migrate. (At least 2 species can choose to)

Find hibernacula or migrate south.

Hungry and thirsty.

Pups are born.

Live in southern USA and Mexico (at least 2 species).

Females are pregnant.

Pups learn to fly.

Leave the summer roost.

Find summer roost.

Males usually roost by themselves, or in small numbers with other males.

Bats find a mate.

Deep Sleep


Little Brown Myotis by Keith Shannon, USFWS

Age: Grades K, 1, 2, 4, 5, 7

Subjects: science

Duration: 15 minutes

Group size: small or large

Setting: Indoors or outdoors

Objectives

Students will be able to;
1. Define hibernation
2. Measure their heart beat

Method

Students will measure their heartbeat and compare it to a bat's heartbeat at rest, when active, and during hibernation. Also take a thermometer and take the temperature of different items to compare that to a bat's temperature when active and during hibernation.

Background

Bats are small and have relatively poor insulation. Normal body temperature is 40 degrees Celsius and their heart rate at rest is 100-200 beats per minute (for a Little Brown Myotis).

When food is scarce, like during a stormy night or during winter, fuel consumption goes down. When this happens, bats can lower their metabolic rate and body temperature. Over short periods of time, this is called torpor; over long periods it's called hibernation.

Extra information:
Breeding females do not go into torpor as much as males, as they need to think about fetal development and high milk production. This is the reason why females choose warmer roosts than males. It is thought that males enter torpor more frequently than females.

At least 13 of BC's bat species hibernate in winter. Before hibernating, some have accumulated as much as 40% of their summer weight in fat to use as energy in winter.

Materials—*found in BC Bat Edu-Kit contents*

A stopwatch
Thermometer

Procedure

We're now going to talk about what bats do in the winter. Can anyone tell me what happens to the insects in winter? Diapause- a dormant state, many have a antifreeze protein or will be in a more protective stage of life; egg, larvae or pupae. There are very few available, if any insects.

Can bats find insects to eat in winter? No. Since there is no food, bats have two options. Anyone

know what these are? Hibernate or migrate south to warmer areas where there are insects in winter.

HIBERNATION
Bats can lower their body temperature and heart rate until they are in a deep sleep.

Heart rate:

⇒ Can everyone find their pulse? (Demonstrate how – on neck or wrist – once they find it, see if they can count it for 30 seconds or one minute). Now I want everyone to jump or run for one minute. Then find pulse and count it again. What happened to your pulse rate? Heart rate for child is 80 -100 beats per minute at rest and can be up to 200 bpm when exercising.

⇒ Compare to a bat: resting heart rate 100-200bpm, and when exercising it goes up to 1000bpm. That's 16 beats in one second. (You can simulate heart beat by tapping hand on chest. Try to do 1 beat per second vs. 16 beats every second).

⇒ When bats go into hibernation, their heart beats go down to less than 5 beats per minute. (If tapping hand on chest, that's about one beat every 11 seconds).

Body temperature:

⇒ Does anybody know what our body temperature is? 37°C. Bats are a bit warmer at 40°C.

⇒ When a bat goes into hibernation, it lowers its temperature to 5 °C. Water freezes at zero Celsius. Food in the refrigerator is about 2°C.

Use a thermometer to take temperature of different items:

- A student
- A glass of cold water
- A glass of water with ice
- A cup of hot water/tea

Waking up from hibernation:

⇒ When a bat wakes up from hibernation, it must increase its heartbeat and shiver to increase its body temperature. This takes about 30 minutes and then it can fly away. This takes a lot of energy. Once a bat is awake, it becomes hungry and thirsty.

⇒ If a bat gets disturbed in a cave during hibernation, it uses up energy to raise its heartrate and warm itself up. When it wakes, it is hungry and thirsty. But it is winter. Are there insects for them to eat? No. Can they get water to drink? Not always, water may be frozen. It's very important to leave bats alone in winter, so they can conserve their energy until spring.

Note: Did you know that bats are able to go into a mini-hibernation at any time even in summer, to save energy? If there is a storm or it gets cold outside and they need to save energy, they go into torpor. They lower their heartrate and body temperature and sleep until the weather improves.

Table. Comparison between a Little Brown Myotis and a human child's heart rate and body temperature.

Little Brown Myotis	**Human child**
Resting heart rate 100-200 beats per minute	80-100 beats per minute
Heart rate when active >1000 bpm (when flying)	Up to 200 bpm
Normal body temperature 40° Celsius Torpid or hibernating body temperature 5° Celsius.	37° Celsius

Migration Station

Age: Grades K, 1, 2, 4, 5, 7

Subjects: math, geography, science

Duration: 15 minutes

Group size: 2 to 6 students, or more if each has a map and ruler.

Setting: Indoors


Hoary Bat, by www.merlintuttle.org ©

Objectives

Students will be able to;
1. understand that some bats migrate,
2. define migration.

Method

Students will measure distance of bat migration on a map.

Background

MIGRATION

Two bat species migrate south where insects are abundant during winter:

- Hoary Bat – likely fly south to southern United States and Mexico.
- Red Bat – likely fly to southeastern United States.

At least one bat species is know to migrate and then hibernate:

- The Silver-haired Bat and in places, the Hoary bat, seem to use a combination of both strategies, they migrate to a different winter range and hibernate there until spring.

Materials—*found in BC Bat Edu-Kit contents*

Maps of North America
Ruler

Procedure

Explain what migration is. It is the seasonal movement from one place to another.

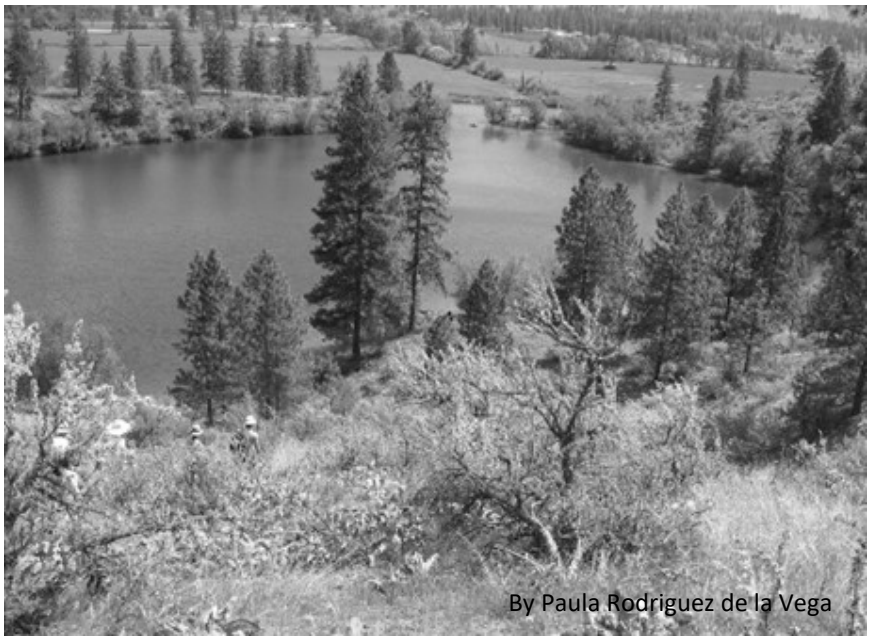
What is another animal that migrates? Birds.

Why do some bats migrate instead of hibernate? Can anyone tell me what happens to the insects in winter? Diapause- a dormant state, many have a antifreeze protein or will be in a more protective stage of life; egg, larvae or pupae. There are very few available, if any insects. Can bats find insects to eat in winter? No. Since there is no food, bats have two options. Hibernate or migrate south to warmer areas where there are insects in winter.

With maps of North America and rulers, have students calculate how far bats migrate.

1. Hoary Bat: From your location in BC to Phoenix, Arizona.
2. Hoary Bat: From your location in BC to Monterrey, Nuevo Leon, Mexico.
3. Red Bat: From Vancouver, BC to Dallas, Texas, USA.
4. Silver-haired Bat: From your location in BC to Spokane, Washington, USA.

Habitat—Food, Water, Shelter or Space?



By Paula Rodriguez de la Vega

Age: Grades 3, 4, 5, 7, 11, 12

Subjects: science

Duration: 10—15 minutes

Group size: 5—10 students or whole class.

Setting: Indoors or outdoors

Objectives
Students will be able to;
1. understand that bats need food, water, shelter, and space in order to survive.

Method
Students reach into a mystery metaphor bag with items that the bat needs to survive. They then have to sort into 'food, water, shelter, or space'.

Background
Bats need 4 basic things to survive: Food, water, shelter, and space.

Materials

- A non-see-through cloth or grocery bag to put items into.
- empty water bottle
- small toy house
- toy insects (ex. beetle, fly, moth, cricket, mosquito, scorpion)
- toy tree
- toy cave
- toy rock cliffs
- toy mine.

If you don't have these toys you can print out the 'Food, water, shelter, or space?' activity sheet provided and cut it out.

Procedure

All living organisms need 4 basic things to survive. Do you know what they are? Food, water, shelter, and space.

We're going to play a mystery connection game. You reach into the bag and pull out one item. Figure out what the item is and whether it is food, water, shelter or space. Make a connection. Get kids to make a connection between how we live and survive and how bats live and survive.

Tips:
Here is some dialogue on some of the items;

Water bottle – can bats get a drink of water from a water bottle? No. What do they need to drink water? Open ponds, lakes, pools.

Toy house – What do you do in your house? Sleep, make food in kitchen, eat, rest, play. So, is a house food, shelter, water, or space? Where do bats make their home? Do bats live in houses? Some do, but not ones they build! Five out of the 15 bats in BC commonly roost in barns, or attics of houses or cabins. Some bats sleep in trees – either hiding behind loose bark, in old woodpecker cavities, or hanging from the branches. Other bats live in rock crevices, cliffs,

caves, or mines.

Insects – Food. Some bats hunt aquatic insects near waterbodies, some hunt forest insects along tree tops, or grassland open areas, others forage along cliffs and rocky slopes. Pallid bats glean for scorpions and centipedes along the ground or on plants. Bats usually eat nocturnal insects, not insects that sleep at night like bees and butterflies.

Creek, forest, lake – Space. All living organisms need space to survive and thrive. You do too…Would you be happy if you were stuck in your bedroom all the time?

Food, Water, Shelter and Space?

Activity Sheet - Print and cut out.

Habitat– My Home Nature Walk

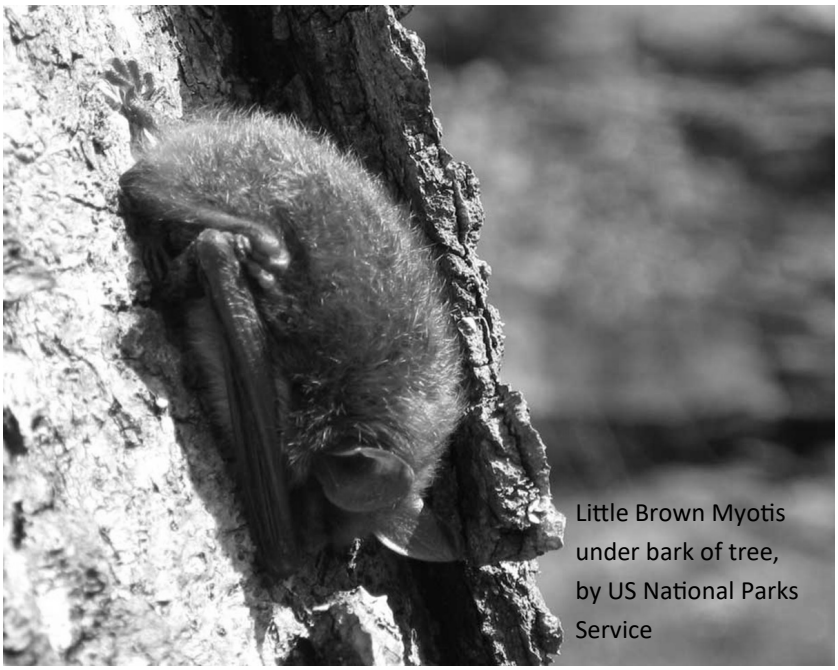
Age: Grades 2,3,4,5,7,9,11

Subjects:

Duration: 15—30 minutes

Group size: class, split into small groups

Setting: Outdoors



Little Brown Myotis under bark of tree, by US National Parks Service

Objectives

Students will be able to;

1. Experience a natural area where bats might live.

Method

Students will go for a walk in a natural area (forest, grassland, riparian area next to pond or lake), pretend to have a bat, and try to identify where bat would find food, water, shelter, and space to survive.

Background

Where do BC bats live? Look for habitat components where bats could roost or hibernate or that they need for their survival.

Materials

- Clipboards
- Worksheet

Procedure

Introduce the nature walk, by talking about what we need to survive. What so we need to survive? Food, water, shelter, space. Bats also need these things.

Go for walk in search of bat habitat. Explain that bats need food, water, shelter and space in natural areas. Hand out worksheet so students can figure out what to look for. Have them describe or draw what they see.

SPACE - Habitat: forests, grasslands, riparian areas, talus slopes, canyon walls, boulders.

FOOD – where would bats get insects around here?

WATER - Drinking water: Where would a bat get water to drink?

SHELTER – Where do bats sleep? Roosts.

- Tree Roosts
- Rock Roosts
- Bridge Roosts
- Building Roosts

What's in my home?

Explore a natural area and look for space, food, water, and shelter for your bat.
Write about what you find or draw a picture in the space provided.

SPACE: Habitat: forests, grasslands, riparian areas, talus slopes, canyon walls, boulders. Contrary to myth, few bats in Canada roost in caves during the summer, but they do use them to hibernate in winter.

FOOD – where would bats get insects around here? Look for places where insects are found, like streams, ponds, lakes, forest edges, cliffs, rock outcrops.

SHELTER – Where do bats sleep? Roosts. Some bats are very specific about where they roost, others are flexible depending on what is available in the environment. Look for good hiding spots high in trees, rock cliffs, or wooden buildings where there are cracks big enough to slide your thumb into.

• Tree Roosts: dead and living trees and stumps. Look under thick bark, behind peeling bark, knot holes, old woodpecker cavities, frost cracks, splits, breakage, and tree cavities. Tree-roosting bats like Hoary Bat and Eastern Red Bat hang on branches and hide among the leaves of larger trees.

• Rock Roosts: In rocky areas, look for;
  - o Cracks and crevices of cliffs, canyon walls, and boulders
  - o Under slabs of rock along rock-faces
  - o Holes in scree of talus slopes or rock piles
  - o Volcanic rock formations
  - o Erosion cavities of rock or solidified mud
  - o Caves and mines

WATER - Drinking water: Where would a bat get water to drink? Wetlands, lakes, ponds, creeks, pools, troughs.

• Bridge Roosts: If it's safe to do so, walk under highway bridges or cement underpasses. Look for crevices that are deep and narrow (1.9 – 2.5 cm wide and 30cm deep).

• Building Roosts: Little Brown Myotis, Yuma Myotis and Big Brown Bat are the three species that commonly use wood buildings. Look around the roof line, soffits, chimney, or attic. Barns and log homes. Bat boxes. Wood piles.

What's for Dinner?

Big Brown Bat with moth

Age: Grades 3, 4, 5, 7, 10, 11.

Subjects: science

Duration: 15 minutes

Group size: 15—30, but can be modified to no less than 5 students.

Setting: Indoors or outdoors

Objectives

Students will be able to;

1. understand that different bat species eat different kinds of insects.

Method

Students will play a game similar to 'musical chairs' where students are bats and they have to walk around food cards while the teacher claps, and sit beside their food item when the teacher stops clapping.

Background

All 15 species of bats that we have in BC eat insects and arachnids. Bats eat hundreds to thousands of insects every night. In a lab setting, one Little Brown Myotis ate 600 mosquitoes in an hour. Some bats eat about half their body weight in insects every night.

Bats eat all kinds of nocturnal insects. Let's play a game to figure out what kind of insects different species of bats eat.

Materials—*found in BC Bat Edu-Kit contents*

'What's for dinner?' activity sheet.

Procedure

The players are bats and they must find their corresponding insect to eat, as per the "What's for dinner?" activity sheet.

You will need as many bat cards and insect cards as you have kids. For example, if you have 10 kids, print out 10 bat cards and 10 of the corresponding insect cards (so make 2 copies of the activity sheet). If you have a very young group, you can simplify it by only doing one bat species with only one kind of insect to eat.

This game is a little like musical chairs but instead of chairs there are insect cards to sit beside and instead of music you call out "Foraging time" and clap while the kids fly/walk around the cards. Then stop clapping and call our "Dinner time". When the clapping stops the bats must sit beside their specific insect card.

Set up: Lay out the insect cards in a row. Spread them out so they are about 2 to 3 feet apart and in random order. Give each student one bat card. Students should read their own card and figure out what insect they eat. Have the students walk around the line of insect cards so they can figure out what insect they eat.

Explain that when you call out “Foraging time” and start clapping, they are to start walking around the food cards. When you stop clapping and call out ‘Dinner time”, it means they have to find their insect food card and sit beside it. Only one bat can touch each insect card.

Play: Try the game once or twice. Once they understand it, remove one insect card so there is now one less insect than there are bats. Repeat the game. If a bat did not get to eat, it goes to the ‘night roost’ (a designated spot) to rest. Remember to remove an insect card after each round. The winner is the bat that gets the last insect. You can play again, but have students switch so they are a different kind of bat.

Note: This game features 5 different species of bats, and thus works best if you have at least 15 players. If you have less players, decrease the variety of bat species. So, for example, if you only have 5 players, just do one species of bat (e.g. Print out 5 Little Brown Myotis cards and 5 corresponding midge cards.)

The table below shows the bats included in the game, an insect that it eats, and where the bat is found in BC. Note that each of these bats eats many different kinds of insects, not just the one featured in the game. However, the larger bat species generally eat larger moths and larger hand-bodied beetles (although not exclusively). Smaller bats generally eat smaller insects like midges (tiny flies), caddisflies, and mosquitoes. One bat in the Okanagan, the Pallid Bat, eats scorpions and centipedes by gleaning them off the ground.

Name of bat	**One of insects that it eats**	**Where is it found?**
Little Brown Myotis	midges	All of BC
Hoary Bat	large moths	All of BC
Townsend’s Big-eared Bat	beetles	Everywhere in BC but Skeena, Omineca, and Peace.
Western Small-footed Myotis	caddisflies	Okanagan, Thompson, Kootenay, Cariboo
Pallid Bat	centipedes	Okanagan

What's for Dinner? Activity Sheet

Print out and designate one bat and its corresponding insect per student

Little Brown Myotis

I like to eat tiny flies called midges near lakes.

Midge (tiny fly)

Hoary Bat

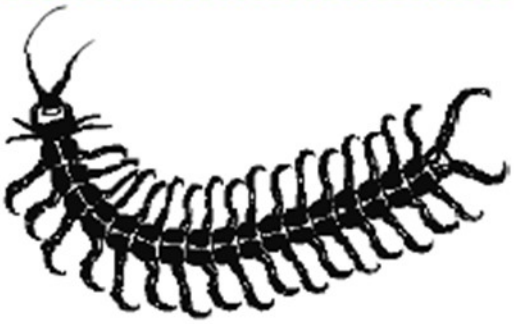
I like to eat large moths.

Large moth

Pallid Bat

I like to eat centipedes.

Centipede



Western Small-footed Myotis

I like to eat caddisflies close to creeks.

Caddisfly

Townsend's Big-eared Bat

I like to eat beetles.

Beetle

Is There Enough Dinner? - A Bug Safari

Age: Grades K—12

Subjects: Math,

Duration: 30 minutes +

Group size: Groups of 2

Setting: Outdoors, space with vegetation.

Objectives

Students will be able to;

1. Understand that bats are consumers of many different groups of insects including moths, beetles, spiders, leafhoppers and other flying insects.

Method

Students will actively look for insects in a 1 foot square area.

Background

There are over one million known species of insects in our world, making up nearly 75% of the animal kingdom. We give insects a bad rap for being "pests" - damaging food crops, our house or biting us. These pests are a small percentage of the whole insect population. Most insects play important roles in our ecosystem and some provide us with very obvious benefits like pollination, predation of pest insects such as wasps on lacewings and decomposition of dead organic materials.

Most important for the bats as all bats in Canada eat nothing but insects (and other arthropods) and in most cases, only flying insects.

One little brown bat can eat 1000 mosquito sized insects in an hour. Bats eat many different kinds of insects. Some are from aquatic environments others from forests, grasslands, or from agricultural lands.

Bats mostly eat insects that are active during dusk and night-time.

Bats eat huge amounts of flying insects, sometimes more than their own weight in insects per night. That's like a 150 lb person eating 600 "quarter-pounder" burgers in one day! Many of the insects that bats eat are likely to be mosquitoes.

Different groups of bats eat different things. There are groups of bats that eat fruit, nectar, insects, mammals, fish, or blood.three species of bats in the world eat bloodthese are the vampire bats of Central and South America. Some bats such as the pallid bat will eat a variety of prey, such as crickets, centipedes, scorpions, grasshoppers, cicadas, praying mantis and long-horned beetles. They have been known to eat lizards and rodents.

The saliva of vampire bats contains anticoagulant that allows the blood to keep flowing after a bite so that the bat can lap up the blood. This chemical is being used as a treatment for strokes because it can help dissolve blood clots in the brain. There is a drug developed called "draculin".

Materials

Bowl and a kitchen scale	Pegs or Flags
Notebook and pencil	Insect ID Guide
Insect net, hand lens (optional)	Find a space with vegetation.

Procedure

Ask students to share their thoughts about insects. As individuals or as a class, write descriptions of insects, create word webs, and/or draw insects using their current conceptions. Ask questions that prompt students to reflect in greater detail. If they mention that insects have legs, for instance, ask them how many and where they're found. Have them brainstorm and list what they know about how insects interact with plants. This will give you and your students something to revisit as they later explore insects and plants up close.

Announce to students that they will be going on an insect safari in the school yard. Encourage them to wear comfortable clothing and shoes. For fun, younger students may enjoy crafting special safari hats.

Before going out on the safari, explain that their job is to observe, draw, and gather information about insects. They can work in teams of two. To adapt the activity for younger students, you may want to provide flash cards of specific insects for them to search for. With older students, you may want to add equipment for more intense study such as hand lenses or insect collecting nets.

Remind them to look in the soil, under leaves, on flowers, and in the air. After all, many creatures carry on their lives out of sight. What is the largest insect they find? The smallest? The most interesting? Instruct them to write about and draw pictures of their findings. Encourage them to include as much detail as possible.

A pallid bat (*Antrozous pallidus*) munches on a scorpion
Courtesy of Richard Jackson

After you return to the class, create a list of all the insects observed and their characteristics. Refer back to the students' reflections before the safari. Did they find any differences between their original ideas about insects and what they observed in real life? What preconceptions were accurate and which were false? What new things did they learn about insects? Use guide books or internet sites to help positively identify all insects observed. Next challenge students to group the insects based on similarities and differences. Follow up by having students research how scientists classify insects, then compare those categories with their own. (Insects are grouped into orders according to physical characteristics and life cycles. Beetles, for instance, are in the order Coleoptera, the members of which are distinguished from other insects by their hardened outer wings that form two halves when folded, two pairs of wings, chewing mouthparts, and complete metamorphosis.) determine whether the insects observed are beneficial, harmful, or neither to plants.

Lastly, identify how many of these insects would be something a bat would eat for dinner. Measure the weight of insects found to determine if there is enough food for a bats dinner. The weight of Insects should equal the weight of a bat. Bats in the Okanagan weigh between 7 grams to 19 grams.

Bats are important predators of pest insects. Big brown bats specialize on beetles and true bugs, including cucumber beetles, June bugs, green and brown stinkbugs and leafhoppers. It is estimated that over one summer season, a colony of 150 big brown bats can eat 38,000 cucumber beetles, 16,000 June bugs, 19,000 stinkbugs, and 50,000 leafhoppers[1]. Be eating 38,000 cucumber beetles, big brown bats control about 33 million cucumber beetle larvae, which are a significant agricultural pest in the west. June bugs, stinkbugs and leafhoppers are also considered agricultural and urban pests—and big brown bats love to eat them. Recent studies in the United States have valued the pest control services provided by bats to be about $74/acre[2] or $3.7 billion/year in the US!

Yuma myotis in pursuit of a moth

To help you identify common beneficial insects, check out online resources such as Beneficial Insects - Predators, Parasitoids and Pollinators OR https://www.bcbats.ca/images/BC-Bat-friendly-Communities-Guide-2018.pdf

- Mass of an insect (e.g. mosquito) - 1– 2 milligrams—Approx. 002 grams
- Average little brown myotis or Yuma myotis—about 7 grams
- Adult female at peak lactation—consumes own weight (or more in insects) - consumes about 7 grams/0.002 = 3500 Insects per bat, per night
- Calculate for a colony of 100 bats = 3500 x 100 = 350,000 insects per night per colony!

Download

To take advantage of the pest control benefits of **bats** can try the following to potentially attract **bats**:

- Provide a water source
- Plant for foraging habitat
- Establish hedgerows of native vegetation to provide habitat
- Use bat-friendly lighting
- Maintain potential roost trees (snags)
- Help protect local roosts
- Maintain/enhance habitat at local bridges

1. Whitaker, J.O., Jr. 1995. Food of the big brown bat, *Eptesicus fuscus*, from maternity colonies in Indiana and Illinois. American Midland Naturalist, 134: 346-360.
2. Boyles, J.G., P.M. Cryan, G. F. McCracken and T.H. Kunz. 2011. Economic Importance of Bats in Agriculture. Science, 332: 41—42.

I'm Thirsty, How Big is my Pond?

Age: Grades 2, 3, 4, 9, 10, 11, 12

Subjects: math, science

Duration: 15 minutes

Group size: at least 2

Setting: Indoors or outdoors

Californian Myotis drinking at a water trough

Objectives

Students will be able to;

1. understand that clean, open water bodies of different sizes are important for bats.

Method

Students will measure out the different size of water bodies that different bats species need. An extension game matching the correct bat to the habitat needs of water.

Background

Water is essential for bat survival. Bats require open, standing water for drinking as they drink while flying. Studies show water must be close (i.e., less than 2 Km) to their summer roosts). Breeding females get especially dehydrated while nursing young in hot maternity roost. One of the first thing bats do when they leave the roost at nightfall is find a water source to drink.

Not all water sources are available to bats. Different bats species approach water differently. If bats are large and built for speed, they are not very maneuverable and need long straight-line flight paths to approach water for drinking. Smaller bats are more maneuverable and slower fliers. They can drink from smaller puddles and may not like large open water bodies due to the increased predation risk out in the open.

Materials

A metre stick or a 30-metre long measuring tape.

Cards to match water source to bat ***found in BC Bat Edu-Kit contents***

Procedure

Choose a bat species from the table below. Get students to measure out the distance of the waterbody on the ground. How big does the waterbody need to be for the other bat species? Discuss the importance of open water to bats for drinking.

Western Small-footed Myotis	Needs 1m stretch of open water. A small pond or even a trough.
Little Brown Myotis	Needs 3m long x 1m wide space of open water.
Big Brown Bat	Needs 15m long stretch of open water.
Hoary Bat	Needs 30m long stretch of open water. Biggest bat in BC, fast flyers.

Procedure

Connect the bats with what you believe would be a good source of water. Use a ruler to determine the bats wing size to help. Remember! Bigger bats need more space!

A lake 	Big Brown Bat: 32 cm long wingspan
A bird bath 	Western Small Footed Myotis 24 cm long wingspan
A pond 	Hoary Bat 40 cm long wingspan
A creek 	Little Brown Myotis 22 cm long wingspan

Answers:

Western Small-footed Myotis=bird bath

Little Brown Myotis=Pond

Big Brown Bat=River

Hoary Bat=Lake

Echolocation—Play Along

Age: Grades 1, 4, 5, 7, 12

Subjects: science

Duration: 15 minutes

Group size: small to large

Setting: Indoors or outdoors

Objectives

Students will be able to;

1. understand how echolocation works.

Method

Students see a physical representation of soundwaves. Two students will simulate being a bat hunting a moth while the teacher holds a slinky representing the echolocation call sound-waves.

Background

Bats have night time superpowers. Bats not only have good eyesight, but they also use echolocation to navigate and hunt for insects. Echolocation is the ability to locate an object by reflected sound. In other words, bats can find their prey or navigate in the dark by listening for their echo.

Bats make very high-pitched sounds that we can't hear or see, and they listen for the echoes. Most bats in BC make high pitched calls at frequencies much higher than our human ears can detect. Humans can detect sounds with frequencies up to 20 kilohertz. Bat echolocation calls generally range from 20 to 120 kilohertz.

Materials—*found in BC Bat Edu-Kit contents*

Slinky

Procedure

Explain that bats have a highly developed sense of hearing. They can create high-pitched calls and then listen for their echoes.

Have students pretend to be bats with large ears (make big ears with their cupped hands on their ears). Have them sing the highest "eeee" that they can. Can they hear the echo of their 'eeee'? No, but bats can. And this is how:

You need two volunteers – one is the bat, one is the moth. Have the bat stand next to you, and the moth about 5 metres away.
"Sound travels in waves that we can't see, and it bounces back when it hits something. Have you ever heard an echo? We're going to pretend that this slinky is the sound wave."
Give one end of the slinky to the bat, while you keep holding on to the other end. Don't let go of this end throughout the whole activity. "Bats make very high-pitched calls that we can't hear, but with the slinky we're going to pretend we can see how the bat uses the high-pitched calls to hunt. This is echolocation."

CLICK AND ECHO
Bat holds the slinky close to their mouth and makes 'clicking' sound. You take the other end of the slinky and stretch it out towards a nearby tree, bush, or wall. The slinky bounces back to the bat (you walk with it) while saying 'echo, echo, echo, tree, tree, tree'. The bat is listening for the echo with its big ears. "Ah that's a tree, I have to fly this way".

AVOIDANCE
Repeat…but this time slinky goes towards a person and bounces back "echo, echo, echo, person, person, person'. The bat hears the echo when you walk back with the slinky. "Ah, that's a person. I don't want to bump into them. I'll fly this way instead".

CATCH A MOTH
Repeat…this time face towards the 'moth'. Bat calls out, you walk the slinky to the moth.
Slinky bounces back 'echo, echo, echo, moth, moth, moth'. The bat hears the echo of the moth and thus knows where dinner is. Explain that "From the echo, the bat can get an accurate picture in its head of the insect. It can tell how big or small the insect is, whether it's hard-shelled like a beetle, or softer like a moth. It can tell if the moth is flying up, down, left, or right, and how fast it is going. This bat can then decide if it wants to eat the moth." Pretend that bat then catches the moth for dinner.

Extension:

On the Internet, research how scientists study sound frequencies. Humans can detect sounds with frequencies up to 20 kilohertz. Bats echolocation calls generally range from 20 to 120 kilohertz.

Also spotted bats, which echolocate at ~12khz and is within range of human hearing. They hunt larger moths, particularly "tympanate" moths that can hear higher pitched echolocations and sometimes avoid predation by other types of bats. Spotted bats occur in Canada only in BC and are vulnerable. They also occur in the USA.

Echolocation—Feel the Sound Waves

Age: Grades 1, 4, 5, 7, 12

Subjects: science

Duration: 5 minutes

Group size: small to large

Setting: Indoors or outdoors

Yuma Myotis hunting a moth by MerlinTuttle.org ©

Objectives

Students will be able to;

1. Get an idea that sound waves bounce back when they hit a hard surface.

Method

Students will pretend they are bats echolocating by using wind and feeling for the echo.

Background

Sound travels in waves that we can't see, and it bounces back when it hits something.

Materials

None.

Procedure

Lead the students in an exercise to show how sound waves could feel like.

1. Make puffing sounds. It could be like sounding out the letter "p" without using your voice (so just the 'p' and not the 'e').

2. Get the students to cup their hands together as if you were trying to hold a glass ball in their hands. Bring cupped hands close to lips.

3. Make the puffing sound while holding hands close to lips. Students should be able to feel the puff of air bounce back to their face. If they can't feel it try puffing a little harder.

4. Keep 'puffing', and then start moving cupped hands away from face slowly.

"How far can you get from your face before you can't feel the 'puff' anymore?"

Echolocation—Bat and Moth Game


Delta Home Learners NatureKids BC Club

Age: Grades 1, 4, 5, 7, 12

Subjects: science

Duration: 15 to 20 minutes

Group size: 5—30

Setting: outdoors

Objectives

Students will be able to;

1. understand that BC bats eat insects,
2. recognize that bats hunt with echolocation.

Method

Students will play a pretend hunting game where one person is a bat and the rest of the class are moths.

Background

Bats are not blind. They likely see better than us in the dusk and dark of night. Most use echolocation to navigate and locate prey. Bats emit regular high-pitched calls and then listen to the echo of their voice. By the sound and timing of the echo, they can determine the range, the size and type of objects in front of them, if they are flying and how fast they are moving.

Materials—*found in BC Bat Edu-Kit contents*

One blindfold for the bat

Procedure

Designate boundaries or have some adults stand along boundaries. This game is a little like 'Marco Polo'. One person is the 'bat'. Blindfold them. They call out 'bat, bat' or 'click, click'. The rest of the kids are 'moths' and they are bat food. Every time the bat calls out 'bat, bat', the moths must reply loud and clear with a 'buzz, buzz'. Objective is for bat to try to catch the moths just by listening.

Game rules:
Moths must respond if the bat calls.
Moths must walk. If they run, they are out of the game. Or you might need to impose another rule where moths can only take a maximum of 3 steps at a time.
When a moth is tagged, they go to the bat cave (designated area) until the next round.

Baby Bat Smell Game

Age: Grades 1, 4, 5, 7

Subjects: science

Duration: 15—20 minutes

Group size: groups of 6, or whole class taking turns

Setting: Indoors or outdoors

South Okanagan NatureKids BC Club

Objectives

Students will be able to;

1. understand that mother bats use sense of smell to find their pups in a maternity roost.

Method

Students will use their own sense of smell to figure out who the baby bat is.

Background

Maternity roosts are locations where females gather to raise pups. Female bats and their pups may roost in groups ranging from two to several thousand individuals. Most females gives birth to one pup.

Females go foraging for insects at night, leaving the pup behind for several hours. When the female returns it has to find its pup among hundreds of others.

Bats find their pups with a combination of calls and by using their sense of smell.

Maternity roosts are often enclosed, sheltered, and warm locations such as in buildings, bat houses, large rock crevices, trees with sloughing bark, or tree cavities.

Note that male bats in BC do not help raise the pups. They do not live in the maternity roost. Males often roost in cooler sites by themselves in what biologists call a 'day roost'. Day roosts are usually within enclosed spaces, well-protected from weather and predators.

Materials

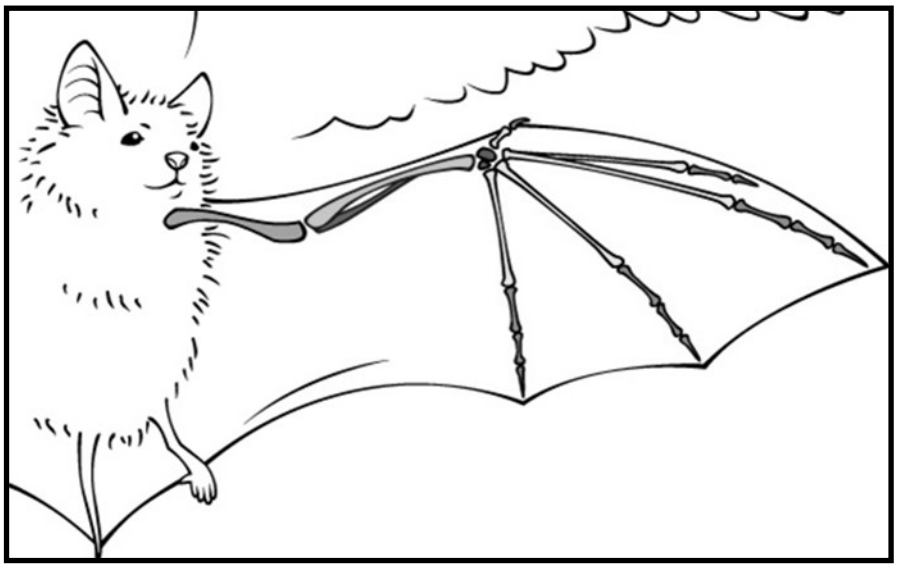
Blindfolds
Small bottles filled with cotton balls and 6 different essential oils

Procedure

Players are the mother bats and they have to find the baby bat by smell.

Players are blindfolded and smell one bottle. Bottle is returned to the lineup, blindfold is removed, and the player tries to pick the scent out of the lineup.

Hand Wings



Age: Grades K—7

Subjects: science

Duration: 15 minutes

Group size: 2-8

Setting: Indoors

Objectives

Students will be able to;

1. Identify the bones in a bats' wing,
2. Understand that bat wings are made of the arm and hand bones
3. Be able to break down the word 'Chiroptera'.

Method

Students will use a magnetic board to figure out which bones belong to the bat, bird, and human arm anatomy.

Background

Bats are the only mammals that can fly. Bat wings are modified tetrapod forelimbs. Meaning that because bats are mammals, the skeletal structures in their wings are similar to the skeletal parts of other four-legged forelimbs. Through evolution, the forelimbs of the bats have changed and become wings.

The magnetic board shows the bone structure of a human arm, a bird's wing, and a bat's wing. Bird wings have a fairly rigid bone structure and they fly mostly with very well developed muscles that attach to their body. A bat has wings that are more flexible. It is very much like a human arm and hand, except it has a thin membrane of skin covering the 'hand' and the body. This skin membrane is called the patagium.

The 'thumb' of a bat extends out of the wing with a small claw. Bats use this claw to climb up trees or to hang on when they land.

Bats belong to the Order Chiroptera. This is a Greek word meaning 'hand-wing'.

Materials—*found in BC Bat Edu-Kit contents*

- Bat wing magnetic board (a large cookie sheet with print out of bat wings versus human arms versus bird wings).
- Foam cut outs of the different bones of the forelimbs of bat, bird, and human.

Procedure

Have students study the bones which are colour coded on each organism.

Allow students to place the bones on each organism and explore some of the similarities and differences of their morphologies.

Can you find the elbow? The wrist? The hand and finger bones?

How many fingers does a human have? A bird?

A bat? Count them.

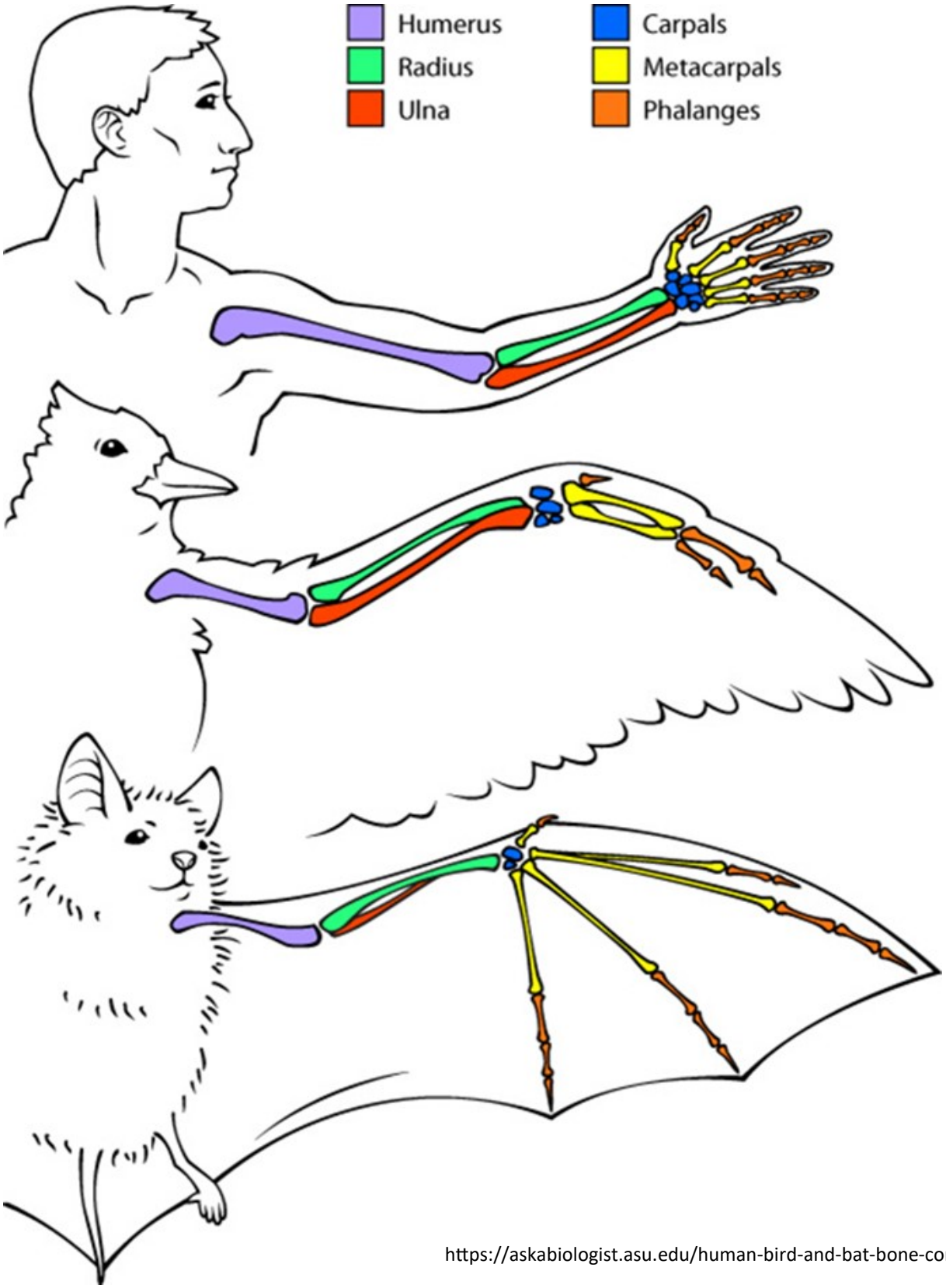
Compare the length of the metacarpals and phalanges.

What happened to the thumb? Bats have a tiny thumb 'claw', which allows them to hang on when they land on a vertical surface.

Bats belong to the Order Chiroptera, which means 'hand-wing'.

- Can you guess why?
- Can you think of other words that start with the word 'Chiro'? Ex. Chiropractors work with their hands.
- Can you think of other words or animals that start with the word 'ptera'? Ex. Pterodactyls (are winged dinosaurs)

Bat wing anatomy: Comparison of bat wing bones to human and bird forelimb bones



https://askabiologist.asu.edu/human-bird-and-bat-bone-comparison

Flight and Technology

Townsend's Big-eared Bat

Age: Grades 7– 12

Subjects: Anatomy, technology, engineering

Duration: 5 days

Group size: Class size or individual

Setting: Indoors and then outdoors

Sources:

1. https://www.cnbc.com/2015/05/22/biomimetics-improving-sonar-by-borrowing-from-nature.html
2. https://www.cuimc.columbia.edu/news/feel-flight-how-studying-bat-touch-could-help-build-better-planes
3. https://www.technology.org/2019/03/01/scientists-created-a-3d-model-of-the-bats-flight-to-aid-creation-of-the-new-generation-of-drones/
4. https://www.cell.com/cell-reports/fulltext/S2211-1247(15)00376-9
5. https://www.mydronelab.com/blog/how-to-build-a-drone.html

Objectives

Students will be able to;

1. Understand the role of echolocation in bat flight.
2. Understand some of the anatomy and neuroscience of bat flight.
3. Able to identify real examples of how the science of bats have contributed to building aircraft, sonar systems and understanding the evolution of powered flight in mammals.
4. Build a DYI drone.

Method

Students will discuss anatomy and sensory skills of bats in order to understand the relevance of this science contributing to modern technology. Follow the instructions to build a drone.

Background

Bats are among the best of fliers, maneuverable, precise and efficient. Scientists are learning from our bats. It is such an amazing system the US Navy studies bats and echolocation to improve human-developed sonar systems.

Scientists also study bats and their flight in new technology.

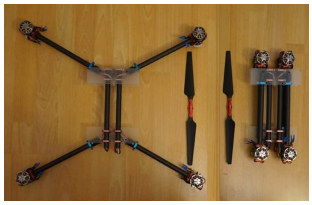
Bat wings have evolved not only for flight, like avian wings, but also for object manipulation, such as pup handling and capturing insects. Wing function is possible because bat wings have more than 20 degrees of freedom in their independently movable joints, allowing them to adjust wing shape or camber. This wing flexibility is unique among flying animals and provides capabilities of executing quick altitude drops and agile directional changes. Hearing and vision sensory input as well as touch sensory hair follicles guide adjustments to bat wings.

Procedure;

- Students and teacher discuss the anatomy of bats, the process of echolocation. (Previous activity).
- Discuss the process as bats flap their wings, they produce complex aerodynamic trails. The air flowing over the wing stimulates microscopic hairs and provide feedback to a bat through a unique arrangement of sensory receptors. Sense of touch—airflow and tactile stimulation was found to activate common neural pathways.
- Build a drone; a wide range of drones on the market. Buy a drone kit like Lego. Or instructions are included in the edu-kit. It may take a fair amount of time and resources but respect for bat anatomy and skills will increase exponentially.

Flight and Technology—Instruction on How to Make a Drone

List of Components



Frame: there are two possibilities when it comes to a frame for your drone. You can make it yourself or buy it in an online store, and for a wide choice of high-quality frames, we suggest checking out our article about best drone frames. If you decide to build it yourself, the project is not that difficult, but you'll need some engineering knowledge and knowledge of the materials you are going to use. For instance, you can use metal (something light), plastic, or even wood slats. If you opt for a wooden frame, you'll need a wood board which is about 2.5 cm thick.

Motors: For an ordinary quad, you will need 4 motors in total, but an octocopter requires eight motors to fly. The recommendation is to use brushless motors – they are lighter on the battery and, unless you are an engineer who completely understands how a motor works, these pieces should be bought from a store. You can also get more familiar with them by reading our article about drone motors.

ESCs or electronic speed control: These are also essential pieces of your drone as they are in charge of delivering power to the motors. Again, their number depends on the number of arms your drone is going to have.

Propellers: When looking for the propellers, you must find the ones that match the frame of your drone. Pay attention to materials – you won't find wooden propellers, but you must make sure the ones you choose are a good fit.

Connectors: You will need 3.5 mm connectors to weld the motors and ESCs, as well as 4.5 mm connectors for the power distribution board.

The power distribution board – this board connects the electronic speed controls to the battery.

Batteries: When purchasing the batteries for your drone, you need to consider the capacity of a battery and its type. The most used batteries for this purpose are Li-Po batteries and their power differs. To have a much better insight on this topic, we strongly suggest checking out **our article about drone batteries**.

Battery monitor: This is not an elementary item, but the monitor is quite useful in warning you when the batteries are close to finishing. This way you don't risk having the drone remain out of juice in the air, over a pond. A battery monitor ensures that your aerial vehicle won't die in the most inopportune place.

Mounting pad: It reduces the vibrations, and thus improves the flight. This one is very useful especially if you are trying to take pictures or videos with your DIY drone.

- **Controller:** This device shares the power and commands the motors at the same time.
- **RC receiver:** Of course, if you have a transmitter (which is usually with you), you'll also have a receiver mounted on the drone.
- **Camera:** If you want to take aerial photos and record the surroundings while flying your drone, you will need a camera. The best cameras are those that can take the quality 4K videos, but everyone will find one according to their needs. For high-quality aerial photography and videography, you might also need a gimbal for the camera.
- **USB key:** This is necessary to save the photos and videos.

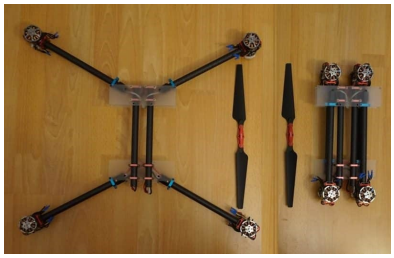
Aside from the above-mentioned parts, you will also need AWG silicone wires, a battery charger, Servo lead wire cables, zip ties, 3M command strips, thread locking compounds, etc. In addition to these components, you can also embed other accessories to your drone and make it more advanced. In other words, there are many, many ways to build a drone, and depending how much of it you truly want to make DIY, these steps will vary and the necessary components will change. The guide below will provide you with insight into the DIY process for a quadcopter.

Source: https://www.mydronelab.com/blog/how-to-build-a-drone.html

STEP-BY-STEP INSTRUCTIONS

There are different types of drones, but people find quadcopters to be more efficient, as they are easy to fly. So for this step-by-step guide, we have focused on showing you how to build a quadcopter with pieces that you can buy separately:

STEP 1: MAKING THE FRAME



No matter what your drone is going to be, it must have a frame. So, the first task is to make a frame. For this purpose, you can use different materials, such as metal, plastic, or wood. These materials will differ based on how sturdy you intend the drone to be.
If you select wood for the frame, find a wood board that is longer than 60 cm and about 25-30 mm thick. Cut up this board in such a way to get two laths which are 60cm long and 30mm wide. These two lengths are required to make the structure of your future quad.
Crossing these two laths you'll make the X frame. Also, you will need a wooden sheet in order to make and add a rectangular piece in the central part of this frame. Its size should be 6×15 cm, and about 2mm thick.
Of course, you can use other dimensions if you like, but these will get you a pretty nice quad. To connect these parts, you will need nails and glue. In case you decide to go with metal or plastic, the dimensions are similar but the way you connect the laths together is going to be different.
Check out our suggestions for the best-premade frames which you can use as a base for your project:
LHI 220-RX FPV Quadcopter Frame (Carbon Fiber)
Readytosky FPV Drone Frame (Carbon Fiber)
iFlight XL5 V3 240mm FPV Frame Carbon Fiber
Mallofusa 4-Axis HJ450 F450 RC QuadCopter Multirotor Airframe
Usmile X style Carbon Fiber Drone Frame
Readytosky S500 Quadcopter Frame with Carbon Fiber Landing Gear

STEP 2: PROPELLERS, ELECTRONIC SPEED CONTROLLERS, AND MOTORS

The ESCs (Electronic Speed Controllers), the motors, and the propellers are among the most important elements of a functional drone. So, you should get these components from an authorized store to ensure quality and reliability. They must be in accordance with the size of your drone, so bare this in mind when buying them. Do not be afraid to ask for assistance from someone at the store.
When looking for **the motors (or rotors)**, you should know that multi-rotor drones produce greater speed and ensure a stable flight, as each rotor works with other's thrust points. **For example, check out these rotors:**
Emax RS2205 2600KV Brushless Motors
Readytosky GT2205 2205 2300KV Brushless Motor
HOBBYMATE 2204 QuadCopter Rotors Combo
AOKFLY 4PCS RV1104 4200KV FPV Brushless Motor

For the propellers, we suggest you buy the metal 9-inch props you can find at a very affordable price on the market. These are durable and won't bend so easily if the drone hits something during flight. However, if you want better performance, it would be better to get carbon props. If you want good performance we recommend you to get any of these:
BTG Quick Release Carbon Fiber Reinforced Propellers
Myshine 9450 Self-tightening Propeller Props
Performance 1245 Black Propellers MR Series
USAQ Carbon Fiber Propellers (2) Pair
Helistar Propellers 6 Pairs 4730F Colored Quick Release Folding Blades

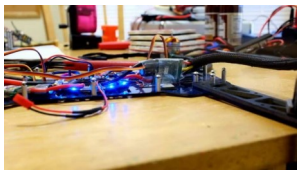
And finally, you need to pick up some **ESCs (Electronic Speed Controllers)**, if you don't want 4 of these (keep in mind we're talking about a quad here) you can buy the 4 in 1 controller. **We would suggest these models, which are great and stable:**
AKK 30A 4 IN 1 2-6S Brushless ESC BLHeli_S Electronic Speed Controller
DShot150/300/600 Capable for Micro Racing Drones
Original Airbot Omnibus F4 Nano Flight Controller

STEP 3: ASSEMBLE THE MOTORS

The next thing you need to do is drill the holes in the frame for the motors, according to the distance between the screws holes on the motors. It would be good to make another hole that will allow the clip and shaft of the motor to move freely.

However, you may skip this action if the motors already came with mountings. Put the motor in the appropriate place and fix it to the frame using the screws and a screwdriver.

STEP 4: MOUNT THE ELECTRONIC SPEED CONTROLLERS



After mounting the motors, you also have to mount the speed controllers. How will you do this? It is recommended to connect the speed controllers on the bottom side of the frame due to several reasons which involve the functionality of the drone. These reasons, among others, include that it will "unload" the upper side of the drone where other components should be added.
In order to fix the ESC very well to the frame, you need to use zip ties. This way, your ESCs are tied down and well secured while flying.

STEP 5: ADD THE LANDING GEAR

This gear is an important part when landing your UAV because it significantly reduces the shock when the drone lands on a solid ground. It can be made in different ways, but you should be creative and make it in your own, unique way.
Here's one idea: find a metal pipe (about 6 inches in diameter) and cut off (with the appropriate tools) 4 rings that will be 1-2 cm thick. Of course, the size of these rings should be in accordance with the general size of your drone. You can then use duct tape to fix these pieces to the frame. If you don't like this metal pipe idea, you can also use other materials that are flexible but strong, such as some new plastics, or anything that will reduce shock.

STEP 6: FLIGHT CONTROLLER

Every flying drone must have a control system. This electronic system allows a drone to be stable in the air while flying and processes all the shifts and changes in direction and the wind.There are two options when it comes to this step:
First, and the easier option, is to buy a ready-to-use controller. With the second option being that you make it yourself.
For this work, you can use one of the following source **flight controller projects**:
DJI NAZA: **DJI NAZA M V2**or **DJI Naza Lite** closed sources.
ArduPilot: An expensive but a very good hardware for drone controllers with great performance. It features an automated flight mode.
OpenPilot CC3D: This superb open-source flight project contains 6 channels and the **MPU-6000** It is very easy to set up and install, and there is a wizard guide that leads you through the installation. Even better, this open project is now available through different sources on the web.
NAZE32: Very flexible but a bit complicated to set up. It has the advanced fliers which improve the control over your drone, but you must make sure you can actually set it up.
KK2: This is one of the most used projects for this purpose since it is cheaper than most other sources of that ilk. It comes with LCD that is based on the advanced AVR controllers. Thus, you can set it up without using a computer. Also, it has the **MPU6050** has a sensor, which allows you to write your firmware. However, KK2 requires manual tuning and it is not convenient for RC beginners.

If you want to make a controller yourself, you should opt for one of these projects that best suits your needs. Follow the links above to do some more research, and examine the individuals features of each in more detail. It is very complicated to construct such a device and requires an expert drone technician. But if you are able, your drone will be the ultimate "**do-it-yourself**" aerial vehicle.

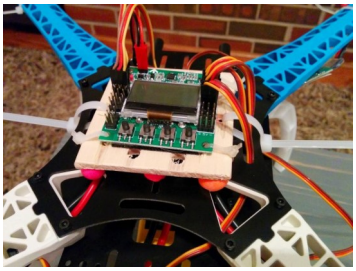
STEP 7: CHOOSING A RIGHT RC TX-RX (WIRELESS REMOTE CONTROL SYSTEM)

This is the remote control system that is needed to control a drone.
There are various available **RC control systems** nowadays, like **Futaba, Spektrum, Turnigy, FlySky**, and so on. You can find more details and do research on all of these systems here:

Futaba 10JH 10-Channel Heli T-FHSS Computer Radio System
Spektrum DX8 Radio Transmitter
Turnigy 9X 9Ch Transmitter w/ Module
Flysky FS-i6X 10CH 2.4GHz AFHDS RC Transmitter w/ FS-iA6B Receiver

In addition to this system, you'll also need a few channels for yaw, pitch, throttle, and roll, as well as the additional channels if you want to mount a camera control to your drone for some aerial photography.

STEP 8: MOUNT THE FLIGHT CONTROLLER



Once you choose the particular flight controller that is best for your needs, you need to mount it. There are several ways to mount it. For instance, you can place it on the top of the frame in a certain direction, but you need to make sure that all the components are fixed well before calibrating your drone. For this purpose, you can also use the zip ties which were mentioned above.
It is recommended to put a small piece of sponge on the underside of the flight controller because it absorbs and reduces the vibrations from the motors. Thus, your drone will be more stable while flying, and stability is key to fly a drone.

STEP 9: CONNECT THE OPEN PILOT TO YOUR DRONE

The next thing you have to do is to configure and connect the flight controller to the electronic speed controllers.
Also, you have to connect it to the remote control. In order to see how to do this step, you will need to find an appropriate tutorial video on the web for the particular flight controller you have previously mounted.
I wrote an ultimate guide on **how to build a quadcopter with the Arduino Uno Controller**. There is lots of info on assembling, wiring everything together, and the programming science involved.

STEP 10: CHECK OUT AND TEST YOUR DRONE

Before you finally use your drone, you must be sure that everything works well. Therefore, you have to check out all the functions before the first flight. You can test the sensors as well as other components of your drone using the special OpenPilot GCS.
To make sure that everything works well, you need to take off the props and make a small experiment with the remote control. This ensures that you can test the drone without risking the potential of breaking it.
For this test, you should find a suitable place and try to move your drone within its control distance. Pay attention to the zip ties and cables to make sure that they are connected well. When everything is okay, your drone is ready to fly!
Be sure not to cut any corners in this step, it is imperative to test everything in detail before actually flying the drone. You would not want your drone's first flight to be its last after all!

STEP 11: TAKEOFF

This is the last (and dare I say, most important) step. Before taking off, the battery must be well connected and all the components must be fixed in place. For the test flight, you need to choose a location carefully, since this aircraft can cause serious damages and can be damaged as well. It is best to choose an open, flat area, so that you do not run the risk of damaging anything with your drone, or vice versa. Also, you will ensure that you can see your drone at all times.

Place your quad on the ground, put it into operation, take the flight controller, and get started with your first flight. It's recommended that you slowly throttle up your drone, and fly it at low altitude for the very first time. Thus, if it starts coming down out of control, the damage won't be that significant.

If the drone starts drifting in one direction, you have to use the trims in order to make the necessary flight correction. Also, you should try out different PID values to see how your drone works in various inputs until you get exactly what you want.

WRAPPING UP

In this article, we managed to briefly cover the pieces and the steps to make in order to build a drone from scratch, but you should consider learning more. What's more, there are also many "intermediate steps" in addition to the basic steps we just described. It is simply the fact that due to the multitude of types of drones, component, programs, and accessories, that there are many ways to build a drone depending on the complexity of drone you are planning to make.

So, what will be the final conclusion when it comes to the do-it-yourself unmanned aircraft? In any case, they are not going to be serious competitors to the ready-to-use drones on the market, especially if they are made by the amateurs.

This general gap in quality between DIY and ready-to-use drones applies to both features and appearance. However, people who build the UAVs from scratch usually don't want to compete with the commercial drones, they simply do it for pleasure. It is indescribable joy when you take off your do-it-yourself aircraft in the air! People who want to build a drone likely just want to learn a new skill, and take pride in something that they have built themselves, regardless of how high-performance the end result may be.

Another big consideration is the total cost for such a drone. Because there are so many potential variables, components, and programs involved, the cost can really fluctuate. The cost will depend on the components you are going to use if you are considering additional accessories. However, as a general benchmark, the total costs for the entire project range from $200 to $300 for an ordinary quadcopter.

Aside from this amount, you also should consider the cost of the camera and if you are going to use a drone for aerial recording and taking high-quality photos as well.

If you check out the prices on the Amazon and other similar websites, you will see that you can buy an advanced drone that supports aerial photography for a similar amount as a DIY drone. However, the satisfaction of having built your own drone does not have a price tag, and often you just want to have the experience of flying something that you have built!

Find My Bat Twin

Age: Grades 3 - 12

Subjects:

Duration: 15 minutes

Group size: 16 or 24

Setting: Indoors or outdoors

Objectives

Students will be able to;

1. Identify 8 of the 15 species of bats that live in BC.

Method

Students will play a card game, where they have to read about their bat and then ask 'yes' or 'no' questions to find another student who has the same bat species.

Background

All of the 15 species of bats that live in BC are unique in their own way. Some look very similar but their habitat or roosting needs are different. Others have evolved to use very specific habitats or eat very specific diets. NatureKids BC developed Bat Cards of 8 different species that kids can use to learn about bats.

Materials—*found in BC Bat Edu-Kit contents*

Print out at least two copies of NatureKids BC Bat Cards. Cut them out. This will give you enough cards for 16 students to play. If you have a larger class you could always try printing out 3 sets and playing 'find your triplets'.

Procedure

Each student receives one Bat Card. Give them time to read the card so they can get familiar with their bat.

You may need to introduce or review some vocabulary.

Diet: The kind of food that a bat eats.

Habitat: The natural home or environment where a bat lives.

Roost: the place where bats rest during the day.

BC range: the regions in British Columbia where a bat is found.

Hibernate: bats do into a deep sleep during the winter.

Migrate: some bats fly south to warmer areas during winter.

Object of the game is to find their identical twin (the other student with the same Bat Card). Students cannot show their card to anybody.

Students must ask 'yes' or 'no' questions to the other students in order to find their twin. Questions like;

- Do you eat large moths and beetles?
- Do you live in deciduous and coniferous forests? (Habitat)
- Do you roost in trees?
- Are you found in all of BC (range)
- Do you migrate south in winter?

Western Small-footed Myotis

Myotis ciliolabrum

The smallest bat in BC weighing as little as a loonie.

Diet: Small insects like caddisflies, midges, mosquitoes
Habitat: Cliffs, rock out-corps, river banks, riparian
Roost: Rock crevices and erosion holes along river banks
BC range: Arid areas of the interior

Hibernates in mines and cliffs.

Hoary Bat

Lasiurus cinereus

The biggest bat in BC with a wingspan of 40cm (15.7"). Fast and long-distance flier.

Diet: Large moths, dragonflies, beetles
Habitat: Deciduous and coniferous forests, grasslands
Roost: 'Tree bat' – branches and leaves of trees
BC range: All of BC

Migrates to southern USA and Mexico.

Pallid Bat

Antrozous pallidus

Gleans insects from the ground. It appears to be immune to scorpion venom.

Diet: Scarab beetles, moths, crickets, scorpions
Habitat: Open arid areas
Roost: Rock crevices, trees, cliffs
BC range: South Okanagan

Hibernates sites unknown.

Little Brown Myotis

Myotis lucifugus

Commonly roost in buildings and bat boxes with colonies of up to 2000 bats. Endangered in Canada due to white-nose syndrome.

Diet: Aquatic insects like caddisflies and mosquitoes, beetles, spiders
Habitat: Forests and grasslands
Roost: Buildings, bat boxes, old trees, rock-crevices, bridges
BC range: All of BC

Hibernates in caves, mines, rock crevices, tree root wads.

Big Brown Bat

Eptesicus fuscus

An excellent forager and can fill its stomach in less than an hour after evening emergence.

Diet: Larger moths, beetles, carpenter ants, termites, lacewings, various flies
Habitat: Forests and grasslands
Roost: Buildings, big bat boxes, wildlife trees, cliffs, rock crevices
BC range: All of BC

Hibernates in buildings, mines, rock crevices

Carl Lausen

Townsend's Big-eared Bat

Corynorhinus townsendii

One of 3 species of BC with enormous ears. It commonly roosts in buildings with large open spaces and are easily disturbed.

Diet: Moths and beetles
Habitat: Forests and grasslands
Roost: Large open attics, big bat boxes, boulder fields, caves, large tree cavities
BC range: Southern two-thirds of province

Hibernates in caves, mines, rock crevices

Cory Olson

Spotted Bat

Euderma maculatum

The only bat in BC whose echolocation calls can be heard by people without the aid of a bat detector. Calls sound like high-pitched, metallic clicks.

Diet: Moths and beetles
Habitat: Arid grasslands
Roost: Cliffs
BC range: Dry interior as far north as Williams Lake

Hibernates in cliffs and mines.

Margi Chantler

Long-eared Myotis

Myotis evotis

Flies slowly and low to the ground. This allows them to roost down low in tree stumps and under boulders and rock piles.

Diet: Moths, beetles, flies, spiders
Habitat: Forests and grasslands
Roost: Cliffs, snags, stumps, talus slopes, rocky areas, mines, bat boxes
BC range: All of BC

Hibernates in mines and rocky areas

Cory Olson

Create a Bat

Age: Grades 1, 2,3,4,5

Subjects: science, art

Duration: 15 minutes

Group size: 5—30

Setting: Indoors

Tree Roost, by Mandy Kellner

Objectives

Students will be able to;

1. understand that bats are anatomically adapted to eat their prey and live in their habitat.

Method

Students will create their own bat by drawing a bat that can eat a particular food item.

Background

A good way to get across the concept of mouth and body adaptations is to have students (working alone or in a group) to create their own bats.

Materials

Paper and drawing utensils

Procedure

Have students choose a food source (encourage them to choose something kind of wacky) and then create and draw a bat that would be well adapted to finding, acquiring, and eating that food.

You could also have them draw its habitat or any other elements you think are useful for getting the students to think about adaptations. Make sure they give their new bat species a name!

Mapping Bat Territory

Age: Grades 5—12

Subjects: geography, science, math

Duration: 15-30 minutes

Group size: 2—4 students

Setting: Indoors

Objectives

Students will be able to;

1. understand bats with their diverse habitat needs.
2. Be able to extrapolate what impact climate change might have on the territory map of bat species.

Method

Students will discuss migration (migration station activity), hibernation and then using resources be able to overlap territory maps. Answer questions regarding territory of species, present to class or in a poster or news format. Extrapolate what the future for bats looks like, considering disappearing habitat, climate change, white-nose syndrome and other considerations.

Background

Bats are of conservation concern and part of understanding and therefore caring for bats is understanding their territory. White-nose Syndrome and climate change will have an unknown affect on our populations of bats.

Materials

BC map

BC Species table of known roosts

First Nations map maps.fpcc.ca

habitat references from ID cards and from **BC Species,** table on the following page with known roosting preferences. Range maps are linked.

Procedure

- Students and teacher discuss the similarities and differences between bats and their roosting preferences and range maps
- Discuss how each environmental has characteristic life forms that have adapted to it climate, kinds of available food, and nursery considerations. Emphasize that all animals are adapted to survive in their environment.
- Ask the students to imagine the place where each bat lives. Talk about the similarities and differences of these regions. Ask the students to think about how each bat looks and whether its features help it to live where it lives. Talk about the different adaptations for each of the bat species.
- Distribute a map to a group of students. Each group can choose a different bat to study. Have them draw in the known path of distribution.
- Outline which First Nation territory(s) the species overlaps with. If found, add First Nation knowledge—ensure to include bibliography.
- Make sure to account for major habitat needs; food, water, shelter and space for migration/hibernation and or reproduction.
- Overlay any incidence of White-nose Syndrome within the bat map territory. http://www.batcon.org/our-work/regions/usa-

canada/white-nose-syndrome

- Can you include any information on the map regarding climate change in the territory? Climateatlas.ca

The left margin of the table on the following page has a hyperlink to more information and a dispersal map of the bat. Additional information can be found at http://www.batcon.org/resources/media-education/species-profiles or BCbats.ca

Students can access this page online, or you might cut and paste the maps onto a blank sheet of paper, photocopy the page of maps, and present that resource to students. They will use their maps to answer the following map-related questions:

1. Which bat can be found in more places in the Canada-- the big brown bat or the little brown bat? (the big brown bat)
2. Is the pallid bat found on the east coast and the west coast of Canada? (the west coast)
3. Which bat can be found in Canada -- the eastern long-eared bat or the evening bat? (the eastern long-eared bat)
4. How many of the sixteen bat species shown on these maps can be found in the Okanagan? (13)
5. Which bat is found mostly in the southern parts of the Okanagan -- the Pallid bat or the Mexican free-tailed bat? (the Pallid bat)
6. Which bat species is found in Peachland Visitors Centre-- the Yuma myotis or the cave myotis? (the Yuma myotis and Little brown bats)
7. Extrapolate how climate change will affect the territory of bats within BC.
8. How will the disappearance of this bat from the ecosystem affect things?
9. What else can mapping a species Territory tell us?

Known Roosting Preferences:

Bats of British Columbia (BC) in summer and winter (modified from Craig and Holroyd 2004).

Link on the graphic on the left hand column to more information, territory map at BC Species and Ecosystems Explorer. (http://a100.gov.bc.ca/pub/eswp/ - all images credit: MerlinTuttle.org

	Common Name	Summer Roosts			Winter Roosts
		Buildings	Bat House User	Natural roosts	
	Spotted Bat			Cliffs	Cliffs, mines
	Pallid Bat	Potentially		Cliffs, rock outcrops, snags, build- ings, mines, orchard	Rock crevices?
	Townsend's Big-eared Bat	Common	Yes, big ones!	Cliffs, caves, buildings, mines	Mines, caves, rock crevices
	Hoary Bat			Snags, trees	Migrates
	Eastern Red Bat			Trees	Migrates
	Silver-haired Bat			Trees, snags (cottonwoods)	Snags, mines, buildings, wood piles, rock piles
	Big Brown Bat	Common	Yes	Snags, cliffs, rock crevices	Buildings, mines
	Yuma Myotis	Common	Yes	Snags, rock crevices, mines, bridges	Mines
	Californian Myotis	Occasional	Yes	Snags, mines, bridges, rock out- crops & crevices	Buildings, mines, caves, rock crevices
	Western Small-footed Myotis	Occasional		Cliffs, rock crevices, mines,	Mines, cliff crevices
	Northern Myotis	Rarely		Snags	Mines
	Long-legged Myotis	Occasional		Cliffs, rock crevices, snags, stumps	Mines, caves, rock crevices
	Little Brown Myotis	Common	Yes	Snags, rock crevices, cliffs, mines	Mines, caves, rock crevices
	Fringed Myotis	Occasional		Mines, cliffs, rock crevices, snags	Mines
	Long-eared Myotis	Occasional	Yes	Cliffs, snags, stumps, talus slopes, rock outcrops, crevices, mines	Mines, buildings
	Canyon Bat[1]			Cliffs, rock crevices	Rock crevices, caves?
	Mexican Free-tailed Bat[1]	Common	Yes	Trees, Caves	Migrates?

Modified from: Craig,V. J., and S. L. Holroyd. 2004. Bat Conservation Strategy for B.C. and Alberta. Draft. Prepared for B.C. Ministry of Water, Land and Air Protection. 112 pp.

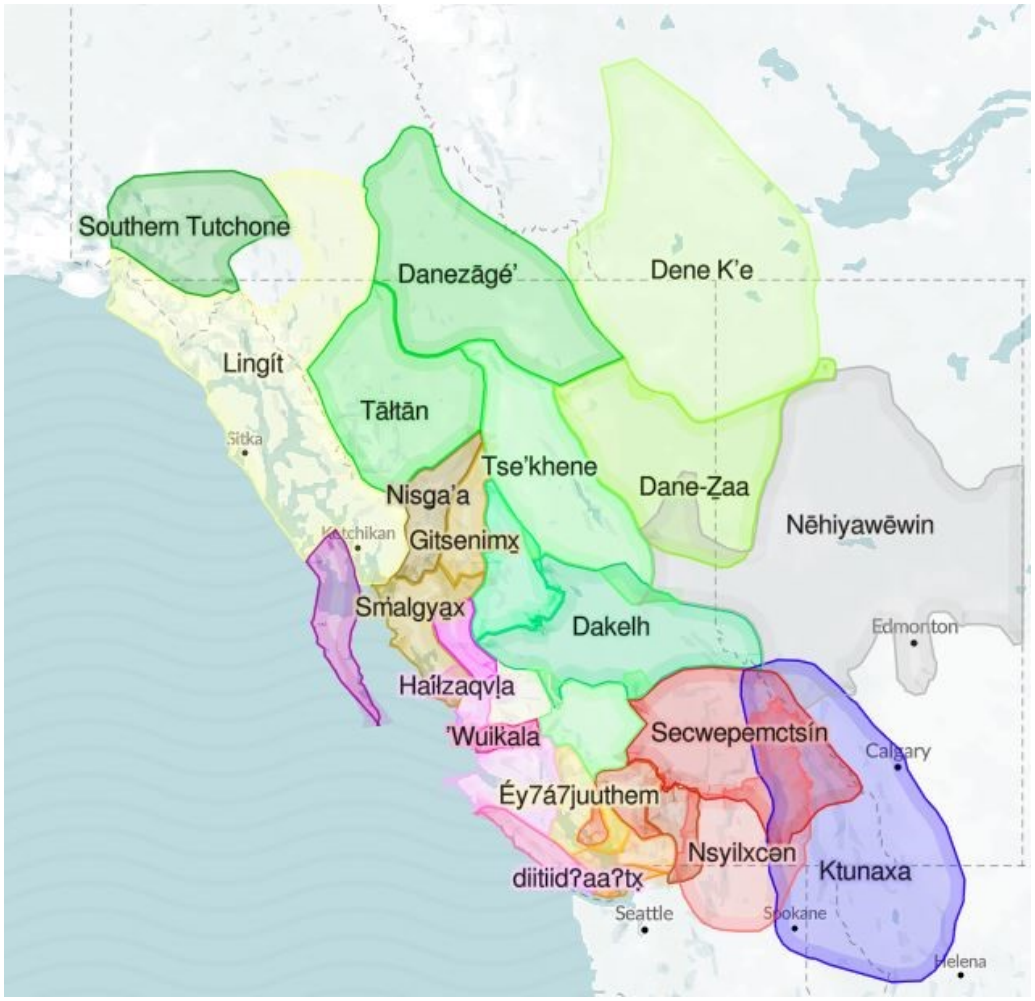
Bat roost information from Barclay & Brigham 2001, Fenton *et al*. 2002, Holloway & Barclay 2001, Nagorsen & Brigham 1993, Rabe *et al*. 1998, Rambaldini 2003, Rasheed & Holroyd 1995, Sarell & Luoma 1994; Vonhof & Barclay 1997.

*Silver-haired bats are considered 'migratory hibernators' which means that local populations may make significant flights further south before hibernating. However, northern populations may move into southern parts of the province to hibernate.

Map of British Columbia

Map of First Nations Peoples and their approximate territories.

Source: maps.fpcc.ca



Ultrasonic Bat Detector

Age: Grades K—12

Subjects: science

Duration: 1 hour

Group size: small

Setting: Outdoors

Objectives

Students will be able to:

1. Learn about soundwaves.
2. Understand that soundwaves have different properties.
3. Understand that bats can emit high-frequency soundwaves.
4. Detect high-frequency soundwaves of bats with an ultrasound detector.

Method

Students will get to hold an ultrasound detector and figure out what sounds are within a human's hearing range, and which ones are inaudible to human ears. If it is possible to do a summer evening excursion, then students can also try to detect bats as they fly and echolocate. This would be done after sunset near a bat colony if there is one.

Background

The ultrasound detector Pettersson D240x is an easy-to handle and very powerful instrument for conversion of ultrasound to audible sound. It is primarily intended for studying bats and other animals emitting ultrasounds (such as rodents, bush crickets, etc.).

Sound travels in waves. **Sound** waves travel through air, water, and solid objects as vibrations. When they reach our ears, these waves make the delicate skin of the eardrums vibrate. The brain recognizes these vibrations as **sounds** made by different things. The size and shape of **sound** waves determines the kind of **sound** heard.

Soundwaves have several properties. We will only be exploring sound frequency which is measured in hertz (Hz) and kilohertz (kHz).

One hertz is one cycle per second (1 Hz). The smaller the wavelength of a wave, the more waves that move past a given point, hence the higher its frequency.

1000 Hz = 1 kHz

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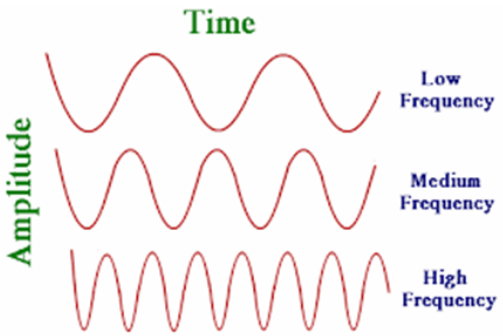


Humans can hear sounds that are between 20 Hz and 20 kHz.
- Human voice ranges on average between 85 Hz less than 5kHz.
- Most bats echolocate at greater than 20 kHz. Anything above 20 kHz is considered ultrasonic.
- Smaller bats which hunt smaller insect use higher frequencies, while the larger bats that eat large moths and insects use lower frequencies.

Materials

A bat detector (the Pettersson D240x is provided with the Okanagan Bat Edu-Kit)

A copy of Table 1 which shows the different BC bat species and their frequency ranges.

A copy of Figure 1 which shows the settings for the bat detector.

Procedure

1. Getting Started

The detector is powered by a 9V battery which we have included for you. The bat detector is not waterproof and should not be used in the rain. It is a sensitive instrument, please ensure kids put the wrist band around their wrists and treat it gently.

The 'settings' are set to what they should be, so ask kids not to touch the buttons, except for the VOLUME and the FREQUENCY control. Refer to Figure 1 if you need to re-set the buttons.

Let's start!

a) **Turn on the VOLUME control/ ON-OFF switch clockwise to switch the detector on**. The LCD display now shows the tuned frequency and the LCD backlight is turned on. The LCD backlight also serves as a battery condition indicator, so if the backlight is too weak to read the display in darkness, it is time to replace the battery.

b) Check to see that these are still set as they should be. The HET/TIME EXP switch to HETerodyne position and the NORMAL/TE->HET switch to the NORMAL position.

c) **Adjust the VOLUME control so that a weak noise is heard in the loudspeaker.** If the volume is turned up too high, acoustic feedback (a howling sound) may occur. To avoid this, turn down the volume.

d) **Turn the FREQUENCY control to give a display reading of approximately 20 kHz** and gently snap or rub your fingers together near the microphone (at the top of the detector). A scarping sound should then be heard in the loudspeaker. Another good ultrasound source to test it on is a jingling bunch of keys.

e) **Now you can toggle the FREQUENCY control to listen to different bats.** The frequency control works in the following way. The display shows the centre of the frequency range (approximately 10 kHz wide), to be transformed. If the control is set to 30 kHz, you can listen to ultrasonic frequencies between approximately 25 and 35 kHz.

f) **You can start by setting the frequency to 20 kHz and pointing up or at a 45-degree angle where you think bats might fly by.** After a minute or two, you can try turning it up to 30 kHz, then 40 kHz, etc.

Learning how to decipher echolocation calls is like learning to differentiate between different songs and calls of songbirds, and usually involves taking a one week-long course. The idea here is to let the students get their hands on a high-tech piece of equipment and letting them change the frequencies to see if they can hear some of the bats. Don't expect to be able to figure out which bat species you are hearing! Hopefully, you can at least hear the clicks of some of the bats as they fly by in darkness.

2. Can you hear the bats echolocating?

Point it up at the night sky where you see bats flying. Can you hear their clicks when they fly by? Can you hear them with the bat detector? Try starting at 20 kHz frequency and slowly raising it to 30 kHz or up to 120kHz. Leave it at each frequency for a few minutes and listen for clicks.

3. What species of bat is it?

Table 1 shows the frequency range for the fifteen different bats in BC. Note the lower ranges of their frequencies. This can help you narrow down some of the bats. When you set a frequency on the bat detector, you can hear to a range of 5 kHz on either side. So, if set it at 20.0 kHz, you are listening to calls between 15 and 25 kHz.

At this level of simplicity, you will not be able to tell which species you are listening to, but you can narrow it down.

Try setting the frequency to 20kHz and listen for clicks. If you hear some then the options of bat species are Hoary Bat, Fringed Myotis, Big Brown Bat, Silver-haired Bat, Pallid Bat, or Townsend's Bat.

If you set it to 40kHz, you might be listening to any of the bats between 35 kHz and 45kHz. These might be the 40 plus bats like Western Small-footed Myotis, Northern Myotis, Little Brown Myotis, and Long-legged Myotis.

Table 1. The fifteen different species of bats in BC and their frequency ranges. The bats in bold print are the ones featured in

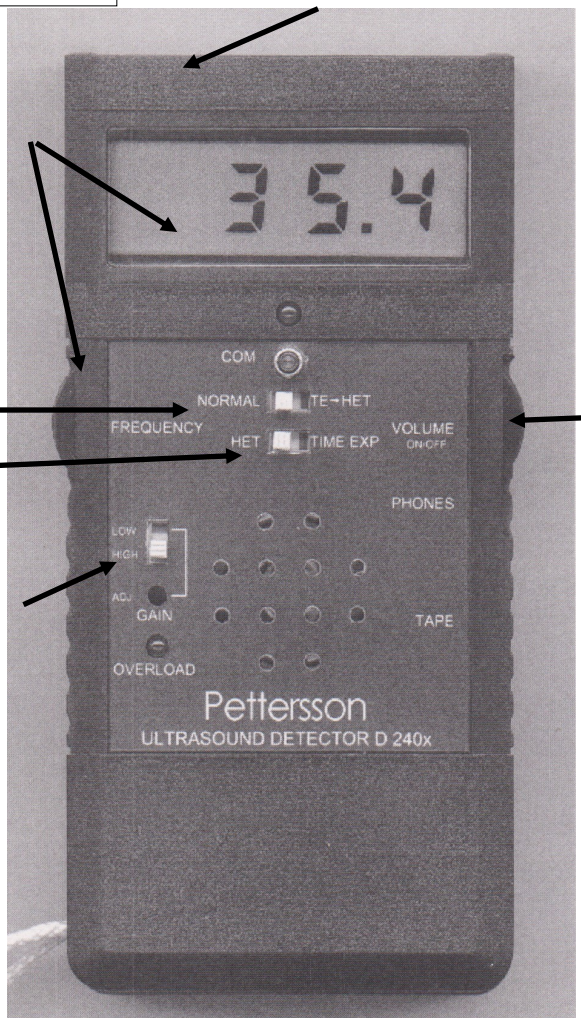
NAME	FREQUENCY RANGE
Spotted Bat (only in Okanagan)	7 kHz – 16 kHz (audible to human ears)
Hoary Bat	18 – 30 kHz
Fringed Myotis	20 – 120 kHz
Big Brown Bat	25- 30 kHz
Silver-haired Bat	25 – 30 kHz
Pallid Bat	25 - 50 kHz
Townsend's Big-eared Bat	25 – 70 kHz
Eastern Red Bat	30 – 50 kHz
Long-eared Myotis (includes Keen's Myotis)	30 – 90 kHz
Western Small-footed Myotis	40 – 80 kHz
Northern Myotis	40 – 100 kHz
Little Brown Myotis	40 – 70 kHz
Long-legged Myotis	40 – 80 kHz
California Myotis	50 – 100 kHz
Yuma Myotis	50 – 100 kHz

Figure 1. Bat detector settings.

Use these settings for the FRONT of the unit.

Microphone that picks up bat calls.

FREQUENCY. Turn dial so that frequency is at approximately 20.0 when starting. Then increase frequency as per table 1.



Set to NORMAL.

Set to HET.

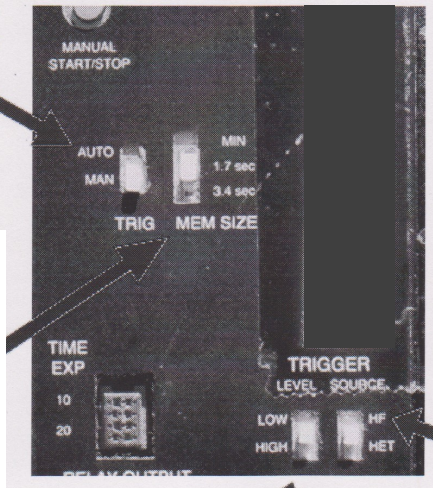
ON/OFF dial.

Turn on to lower volume setting when starting.

Use HIGH gain for most situations to maximize range reception of bats; use low gain in situations when detector is very close to bats.

The BACK of unit is for recording calls which you will not be doing. However, here is an explanation for

Set trigger setting to AUTO.



Set to 1.7 sec.

The HF setting triggers the detector with any high frequency sound, including audible bats. Use this setting unless you desire to limit detection to a narrow bandwidth based on the heterodyne frequency selected.

Use a LOW trigger level for most recording situations. The HIGH setting may be useful in situations with much insect noise. Note that this would limit the triggering to only bats that make a close approach to the detector.

BATS ARE IMPORTANT

By Bat Education and Ecological Protection Society

Bats are Important

Age: Grades K—12

Subjects: science, English, art

Duration: 15—30 minutes

Group size: small or large

Setting: Indoors

Objectives
Students will be able to;

1. understand that bats are important and integral part of our natural ecosystems, economy, and agricultural and forestry systems.

Method
Students will either draw or write a story to describe why bats are important.

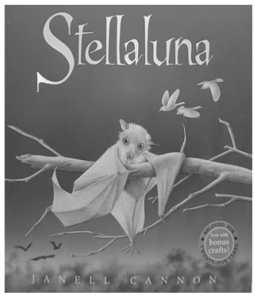
Background
Bats are an important part of our natural ecosystems, economy, agricultural systems, and forestry systems.

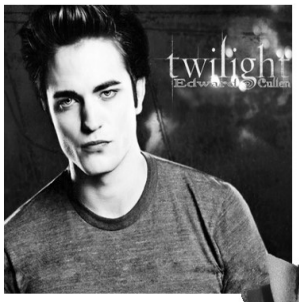
Materials
Paper and pen

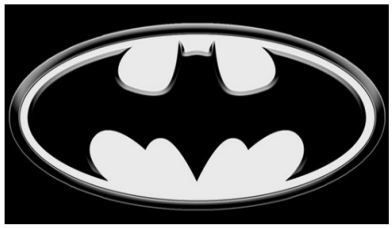
Procedure
Students choose one of these statements and either draw or write a story to describe why bats are important.

1. Bats eat insects that are considered pests to farmers, forestry and humans. For example, a colony of 150 Big Brown Bats can eat up to 1.3 million insects in a year!
2. Bats are part of nature, food webs, and our ecosystems. An example of a food web is: The energy of the sun makes a cucumber grow, a cucumber beetle eats the cucumber, a bat eats the cucumber beetle, and an owl eats the bat.
3. Bats help in nutrient cycling. For example, bats eat insects near wetlands. The bats then fly off to their roost in the forest, digest the insects and then excrete the nutrients uplands. Thereby moving nutrients from a wetland to the forest that is further away.
4. Bats help with pollination of plants in other parts of the world. By crawling through various vegetation in search of insects or nectar, they also pick up pollen from one flower and spread it to another. Bats help pollinate over 500 species of plants including agave, banana, and mango flowers.

Bats in Modern Culture







Age: Grades K—12

Subjects: science, English, art

Duration: 30 minutes or longer

Group size: small to large

Setting: Indoors

Objectives
Students will be able to;
1. understand that bats are an important part of our culture.

Method
Students will choose a fictional character from a book or a movie and compare it to a real bat to figure out what characteristics and behaviours are like a real bat and which are not.

Background
Bats are nocturnal and thus have been a big mystery to people for thousands of years. Remember that electricity was only invented in 1879. For millennia before that, humans had no source of light at nighttime other than fire and the moon.

People love to tell stories about things they don't understand. Bats and vampires are often portrayed as ugly, scary, nasty, harmful, and blood-sucking pests. Most of these stories are false. They are called myths.

In the history of humanity, it has only been in the last century that scientist have started to study bats in detail. They are finding that they are interesting and important living organisms. Still so, everyone loves a good story with vampires or bat heroes.

Materials
Paper, pen, colouring pencils

Procedure
Students choose a character from a book or a movie that resembles a bat or a vampire.

- Describe this character (name, what it looks like, what it eats, where it lives, what it behaves like).
- What characteristics make it like a bat?
- What characteristics does it have that are not like a real bat?
- Is this character a villain or a hero?

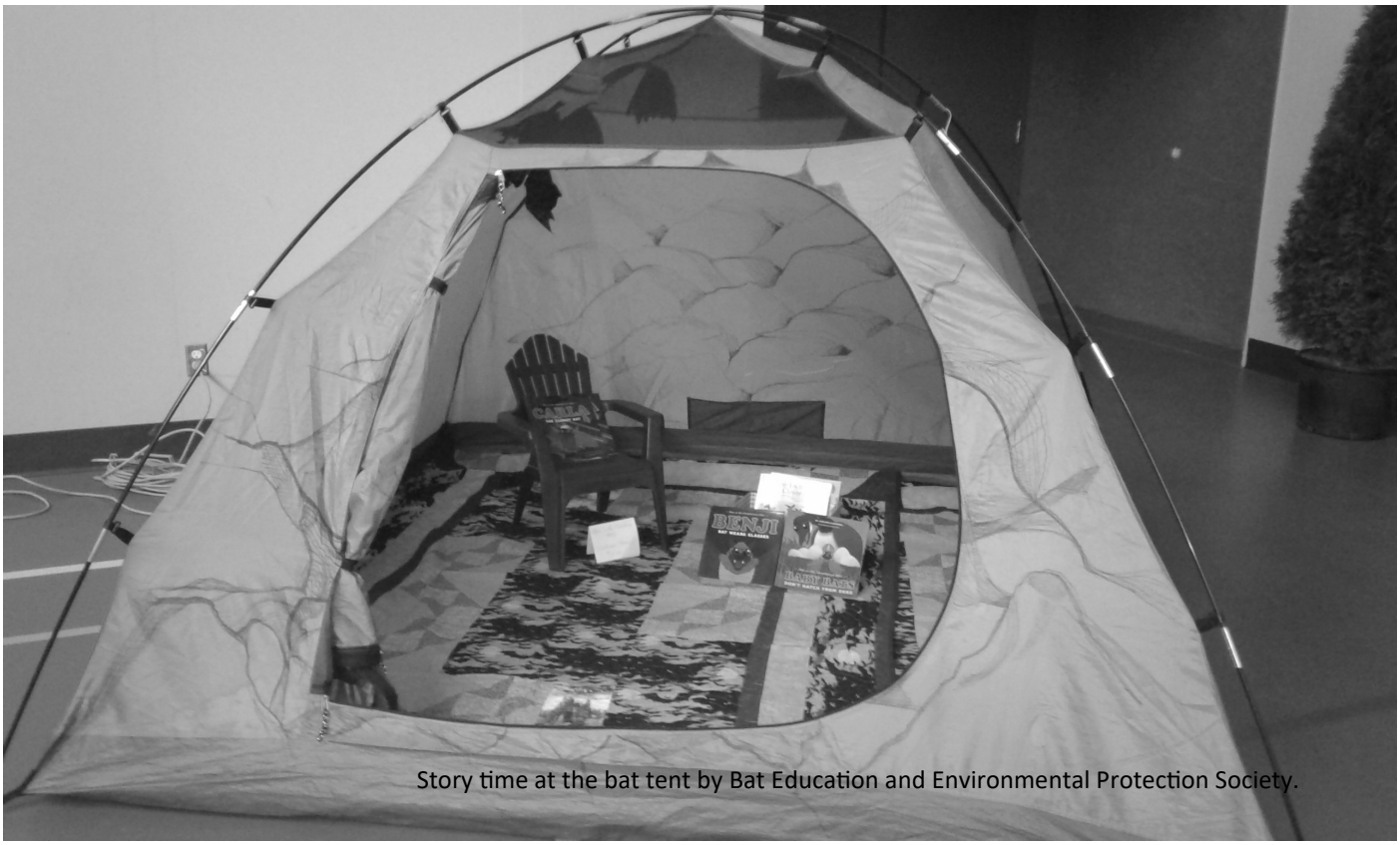
Many batty fictional characters are based on vampires.

Here are some facts about vampire bats;

- Only 3 of the more than 1,200 bat species in the world are vampire bats.
- There are no vampire bats in Canada or the USA. Vampire bats are found in Mexico and Central and South America.
- At night, they drink the blood of other animals such as cows, pigs, horses and birds.
- Rather than sucking blood like a vampire, these bats make a small cut with their teeth, then lap up the flowing blood with their tongues. The animals are so light and graceful that they can sometimes drink blood from an animal for more than 30 minutes without waking it up. The blood-sucking

doesn't hurt or kill their prey.

- Vampire bats sleep during the day but not in coffins. They prefer caves, old wells, hollow trees, and buildings.
- The saliva of vampire bats has anti-coagulant properties, so the wound keeps bleeding as they lick it. These chemicals were used to develop medicine to stop blood clots in heart/ stoke patients.



Story time at the bat tent by Bat Education and Environmental Protection Society.

Bats in the Okanagan Culture

Age: Grades 4—12

Subjects: Social, Science, Art

Duration: 1 hour or up to two days

Group size: small or class size

Setting: Classroom

Objectives

Students will be able to;

1. understand we are on the traditional and unceeded territory of the Okanagan Syilx First Peoples.
2. Hear/ Read on or all of the Trilogy of Okanagan Legends.
3. Opportunity to investigate an important area for bat habitat (winter and summer hibernacula) at Johns Family Nature Conservancy

Method

Students will use nature as a schoolyard for learning, research, citizen science, reflection and personal transformation. Learn about some specific habitat that also has importance for Syilx Nation in the Central Okanagan.

Background

A Syilx Okanagan Perspective
tmix^{w} is the nsyilxcən word that most closely translates to ecology.
tmix^{w} includes everything that is alive – the land, water, insects, people, animals, plants and medicines. Underneath all of the tmix^{w} is tmx^{w}ulax^{w} (the land), the core spirit from which all of creation arises and which unites everything. The needs of tmix^{w} and tmx^{w}ulax^{w} can be achieved when we work together to directly participate in protecting and restoring the environment. It is all of our responsibility to act now.

t'əntanwiya

There are two nsyilxcən words for bats. The most common word is t'əntanwiya, which references all bats. The word describes the 'this way and that way' flight pattern of bats.
The other word, saṗyaxn, is not as common. saṗyaxn comes from the root word siṗy meaning skin or hide. The last part of that word comes from the root word skwaxn meaning wing. The word saṗyaxn is most commonly used by the Colville and sometimes used by the Similkameen.

Johns Family Conservancy Regional Park—Lakeshore Road, Kelowna

The Okanagan / syilx people are the original inhabitants of this territory and have been

living with the land since time immemorial. Their territory covers a vast area and consists of numerous community groups connected through the language, nsyilxcən.
They moved freely throughout their territory as semi-nomadic people sharing resources with one another but always returned to their permanent winter communities scattered throughout the syilx / Okanagan Nation. In our area the First Nations community has come to be recognized as Westbank First Nation.
As you walk in this park you will see the trail names in both English and nsyilxcən. An interpretive panel at the beginning of each trail provides more information on the nsyilxcən name and cultural relevancy of this particular area.

Current Bat Research
COLT (Central Okanagan Land Trust) owns Johns Family Nature Conservancy Regional Park and has partnered with Regional Parks to administer the land. COLT collaborates in order to conduct a bat survey in the area. Below is findings from the previous few years of monitor equipment within the park.

qʷilqn sxʷuytns

qʷilqn sxʷuytns translates into Porcupine's Trail in the nsyilxcən/Okanagan language. Porcupines have been,

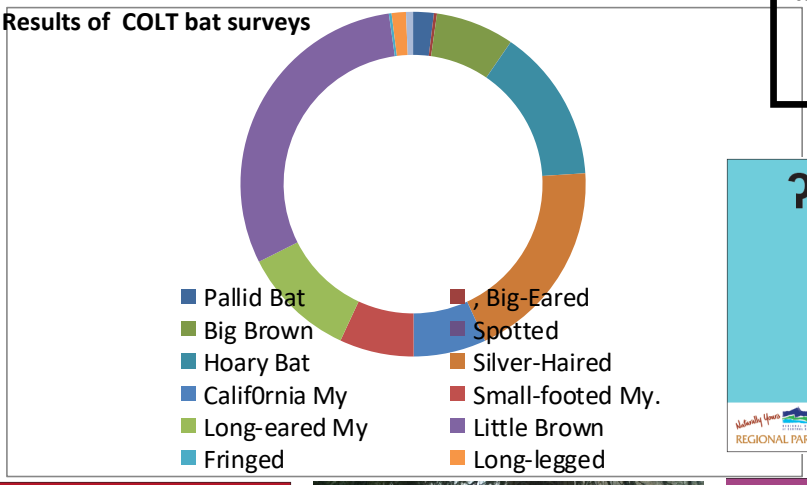
and still are, a very important resource for the Okanagan/syilx people for a variety of reasons.

The real value of qʷilqn is in its coat of quills—upwards of 30,000 for an adult! Long ago the quills had a practical purpose in making items like clothing, baskets, and mats. Today, artists and crafters prize porcupine quills. While still creating similar items, the primary use now is in more decorative pieces used for special occasions and gatherings.

Although the quills are often most commonly sought, it can be argued that the most esteemed resource obtained from the porcupine is pitch/sx̌ əx̌ úkʷaʔ. sx̌ əx̌ úkʷaʔ is created when porcupines, who are excellent climbers, gnaw on the tops of broken trees creating an abundance of sap. The pine pitch is then gathered and boiled for use in creating tools or waterproofing items. The sap in its raw form is also used as medicine.

Once abundant in our pine/sʔatqʷɬp forests, numbers of qʷilqn have dwindled over the decades. Even their spiky armor can't save them from the squeeze of habitat loss.

Results of COLT bat surveys



cnlq̓ ʷus in nsyilxcən (the Okanagan language) translates to *reaching for the top*, which is a metaphor that people from all walks of life can relate to. Climbing mountain peaks and cliff edges were common tests for young people of the Okanagan Nation as it required thorough planning, great strength and determination as well as respect and knowledge of the terrain itself. Quite often those who scaled the highest peaks would spend extended amounts of time on top in solitude to allow for appreciation, reflection and to just sit and listen to the flawless world around them. This particular area was treated with great respect as it housed some of the most rare and sacred medicines of the Okanagan. It still provides these medicines for the people and animals of the area and often the best way to find them is by looking out from the peaks of the surrounding crags.

These high crags would also serve as a communication tool as people from all around, even across the lake, would be able to see a flame burning bright from the top of the rock. The flame could be to warn of an invasion or to share messages such as information regarding a hunt or the rounding up of wild horses which once roamed freely.

Today, Okanagan people still continue to find places of solitude to seek out peace and to listen to the voices of nature calling to them. We must all listen carefully as some of the voices have been silenced, but if we remember to respect these places, they will return to share their story once again.

Materials—*found in BC Bat Edu-Kit contents*

- Audio of Syilx words
- We are the people, A Trilogy of Okanagan Legends
- Journal to record observations while on solo.

Procedure

- Review how to say bat and pronunciation of Syilx words, review other animals and relationships to the area.
- Review bat habitat and suitability of park for bats hibernaculum (potentially year round). Proven from bat surveys
- A "solo." A simple, elegant activity that works best when you do it regularly. Simply have students find a spot in the schoolyard or park, and sit quietly, observing what's going on around them. This is another great way to get to know nearby nature intimately, and to notice changes you might otherwise miss.
- Find a "high place", a place of solitude… either travel to Johns Family Conservancy Regional Park or find your own likely important bat habitat and spend some time in solitude—

  Questions to ask self;

  ∗ What animals are around? Sounds, signs that they have passed by; scratchings, scat, tracks, buds/leaves eaten

  ∗ What makes this place suitable for the animals, the people—habitat for bats, porcupines, deer and wild cats.

  ∗ Experience their presence and the ancestral presence.—the history of the place.

  ∗ How do you feel looking out over the Okanagan from this high point.

  ∗ What mountains do you have to climb? Physically and metaphorically.

BATS ARE THREATENED

Little Brown Myotis with White-nose Syndrome,
By Alan Hicks, New York Sate Department of Environmental Conservation

Meet My Bat Friend


Long-eared Myotis by Merlin Tuttle.org

Age: Grades 3 – 12

Subjects: science, art, English

Duration: 15 minutes

Group size: Approximately 8 to 30

Setting: Indoors

Objectives
Students will be able to;
1. understand learn about each of the 15 species of bats that live in BC.
2. Understand that some bats are listed as 'at risk'.

Method
Students will choose one or more bat species, read about them, and then either make a poster, a presentation, or write a story about that bat species.

Background
Bats are difficult to tell apart without close examination and extensive training. Species can sometimes be determined using a combination of physical appearance, behaviour and habitat use. Most of the time, biologists need recordings of bat echolocation calls and genetic testing from a sample of guano (bat feces) to reliably identify the species.

Getting to know each bat is fascinating and a little like becoming a bat detective.

Materials
- Print and cut out the following 4 pages of bat species.
- For each group researching bat species, print out a copy of the 2 tables on where bats are found in BC and where they roost (or print out one copy and post it for all to see).
- Poster-making material or computer.

Procedure
There are 15 bat species, so divide your class up into 15 groups. For example, if you have 30 students, divide them into pairs.

Give each group a bat species. Have them research it and then present their finding.

Choose some of the following questions to research:
1. What is it's English name? Scientific name?
2. What region of BC is it found in?
3. What kind of habitat does it use?
4. Where does it roost?
5. Do they use bat boxes?
6. Tell me something unique about this bat?
7. How are it's populations doing (i.e. is it 'at risk')?
8. Tell me something about their reproduction. How many pups do they have? When are they born?
9. What do they eat?

Pallid Bat
Antrozous pallidus

Pallid bats are one of BC's most threatened bat species – and one of the rarest mammals in the province. In Canada, they are only found in the Okanagan Valley. They are also one of the largest bats, second only to the hoary bat. They can be easily identified by their pale colour.

Pallid bats prefer the Okanagan's arid grassland and open forest habitats. They hunt over open grasslands, but have also been seen feeding over gravel roads in open forest habitats. Pallid bats are strong. They can capture large invertebrates, such as scorpions, which they typically take back to their roost to consume. They feed by gleaning prey from the ground or from foliage, and occasionally by catching prey in the air.

Pallid bats produce a skunk-like odour from their muzzle glands, possibly to deter predators. They give birth to one or two pups in May or June.

Townsend's Big-eared Bat
Corynorhinus townsendii

Check out those ears! The Townsend's ears are nearly half its body length. During winter hibernation they curl them back (like ram horns), likely to help reduce heat loss. They are easily awoken during hibernation if there are significant temperature changes or disturbances. By end of winter they may be at half their pre-hibernation body weight.

The Townsend's big-eared bats' habitat ranges from coastal forests to arid grasslands. They mate in the winter, between November and February. Females give birth to one pup in late June to mid-July.

Big Brown Bat
Eptesicus fuscus

As its name suggests, big brown bats are one of BC's largest species. Big brown bats look similar to myotis bats, but are considerably larger. They can be found in a variety of habitats, including arid grasslands, and interior and coastal forests.

Big brown bats can catch an insect every three seconds – this includes time to find, catch, chew and swallow their prey! A colony of 150 big brown bats can eat enough cucumber beetles during the summer to prevent 33 million eggs from being laid, and consequently hatching into rootworms, which are a crop pest.

Females gestate for around 60 days before giving birth to one to two pups.

Spotted Bat
Euderma maculatum

This bat is distinguished by its black fur with three white spots. It also has the biggest ears of any North American species of bat. In Canada, it can be found only in BC. Provincially, it is a blue listed species of special concern.

Important spotted bat roosting sites in the Okanagan Valley include the cliffs at Gallagher Bluff, Spotted Bluff, McIntyre Bluff, Vaseaux Lake and the Vaseaux canyon. Spotted bats hunt near marshes, agricultural fields and over ponderosa pine forests. They eat mostly medium-sized moths.

Females birth one pup in June or July.

Silver-haired Bat
Lasionycteris noctivagans

This species is commonly found throughout the province. They frequent grassland and forest habitats. The Okanagan Valley's cottonwood trees provide important roosting sites for silver-haired bats. They roost alone or in small groups of up to six.

Silver-haired bats have two active feeding peaks: the first is between 10pm and 12am, the other is an hour before dawn. They are skilled at hunting in swarms of insects. The species typically eats small insects, such as ants, midges, moths and flies.

They give birth to one to two pups each summer. The pups develop quickly and are able to fly after three weeks.

Eastern Red Bat
Lasiurus borealis

Male red bats are more brightly coloured than the females. Both prefer forest habitats and roosting in foliage. This can make the species more susceptible to predation from hawks and other tree dwelling animals. They do have one trick up their wing, which is to act like a leaf. Resembling dead leaves makes them difficult to spot.

Eastern red bats give birth to one to four pups. They have four mammary glands in order to feed all of their pups simultaneously.

Hoary Bat
Lasiurus cinereus

Hoary bats are the largest bats in BC. They can be identified not only by their size, but also by their hoary colour and long, soft fur. Their colouring helps them camouflage against bark, and their fur keeps them well-insulated.

The species is usually found in the province's forests and grasslands. They feed throughout the night on large insects, such as dragonflies, beetles and moths. They've been found taking advantage of hunting near artificial lights that attract moths. Hoary bats are territorial hunters. They make loud chirping noises when defending their territory.

Female hoary bats do not form maternal colonies. Instead, they maintain family groups for several weeks after pups take flight. They have between one to four pups in mid-May to mid-June. Hoary pups take flight when they are five weeks old.

California Myotis
Myotis californicus

This bat is one of the province's smallest species. It looks similar to the western small-footed myotis, which can make identification difficult.

The colour of their fur can vary from dark to reddish-brown. They inhabit grasslands as well as coastal and montane forests. In the Okanagan Valley they mainly eat caddisflies, but also occasionally feed on moths, flies and some beetles.

California myotis bats mate in late fall, but delay fertilization until spring. Like other bat species, the females store sperm throughout the winter and ovulate in time to birth one pup from May to early June.

Western Small-footed Myotis
Myotis ciliolabrum

Western small-footed myotis are commonly found in BC and are the province's smallest bat species. In the Okanagan, these tiny bats feed mainly on caddisflies. They also eat other types of flies as well as beetles and moths. Westerns prefer to feed over rocky bluffs. They rarely hunt over open water.

This species usually hibernates alone, or in very small groups of two to three. They wedge themselves into tight crevices to stay warm over the winter. Females typically give birth to one pup in early summer.

Long-eared Myotis
Myotis evotis

These bats are common in BC. Their fur can range in colour from yellowish brown to nearly black.

Long-eared myotis can be found in a variety of the province's habitats, including grasslands, ponderosa pine forests, montane forests and coastal regions. Their hunting habits vary. They glean insects from vegetation or the ground or catch insects in flight. They use their long ears to listen for prey just before attacking.

Females give birth to a single pup during the summer.

Little Brown Myotis
Myotis lucifugus

Despite its name, the little brown myotis is actually a mid-size myotis species. It can be hard to differentiate from Yuma myotis bats.

Little browns occupy a range of habitats and have the widest altitudinal range of all of BC's bats. They have been spotted at sea level and in the Rocky Mountains. They often use human structures, like buildings or bat boxes. Their favourite prey are aquatic insects, including caddisflies, mayflies and midges. They eat their prey while flying. They typically feed for 15 to 20 minutes before resting.

Little brown bats are endangered in Canada due to the devastating impact of White-nose Syndrome.

Northern Myotis
Myotis septentrionalis

Northern myotis bats are one of province's rarest. In BC, their range extends from the Revelstoke area to northeastern BC. Elsewhere in Canada, they are typically found in boreal forests.

They prefer to hunt just above the forest understory, three to ten feet above the ground. Northern myotis bats prey on caddisflies, beetles, moths, leafhoppers, flies and spruce budworms (a forest pest), amongst other insects.

Females give birth to a single pup each summer.

Fringed Myotis
Myotis thysanodes

Fringed myotis bats get their name from the fringe of small stiff hairs that cover the edges of their tail. In BC, they can be found in arid grasslands and ponderosa pine and Douglas fir forests. They eat many kinds of insects, including crickets, lacewings, moths, flies and beetles.

Fringed myotis bats begin hunting one to two hours after sunset. In flight, they are slow, but agile and have the ability to hover.

In maternity colonies, if a pup falls from the roost, its mother or another female guardian will fly down to retrieve it. The pup grabs hold of the adult and is carried away to the safety of the colony.

Long-legged Myotis
Myotis volans

Long-legged myotis bats are one of the most widespread species in the province. They can be found in a range of habitats. They are also one of the largest myotis species in BC. The colour of their fur varies from reddish brown to black.

They remain active for most of the night, even when temperatures cool. Long-legged myotis bats feed mainly on moths, but are also opportunistic hunters and will eat termites, spiders, flies and other insects.

Scientists have recorded long-legged myotis bats living over 21 years.

Yuma Myotis
Myotis yumanensis

Yumas are found in low elevations in the province. They inhabit coastal forests, ponderosa pine and Douglas fir forests as well as grasslands, and often use human structures, like buildings and bat boxes.

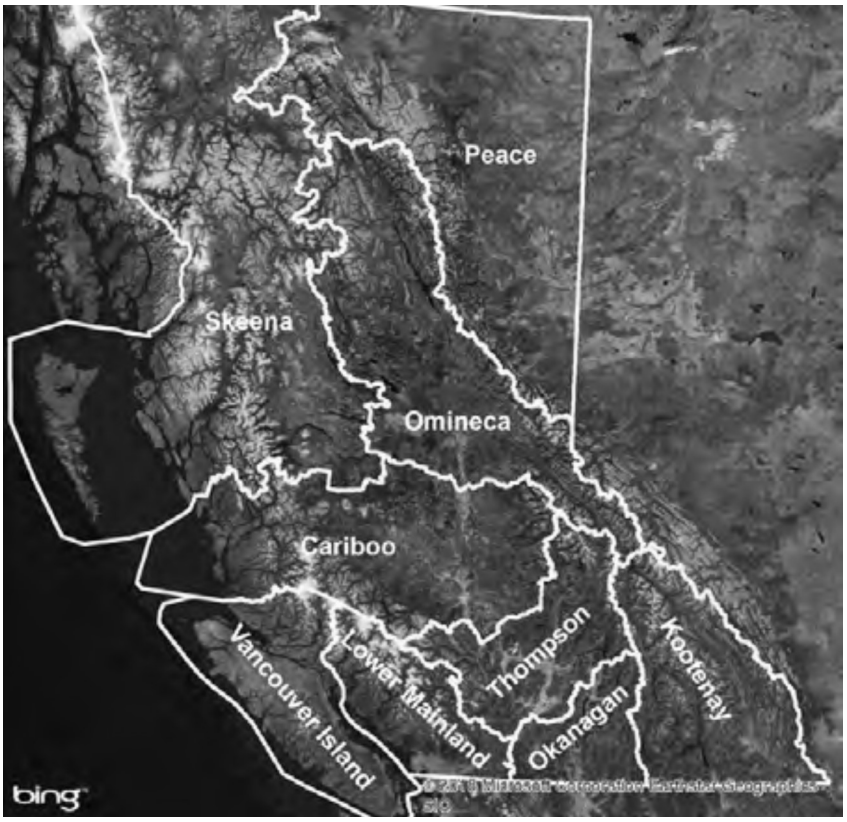
Yuma myotis bats are efficient hunters. They can eat enough for one night in just ten to 15 minutes! In the Okanagan Valley, their diet consists mainly of aquatic insects, especially midges, mayflies and caddisflies. Yumas are closely associated with water. They are the most frequently caught species when mist nets are set up along streams and rivers.

Table. Bat species found in each region of BC, and their federal and provincial 'at risk' status.

	Scientific Name	Status	BC Ministry of Environment Region									
			Vancouver Island	Lower Mainland	Sunshine Coast	Thompson	Kootenay	Cariboo	Skeena	Omineca	Okanagan	Peace
Spotted Bat	*Euderma maculatum*	SC[1]; Blue (BC)				x		x			x	
Pallid Bat	*Antrozous pallidus*	T[1]; Red (BC)									x	
Townsend's Big-eared Bat	*Corynorhinus townsendii*	Blue (BC)	x	x	x	x	x	x			x	
Hoary Bat	*Lasiurus cinereus*	Not at risk	x	x	x	x	x	x	x	x	x	x
Eastern Red Bat	*Lasiurus borealis*	Red (BC)					?				x	x
Silver-haired Bat	*Lasionycteris noctivagans*	Not at risk	x	x	x	x	x	x	x	x	x	x
Big Brown Bat	*Eptesicus fuscus*	Not at risk	x	x	x	x	x	x	x	x	x	x
Yuma Myotis	*Myotis yumanensis*	Not at risk	x	x	x	x	x	x	x		x	
Californian Myotis	*Myotis californicus*	Not at risk	x	x	x	x	x	x	x		x	
Western Small-footed Myotis	*Myotis ciliolabrum*	Blue (BC)				x	x	x			x	
Northern Myotis	*Myotis septentrionalis*	E[1]; Blue (BC)					x	x	x	x		x
Long-legged Myotis	*Myotis volans*	Not at risk	x	x	x	x	x	x	x	x	x	x
Little Brown Myotis	*Myotis lucifugus*	E[1]	x	x	x	x	x	x	x	x	x	x
Fringed Myotis	*Myotis thysanodes*	Blue (BC)	?	?	?	x	x	x			x	
Long-eared Myotis[2]	*Myotis evotis*	Not at risk	x	x	x	x	x	x	x	x	x	x

1 COSEWIC Status (federal): E = Endangered, T = Threatened, SC = Special Concern, 2 Long-eared Myotis (*Myotis evotis*) includes the species formally known an Keen's Myotis because genetic evidence indicates these are the same species. *Modified from: Craig, V. J., and S. L. Holroyd. 2004. Bat Conservation Strategy for BC and Alberta. Draft. Prepared for BC Ministry of Water, Land and Air Protection. 112 pp.*

For more detailed information on range maps, please go to BC Species and Ecosystems Explorer.



Map of the BC Ministry of Environment Regions.

Definitions:

COSEWIC: Committee on the Status of Endangered Wildlife in Canada.

Special Concern: A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.

Threatened: A wildlife species likely to become endangered if limiting factors are not reversed.

Endangered: A wildlife species facing imminent extirpation or extinction.

Extirpated: A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.

Extinct: A wildlife species that no longer exists.

Table. Summer and winter roosts of BC bats. For more detailed information on range maps, please go to http://a100.gov.bc.ca/pub/eswp/reports.do?elcode=AMACC04010

Common Name	Summer Roosts			Winter Roosts
	Buildings	Bat House User	Natural roosts	
Spotted Bat			Cliffs	Cliffs, mines
Pallid Bat	Potentially		Cliffs, rock outcrops, snags	Rock crevices?
Townsend's Big-eared Bat	Common	Big ones	Cliffs, caves, mines	Mines, caves, rock crevices
Hoary Bat			Snags, trees	Migrates
Eastern Red Bat			Foliage of trees	Migrates
Silver-haired Bat			Trees, snags (cottonwoods)	Snags, live trees, mines, buildings, wood piles, rock crevices
Big Brown Bat	Common	Yes	Snags, cliffs, rock crevices	Buildings, mines, rock crevices
Yuma Myotis	Common	Yes	Snags, rock crevices, mines, bridges	Mines, rock crevic-es, caves
Californian Myotis	Occasional	Yes	Snags, mines, bridges, rock out- crops & crevices	Buildings, mines, caves, rock crev-ices, tree root wads
Western Small-footed Myotis	Occasional		Cliffs, rock crevices, mines,	Mines, cliff crevices
Northern Myotis	Rarely		Snags	Mines, caves, rock crevices
Long-legged Myotis	Occasional		Cliffs, rock crevices, snags, stumps	Mines, caves, rock crevices
Little Brown Myotis	Common	Yes	Snags, rock crevices, cliffs, mines	Mines, caves, rock crevices, tree root wads
Fringed Myotis	Occasional		Cliffs, rock crevices, trees, mines	Mines, rock crevic-es
Long-eared Myotis	Occasional	Yes	Cliffs, snags, stumps, talus slopes, rock out-crops, crevices, mines	Mines, buildings, rock crevices

From BC Community Bat Program. **Bat-Friendly Communities: A guide for managing and enhancing bat habitat in British Columbia. 2018.**

Live or Die

Hoary Bat

Age: Grades 3—12

Subjects: science, English

Duration: 15 minutes

Group size: small to big

Setting: Indoors or outdoors

Objectives
Students will be able to;
1. understand that bats are in trouble due to many factors.

Method
Students will play a card game where they pretend they are bats and their fate is foretold by the 'Dead or Alive' card that they receive.

Background
Bats face many challenges everyday. Almost half of the bats in BC are listed as being 'at risk'. Human development has brought many sources of mortality to many regions of BC, such as collisions with wind turbines and vehicles, introduction of new predators (such as cats), extermination, and habitat destruction. Two of BC's bat species are listed as Endangered in Canada because of white-nose syndrome, a fungal disease recently introduced to North America. This disease is spreading across North America, and is killing billions of bats.

Materials—*found in BC Bat Edu-Kit contents*
'Dead or Alive' cards found on next page

Procedure
Print and cut out the 'Dead or Alive' cards. There are 18 of them, so if you have a big class you can make copies as well.

Students pretend to be bats. Hand out one 'Dead or Alive' card to each student. Tell them not to look at them until everybody has one.

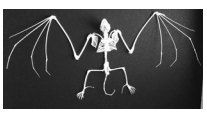
Students then read their fate.

If they die, they can be as dramatic as they want and pretend to fall to the ground and die. If they live, they can fly off.

Collect all the cards and play again.

Live or Die

Cut out each square and use them as cards. ***found in BC Bat Edu-Kit contents***

It's summertime. The tree where you usually sleep has been cut down for firewood. But you're lucky, there's another one nearby. 	The cave where you hibernate in winter is visited by recreational cavers who did no clean and disinfect their boots and climbing gear. They have spread white-nose syndrome to your cave. You get sick. You die. 	You find a condominium complex with a crack that allows you to enter the attic. A great place to raise your young. But the condominium owners don't like you. They follow best practices and evict you in the fall. You are able to get away safely. But you will have to find a new place to roost next year. 
It's spring time. The wildlife tree where you roost in has been logged along with the forest nearby. There is no shelter. You die. 	Your summer roost is in the attic of the Peachland Visitor Centre. It is a Bat-Friendly Community and you are welcomed to stay there. 	The tree where you roost is beside the lake. Unfortunately, people are building a new housing subdivision and they cut down all the trees. You die. 
The cave where you hibernate in winter remains a safe place because BC Parks installed a gate so people couldn't go into the cave to disturb you. 	You find a log home and think it's a great place to roost for the summer. The homeowners aren't too pleased to have bats. They contact the BC Community Bat Program and find out more about managing bats in buildings. After reading about how important bats are, they decide it's OK if you stay. 	A new road with bright streetlights is built right next to the wetland where you forage for insects at night. You can't get to your feeding grounds without flying across the road. You get runover by a car. You die. 

Live or Die

Cut out each square and use them as cards.

You decide to roost in a barn for the summer. Unfortunately, there are several barn cats who can hear your echolocation calls at night. You fly too low one evening and get killed by a cat. You die. 	As soon as you wake up at night, you love flying to the pond for a drink of water. A farmer has been using fertilizers too close to the pond. As a result, an algal bloom covers the pond in summer and there is no open water. You can't get a drink of water. You die. 	There is a storm. You take shelter in some cottonwood trees near the lake. Luckily that area is a regional park that protects the shoreline vegetation. You are safe. 
You roost in a cliff on the outskirts of town. But the city is expanding, and humans are building a new housing subdivision. They need to blast through the rock to build the road. Your roost in the cliff is destroyed. You die. 	You love eating small insects like mosquitoes, midges, lacewings, small moths and caddisflies. The farmer that owns the area where you live decides to stop using pesticides and grow vegetables organically. 	There is a drought due to climate change. Next thing you know, the forest where you live in on fire. You die. 
You love eating big insects like large moths and larger hard-bodied beetles. A homeowner gets rid of her lawn and plants a beautifully designed native plant garden that attracts night-flying insects. 	You're thirsty and find a backyard pool to get a drink from. Oh no, you fall in because it is too small, and you didn't clear the side walls. Luckily the homeowner installed a wildlife ramp and you can climb out. 	It is autumn and you decide to roost on a building that has a nice stucco finish. It turns out it's a school and the teachers are very worried there's a bat roosting above the entrance doors of the building. They contact the BC Community Bat Program and find out how to safely deal with the situation. The bat is roosting high up safely out of the reach of curious young children. The school learns to leave the bat alone and secure the area to make it safe. 

BATS NEED US - YOU CAN HELP

By Bat Education and Ecological Protection Society

Safety First

Age: Grades K - 12

Subjects: science, health

Duration: 15 minutes

Group size: 1 - whole class

Setting: Indoors

Bat roosting at school entrance.
By Paula Rodriguez de la Vega

Objectives
Students will be able to;
1. understand that they should never touch a bat,
2. understand that bats are wild animals that can and will bite especially if they feel threated,
3. understand that bats are protected under the BC Wildlife Act and should not be harassed or killed.

Method
Students will discuss which animal stuffie is safe to touch (pretending they are real animals).

Background
Millions of bats live near people and provide tremendous benefits because of their control of insect pests. When left alone, bats are not a danger to people. However, as with all wildlife, there are important procedures and safety considerations everyone should be aware of to ensure both people and bats remain safe. *Never touch bats with your bare hands.* Although very rare, there is potential to contract rabies from a bat bite or scratch, usually from accidental contact or deliberate handling of bats. Like many wild animals, bats will defend themselves by biting if they feel threatened, such as when someone attempts to pick them up.

Rabies is a virus that occurs at very low levels in bat populations throughout BC (about one in every thousand bats). There have been 2 human deaths from rabies in BC since record keeping began in 1924. The rabies virus is transmitted by a bite or scratch from a infected animal. Post-exposure shots must be administered as soon as possible after any exposure, or suspected exposure, because once rabies symptoms appear, the virus is almost always fatal.

The best prevention is to never handle bats with bare hands. Bats should not be allowed to enter the living quarters of a home or school, although they can quite often safely use portions of a building where human contact will not occur.

Biologists who handle bats are trained experts who have also been vaccinated against rabies.

Schools that find bats on the inside or outside of their buildings should contact the BC Community Bat Program (www.bcbats.ca) to find out more information on safety. Teach students to leave bats alone and to never touch them. At the same time, teach appreciation and respect. Having a bat roost on the outside of the building for a few

days is normal, especially during the fall. Leave bats alone when it is safe to do so, and use them as an opportunity to teach about the importance of bats.

Bats are classified as wildlife, not pests, under the *BC Wildlife Act*. They are protected from harassment and killing.

Materials
Small bat finger puppet—***found in BC Bat Edu-Kit contents***
Dog plush toy or figure
Bear plush toy or figure
Deer plush toy or figure

Procedure
On the table lay out the deer, bear, dog, and bat plush toys or puppets. Explain that we're going to pretend these are real animals.

Set up some scenarios, such as:

- You are out for a walk in the woods with your family and all of a sudden you see a bear in the distance.
- You are walking home from school and you see a mule deer in your neighbors front yard browsing on the plants (In some BC communities this is common).
- You're out for a walk and see a dog owner with a cute dog on a leash.
- You are at school and notice a small bat clinging to the side of the building.

Then go through each one and figure out whether it is safe to touch/pet the animal or not.

- Bear - No. Bears are wild animals. Stay close to your family and make noise when you are out for a hike in bear country. Be Bear Aware.
- Deer - No. Deer are wild animals. They can get scared of you, and might feel threated if you approach them. They could hurt you when they try to protect their fawns. Give them lots of space. See WildSafe BC.
- Dog - No. You should never approach a dog to pet it. Always make sure you ask the owner if you can pet the dog. Not all dogs are comfortable being touched. See SPCA Petting do's and don'ts.
- Bats - No. Bats are small and cute, but they are also considered wild animals. They can bite if they feel threatened by a person, even a small one like you.

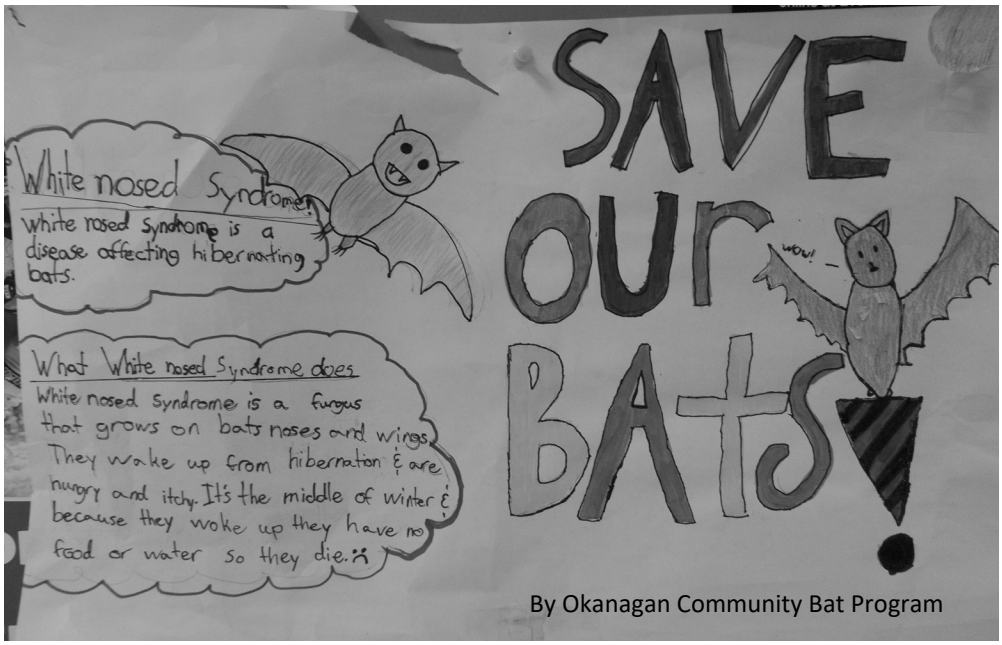
Bats, deer and bear are some of the animals classified as wildlife under the *BC Wildlife Act*. Explain to students that all 3 are protected and it is illegal to harass or kill any of them.

If you find a bat, students should:
- Leave the bat alone.
- Tell an adult/teacher.
- Tell an adult if someone touches a bat.

Adults, you can get more information on what to do with a bat at school, by contacting the BC Community Bat Program. www.bcbats.ca, Tel. 1-855-9BC-BATS.

Generally, it is best to leave the bat alone if it is safe to do so. It will usually fly off in the evening when they wake up to hunt for insects. Be sure to alert staff who supervise the outside areas and ensure students do not harass or try to touch the bat. Sometimes this can become a great opportunity for classrooms to come outside and have a nature moment. Teach students about the importance of bats and how to be safe around them.

Be a Bat Hero



By Okanagan Community Bat Program

Age: Grades K—12

Subjects: science, social sciences, art, English

Duration: 15 minutes

Group size:

Setting: Indoors

Objectives

Students will be able to;

1. understand that they can help bats by raising awareness about the importance of bats.

Method

Students will raise awareness about bats by coming up with some ideas of their own on how to spread the word about the importance of bats within their school or community.

Background

Many people fear bats and it's important to dispel myths so that people start to like and appreciate bats.

Materials

Poster paper, glue, colouring pens
Bat costume for bat skit—***found in BC Bat Edu-Kit contents***

Procedure

Have a discussion on how people have misconceptions around bats. It's important to dispel those myths and communicate messages that bats are interesting and important.

Remember that:
Bats are important.
Bats are interesting.
Bats are in trouble.
Bats need our help.

How can students get message out to their peers, teachers, and community members?

Have students brainstorm ideas.

They can be Bat Heroes by getting the word out about the importance of bats.

Some options might be:

- Make a poster for the school hallway.
- Make a skit and present it to other classes.
- Make a series of short facts that you can present during morning announcements.
- Make a Bat Fact Sheet to take home to show their family.
- Start a bat conservation club at your school.

Bat Challenge


By Okanagan Community Bat Program

Age: Grades 4—12

Subjects: science, social studies, art

Duration: 15 minutes

Group size: 5 - 40

Setting: Indoors

Objectives
Students will be able to;
1. Be empowered by taking action to help bats.

Method
Students will choose a bat challenge and research ideas on how to solve that problem.

Background
Bats face many challenges in order to survive. Most of these challenges are caused by humans and include predation by domestic cats, artificial night-time lighting, eviction from their roosts by homeowners, persecution by people, ang bat habitat destruction.

Materials
Access to internet

Procedure
Bats face many challenges in order to survive. Have students discuss the challenges below. Perhaps have them break into groups and research one of those challenges. Figure out what can be done to help the bats. The next page has suggested websites to research.

Some of the challenges that bats face;
- Cats kill bats.
- Artificial lighting at night affects bats.
- Homeowners evict and sometime trap and kill bats.
- Natural bat habitat is being destroyed.

Bat Challenge

Challenge 1. Cats kill bats.

Bats have many predators. Most of these are wild animals that need to eat the occasional bat to survive. However, there is one predator that is well fed by people and does not need to eat bats to survive. These are domestic cats. Cats can hear the echolocation calls of bats and often will hunt and kill them.

http://stewardshipcentrebc.ca/PDF_docs/CatsBirds/HappyCat_Trifold_8.5x11_2019.pdf

Challenge 2. Artificial lighting at night affects bats.

https://www.bcbats.ca/images/BC-Bat-friendly-Communities-Guide-2018.pdf

Challenge 3. Homeowners are scared of bats and do not want them roosting on their buildings. Sometimes bats get evicted or trapped and killed.

https://www.bcbats.ca/index.php/got-bats/living-with-a-bats

Challenge 4. Natural bat habitat is being destroyed by humans. Bats require summer roosting habitat (such as large trees, caves, or cliffs), winter hibernation sites, and a good source of insects (like wetlands), all of which are impacted by human activities.

https://www.bcbats.ca/index.php/get-involved/create-and-enhance-habitat

Challenge 5. White-nose Syndrome is a devastating fungal disease that is killing millions of bats in North America.

https://www.bcbats.ca/index.php/bat-basics/bat-conservation

Bat Habitat Stewards

Age: Grades 4-12

Subjects: science, social studies

Duration: 30 minutes

Group size: small or large

Setting: indoors or outdoors


By Paula Rodriguez de la Vega

Objectives

Students will be able to;

1. Learn about how to help bats by helping their habitat.

Method

Students will get ideas on how to help the habitat that bats use.

Background

In order for bats to survive, they need water, food, shelter, and space to thrive. Scientists and conservation organizations are working hard to help bats. The BC Community Bat Program has developed a guidebook that describes things we can do to help bats have better habitat.

Materials—*found in BC Bat Edu-Kit contents*

Download the Bat-Friendly Communities Guidebook. https://www.bcbats.ca/images/BC-Bat-friendly-Communities-Guide-2018.pdf

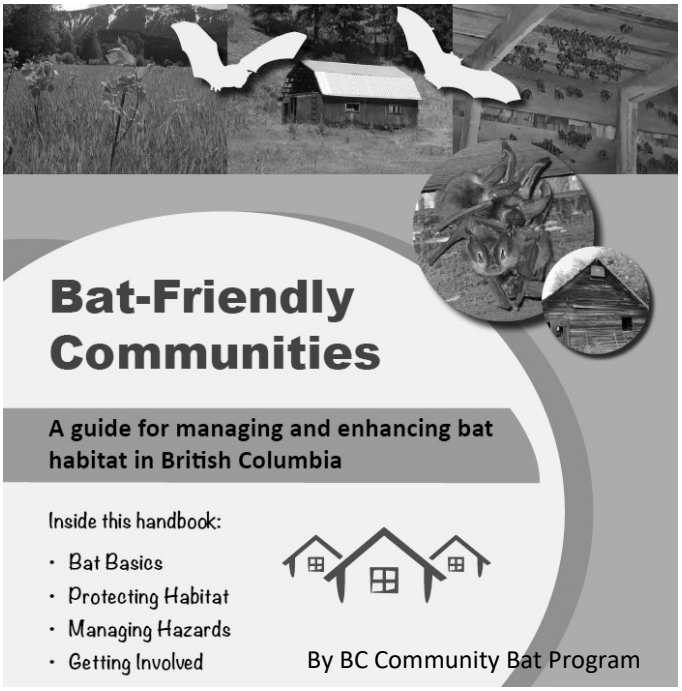
Procedure

Can you figure out some of the things that can be done to help secure bat habitat? Refer to the Bat-Friendly Communities Guidebook (BFCG) to find some answers. Perhaps you can come up with your own as well.

Focus on these topics:
Bats need drinking water (BFCG pages 15--17)
Bats need roosting habitat (BFCG pages 18-31).
Bats need foraging habitat (BFCG pages 32-34).

If you have the ability to do so, implement some of the solutions.

Become a Bat-Friendly School



Age: Grades 11, 12

Subjects: political science, social science, biology

Duration: several days to weeks

Group size: 4—whole class

Setting: Indoors

Objectives
Students will be able to;
1. Lead a campaign to become a Bat-Friendly School or Community.

Method
Students will learn how to organize themselves, present, and lead a campaign in the school or community in order to become a Bat-Friendly School or Community.

Background
Bats are an important part of the wildlife fauna in British Columbia. BC has at least 15 species of bats, and many of these are among the most common wildlife in our communities. Bats are major predators of insects, and are important for maintaining healthy ecosystems throughout the province. Many pests of forests, crops, and people are among the favourite foods of bats.

Bats are in trouble and face many threats to their existence. Bats have low reproductive rates giving birth to just one pup per year, and only about half of those young make it through their first winter. Their slow reproductive rate means they are particularly vulnerable to habitat loss and other sources of mortality. Human development has brought new sources of mortality to many regions, including introduction of new predators (such as cats), entrapment, extermination, habitat destruction, and even collision with wind turbines and vehicles.

Bats need three basic things to survive: food, shelter and water. Well managed habitats in urban, rural and wild areas can provide these key elements, and the diversity of habitats that are important for ensuring the success of our bats. While buildings and bat houses may provide important shelter for bats, this is not sufficient to sustain our bats if they cannot access drinking water or food in form of insects.

The Bat-Friendly Communities initiative is being implemented in towns across BC, and involves working with your regional Community Bat Program coordinator to develop a community plan that works for your area. Although it is intended for municipalities, it can be scaled down to a school level.

What does a Bat-Friendly Community do?

- Encourage the appreciation of bats among the public, such as by holding talks, bat interpretive walks, and workshops.
- Promotes bat-friendly management information among the public. Sources of information include the Bat-Friendly Communities Guidebook, other resources from the BC Community Bat Program, and provincial Best Management Practices.
- Reduce pesticide use, as well as noise and light pollution.
- Encourage green spaces, wetlands, and trees, with a focus on native, bat-friendly plants.
- Reviews/revises by-laws to promote bat-friendly practices.

Materials

Download the Bat-Friendly Community Guidebook at https://www.bcbats.ca/index.php/get-involved/bat-friendly-communities to get ideas about what you and your community can do to help bats.

Procedure

This project can be done at many different levels. It can be a few students or a whole class taking on different sections of the initiative. Perhaps you have an environmental club in your school and want to suggest that the school or your community can become a 'Bat-Friendly Community'.

Download the Bat-Friendly Community Guidebook and refer to page 46 for further instructions.

Assign a few people to investigate each of the bullets on the left (what does a Bat-Friendly community do?), and develop strategies to accomplish them.

Perhaps there is an organization in your community who is already working towards the goal of having city council become proclaimed as a Bat-Friendly Community. Contact your local BC Community Bat Program Coordinator to find out. Email: info@bcbats.ca.

Make a Radio Show

Age: Grades 5-12

Subjects: Language arts

Duration: 1 hour

Group size: small

Setting: Indoors

Objectives

Students will be able to;

1. communicate important facts about bats.

Method

Students will prepare ratio broadcasts on bats.

Background

It's important to get the message out there that bats are important. Here's a chance for students to develop a radio broadcast to tell the world why bats are so amazing.

Materials

Access to website:
https://www.educationworld.com/a_lesson/lesson/lesson031.shtml
Recorder

Procedure

Use the scripts from several episodes of the Earth & Sky radio program. Students can work in small groups (dividing up the parts in the scripts for as many students as are in the group, if that is preferred). Each group can focus on a different bat-related episode of the popular series. They can rehearse the scripts and concoct their own special sound effects as they create "radio broadcasts" in the classroom. Tape record their broadcasts.

Scripts for five episodes are available online. They include **Bat Talk**, **The Bats and the Bees**, **Echolocation**, and **Vampire Bats**. This activity might motivate pairs or groups of students to create scripts for "radio broadcasts" on other areas of interest. Please note that the content is not BC bat—specific, but international.

Bat Week

Age: Grades K—12

Subjects: art, Language arts.

Duration: 15 minutes

Group size: small to large

Setting: Indoors and outdoors

Objectives

Students will be able to;

1. understand that bats are celebrated around the world.

Method

Students will go online and check the Bat Week website to get ideas of how people celebrate bats around the world.

Background

Bats are celebrated around the world every year during Bat Week. It falls the last week of October, just in time for Halloween.

Bats are also celebrated on Bat Appreciation Day, April 17th. Bats are emerging from hibernation and people start to notice bats flying around in the evenings. The date is also close to Earth Day (April 22nd), so it's a great time to focus on bats.

Materials

Access to website www.batweek.org.

Procedure

Go to www.batweek.org to see lots of amazing activities to celebrate bats internationally.

APPENDICES

By Bat Education and Ecological Protection Society

BAT CRAFTS

Please see the Bat Craft Binder in the BC Bat Edu-Kit.

By Bat Education and Ecological Protection Society

Resources and Websites

Key messages in BC;
1. Bats are interesting.
2. Bats are important.
3. Bats are threatened.
4. Bats need us—you can help

Key action messaging from BC Bat Action Team;
1. Consider living with bats in your buildings, when safe to do so.
2. Make your community a Bat-friendly Community (https://bcbats.ca/index.php/get-involved/bat-friendly-communities).
3. Protect and restore natural bat habitats.

Bats Out of the Darkness Travelling Museum Display

With so many bats in our midst you'd think we'd know more about them, but most of us are in the dark about bats. However, their survival depends on our enlightenment. This exhibition shines a light on the bats of British Columbia, bringing them out of the darkness and into our consciousness. The exhibition celebrates these amazing creatures and serves as a reminder of how essential bats are to the environment and the economy.

This is your chance to see bats in a new light! Discover fascinating facts about bats, examine BC bat specimens up close and hear their calls, uncover common myths about bats and participate in hands-on activities, including dressing up as a BC bat and joining a virtual bat count. Visit the exhibition to learn about the threats bats face and how you can help these fascinating mammals.

This display is available for borrowing. Please contact the Okanagan Heritage Museum in Kelowna for more information.

Bat websites

British Columbia:

- BC Bat Action Team: http://www.bcbat.ca/
- BC Community Bat Program: https://www.bcbats.ca/
- NatureKids BC – Bat Citizen Science Project - https://www.naturekidsbc.ca/be-a-naturekid/stewardship-citizen-science/bat-citizen-science/
- BC government Conservation Data Centre - https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre/explore-cdc-data/species-and-ecosystems-explorer
- BC government Best Management Practices for Bats
- Bat Caver - www.batcaver.org

Canada and International:

- Bat Conservation International: http://www.batcon.org/
- Bat Week – annually end of October - https://batweek.org/
- White-nose syndrome: https://www.whitenosesyndrome.org/
- North America Bat Monitoring Program

Other resources:

Bat Education link: https://batslive.pwnet.org/

Wildlife Habitat Council webinars on bats: https://www.wildlifehc.org/knowledge-center/on-demand-webinars/

Project EduBat: Learn and Share About the Benefits of Bats https://www.wildlifehc.org/knowledge-resource/project-edubat-learn-and-share-about-the-benefits-of-bats/

Echolocation song for kids: https://www.youtube.com/watch?v=8OYmHVuguWI

Video of someone reading "Stella Luna" http://www.storylineonline.net/ http://www.storylineonline.net/books/stellaluna/

Colouring pages http://www.theteachersguide.com/batslessonplans.htm

Bat crafts http://www.dltk-holidays.com/halloween/bat_crafts.html

Bat math activities http://mathwire.com/themes/themebat.html

Bat reading and making a bat-shaped book http://www.kidzone.ws/animals/bats/activities-books.htm

Bat games (including smelling pups and echolocation) http://www.twigglemagazine.com/October-activities/Bats-kids-lesson-kindergarten.html

Online bat quiz (computer) http://www.lawrencehallofscience.org/kidsite/portfolio/bat-quiz/

Make an itsy bitsy book http://www.kidzone.ws/animals/bats/ws16.htm

Online jigsaw puzzle http://www.dltk-kids.com/puzzles/theme.asp?tid=88

Lots of good bat activities http://www.kidzone.ws/animals/bats/activities.htm

Lesson plans http://batslive.pwnet.org/resource/lesson_plans.php

Bat toilet paper roll craft http://www.dltk-kids.com/animals/mbat.htm

www.jedessine.com/templates/print/php?id=26357 2 vampire bat colouring pages

https://www.educationworld.com/a_lesson/lesson/lesson031.shtml

Bats Live: https://batslive.pwnet.org/resource/lesson_plans.php

Bats of the NWT- https://www.enr.gov.nt.ca/sites/enr/files/bat_poster.pdf

All about bats True-False http://batweek.org/wp-content/uploads/All-About-Bats-Bat-for-Bats-UPdt2018.pdf

Super hero bats colouring page: https://batslive.pwnet.org/edubat/COMIC%20COLORING%20PAGE.PDF

THANKS FOR HELPING US BRING

BATS OUT OF THE DARKNESS!