Mexican Free-Tailed Bats: Food Chains & Webs Grades 3 – 5

Learning Objectives

1. Grade 3: Students will create food chains to show Mexican free-tailed bats' role in the ecosystem.
2. Grades 4-5: Students will create food webs to show Mexican free-tailed bats' role in the ecosystem.
3. Students will describe how energy flows in food chains or food webs.
4. Students will predict how the removal of Mexican free-tailed bats will affect the ecosystem.

Essential Questions

1. What roles do Mexican free-tailed bats have in the ecosystem?
2. How would the removal of Mexican free-tailed bats impact the ecosystem?

Time Needed

• Engage: Meet the Mexican Free-Tailed (MFT) Bat	5-10 minutes
• Explore 1: More About MFT Bats	20-30 minutes
• Explore 2: Bats of Bracken Cave	20-30 minutes
• Explore 3: Predators & Prey of MFT Bats	30-40 minutes
• Explain: Food Chains/Food Webs	30-40 minutes
• Elaborate: The Bat Survival Game	30-40 minutes
• Evaluate: What did you learn?	15 minutes

Texas Essential Knowledge & Skills (TEKS)

2017 Science TEKS	Science TEKS Approved by SBOE 2021
• 3(9)(B) identify and describe the flow of energy in a food chain and predict how changes in a food chain affect the ecosystem such as the removal of frogs from a pond or bees from a field • 4(9)(B) describe the flow of energy through food webs, beginning with the	• 3(12)(B) identify and describe the flow of energy in a food chain and predict how changes in a food chain such as the removal of frogs from a pond or bees from a field affect the ecosystem • 4(12)(B) describe the cycling of matter/flow of energy through food

Sun, and predict how changes in the ecosystem affect the food web • 5(9)(B) describe the flow of energy within a food web, including the roles of the Sun, producers, consumers, and decomposers	webs, including the roles of the Sun, producers, consumers, decomposers • 5(12)(B) predict how changes in the ecosystem affect the cycling of matter and flow of energy in a food web
Scientific and Engineering Practices Approved by SBOE 2021	
• 3-5(1)(G) develop and use models to represent phenomena, objects, and processes or design a prototype for a solution to a problem • 4-5(3)(A) develop explanations/propose solutions supported by data and models • 3-5(3)(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats	
Recurring Themes and Concepts Approved by SBOE 2021	
• 3-5(5)(B) identify and investigate cause-and-effect relationships to explain scientific phenomena or analyze problems • 3-5(5)(E) investigate the flow of energy and cycling of matter through systems	

2018 Social Studies TEKS	Social Studies TEKS Adopted by SBOE 2022
• 3(4)(A) use cardinal and intermediate directions to locate places on maps and globes in relation to the local community • 4(20)(A) apply mapping elements, including grid systems, legends, symbols, scales, and compass roses, to create and interpret maps • 5(24)(A) apply mapping elements, including grid systems, legends, symbols, scales, and compass roses, to create and interpret maps	• 3(4)(A) use cardinal and intermediate directions to locate places on maps and globes in relation to the local community • 4(20)(A) apply mapping elements, including grid systems, legends, symbols, scales, and compass roses, to create and interpret maps • 5(24)(A) apply mapping elements, including grid systems, legends, symbols, scales, and compass roses, to create and interpret maps

Next Generation Science Standards (NGSS)

- 5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

The performance expectation listed above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science & Engineering Practices Developing and Using Models Modeling in 3–5 builds on K–2 models and progresses to building and revising simple models and using models to represent events and design solutions. • Develop a model to describe phenomena. (5-LS2-1) Use materials to design a device that solves a specific problem or a solution to a specific problem.
Disciplinary Core Ideas LS2.A: Interdependent Relationships in Ecosystems • The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plant parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1) LS2.B: Cycles of Matter and Energy Transfer in Ecosystems • Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. (5-LS2-1)
Crosscutting Concepts Systems & Systems Models • A system can be described in terms of its components and their interactions. (5-LS2-1)

Academic Vocabulary

From: lead4ward Academic Vocab https://lead4ward.com/resources/

Grade 3	Grade 4	Grade 5
• community • decomposer • drought • ecosystem • environment • environmental change • population • species	• carnivore • flow of energy • food web • herbivore • omnivore • photosynthesis • predator • prey	*Previously Introduced* • migration • offspring • parent

• survive • thrive *Previously Introduced* • consumer • energy • food chain • producer • Sun	• protection *Previously Introduced* • habitat • organism • Sun	

Background Information

Bats are unique and fascinating animals. They are the only mammals capable of true flight. They belong to the order Chiroptera which includes more than 1,400 bat species. They live on every continent, apart from Antarctica, and have survived on Earth for over 50 million years (BCI, 2023).

Mexican Free-Tailed Bats

This lesson focuses on one species of bat that is native to North, Central, and South America, the Mexican free-tailed bat, *Tadarida brasiliensis.* These bats are also called Brazilian free-tailed bats.

- Habitats
  Mexican free-tailed bats live in a variety of habitats, including caves, abandoned mines, culverts, bat houses, and under bridges. The colonies of this species tend to be large, reaching hundreds of thousands, even millions of bats.

- Distribution
  In North America, most Mexican free-tailed bats are migratory. They spend the summer months in the central and southern United States where males and females roost separately. The females form maternity colonies where they each give birth to and raise a new pup. Males form smaller bachelor colonies.

  In the summer, Mexican free-tailed bats are found throughout Texas. Although some appear to stay in Texas year-round, most of the western sub-species of Mexican free-tailed bats (*Tadarida brasiliensis mexicana*) that spend the summer in Texas migrate to Mexico in the autumn. The subspecies, *Tadarida brasiliensis cynocephala* lives in the eastern quarter of Texas year-round. Due to their wide distribution throughout the state, Mexican free-tailed bats are designated as the state's official flying mammal (Texas Tech University, 2023).

- Diet
  Mexican free-tailed bats are insectivores that primarily feed on moths. They also eat other flying insects such as beetles, flies, true bugs, and ants, to name a few. Insectivore bats play an important role in controlling the insect population. It is estimated that one nursing Mexican free-tailed bat eats at least her body mass in insects every night. An adult female Mexican free-tailed bat has a mass of about 12 grams. This means each night a nursing Mexican free-tailed bat eats roughly 12 grams of insects, which is about the same mass as 2 quarters or 1 AAA battery. This may not seem like a lot, but 20 million bats each consuming 12 grams of insects every night adds up to 220 tons of insects. That's the approximate mass of 55 elephants – consumed each night!

- Role in the Ecosystem
  Mexican free-tailed bats play an important role in the ecosystem. Large populations help control insect populations. When they live near farmland, Mexican free-tailed bats protect agricultural crops from pests. Bats also are a food source for many animals including hawks, owls, raccoons, and snakes.

- Echolocation
  One of the *Deep in the Heart* videos included in this lesson, *Bats of Bracken Cave* mentions echolocation. In addition to sight, a Mexican free-tailed bat relies on echolocation to navigate its environment and hunt prey. A bat emits high-frequency sounds through its mouth or nose that are too high for a human to hear. These sounds bounce off objects and return to the bat as echoes which provide information about the distance and size of objects around it. The echolocation calls of Mexican free-tailed bats range between 20 and 75 KHz, depending on habitat and weather conditions (BCI, 2023).

- Communication
  Mexican free-tailed bats also make a variety of social vocalizations including isolation calls, begging calls, and multi-syllabic songs (BCI, 2023). Each night a mother bat leaves the cave to hunt. She leaves her new pup in the cave, huddled with the other pups in the colony. Upon her return, she uses calls and smells to find and nurse her own pup. An amazing feat in a colony of millions!

- Structures & Functions
  - Mexican free-tailed bats' fur varies in color and may include shades of dark brown, rusty brown, and gray.

- A bat's body is adapted for flight. Its chest and shoulders are larger with muscles that provide power to the wings. Its hips and legs are slender (Wilson, n.d.).
- An adult Mexican free-tailed bat has a mass of about 12 grams, about the same as 2 quarters or 1 AAA battery.
- An adult Mexican free-tailed bat's wingspan ranges from 11-14 inches, and its body length ranges from 3.5-4 inches.
- A bat's wing has a similar bone structure to a human's hand. The bones of a bat's wing are connected by a thin membrane of skin. The thumb, however, is free from the wing membrane, has a claw at the end, and is used for crawling and climbing. (Bonus fact: As mentioned above, bats are mammals that belong to the order Chiroptera. This name comes from the Greek words, "cheir" which means hand, and "pteron" which means wing.)
- The uropatagium is a skin membrane that extends between the legs and tail of a bat. In many bat species, the uropatagium extends from the legs to the entire length of the tail. However, in Mexican free-tailed bats, some of the tail extends beyond the uropatagium. This is why this species has "free-tailed" in its name. Other species of bats also have this feature. All free-tailed bats are classified in the Molossidae family which is the 4th largest family of bats. The Molossidae family includes over 100 bat species that live in North America, South America, Europe, and Africa. Insectivores, like the Mexican free-tailed bat, use the uropatagium to catch insects mid-flight.
- Mexican free-tailed bats have small dark eyes. They see about as well as humans see in the dark. To hunt and navigate their environment at night, Mexican free-tailed bats rely on echolocation.

- Conservation Status
  Mexican free-tailed bats are classified as "Least Concern" on the International Union for Conservation of Nature's (IUCN) Red List. They currently have a broad geographic range and large population sizes. They have adapted to living in urban areas and roost in human-made structures such as houses, tunnels, and under bridges. Potential conservation threats to this species include habitat loss, the impacts of climate change, wind energy development, accumulation of pesticides in their diet, and persecution.

Bracken Cave
Texas is home to the world's largest bat colony and one of the largest concentrations of mammals on Earth. Bracken Cave, located along the southeastern edge of the Hill Country near San Antonio, Texas, is home to approximately 20 million Mexican free-tailed bats. This population is a maternity colony, consisting of females and their pups. The emergence of these millions of bats as they leave the cave at dusk during the spring, summer, and fall for their nightly insect hunt, is an unforgettable sight. They fly out of the cave in a spiral that looks like a tornado, a tornado of bats, a batnado!

Congress Avenue Bridge in Austin, Texas
The largest urban colony of bats in the world is made up of an estimated 1.5 million Mexican free-tailed bats that live under the Congress Avenue Bridge in Austin during the summer. The emergence of this colony each night has become one of the city's most popular summer tourist attractions.

Threats to Bats Worldwide
Bat populations are declining worldwide. Some of the main reasons for their population declines include:

- Human activity that destroys bat habitats such as cutting down forests, mining guano (bat poop), and thoughtless tourism into caves and abandoned mines.
- The impacts of climate change harm bat populations. Some examples include:
    - Increased extreme weather events increase bat mortality.
    - Increased aridity and drought make it difficult for some bat populations to survive and reproduce.
    - Changes in seasonal timing negatively impact bats that migrate.
- A disease called white-nose syndrome is currently spreading throughout bat populations in the United States and Canada. This disease is caused by a fungus that infects hibernating bats.
- Bats are hunted for sport and meat.
- Dead bats are found under wind turbines worldwide. While wind turbines are a step toward reducing our reliance on fossil fuels, they are negatively affecting bats.
  (BCI, Bats 101, 2024)

Common Misconceptions about Bats

Myth	Facts
Bats are blind.	No. All bats are able to see. There is variation in eyesight from species to species. Some bat species have night vision which allows them to see in dimmer light, similar to the adaptation of a cat's eyes. Some species of bats can see ultraviolet light. Other bat species, like the Mexican free-tailed bat, rely on echolocation to navigate and hunt in the dark. While these species do not see well in the dark, they are still able to see. Their night vision is similar to that of a human's (BCI, FAQ, 2023).
All bats drink blood.	No! Of the 1,400+ species of bats on Earth, only three are vampire bats that feed on blood. These three species all live in the New World tropics (i.e., South America, Central America, and Mexico) (BCI, FAQ, 2023). Vampire bats do not actually suck blood. Instead, they use sharp, pointed front teeth to make small cuts in the skin of another animal and then lap up the blood. The saliva of these bats has proteins that prevent wounds from clotting. This anticoagulant has been developed into a medication that helps prevent strokes in humans (BCI, Common Vampire Bat, 2023).
Bats will fly into your hair.	No! Bats are not attracted to human hair. This is an old misconception. This idea could have evolved from humans seeing bats foraging for insects low, just above people's heads. Bats are able to catch small flying insects mid-flight and can definitely avoid a human head! (Virginia Department of Wildlife Resources, 2023). This myth may have been told as a way to deter young women from going out at night (Neighborhood Bat Watch, n.d.).
All bats have rabies.	Most bats do NOT have rabies. It is estimated that less than 0.005% of bats in wild populations contract the

	rabies virus (Idaho Fish and Game, 2005). Even among bats submitted for rabies testing in the U.S., only about 6 percent had rabies (Florida Fish and Wildlife Conservation Commission, 2024). All mammals can contract rabies. In 2021, 8,686 mammals (multiple species) in Texas were tested for rabies. Of those 8,686 animals, 455 (5%) were positive for rabies. In 2021, skunks were the primary source of positive rabies cases in Texas and bats had the second-highest number of confirmed rabies cases (Texas Department of State Health Services, 2021). It is very important to NEVER touch a wild animal, including a bat. If you find a bat on the ground or out during the daytime, there is a high chance that it is sick or injured. If you encounter a bat in a building or on the ground, contact a local rescue organization to help (BCI, FAQ, 2023).
Bats are not that important. Bats are "vermin" and should be exterminated.	Not true! All around the world, bats provide vital ecosystem services such as insect pest consumption, plant pollination, and seed dispersal. They are essential to the health of global ecosystems (BCI, Bats 101, 2023).
Bats are flying mice.	No! The most recent studies using gene comparisons suggest that bats are in the superorder Laurasiatheria. Bats' exact placement within the Laurasiatheria superorder is still uncertain, but they are thought to share a most recent common ancestor with hooved animals like horses and antelope as well as carnivores (Tsagkogeorga et al., 2013).
All bats are the same.	There are over 1,400 different bat species worldwide that vary in size, appearance, and characteristics. 32 of those species live in Texas.

Tips for Addressing Concerns/Fears About Bats

Many people are afraid of bats. For some people, this may stem from a personal experience. However, most people have never been close to a bat. They may have seen the silhouette of a bat flying at night but have never encountered a bat in close range. This means that a fear of bats often comes from social cues.

Some of the common myths listed above may teach people to fear bats. The way bats are depicted for Halloween could also make people leery of bats. These portrayals may come from the fact that bats are different than us. They are active at night and live in dark spaces like caves. A fear of bats may develop due to unfamiliarity.

Watch carefully for your students' reactions as you introduce bats in the Engage section of this lesson. If you notice any fears or discomfort, gently address these concerns directly. Ask students to share what they know about bats and any previous experiences they've had with bats. Use the information in this background reading to speak to any misconceptions students have about bats. Encourage students to become curious about bats, to learn more about bats through this lesson, and see if any of their ideas about bats change by the end of the lessons.

As students observe Mexican free-tailed bats in pictures, diagrams, and videos throughout this lesson, they may develop the opinion that Mexican free-tailed bats are cute! They are small, furry, and curious about what is going on around them.

There are legitimate reasons to steer clear of bats. Like all wild animals, bats should never be touched. If a bat is found on the ground and/or outside during the day, it may be sick. Give the bat plenty of room and contact a local rescue organization to help. Like all mammals, bats can have rabies. This is one reason why one should never touch a bat or any other wild animal.

The organization Bat Conservation International is leading the charge to ensure the worldwide survival of bats. Part of their conservation work includes teaching people about specific bat species and the ecological and economic value of this extraordinary mammal. Learn more about their conservation work and bats in general here: https://www.batcon.org/our-work/inspire-through-experience/

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Optional Literacy Connections

- *The Bat Book* by Charlotte Milner
- *Bats Biggest! Littlest!* by Sandra Markle
- *The Case of the Vanishing Little Brown Bats* by Sandra Markle
- *Fly Guy Presents Bats* by Tedd Arnold

Materials

Per Class

- *Deep in the Heart: A Texas Wildlife Story* Mexican Free-Tailed Bats: Food Chains & Webs Grades 3 – 5 PowerPoint files
  - English: https://docs.google.com/presentation/d/1zFHVJBwM4zxJ2zeO9rj6_Sv9pWY1znUp/edit?usp=sharing&ouid=103309533954542071568&rtpof=true&sd=true
  - Spanish: https://docs.google.com/presentation/d/1lw_SpEgm7lGBCgLcyYq8tjDHP_WkuSNF/edit?usp=sharing&ouid=103309533954542071568&rtpof=true&sd=true
- *Frankie the Free-Tailed Bat* by Nyta Hensley & Patricia Morton, Illustrated by Steve Stratakos
- Videos (these videos are embedded in the PowerPoint files):
  - *Deep in the Heart: A Texas Wildlife Story Bats of Bracken Cave* video https://youtu.be/H-q58Jd50Lk?si=gm5xZp_WkthqGXd0
  - *Deep in the Heart: A Texas Wildlife Story Snakes Hunt Bats* video https://youtu.be/60Zf7-hLS4E?si=RmHjTr73O0oyXQCS
  - *Deep in the Heart: A Texas Wildlife Story Bats' Greatest Strength: Their Numbers* video https://youtu.be/Va7otBnHq_s?si=lZjAKVvxg2ujWA60
- 2 quarters or 1 AAA battery
  to represent the mass of a Mexican free-tailed bat ~12 grams

Per Group of 4 students

- 'Food Chain/Web Cards' (pages 21-22 for English and pages 30-31 for Spanish)
- 1 piece of butcher paper (large enough to create a food chain/web with the 'Food Chain/Web Cards')
- 2-3 markers
- 1 roll of masking tape
- 1 die
- 24 cotton balls (or other small item to represent bats – each student in each group needs 6 "bats")
- 1 bowl (that can hold the 24 cotton balls or other similar items to represent bats)
- The 'Bat Survival Game' handout (pages 23-29 for English and pages 32-38 for Spanish)

Per Student

- Science journal or piece of blank writing paper
- 1 pen or pencil

Prep

1. Watch the videos ahead of time to ensure they are appropriate for your students. The 2nd and 3rd videos show predators hunting prey. See the links in the Materials List above.
2. Download the PowerPoint files instead of viewing them in Google Drive so you have access to the embedded videos and animations.

Engage – Meet the Mexican Free-Tailed Bat

1. Use PowerPoint slides 3-7 to show pictures of Mexican free-tailed bats to the class. Provide a few minutes for students to observe the images.
2. Then, ask students to share what they notice about these bats.
3. Tell students the bats in the images are Mexican free-tailed bats. They are also called Brazilian free-tailed bats.
4. Next, ask each student to think of one question they have about Mexican free-tailed bats. Tell students to each write down their question in their science journal (or in another place they can reference later).
5. Tell the class they will learn more about Mexican free-tailed bats throughout this lesson. Tell students to keep their question in mind to see if they can answer their question through what they learn in this lesson.

Explore 1 – More About Mexican Free-Tailed Bats

6. Pass around 2 quarters. Tell students that Mexican free-tailed bats have roughly the same mass as 2 quarters. (About 12 grams – Something else with this mass could be used instead of quarters. For example, one AAA battery also has a mass of about 12 grams.) As they hold the quarters or AAA battery, prompt students to imagine they are holding a small, fury bat with wings that fold up.
7. Ask, "Why do you think this type of bat is called a 'free-tailed bat'?" Provide time for students to share their initial responses to this question. Prompt them to refer to the images of Mexican free-tailed bats on PowerPoint slides 3-7 as they share their ideas.
8. Show PowerPoint slide 9. This slide includes images of a variety of bat tails. Guide students to identify the difference between a Mexican free-tailed bat's tail and other bat tails. Then support students to use their observations to explain why Mexican free-tailed bats have "free-tailed" in their name. In PowerPoint presentation mode, activate the animation feature so this question appears on the slide. Guide the discussion so that students identify:
    a. The tails of Mexican free-tailed bats extend beyond the tail membrane.
    b. The tails of most other bats are completely enclosed within the tail membrane. However, there are other free-tailed bats. Of the 1,400+ bat species worldwide, about 100 of them are classified in the family Molossidae, the 'free-tailed bat' family (NH PBS, 2023).
    c. The entire length of the tail of a Mexican free-tailed bat can be almost half its total body length.
9. Make a local connection. Show the map on PowerPoint slide 10 that identifies where Mexican free-tailed bats live. Ask students, "Do Mexican free-tailed bats live in your area?" Guide students to use the map to answer this question.
10. Show PowerPoint slide 11 and ask, "Do you think bats are an important animal in our ecosystem? Why or why not?" (Table 1)
11. Direct students to discuss this question in small groups. Then have each group share their responses and reasons/reasoning with the class. As groups share, record students' ideas in Table 1 on PowerPoint slide 11. Note: Record all responses at this point, even if they are contradictory. Students will come back to this chart throughout the lesson to edit it as they learn more.
    Another option: Instead of using PowerPoint slide 11, create Table 1 on a piece of chart paper and use posit notes to record and post students' ideas on the table.

Table 1: **Do you think bats are an important animal in our ecosystem?**

Why?	Why not?

12. Read *Frankie the Free-Tailed Bat* by Nyta Hensley & Patricia Morton, illustrated by Steve Stratakos. https://tpwd.texas.gov/publications/pwdpubs/media/pwd_bk_w7000_1423.pdf

Explore 2 Bats of Bracken Cave

13. Tell students they will now watch some videos to learn more about Mexican free-tailed bats.
14. Show the *Deep in the Heart Bats of Bracken Cave* video clip (4 minutes). This video is embedded in slide 13. It is also available on YouTube here: https://youtu.be/H-q58Jd50Lk?si=1j1TePoUr2TrAiua
15. After the video, ask the question, "What is one thing you noticed about Mexican free-tailed bats in this video?"
    a. First, direct students to discuss this question in small groups. Tell students to decide who will be the scribe in the group (or assign one scribe per group) and have the scribe write down as many Mexican free-tailed bat observations as the group can think of in a science journal or on a piece of paper.
    b. Then, have each group share at least one observation of bats they made from the video. Challenge each group to share a unique observation – one that has not been shared by another group.
    c. As groups share, record the observations in Table 2 on PowerPoint slide 14. Another option: Instead of using PowerPoint slide 14, create Table 2 on a piece of chart paper and use sticky notes to record and post students' ideas on the table.

Table 2: **What did you notice about Mexican free-tailed bats?**

Explore 3 – Predators & Prey of Mexican Free-Tailed Bats

16. Tell students they will now learn about the predators and prey of Mexican free-tailed bats.
17. Show PowerPoint slide 16. (This slide is animated. When viewing the slide in presentation mode, as you click on the slide, each new feature will appear.)
18. First ask, "Which animal in this image is a predator?" Click the slide so the word "predator" appears. Discuss students' responses.
19. Then ask, "How would you describe what a predator is?" Discuss students' replies and then click to show the definition. A predator is "an animal that kills and eats other animals." Identify the snake in the image as a predator.
20. Then click to show the word prey on the slide. Ask, "Which animal in this image is prey?"
21. Then ask, "What does it mean if an animal is prey?" Discuss students' replies and then click to show the definition on the slide. Prey is "an animal that is killed and eaten by other animals." Identify the bat in the image as prey.
22. Ask students to name a few examples of other animals that are predators. Then, ask students to name a few other animals that are prey. Optional: Challenge students to reply to the following questions:
    a. Can a snake ever be prey to another animal? Explain.
    b. Can a bat ever be a predator? Explain.
23. Show Table 3 on PowerPoint slide 17. Guide students to share what they already know by asking, "What do Mexican free-tailed bats eat?" Record students' responses in the table on the PowerPoint slide. Accept all responses at this point. You can edit this table with student input as they learn more. Then ask, "What eats Mexican free-tailed bats?" Record student responses in the table. Another option: Instead of using PowerPoint slide 17, create Table 3 on a piece

of chart paper and use posit notes to record and post students' ideas on the table.

Table 3: **Predators & Prey of Mexican Free-Tailed Bats**

What *do* Mexican free-tailed bats *eat*?	**What *eats* Mexican free-tailed bats?**

24. Show the *Deep in the Heart Snakes Hunt Bat* video. This video is embedded in slide 18. It is also available on YouTube here: https://youtu.be/60Zf7-hLS4E?si=nbjrPpPXanK9zE52 The video is 5 minutes and 22 seconds.
25. After watching the video clip, edit Table 3 on PowerPoint slide 17 as a class. (Or, if you created the table on a piece of chart paper, edit Table 3 there.) Ask students if they want to update any of the information already recorded on the table and/or if they'd like to add anything to the table.
26. Tell students they will watch one more video to further explore the prey and predators of Mexican free-tailed bats.
27. Show the *Deep in the Heart Bats' Greatest Strength: Their Numbers* video clip. This video is embedded in slide 19. It is also available on YouTube here: https://youtu.be/Va7otBnHq_s?si=TULhvDKykMGd6ER0 The video is 3 minutes and 50 seconds.
28. After watching the video clip, edit Table 3 on PowerPoint slide 17 as a class. (Or, if you created the table on a piece of chart paper, edit Table 3 there.) Ask students if they want to update any of the information already recorded on the table and/or if they'd like to add anything to the table.

Explain – Food Chains/Food Webs

29. Create small groups of roughly 4 students. To each group, distribute:
    a. a set of Food Web Cards (see pages 21-22 for the English cards and pages 30-31 for the Spanish cards)
    b. 2-3 markers
    c. 1 roll of masking tape
    d. a piece of butcher paper
30. For Grade 3, direct students to use the cards, markers, and tape to make a food chain on the butcher paper. Two possible examples include:
    Sun → cotton plant → cotton bollworm moth → MFT bat → coachwhip snake
    Sun → corn plant → corn earworm moth → MFT bat → Swainson's hawk
    For Grades 4-5, direct students to use the materials provided to make a food web.
31. When all groups have finished, host a gallery walk. Tell each group to leave their cards displayed in the food chain or food web on their group's table/desks. Tell students to walk around the room to look at the food chains or webs other groups made. Prompt students to look for how the other food chains or webs are similar and different from the food chain or web their group made.
32. After the gallery walk, lead a class discussion about students' observations. Discussion questions:
    a. How are the other food chains/food webs similar to the one your group created?
    b. How are the other food chains/food webs different than the one your group created?
    c. Is there anything you'd like to add to or change in your food chain/food web after looking at the other models?
    d. Did you notice anything in a food chain/food web that was not correct? Discuss. Provide time for students to correct mistakes if needed.
    e. Show PowerPoint slide 21:
        i. Ask, "What would happen if all the bats in your group's food chain/food web died?"
        ii. Tell students to take the bat out of their groups' food chain/food web.
        iii. Give students a few minutes to talk with their group members about what would happen to the rest of the organisms if all the bats were no longer part of this food chain/web.

f. Show the questions on PowerPoint slide 22, one at a time:
   If the bats in the area died out…
   i. What would happen to the corn earworm moths?
   ii. What would happen to the corn plants?
   iii. How might the peregrine falcon be impacted?

Elaborate – The Bat Survival Game

33. To play The Bat Survival Game, divide students into groups of 4.
34. Distribute the materials. Each group will need:
    a. the game directions and prompts (pages 23-29 for English and pages 32-38 for Spanish)
    b. 1 die
    c. 24 cotton balls or other small items to represent bats (Each student needs 6 "bats.")
    d. 1 bowl (that can hold the 24 cotton balls or other items that represent bats)
35. Review the game directions as a class (page 23 for English and page 32 for Spanish) and then provide time for students to play.

Evaluate – What did you learn?

36. Instruct students to find the question they wrote down about Mexican free-tailed bats in the Engage phase of this lesson (either in their science journal or on another pieces of writing paper). Ask, "Do you now know the answer to your question?" Provide a few minutes for student to write about what they now know about bats in relation to their question. If any student does not know the answer to their question, prompt them to identify how they could find the answer their question. Provide time for students to use additional resources to answer their question if needed.
37. Return to the table that was used in the Explore 1 part of this lesson. See Table 1: Do you think bats are an important animal in our ecosystem? on PowerPoint slide 11.
38. Read the first statement that was added to the chart during the Explore 1 part of this lesson. Tell students to react to each statement with a thumbs up (agree) or a thumbs down (disagree). Discuss any discrepancies until the class comes to an agreement. Cross off and edit statements on Table 1 to reflect what students now know about bats' role in our ecosystem.

FOOD WEB/CHAIN CARDS Page 1 of 2


sun


Mexican free-tailed bats


cotton bollworm moth


corn earworm moth


cotton


corn


coachwhip snake


peregrine falcon


Swainson's hawk

FOOD WEB/CHAIN CARDS Page 2 of 2

Great Plains Rat Snake (*Pantherophis emoryi*) by Peter Paplanus on Flickr CC BY 2.0 DEED

rat snake

Photo by Henry Dinardo on Unsplash

raccoon

Photo by Bryan Pedron on Unsplash

skunk

red-shouldered hawk

Great Horned Owl by Becky Matsubara on Flickr CC BY 2.0 DEED

great horned owl

The Bat Survival Game

You will begin this game with 6 bats. As you play, you'll face some of the same challenges the bats of Bracken Cave experience. Your goal is to keep all 6 bats alive. The player who has the most bats left when the game ends is the winner!

Step 1: Gather Materials

Each student needs:	Each group needs:
○ 6 cotton balls or other small items to represent 6 bats	○ 1 die ○ 1 bowl ○ game directions & prompts (this handout)

Step 2: Read These Directions

Make sure each player has 6 "bats." (Use 1 cotton ball or other small items to represent 1 bat.) These bats are Mexican free-tailed bats, and they live in Bracken Cave. For about 6 months each year, female bats and their pups live there. Each night the adult bats and the young bats who are old enough to fly, leave the cave to hunt for insects. But, every time they leave the cave, dangers are waiting for them.

You will play 6 rounds of this game. In each round:

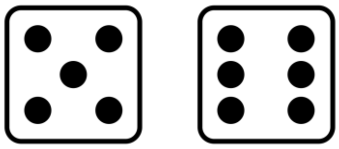
1. All players select one of their bats and place it in front of them.
2. One player reads the prompt for that round.
3. Each player takes turns rolling the die to see what will happen to their bat. After each roll, the player who rolled the die will follow the directions on the prompt, either keeping their bat or putting the bat in the group bowl.
4. After the last round, the player with the most bats remaining wins!

Step 3: Play the game!

Round 1 - Baby Bat Prompt

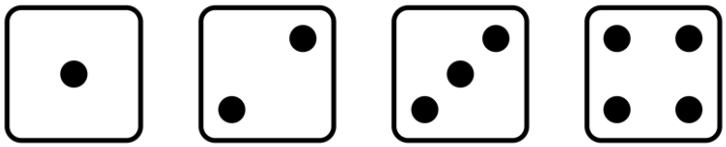

Image: Fin & Fur Films Productions

You're a baby bat who can't fly yet. You need your mom's milk to grow big and strong. Your mother goes out at night to find food for herself, so her body produces milk for you. But sometimes, mother bats do not come back to the cave because it's dangerous outside.



If you roll 5 or 6:

- This means your mom is in trouble, and she can't come back. No other mother bats will help you, and you won't live without milk. Put this bat back in the group bowl.



If you roll any other number (1, 2, 3, or 4):

- Your mom is safe and comes back with lots of milk for you. Keep this bat.

Round 2 - Dermestid Beetles Prompt

Reesa vespulae by Jean-Raphaël Guillaumin from Flickr CC BY-SA 2.0 DEED

You're a young bat, and you're learning how to fly without bumping into other bats. If you accidentally fly into another bat, you could hurt yourself and fall to the cave floor. If this happens, you might not be able to fly away. You won't have any food on the cave floor, and you could die there. On the cave floor, there are insects called dermestid beetles. They eat decaying flesh and fur, so they are sometimes called flesh-eating beetles. If you die on the cave floor, these beetles will eat everything except your bones.

If you roll an even number (2, 4, or 6):

- This means your flight was successful. Fly on! Keep this bat.

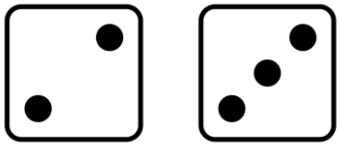
If you roll an odd number (1, 3, or 5):

- Oh, no! You accidentally collided with another bat while leaving the cave and hurt your wing. When you fell to the cave floor, you couldn't get up. Eventually, the dermestid beetles ate you. Put this bat back in the bowl.

Round 3 – Drought Prompt

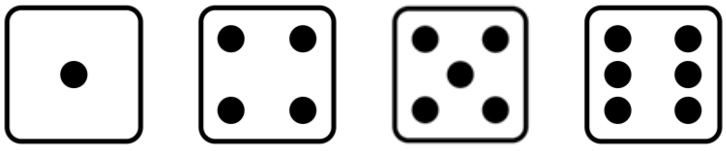

Drought by Alabama Extension ACES | Janet Guynn on Flicker CC0 1.0 DEED

You are now an adult bat. You will eat almost any flying insects, but you usually eat cotton bollworm moths. You have flown over 60 miles tonight searching for some tasty moths. Because it has not rained in a long time (a drought), you cannot find any moths. This is the third night in a row that you're hungry and can't find food. Do you have enough energy to fly home safely tonight? Roll the die to find out.



If you roll 2 or 3:

- Oh, no! You're really tired and have run out of energy. Put this bat back in the group bowl.



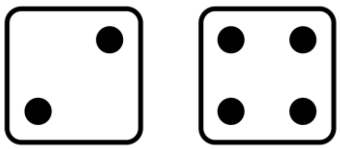
If you roll any other number (1, 4, 5, or 6):

- Good news! You had enough energy to get back to the cave. Hopefully tomorrow night you'll find some moths to eat. Keep this bat.

Round 4 – Coachwhip Prompt

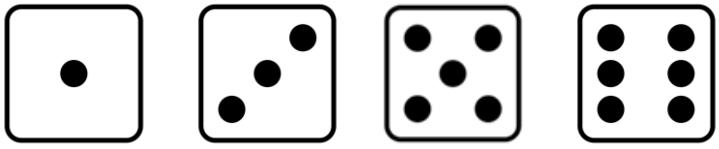

Image: Fin & Films Productions

Tonight, you fly out of the cave pretty low and accidentally get stuck in a cactus. Uh-oh! Now you must figure out how to get out of the cactus before a hungry coachwhip snake comes along and eats you. Roll the die to see what happens.



If you roll 2 or 4:

- The coachwhip was too fast! It ate you. Return this bat to the group bowl.



If you roll any other number (1, 3, 5, or 6):

- What a relief! You managed to escape from the prickly cactus and fly away before the snake could get you. You are safe. Fly on! Keep this bat.

Round 5 - Windmill Prompt

Tonight, while flying around searching for moths to eat, you pass by a windmill farm. Bats like you are always pretty curious, so you decide to get a closer look.


Image: Fin & Films Productions

If you roll a 6:

- You got too close to the spinning blades and didn't survive. Return this bat to the group bowl.

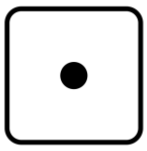
If you roll any other number:

- You are lucky! The people who run this windmill farm added a special sound to warn you about the danger, so you don't fly too close to the spinning blades. You are safe. Fly on! Keep this bat.

Round 6 - Peregrine Falcon Prompt

Tonight, the peregrine falcons are flying around the cave entrance, looking for something to eat. Will you be able to safely fly out of the cave without being captured by a falcon's talons? Roll the die to find out.


Image: Fin & Fur Films Productions



If you roll a 1:

- You are one of the unlucky bats that a falcon managed to grab. Put this bat back in the group bowl.

If you roll any other number (2, 3, 4, 5, or 6):

- You made it! You stayed safe while the falcons hunted other bats. Fly on! Keep this bat.

Count the bats you have left. The player with the most bats wins!

TARJETAS DE RED/CADENA ALIMENTICIA Página 1 de 2

Photo by Johannes Plenio from Pexels

sol

Photo from Fin & Fur Films Productions

murciélago mexicano de cola libre

Helicoverpa armigera by Ilia Ustyantsev from Flickr CC BY-SA 2.0 DEED

gusano cogollero

corn earworm, moth, back_2014-06-06-15.37.55 ZS PMax from USGS Bee Inventory and Monitoring Lab on Flickr PDM 1.0 DEED

gusano elotero

Photo by Mr. Location Scout from Pexels

algodón

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maíz

IMG_3414 by Always a birder! on Flickr CC BY 2.0 DEED

serpiente látigo

Photo by Frank Cone from Pexels

halcón peregrino

227 - Swainson's Hawk (10-3-2015) san rafael grasslands, santa cruz co, az -01 by Alan Schmierer on Flickr CC0 1.0 DEED

halcón de Swainson

TARJETAS DE RED/CADENA ALIMENTICIA Página 2 de 2

Great Plains Rat Snake (*Pantherophis emoryi*) by Peter Paplanus on Flickr CC BY 2.0 DEED

serpiente
rata

Photo by Henry Dinardo on Unsplash

mapache

Photo by Bryan Padron on Unsplash

zorillo

Red-shouldered Hawk by jeannetteyvonne on Flickr PDM 1.0 DEED

halcón de
hombro rojo

Great Horned Owl by Becky Matsubara on Flickr CC BY 2.0 DEED

gran búho
cornudo

El juego de supervivencia del murciélago

Empezarás el juego con 6 murciélagos. Mientras juegas, enfrentarás algunos de los mismos desafíos que se enfrentan por los muricélagos de la cueva Bracken. Tu objetivo es mantenerse vivos a todos los 6 murciélagos. El jugador al que le queden más murciélagos al fin del juego ¡es el ganador!

Paso 1: Reunir materiales

Cada estudiante necesita:	Cada grupo necesita:
○ 6 bolas de algodón u otros objetos pequeños para representar los 6 murciélagos	○ 1 dado ○ 1 tazón ○ Instrucciones para el juego & las rondas (este folleto)

Paso 2: Leer las instrucciones

Asegurar que cada jugador tenga 6 "murciélagos." (Usa 1 bola de algodón u otro objeto pequeño para representar 1 murciélago.) Estos son murciélagos de cola libre mexicanos, y viven en la cueva Bracken. Durante unos 6 meses cada año, las hembras y sus crîas viven ahí. Cada noche los murciélagos adultos y los jóvenes que tienen edad suficiente para volar, salen de la cueva para buscar insectos. Pero, cada vez que salgan, los peligros los están esperando. Jugarán 6 rondas de este juego. En cada ronda:

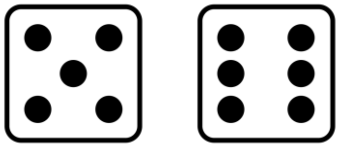
1. Cada jugador escoge un muriciélago y lo pone delante de él.
2. Un jugador lee las instrucciones para la ronda.
3. Cada jugador tomará turnos para tirar el dado, a ver que pasará con su murciélago. Después de cada tirada, el jugador que tiró el dado seguirá las instrucciones en la tarjeta, ya sea quedándose con su murciélago o devolviéndolo al tazón del grupo.
4. Después de la última ronda, el jugador al que le queden más murciélagos ¡gana!

Paso 3: ¡Jugar el juego!

Ronda 1 – El murciélago bebé

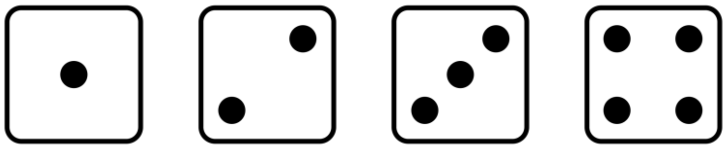

Image: Fin & Fur Films Productions

Eres un murciélago bebé que aún no puede volar. Necesitas la leche de tu madre para crecer grande y fuerte. Tu madre sale de noche para buscar alimento para si mismo, para que su cuerpo produzca leche para tí. Pero a veces, las madres no regresan a la cueva porque hay peligro afuera.



Si sacas un 5 o 6:

- Significa que tu madre se ha metido en problemas, y no puede regresar. Ninguna otra madre murciélago te ayudará, y no puedes sobrevivir sin leche. Devuelve este murciélago al tazón del grupo.



Si sacas cualquier otro número (1, 2, 3, o 4):

- Tu madre está a salvo y regresa con mucha leche para tí. Quédate con este murciélago.

Ronda 2 - Dermestid Beetles Prompt


Reesa vespulae by Jean-Raphaël Guillaumin from Flickr CC BY-SA 2.0 DEED

Eres un murciélago jóven, y estás aprendiendo a volar sin chocar con los otros murciélagos. Si accidentalmente vuelas hacia otro murciélago, podrías lastimarte y caer al suelo de la cueva. Si esto ocurriera, tal vez no podrías salir volando. No tendrías alimento en el suelo de la cueva, asi que podrías morir allí. Hay insectos llamados escarabajos de piel en el suelo de la cueva. Ellos comen carne y piel en descomposición, entonces a veces se les denomina el "escarabajo carnívoro". Si mueres en el suelo de la cueva, estos escarabajos comerán todo excepto tus huesos.

Si sacas un número par (2, 4, o 6):

- Significa que tu vuelo era exitoso. ¡Sigue volando! Quédate con este murciélago.

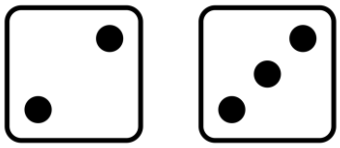
Si sacas un número impar (1, 3, o 5):

- ¡Ay, no! Chocaste accidentalmente con otro murciélago mientras salías de la cueva y te lastimó el ala. Cuando caíste al suelo de la cueva, no podrías levantarte. Eventualmente, los escarabajos de piel te comieron. Devuelve este murciélago al tazón del grupo.

Ronda 3 – Sequías

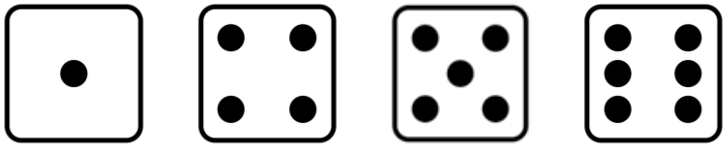

Drought by Alabama Extension ACES | Janet Guynn on Flicker CC0 1.0 DEED

Ya eres un murciélago adulto. Te gusta comer casi todo insecto volador, pero usualmente comes los gusanos cogolleros. Has volado más de 60 millas esta noche buscando unas sabrosas polillas. Porque hace mucho tiempo que no llueve (una sequía), no puedes encontrar ningunas polillas. Esta es la tercera noche consecutiva en que tienes hambre y no puedes encontrar alimento. ¿Tienes suficiente energía para regresar volando sano y salvo a tu hogar esta noche? Tira el dado para saber.



Si sacas un 2 o 3:

- ¡Ay, no! Estás demasiado cansado y te quedas sin energía. Devuelve este murciélago al tazón del grupo.



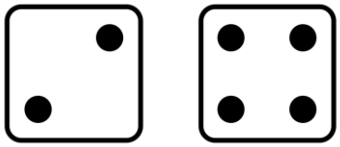
Si sacas cualquier otro número (1, 4, 5, o 6):

- ¡Buenas noticias! Tenías suficiente energía para regresar a la cueva. Ojalá que mañana por la noche encuentres unas polillas que comer. Quédate con este murciélago.

Ronda 4 – La serpiente látigo

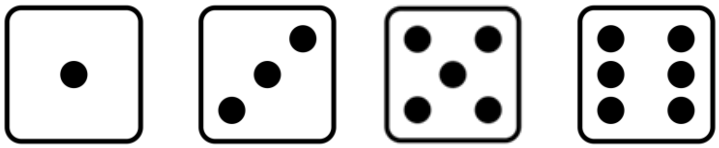

Image: Fin & Films Productions

Esta noche, saliste de la cueva volando bastante bajo y te quedaste atrapado en un cáctus. ¡Oh-oh! Ahora tienes que descubrir cómo escapar del cáctus antes de que la hambrienta serpiente látigo llegue y te coma. Tira el dado para ver que pase.



Si sacas un 2 o 4:

- ¡La serpiente látigo era demasiado rápida! Te comió. Devuelve este murciélago al tazón del grupo.



Si sacas cualquier otro número (1, 3, 5, o 6):

- ¡Que alivio! Lograste escapar del cáctus espinoso y salir volando antes de que la serpiente te pudiera coger. Estás a salvo. ¡Sigue volando! Quédate con este murciélago.

Ronda 5 - La turbina eólica

Esta noche, mientras vuelas en busca de polillas para comer, pasa por un parque eólico. Los murciélagos como tú son siempre curiosos, entonces decides echar un vistazo más de cerca.

Si sacas un 6:

- Te acercaste demasiado a las aspas giratorias y no sobreviviste. Devuelve este murciélago al tazón del grupo.

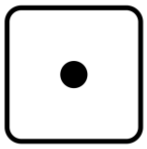
Si sacas cualquier otro número:

- ¡Que suerte tienes! La gente que dirige este parque eólico ha añadido un sonido especial para avisarte sobre el peligro, para que no volara demasiado cerca a las aspas giratorias. Estás a salvo. ¡Sigue volando! Quédate con este murciélago.

Ronda 6 - El halcón peregrino


Image: Fin & Fur Films Productions

Esta noche, los halcones peregrinos están volando alrededor de la entrada de la cueva, buscando algo que comer. ¿Podrás salir volando de la cueva con seguridad sin ser capturado por las garras del halcón? Tira el dado para saber.



Si sacas un 1:

- Eres uno de los murciélagos desafortunados que el halcón logró agarrar. Devuelve este murciélago al tazón del grupo.

Si sacas cualquier otro número (2, 3, 4, 5, o 6):

- ¡Lo hiciste! Te quedaste seguro mientras los halcones cazaban los otros murciélagos. ¡Sigue volando! Quédate con este murciélago.

Cuenta los murciélagos que te quedan. El jugador al que le quede el mayor número de murciélagos ¡ga

Image Sources

Food Chain/Food Web Cards Images

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- Mexican free-tailed bat photo from Fin & Fur Films Productions
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