NEBRASKA JUNIOR MASTER NATURALIST

LEADER GUIDE

ZOOLOGY MASTER

ZOOLOGY MASTER BADGE GUIDE

REQUIREMENTS

To obtain the Zoology Master Badge students must complete one of the following:

Two Junior Nebraska Master Naturalist provided Lesson Plans and one extension activity.

OR

Three Junior Nebraska Master Naturalist provided Lesson Plans.

OBJECTIVES

Students will form a connection with animals that are native to Nebraska and be able to define and identify adaptations, and challenges that the animals face.

NE Science State Standards:

3.7.2.A	5.8.2.C
3.7.2.C	5.11.3.C
3.7.2.D	5.13.4.D
3.9.3.D	5.13.4.E
4.6.3.B	6.6.2.D
4.6.3.C	6.9.3.A
5.8.2.A	6.9.3.B

EXTENSION ACTIVITIES

- Projects in the community that relate to topics in zoology. Examples include surveying local bird species, establishing native pollinator habitats.
- Field trips to a site where students can complete an activity related to topics in zoology. Examples include a local zoo, state park, or other public land.
- Virtual field trips that include a speaker or activity that is related to topics in zoology.
- Guest Speakers who are experts in zoology or related fields. Examples include biologists, zoologists, NMN Volunteers, or NE Extention Educators.
- Hands-on, classroom experiments related to topics in zoology.

NJNMN Lesson Plans

Mammals:

Birds:

Fish:

Reptiles & Amphibians:

Insects:

What Makes a Mammal?

ZOOLOGY MASTER

Appropriate Ages 8-12

Expected Time: 50 min

Students will learn about mammals that live in Nebraska and how their adaptations help them survive in their natural habitat.

This activity satisfies one of the required JNMN lessons needed to complete the Junior Zoology Master Badge.

Learning Objectives:

Students will be able to describe the common traits that most mammals share.

Students will be able to explain how physical and behavioral traits support an animal's survival.

NE Science Standards:

Grades 3-4

SC.3.9.3.D:

SC.4.6.3.B

Did You Know...
In Nebraska there are 89 native mammal species. 4 introduced/invasive and 8 domestic/feral species.

Black-tailed Prairie Dog are a keystone species. They provide habitat for a multitude of other species.

There have been over 354 positive Mountain Lion sightings in Nebraska from 1991-2014

BEFORE YOU TEACH

BACKGROUND KNOWLEDGE

Mammals are warm-blooded vertebrates that are distinguished by their production of milk used to feed their young. Mammals have special physical and behavioral adaptations that allow them to thrive. Some of these adaptations are common in all mammals and some are specific to just a few species.

VOCABULARY

Adaptation: A special skill or feature which helps an animal to better survive in its enviroment. Adaptations could be physical features on an animal's body or behavioral traits.

Trait: A quality that makes one animal different from another.

Mammal: A warm-blooded animal, with a backbone that feeds its young with milk produced by the mother and has skin usually covered with hair.

MATERIALS AND PREP:

- Mystery Mammal Clues Worksheet
- Nebraska Mammal Cards
- 4 Skulls, otter, muskrat, bald eagle, possum
- Stuffed animals, Big Horned Sheep, Possum, Bison, Muskrat
- 4 Fur Pelts otter, muskrat, bison, mink or others

Engage: 5 Min

Display the skulls, pelts, and stuffed animals by species and let the students touch and exaimine them.

Then introduce students to the fact that humans are also mammals and have a lot in common with the animals they will be learning about today. Leaders will have students independently brainstorm different ways we categorize things into groups. Examples could be colors, numbers, size, living or nonliving, patterns, etc. Next, ask them specifically how we can categorize animals. Examples could be color, fur or no fur, warm-blooded or cold-blooded, etc. Explain that there are 6 large categories that all animals can fit into; fish, mammals, birds, reptiles, and amphibians and invertebrates. Today we will be focusing on what makes a mammal a mammal.

Explore: 10 Min

Give each student a piece of paper and utensils for drawing. Use the 'Mystery Animal Clues' Lesson Resource and explain that you will read one clue at a time. After each clue is read, students will take notes and draw the characteristics of the animal on their paper. The goal of the game is to create what they think the animal looks like based on all the clues given. For instance, if the clue is that this animal keeps its baby in a pouch, they would draw a pouch on their animal. The goal is for students to discover that the animal described is a real Nebraska mammal as more clues are given. Instruct students to keep their answers to themselves until all the clues are given. Repeat the activity with a few different mammals.

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Explain: 5 Min

Have students share the similar characteristics they noticed all of the mystery animals had in common. Explain that each species of mammal has different traits, but they are all categorized by a few shared characteristics: have fur, have live births (not in an egg), mothers nurse their young, have lungs to breath air, and are warm-blooded. Answer any questions that students have about what species are mammals based on those facts and clarify any misinformation.

Extend: 15 Min

Have students work alone, in pairs or in groups depending on the size of your class. Assign each student/group a "Nebraska Mammal Card". Instruct students to research their assigned mammal and come up with their own set of 4-6 mystery animal clues. One of these clues must be one of the shared mammal characteristics discussed in class. Make sure they keep their animal a secret from their classmates!

Evaluate: 15 Min

Each individual or group will read aloud their clues begining with the least likly to guess clues. While the other groups/individuals try to figure out what Nebraska mammal they are describing. Once all clues are read, allow other groups to make thier guesses. Have students identify the common characteristics of mammals that was described in the clues after each group shares. Have students identify traits that are not common to all mammals and ask them how those traits help the animal survive. Ex: For the White Tailed Deer, when predators are near, the white tail acts as an alarm flag. Define the term adaptation. If desired, go further in depth by identifying physical and behavior adaptations.

Hands On Extension

In the Lab: Classroom Experiment

One thing mammals have in common is that they all drink milk as babies! Milk has fat molecules that help offspring grow fast and stay warm. Consider this chemistry experiment where the main ingredient is fatty and dense milk. The results from this mixture are jaw dropping. Dip a q-tip in dish soap, touch it to the surface of milk and watch the polarizing molecules race around. For more on this experiment visit: https://www.youtube.com/watch?v=9XJbXy2PQhA

In the Community:

Connect with a wildlife rehabilitation facility and learn about why some species of mammals are more likely to need care. Ask what conservation practices would help them avoid danger. Listen to the stories from experienced staff, both their successes and failures.

*COMPLETING ANY ACTIVITY FROM THIS SECTION WILL COUNT AS YOUR SECOND ACTIVITY REQUIREMENT FOR THE ZOOLOGY MASTER BADGE.

RESEARCH AND RESOURCES

For information on the biodiverstiy of Nebraska's mammals, visit **http://outdoornebraska.gov/biodiversitymammals/**

For information on identifying Nebraska's mammals, visit **https://wildlife.unl.edu/identification.**

The University of Nebraska State Museum also offers a *Mammals of Nebraska Checklist, Key, and Bibliography* in Volume 23 of their bulliten. This guide serves as excellent practice using a dichotomous key for higher grade level students.

Mammals 1-4 Clue Card drawings

Mammals 5-8 Clue Card drawings

Nebraska Mammals

Cyote

Red Fox

Mountain Lion

Mountain Lion

Mule Deer

Beaver

Bobcat

Weasel

Shrew

Tree Squirrel

Eastern Mole

Flying Squirrel

Raccoon

Badger

Black Tailed prairie dog

Woodchuck

13 Lined ground squirrel

Chipmunk

Deer Mouse

Pronghorn

Jack Rabbit

ZOOLOGY MASTER

What Makes A Mammal?
Leader Resource

Nebraska Mammal Clues

Zoology Master: Mammals

Use the resource below while teaching the 'Explore' section of the *Zoology Master: Mammals* lesson plan. To complete this activity, first choose the mammal you will be describing. Give students the clues one at a time by reading them out loud to the class. Have the students draw a different part of the animal that matches the clue. When all of the clues have been read, ask students if they have figured out what animal they were drawing! You can also have students ask quesions about the mammal before or after you reveal what it is.

BIG BROWN BAT

1. This mammal only weighs about 20 grams.
2. This mammal has brown fur.
3. This mammal flies at night time. (has wings)
4. This mammal uses echolocation and needs to be able to hear really well.
5. This mammal hibernates in large groups in the winter.

COTTONTAIL RABBIT

1. This mammal lives in open grassy areas and hides underneath bushes.
2. This mammal has light brown fur.
3. This mammal hops instead of walking and can run 18 mph.
4. This mammal has long ears.
5. This mammal only eats plants.

BIG HORN SHEEP

1. This mammal lives in large herds.
2. This mammal has thick, white fur.
3. It snows a lot where this animal lives.
4. This mammal uses echolocation and needs to be able to hear really well.
5. This mammal has hooves made for walking on steep cliffs.

WHITE-TAILED DEER

1. This mammal has hooves made for walking through forests.
2. This mammal has reddish brown fur.
3. This mammal has white spots as a baby.
4. The males of this mammal have antlers.
5. This mammal can run up to 30 mph

PORCUPINE

1. This mammal is a rodent and can eat tree bark.
2. This mammal has black, white, and grey fur.
3. This mammal can climb trees.
4. This mammal is round and walks low to the ground but can weigh more than 30 pounds.
5. This mammal has sharp quills they use to defend themselves.

EASTERN FOX SQUIRREL

1. This mammal is small can be found in trees or on the ground.
2. This mammal has reddish-brown fur.
3. This mammal eats nuts and seeds. They store them underground for the winter.
4. This mammal has a big fluffy tail.
5. This mammal only eats plants.

COYOTE

1. This mammal is about the size of a dog.
2. This mammal has greyish-tan ffur.
3. This mammal is most active at dusk and dawn.
4. This mammal is an omnivore, eating small mammals as well as fruit.
5. This mammal can run at speeds up to 40 mph!

STRIPED SKUNK

1. This mammal has a long fluffy tail.
2. This mammal has black and white fur.
3. This mammal scares its predators with a stinky smell.
4. This mammal eats mostly insects.
5. This mammal lives in dens it digs for itself.

ZOOLOGY MASTER

Magnificent Migration

Appropriate Ages 8-12

Expected Time: 50 min

Students will explore the challenges and benefits of migration by acting out a seasonal bird migration.

This activity satisfies one of the required JNMN lessons needed to complete the Junior Zoology Master Badge.

Learning Objectives:

Students will learn that when migrating, birds form large groups which help individual birds accurately navigate to where there is available food.

Students will learn about the electromagnetic force and its connection to the Earth and birds.

Students will learn of unique physical adaptations that birds use when preparing their bodies for long migrations.

Students will learn that birds make behavioral changes when processing information from sensory receptors.

NE Science Standards:

Grades 3-6

SC.3.7.2.A

SC.3.7.2.D

SC.4.6.3.B

SC.5.11.3.C

SC.6.6..2.D

SC.6.9.3.B

Did You Know...
The largest crane migration in North America flies through Central Nebraska every year!

Birds use Earth's magnetic field like a compass to assist with navigation.

JUNIOR NEBRASKA MASTER NATURALIST

BEFORE YOU TEACH

BACKGROUND KNOWLEDGE

Birds are warm-blooded, egg laying, animals with wings and feathers. Most birds can fly using their wings to create lift. Many of the birds here in Nebraska are migratory birds, including geese, ducks, cranes, and songbirds. Migratory birds usually migrate seasonally, flying South for the winter and North for the summer. This can be stimulated by changing temperatures, seasonal food availability, and more.

VOCABULARY

Migration: When an entire population moves to find food.

Nocturnal: Active at night.

Electromagnetic Field: result of the movement of liquid iron in the outer Earth's cores. As the liquid metal moves, it generates electric currents creating a magnetic field.

MATERIALS AND PREP:

- Migration Game Cards
- Laminated photos of Hummingbird tongue/beak
- Hummingbird nest/egg and skull
- Medium sized poster paper
- Laminate of Indigo Bunting
- Flash drive containing Omaha's purple martin roost or youtube https://youtu.be/g2y-lQcNF4s
- https://birdcast.info/science-to-action/ - (Opened and ready before class)
- https://birdcast.info/migration-tools/migration-forecast-maps/

Engage: 5 Minutes

Ask if students can identify a physical adaptation with the beak and tongue. Why might their shapes be useful?

Have students brainstorm the reasons they leave their house. Examples could be shopping for groceries, doctor visits, school, or to play. Instruct students to create a map of their house and all the spots they visit frequently relying solely on their memory. Explain that this demonstrates how animals use their senses and memory to migrate. Explain that birds migrate for many of the same reasons that we leave our house,including to find food.

Show video of the purple martin Roost in 2016 that illustrates volume of birds, their speed and spacing. Open the http://birdcast.info/science-to-action map and insert your city to see live migratory bird estimates traveling through your area overnight. Nearly all species of birds migrate in groups. Have students consider why a group may increase survival?

Explore: 20 Minutes

Since most songbirds migrate at night, turn out the lights to mimic their migration. Randomly assign a bird card to each student and have students line up on one side of the room. Secure the masking tape on the floor or outside surface to denote both the beginning and end lines for the migration. Their goal is to "migrate" to the other side as quickly as possible. Explain that each student is going to pretend they are the bird they were assigned and will follow instructions from the provided migration game cards. Not all birds will move after each card is read. When something that benefits migrators occurs, students will move forward. Like the Purple Martins from the video, have them migrate very close together. When something negative for migrators occurs, students may have to move backwards. Shuffle the provided migration game cards and read aloud the instructions on each card, one at a time. Once they reach their final destination they will no longer need to move forward or backward. After all of the cards have been read, inform them that any 'bird' that did not make it to the finish line did not survive their migration.

Explain: 5 Minutes

When students have finished the game, ask them what challenges they faced while migrating? What challenges did they expect and which ones were unexpected? What kinds of birds faced the most challenges? What birds had the farthest distance to travel? The shortest?

Ask students what environmental factors may change that initiate a bird's migration? When birds are ready to migrate they tend to do so seasonally. The length of daylight to nighttime is very important, as well as temperature. and having enough food availability. Physical adaptations occur in the body too. Fat deposition are necessary so that birds can endure their migration journey. Other physical adaptations involve the change in steroid and hormone levels within the birds' bodies. A 'restlessness' also happens before migration. Have students predict how birds are able to fly thousands of miles and yet return to their home range.

Introduce the words electromagnetic field and its definition: A result of the movement of liquid iron in the outer Earth's cores. As the liquid metal moves, it generates electric currents creating a magnetic field.

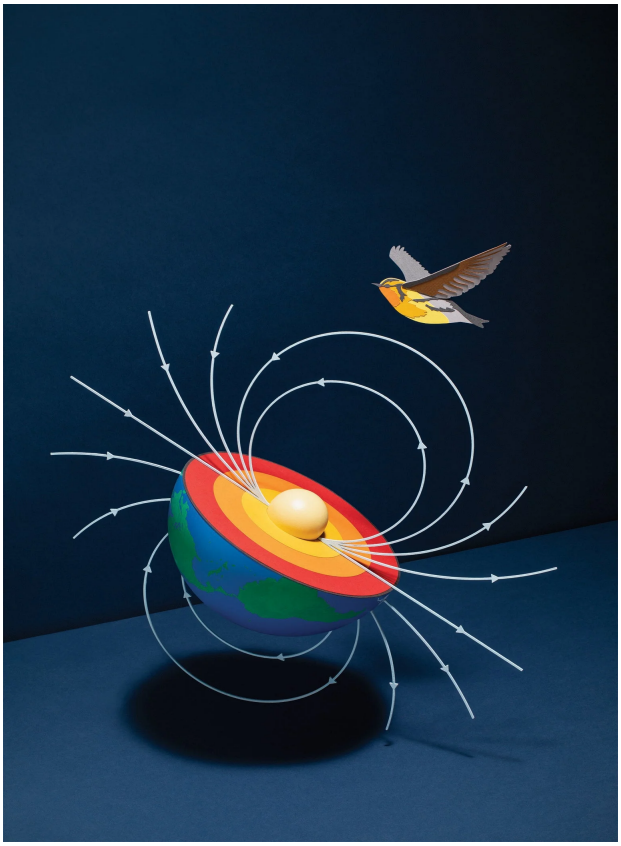
- Scientists believe birds rely on the position of the sun, the stars and the Earth's electromagnetic field in order to migrate. Scientists who have captured birds and allowed them to fly are able to sense when they leave the electromagnetic field, and quickly fly back into it.
- Research is being done that is looking for how birds bodies can help them stay on course and results point to a physical adaptation, a sensory protein near their eye that allows them to sense the electromagnetic field.
- Each place on Earth has its own electromagnetic signature based on how near or far that place is from the North and South Poles, kind of like GPS. Birds likely have in addition to the five senses their own GPS-like sense.
- Then there's flying within a group so the newly hatched and first year birds follow the group and as they grow, they learn from the older birds.

Extend: 15 Minutes

Discuss why birds migrate at night.

1) Fewer predators
2) Cooler temperatures
3) Less wind
4) Celestial navigation.

Students will now work in groups to create a solution to a challenge a bird faces while migrating. Split students into groups and have them pick a challenge they faced while playing the migration game. Give them paper and time to design a solution to the challenge. Solutions could be laws that protect land, protecting birds from hunting, bird decals to warn birds of glass windows, etc. Allow the students to be as creative as they want when designing these solutions. They can draw the solution, or write about it. Pass out poster sized papers. or assign one of the following conservation tools to research and on their posters, draw or write a description of their bird protection device: Birdcast.info radar mRI1, Ebird data collection app, the Motus wildlife tracking system of radio transmitters, or the bird tracking satellite receivers, Icarus.



Evaluate: 5 Minutes

Have students share their migration challenges and solutions with the class. Have students explain how scientists' inventions are helping track birds' migrations. How can this help protect birds?

Hands On Extension

In the Lab:
Download the Ebird App, or use https://ebird.org Navigate to Explore, enter the place you are located and compile a list of places within your county where birders have reported in their recent sightings. The locations are found when one selects "details". Perhaps print a copy of the results of two or three birder's accounts so that you will be prepared for the birding field trip. Download the free Merlin ID app and record the birds you encounter. The app is designed to listen and identify birds by their chirps, calls and songs. Keep track of the birds you see or hear, the place you visited and the time of year.

In the Field:
Visit a nature center with birds on display! One such Nature Center is Fontenelle Forest's Raptor Woodland Refuge. Fontenelle Forest houses a variety of rescued raptors. Head out to well established bird feeders at local parks, such as Platte River State Park, Wildcat hills nature center, Rowe Sanctuary, Spring Creek Audubon Center. Or find a local birding spot via the Nebraska Birding Guide https://birdtrail.outdoornebraska.gov/

Or Take a birding field trip to the places identified with IN THE LAB research.

In the Community:
EBird and Cornell are free community science apps and are a great way to get students involved in community science. It's easy to help bird biologists with their research projects by adding your bird sightings to other birders' data. Students and educators can easily download the ebird app. Create an account and start recording their group's observations. Scientists can use these observations to track migration patterns, habitat ranges, and population changes.

OR

In the Spring or Summer, you may have noticed a bird or two attempting to fly into your window. Have students research ways to keep birds safe from windows and create a classroom or school wide initiative to decorate windows to keep birds from hitting them. Your effectiveness in preventing bird deaths is based on time of year, so be sure and consult Birdcast.org forecasts. There are several companies that sell bird window decals, for help in locating them contact your JNMN Coordinator.

***COMPLETING ANY ACTIVITY FROM THIS SECTION WILL COUNT AS YOUR SECOND ACTIVITY REQUIREMENT FOR THE ZOOLOGY MASTER BADGE.**

RESEARCH AND RESOURCES

To become a citizen scientist and help researchers track bird populations and migrations, visit https://ebird.org/home

To explore a migration calendar of the birds in Nebraska, visit https://audubon-omaha.org/go-birding/birding-calendar.html

Ebird, Cornell's Merlin, and Audubon bird identification moblie apps can be found in your app store.

Gravitational-magnetic-electric field interaction Article: https://www.sciencedirect.com/science/article/pii/S2211379718314128

Audubon Magazine: Audubon The Wonder of Migration Spring 2022, Richard Holland, Sensory Biologist, Bangor University & Nathan Senner, Ornithologist, USC https://www.audubon.org/magazine/spring-2022

Articles: Endocrine Effects, Rankin Amer Zool 1991 Magnetically sensitive cryptochrome, Robinson, National Academy of Sciences, 2012 https://www.jstor.org/stable/3883471

Fish-in' the Food Web

Zoology Master: Fish

ZOOLOGY MASTER

Appropriate Ages 8-12

Expected Time: 45 min

This activity satisfies one of the required JNMN lessons needed to complete the Junior Zoology Master Badge.

Learning Objectives:
Students will be able to identify the different trophic levels as well as construct an aquatic food web using Nebraska organisms.

Students will understand the transfer of energy through an ecosystem.

NE Science Standards:
Grades 3,5,6
SC.5.8.2.A
SC.5.8.2.C

Did You Know...
Humans play an important role as the top predator in most aquatic food webs. It is our responsibility to ensure that our state's fisheries are healthy and sustainable through monitoring and conservation.

Nebraska is home to more than 100 species of fish!

BEFORE YOU TEACH

BACKGROUND KNOWLEDGE

Every organism on earth needs energy to survive. Organisms within an ecosystem depend on each other food as energy. The simplest of these links is referred to as a food chain. Food chains are a linear network of at least three organisms, starting from producer organisms and ending at consumer, illustrating how organisms are related to each other by the food they eat. Within an ecosystem, there are many food chains, which combined, create a food web.

MATERIALS AND PREP JNMN PROVIDED:

- #25 Aquatic Organism Necklaces
- Ball of Yarn
- Freshwater Food Web Worksheet
- Freshwater Food Web Answer Sheet
- Crappie and Fisherman ID Necklaces
- Small Cups
- Medium Cups
- 2 Buckets

NOT PROVIDED:

- Paper
- Scissors

Engage: 5 Minutes

To begin this lesson, have students identify plants and animals they can expect to find in a lake or river. On a whiteboard or posterboard, space out the organisms identified so they cover the entire board. Once the class has 15-20 organisms listed, ask the class if of the animals would eat another organism listed. If so, connect the two with a line or arrow. Ask students if they are familiar with the term's food chain and food web? Are they the same?

VOCABULARY

Trophic Level: The different levels in a food chain: producers and consumers.

Producer: Organisms that can produce their own food using the sun, water, and carbon dioxide.

Primary Consumer: Makes up the 2nd trophic level. Herbivorous organisms that consume producers.

Secondary Consumer: Makes up the 3rd trophic level. Carnivorous or omnivorous organisms that can consume both primary consumers and producers.

Tertiary Consumer: Makes up the 4th trophic level. Carnivorous organism that primarily consume secondary consumers.

Food Chain: The transfer of food energy from one organism to another as each consumes a lower member and in turn, is preyed upon by a higher member.

Food Web: An interlocking pattern of food chains.

Carrying Capacity: The maximum population size of a species an environment can support.

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Explore: 10 Minutes

The class will now construct an aquatic food web based off the organism necklace they are assigned. Pass out a necklace to each student and have the class create a circle so that each student is shoulder to shoulder. While assigning an organism, instruct the class to read a brief overview of their organism on the back of their necklace. Place the ball of yarn in the middle of the circle and ask the class where energy comes from? Energy comes from the sun, a burning ball over 94 million miles away! The student representing the sun will grab the yarn and return to the circle. Next, ask the class what organisms get their energy directly from the sun? Introduce the term producer. Producers are organisms that can produce its own food from inorganic sources such as sunlight, water, and carbon dioxide. There will be more than one organism that is a producer, select the student who identified themselves first as a producer and extend the yarn string to make a line connecting the sun to the producer. Next, have students ask if their organism would consume the selected chosen producer from the last round. Introduce the terms primary, secondary, and tertiary consumers. Repeat until you reach top of the food chain, each time connecting the yarn to the chain. Start over but keep the yarn connections from the previous rounds to make a food web, a collection of many food chains. Have the class select new examples of producers and consumers until everyone has had an opportunity to participate (there might be some organisms that are chosen more than once to make that happen).

Explain: 5 Minutes

After every organism has entered the food web, have the class lightly tug on their section of yarn. This represents the interconnectivity of the food web. Reinforce the message by selecting a student to drop their section of string, representing an organism that is no longer present in the ecosystem. Instruct students to also drop their yard on the floor if their organism is directly connected in the food web. Eventually, all the yarn should be laying loose on the floor. This represents the interconnectivity of the food web and how population loss and extinctions often negatively impact an entire ecosystem. Following, roll up the yarn and collect the organism necklaces.

Extend: 15 Minutes

Build upon the food web concept by illustrating carrying capacity and energy transfer in ecosystems by playing 'Fish Food Tag'. Instructions provided on pg. 4.

Evaluate: 10 Minutes

Distribute the Freshwater Food Web worksheet to the group. Using the background information on the back of the worksheet, students will try to create a complete food web utilizing all the organisms featured. Display the answer sheet, showing the true interconnectivity of the ecosystem.

Hands On Extension

In the Classroom:
Trout in the Classroom - Nebraska Game and ParksNebraska Game and Parks | outdoornebraska.gov Adopt a fish tank, and watch trout eggs begin their lifecycle.

OR

FiNS_tale-of-a-scale_04222016.pdf outdoornebraska.gov

OR

Research lead poisoning in both Nebraska's waterfowl and raptors as it relates to fishing, and what we as fishermen can do to eradicate it. To coordinate a speaker to present on the subject or to arrange a viewing of an educational video provided by Audubon Society of Omaha, contact your JNMN Coordinator

In the Field:
Aquariums and Fish Hatcheries are a great place to teach kids about fish where they can observe their behavior. Visit your local aquarium or hatchery to learn about freshwater fish, saltwater fish, and more! Each offers different programs and species so be sure to find one that fits your students and learning goals!

In the Community:
Have a clean up day at your local lake or pond! Pollution can be harmful to any ecosystem and we can do our part by heading out into the habitat and picking up fishing line, trash and litter left behind by other visitors. Visit a nearby public land with a water source and get started!

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IN THE LAB:
Focusing on plants and animals of the Platte River Basin, students test their food web knowledge by trying to complete the 4 challenges.
http://projects.plattebasintimelapse.com/prp_a/food_chain.html?game=food_chain_02

***COMPLETING ANY ACTIVITY FROM THIS SECTION WILL COUNT AS YOUR SECOND ACTIVITY REQUIREMENT FOR THE ZOOLOGY MASTER BADGE.**

RESEARCH AND RESOURCES

https://www.noaa.gov/education/resource-collections/marine-life/aquatic-food-webs

https://education.nationalgeographic.org/resource/food-web

https://www.sheppardsoftware.com/science/animals/games/food-chain/

Fish Food Tag

FISH FOOD TAG – Instructions:

Students will learn about the carrying capacity and energy transfer in ecosystems.

1) Split the class into three groups. These groups will not be uniform in size.
a. Zooplankton: 75% of the class - Primary Consumer
b. Crappie: 20% of class – Secondary Consumer
c. Fishermen: 1 student (2 if the group size exceeds 40)– Tertiary Consumer

2) Pass out small cups to the zooplankton, large cups to the crappie, and small bucket to the fisherman. For the crappie and fishermen groups, also hand out the associated necklaces to help identify them during the game. If you do not have the provided necklaces, a piece of colored scrap cloth or colored tape can be used in its place.

3) Define the playing area. The game is best played using half a basketball court for boundaries but could also be played outside (40'x40') or even in a classroom by moving desks to the corners of the room.

4) Disperse 200 poker chips around the playing area. The chips will represent energy during the game. To avoid collisions, instruct all groups that they may not run during any portion of the game (you will likely need to reiterate this between each round).

5) Give the Zooplankton group 1 minute to pick up as much algae (chips), as they can by placing them in their cup, representing their body. When 1 minute is up, have the zooplanktons sit down and count how much algae is in their cup.

6) Have students share how much algae they were able to collect. Due to varying class sizes and motiva tion to collect the chips, the amount collected can vary greatly. Make note of how many chips each student collected. You will need to decide on a number that allows roughly 75% of the zooplankton to survive. Inform the class of that number, any zooplankton that collected that or more survive, those that did not, unfortunately have died due to lack of food resources and will have to leave the playing area. This would be a good time to introduce the term, carrying capacity- the maximum population size of a species an environment can support.

7) Have the surviving zooplankton remain in the playing area. Instruct the crappie that their goal is to tag all the zooplankton. Allow the crappie to "hunt" the phytoplankton, transferring the eaten phyto plankton's chips into the crappie cups when they are tagged. The zooplankton will continue to collect the remaining chips while avoiding being tagged. When there are only 1 or 2 zooplankton remaining, stop play and have the crappie group sit down and count their chips.

8) Like the last groups, take note of how many chips each crappie collected and select a number that would allow for 75% of the crappie to remain alive. The crappie that perished have again succumbed to the limitations of what the habitat can support and must leave the playing area.

9) Lastly, have the fishermen join the playing area. Instruct the crappie to avoid the fishermen, if they are caught, they will empty the contents of their "stomach" (cup) into the fishermen's bucket. Stop the game when only 1 crappie remains.

10) Have the fisherman place all their chips in a pile. As energy moves up a food chain, on average, only 10% of the energy is stored and passed on to the next trophic level. Most of the energy is lost as waste, heat, breathing, movement, offspring, etc. During this activity, we have moved through three trophic levels, primary to tertiary consumer, so that means only 1% of the initial total energy remains for top predators. Therefore, there is rarely more than 5 trophic levels in a food chain.

Largemouth Bass

JUNIOR NEBRASKA MASTER NATURALIST

Background: One of the most popular sport fish due to their appetite and fight. Bass have a torpedo-shaped body with upper jaw extending beyond rear margin of eye and dorsal fin almost divided. The side of the fish has a broad, continuous stripe. It is an important predator, especially in small waters, and thrives in warm, moderately clear waters having little or no current.

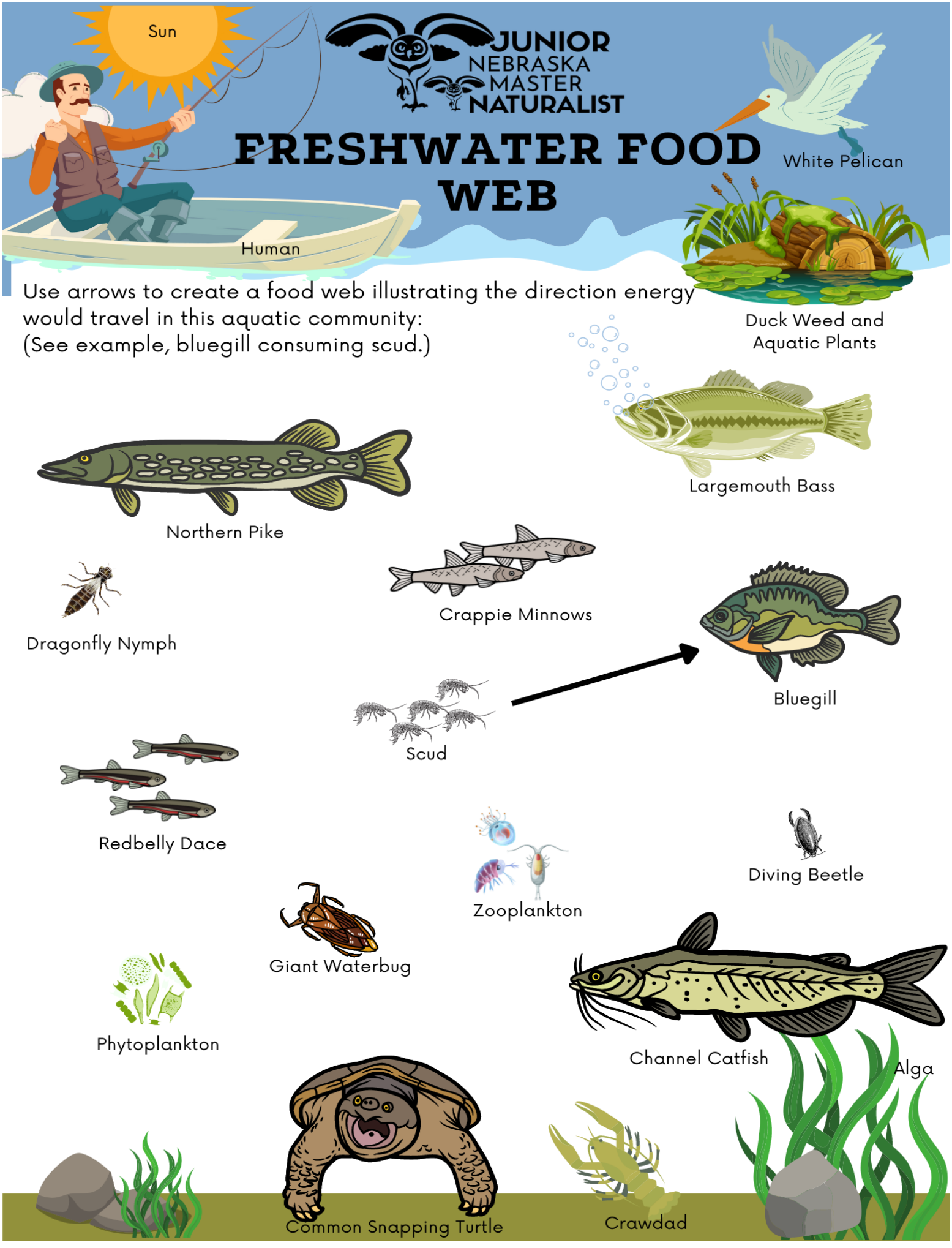
Diet: Secondary Consumer. Young primarily feed on small crustaceans, insects, and small fish; whereas, adults primarily feed on fish, crayfish, and large insects, along with almost any other animal that swims or falls into the water.

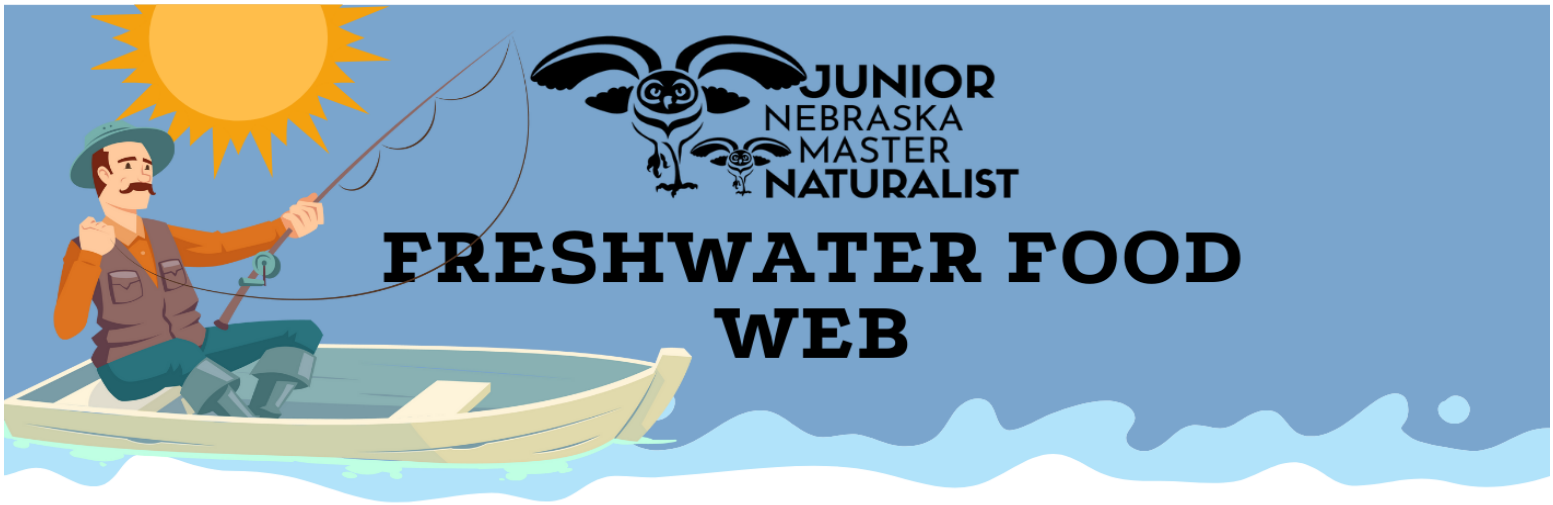
Size: 18"

FRESHWATER FOOD WEB

JUNIOR NEBRASKA MASTER NATURALIST

Use arrows to create a food web illustrating the direction energy would travel in this aquatic community:
(See example, bluegill consuming scud.)





JUNIOR NEBRASKA MASTER NATURALIST

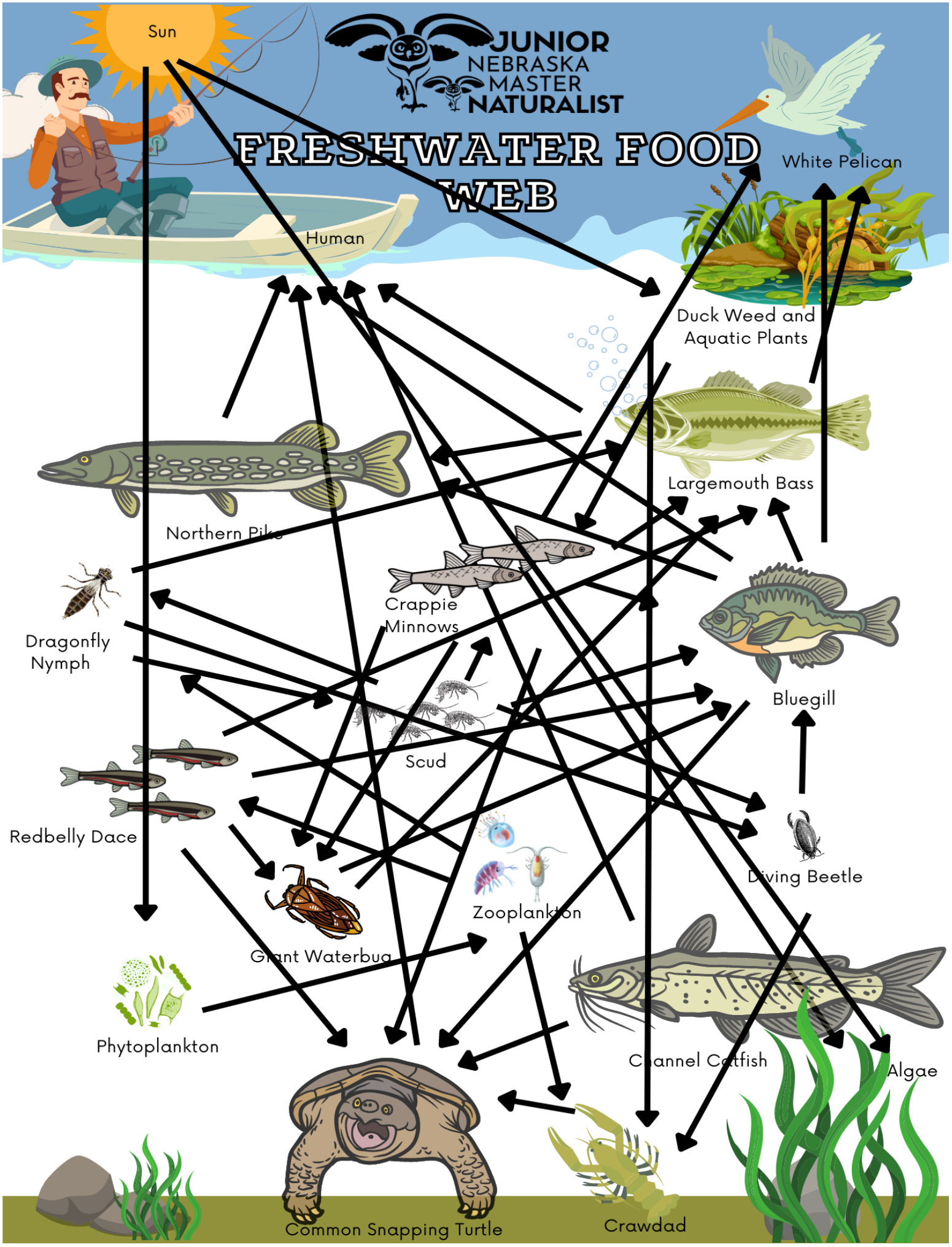
FRESHWATER FOOD WEB

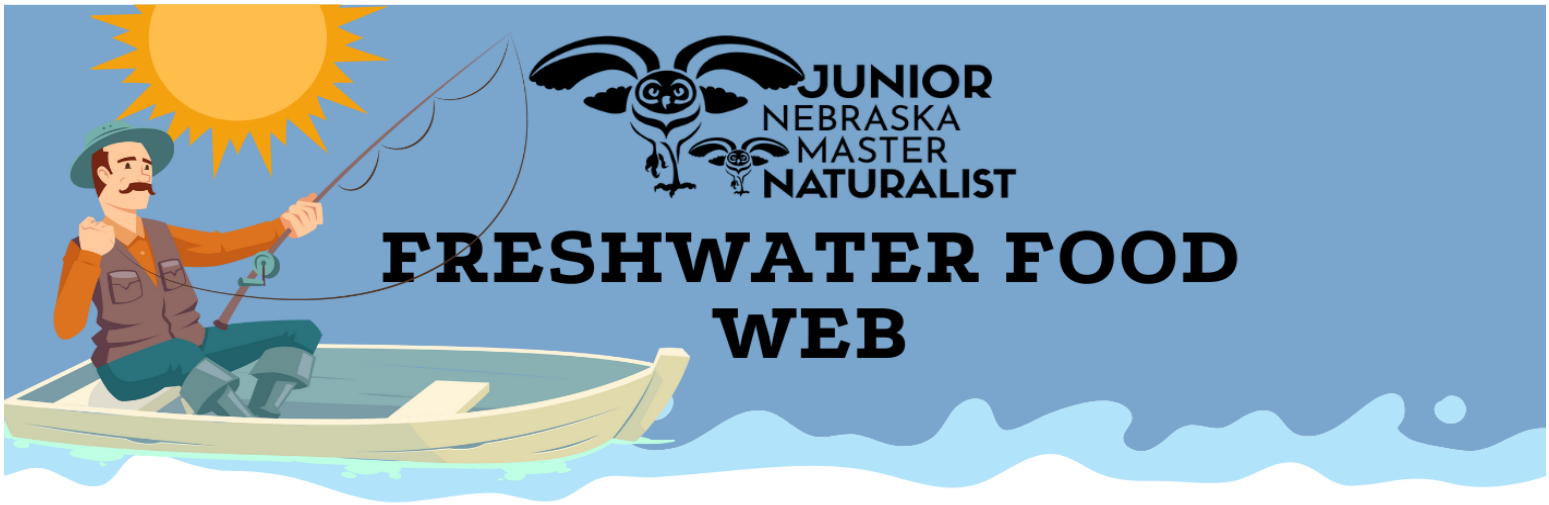
Name three consumers in the food web above:

Name two producers in the food web above:

What is the difference between food chains and food webs?

Which animal would you consider the apex (top) predator in this food web?


JUNIOR NEBRASKA MASTER NATURALIST
FRESHWATER FOOD WEB
Sun
Human
White Pelican
Duck Weed and Aquatic Plants
Largemouth Bass
Northern Pike
Crappie
Minnows
Dragonfly Nymph
Bluegill
Scud
Redbelly Dace
Diving Beetle
Zooplankton
Giant Waterbug
Phytoplankton
Channel Catfish
Algae
Common Snapping Turtle
Crawdad



JUNIOR NEBRASKA MASTER NATURALIST

FRESHWATER FOOD WEB

Name three consumers in the food web above:

Potential Answers: Common Snapping Turtle, Crawdad, Channel Catfish, Giant Waterbug, Zooplankton, Diving Beetle, Scud, Redbelly Dace, Crappie Minnow, Bluegill, Dragonfly Nymph, Northern Pike, Largemouth Bass, White Pelican, Human

Name two producers in the food web above:

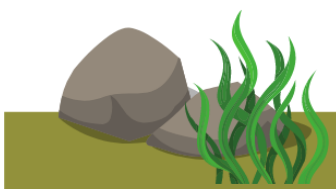
Potential Answers: Algae, Zooplankton, Duck Weed and Aquatic Plants

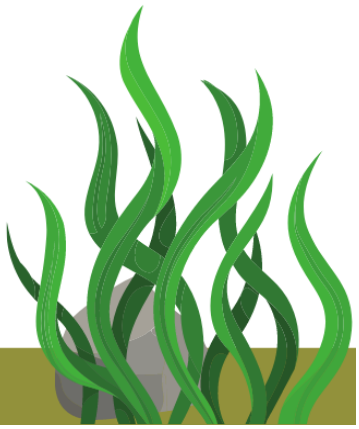
What is the difference between food chains and food webs?

Answer: A Food Chain shows the transfer of food energy from one organism to the next as each consumes a lower member in the chain and in turn, is preyed upon by members higher in the chain.
A Food Web is an interlocking pattern of multiple food chains, making a web of who eats who.

Which animal would you consider the apex (top) predator in this food web?

Answer: Human





Bodies and Behaviors

Students will learn how **Reptile and Amphibians** behavioral and physical adaptations help them survive and reproduce.

This activity satisfies one of the required JNMN lessons needed to complete the Junior Zoology Master Badge.

ZOOLOGY MASTER

Appropriate Ages 8-12

Expected Time: 55 min

Learning Objectives:

Students will learn Internal structures, bones, not only support the body, but also allow specific movements relative to reptile, amphibians, or turtles.

Students will learn (lesser known) behavioral adaptations, including winter survival.

Students will learn that an individual's behavioral and physical adaptations both play a role in successful reproduction.

NE Science Standards:
Grades 4-6

SC.6.9.3
SC.3.7.2
SC.4.13.4
SC.6.13.4

Did You Know...
Turtles can breathe through their butt while hibernating underwater!

When multiple snakes are found together in the Spring, that this is a normal event, a temporary winter survival strategy?

JUNIOR NEBRASKA MASTER NATURALIST

BEFORE YOU TEACH

BACKGROUND KNOWLEDGE

Reptiles and Amphibians sometimes are overlooked when compared to soft furry mammal babies, but the tactics they use to survive are fascinating. Many animals in this category are prey for larger animals, but also occasionally find themselves at the top of a singular food chain, their existence within a food web is crucial for the overall functioning of an ecosystem.

MATERIALS AND PREP:

Engage: 10 Min

Review Nebraska reptiles, amphibians, and turtles by asking for examples. What are some differences between reptiles, turtles, and amphibians. Clues might be...

- time of day they're active,
- outer coverings on bodies,
- speed that they move,
- habitat,
- the place they lay eggs, etc.

List similarities on an erase board. Clues might be...

- how they catch their prey, (ambush)
- their babies hatch,
- internal structure of the back,
- body temperature,
- action to warm their bodies and
- what they do in the winter.

Explore: 25 Min

Softshell aquatic turtles bury into mud for an ambush, snakes smell that the prey have used a path, and sit and wait along that path. Frogs sit and wait underneath the water where just their eyes are above water. Another behavioral adaptation is that some species of snakes can climb trees

VOCABULARY

Reproduce: To produce new individuals of the same kind

Adaptation: A change in an organism or its parts that fits it better for the conditions of its environment

Aquatic: living in or often found in water

Ectotherm: An animal that relies primarily on its external environment to regulate the temperature of its body

Brumate: When reptiles stop eating and become inactive. It's different from hibernation in that during brumaiton, the reptiles are not technically in a sleeping state but rather have a slowed down metabolism that requires them to eat less.

Hibernaculum: A burrow, crevice a shelter occupied during the winter by an animal that is almost hibernating.

Vertebrate: Having a spinal column

Metamorphosis: A process of change in the form and habits of some animals during transformation from an immature stage (as a tadpole) to an adult stage (Frog)

Explore Continued:
Another behavioral adaptation is that some species of snakes can climb trees

Display skeletons and turtle shells. Point out…
1. the neck vertebrate in the turtle, and
2. the ribs attached to the backbone in the snake,
3. the broad feet and long legs for jumping in the frog skeleton.
4. Hand out snakeskins to every student, what adaptation does what you're holding represent?

Next, show the tools that may open the walnut. Try both the walnut cracker tool and the pliers on the walnut, then make the connection that a snake's jaws are like the pliers. Can we open our jaws like that? It would be impossible, to put something in your mouth the size of a watermelon.

Explain: 15 Min
Have students break into 6 groups, number them and hand out the frog namecards, Using the flash-drive, play frog call #1, pause for their vocalization. Similarly, each group listens, memorizes and vocalizes their frog's call. Play the chorus of 2-3 frog calls together, distinguish? Have students decide as a group if their frog was featured in the audio recording. Repeat with other chorus recordings. Give each person in the winning group a mini plastic frog.

Extend: 5 Min
Walk by students with the embossed jars and plastic pieces of the frog's life cycle. Ask which of the plastic metamorphosis pieces goes first in the life cycle of the frogs? List the different phases on the whiteboard and seek student's life experiences with seeing the different phases. Then quiz students of what's the average number of eggs laid by North American frogs? Answer is 1000-6000? Land and Aquatic Turtles? 4-50, and the final question how many eggs laid by small snakes versus large snakes? 12, 100. Why do reptiles and amphibians lay so many eggs? Introduce term brumate, what does this behavior seem like to you? Where do reptiles brumate? Snakes in groups so they can stay warm? Introduce term Hibernaculum and inform students that once Spring arrives, the snakes disperse into separate territories. Frogs? Aquatic turtles bury themselves in the mud of their habitat, and land turtles burrow down into the ground.

Evaluate: 5 Min

Is a frog's call a physical or behavioral adaptation? What behaviors are necessary to find other animals of its own kind when reproducing? Which of the five senses are used by frogs to find another frog? What sense for reptiles and turtles? Smell. To reproduce and lay eggs they must find one another – if not enough frogs, may be unable to reproduce, same with turtles and reptiles who often travel to find their mates.

How can scientists check to see whether species are reproducing enough to keep their populations numbers up, radio transmitter chips under the snakes' skins, and citizens report sightings to help the scientists. Introduce Dennis card help track numbers of, rep, turtle and identify your frog by recording a video on your phone, then comparing with this website. Share website, select identify from menu, choose a species, and scroll down to its call recording. Notice the Report tab and share the data collection page.

Hands On Extension

In the Lab: *Classroom Experiment*

snake craft with snake movement worksheet

In the Field:
Hibernaculum build, with diagram
or Herp Walk

In the Community:
Invite UNL's herpetology expert to speak virtually or in person about conservation of snakes and frogs in Nebraska.

*COMPLETING ANY ACTIVITY FROM THIS SECTION WILL COUNT AS YOUR SECOND ACTIVITY REQUIREMENT FOR THE ZOOLOGY MASTER BADGE.

RESEARCH AND RESOURCES

For information on the biodiverstiy of Nebraska's mammals, visit
http://outdoornebraska.gov/watchablewildlifereptilesamphibians/

For information on identifying Nebraska's reptiles and amphibians, visit https://herpneb.unl.edu/

Hands On Nature, Introducing Reptiles, Hickman, Pamela, 1993
Hands-On Herpetology, Schneider, Krasny, Morreale, 2001

Are Frogs Nocturnal? - AZ Animals (a-z-animals.com)
Are Turtles Nocturnal or Diurnal? (Beginner's Guide) – Reptiles Time
How Many Eggs Do Frogs Lay? (toadsnfrogs.com)
The Secrets of Wintering Wildlife: Turtles, Frogs and Snakes (delaware.gov)
https://a-z-animals.com/blog/everything-youve-ever-wanted-to-know-about-snake-eggs/
Frog Skin: Everything to Know (toadsnfrogs.com)
How do Snakes Mate? (With Pictures) - ReptileHow.com
Softshell Turtle - Description, Habitat, Image, Diet, and Interesting Facts (animals.net)
Life Cycle of a Frog: Stages of Frog Development Explained (reptile.guide)
Snake Predation Strategies – Part 1: Bodies and behaviours (unimelb.edu.au)
Similarities & Difference Between Amphibians and Reptiles (bioexplorer.net)

Classroom Camoflauge

ZOOLOGY MASTER

Appropriate Ages 8-12
Expected Time: 50 min

Students will describe how camouflage can benefit an animal by testing camouflage techniques in the classroom.

This activity satisfies one of the required JNMN lessons needed to complete the Junior Zoology Master Badge.

Learning Objectives:

Students will be able to describe advantages of camoflauge.

Students will define and model different kinds of camouflage strategies and test the effectiveness of each strategy.

NE Science Standards:

Grades 3,4,6

SC.3.7.2.C

SC.3.7.2.D

SC.4.6.3.B

Did You Know...

Some caterpillars attach pieces of leaves to their bodies to camouflage from predators.

Some invertebrates are red because this color stands out. It doesn't camouflage, but instead its coloration is a signal to warn predators to stay back.

BEFORE YOU TEACH

BACKGROUND KNOWLEDGE

Invertebrates are animals that lack a backbone or any internal skeleton. Instead, they posess some kind of exoskeleton that serves as a protective shell for the animal. Examples of invertebrates include snails, butterflies, aquatic insects, spiders, ants and caterpillars.They can range in size from microsopic organisms to giant squid. Invertebrates make up over 90% of all living animal species.

Invertebrates are important to our ecosystems as they are a great food source for other animals but also serve as pollinators, decomposers, and more.

MATERIALS AND PREP:
JNMN Provided

8 Slides of camouflaged organisms
28 insect blocks
Types of Camouflage chart
3, 4 or 5 Insect collections
Macrobenthic Invertebrate gear
Insect trays
Invertebrate ID chart
Sampling unit, mesh sieve
Dip nets
Long handled nets
Nighttime insect sampling photo

VOCABULARY

Adaptation: A special skill or feature which helps an animal to better survive its environment. Adaptations could be physical features on an animal's body or behavioral traits.

Camouflage: A way of hiding something by covering or coloring it so that it blends in with its surroundings.

Invertebrate: An animal that does not have a backbone or internal skeleton.

Patterns: Are spots, stripes, shapes that help break up an animal's silhouette.

Mimicry: When one organism copies the physical traits of another organism in order to receive a selective advantage.

Blending: A matching background that the invertebrate can conceal itself.

Disguise: Imitating something that's not food in an invertebrate's environment.

Engage: 5 min

To begin this lesson, explain to students they will have to find animals in a series of images. Show the images on your smartboard or projector and have students circle or point out where the animals are in each photo. Ask which animals were hardest to find and which were the easiest. What makes the animals difficult to find? Explain that when animals blend in with their surroundings it's called camouflage. Ask students why it is beneficial for an animal to camouflage. Can they think of any other examples of animals that use camouflage?

JUNIOR NEBRASKA MASTER NATURALIST

Explore: 10 min
Both leader and students will alternate hiding and finding insects in the classroom. Before class, hide the provided insects where they will camouflage the best. Ask students what predators eat insects; lizards, birds, bats, frogs and turtles are a few. Tell students that you have hidden camouflaged insects around the classroom and instruct them to find them. Make this a competition by awarding the student who is the most successful predator or instruct students to sit down after they find one or two. Play animal charades using the five species of predators from above before hunting' for the camouflaged insects.

Now the tables are turned and students get the chance to hide one insect each throughout the classroom. Leaders will act as predators and attempt to find as many insects as they can. When an insect is found, it should be taken out of the classroom 'ecosystem' and displayed somewhere where students can see which insects have been found. If any insects remain at the end of the class, congratulate the students and let them know their insect 'survived'! You can award successfully camouflaged insects with bonus points or another prize if you'd like. Have students whose insects were not found talk about what strategy they used to hide their insect.

Explain: 15 min
For the insects that have been found, which ones were camouflaged the best, the worst? Does camouflage help predators or prey more?

Bring out the insect collections, and after students look them over, use the provided "Four types of Camouflage Worksheet" to teach students about the four types of camouflage: blending, disguise, mimicry, and patterns. Blending is defined as background matching. Patterns are usually many spots or many stripes that help break up an animal's silhouette. Mimicry is copying the appearance of another living thing. Disguise is like pretending to be something that's not food, for example, a walking stick.

Evaluate: 15 min - depending on the number of insect collections.

After sharing these definitions, have them take another look at the insect collections. Ask them to point to specific examples as you challenge them to find insects that fit into each category. As they look at the insect collections again, give students pencils and paper, and have them draw the outlines of up to four insects, label them by name and with the appropriate camouflage category. Have students discuss which insects they chose and why.

Extend a: 10 min
Transition students to the display of aquatic insects, known as benthic macro-invertebrates. Explain the functions of each piece of sampling gear: dip nets, sampling screen, insect trays, nets and insect charts. Invite students to investigate the gear and explain that these aquatic insects act as bioindicators, organisms that can indicate water quality. Experience sampling for macrobenthic invertebrates involves data collection, analyzing, reporting and correlating species with abundance and pollution tolerance.

Extend b: 15 min
Play "Ranger, Ranger", a game similar to "Red Rover". Students will review the specimens provided and select an insect to represent. Head to an area with plenty of space, such as a gym or outdoors and using cones or other objects, delineate the playing area based on the size available. Like an endzone on a football field, create a safe zone for each side of the playing area. Select one or two students from the group to be the Ranger and position them in the middle of the playing area. The rest of the group will ask the Rangers, "Ranger, Ranger can I come over?" The Ranger will choose identifying characteristics of insects such as: coloration, wings, pollinator, lives underground, diet, stinger, antenna, etc... and respond, "Only if you have ____characteristic_____." Students who think their insect possesses that characteristic, will try and run to the other safe zone without being tagged by the Ranger/s. If they are tagged, they will join the Ranger Team to try and tag the remaining insects (make sure Rangers remain in the middle of the playing area). Play until the number of insects remaining matches the number of Rangers. The surviving insects have won the round and are now selected to be the Ranger. Repeat as time permits. [Additional characteristics: see through wings, found on the ground, an insect that doesn't fly, lives in dying logs, loves bright lights...]"

Hands On Extension

In the Lab:
Contact your JNMN Coordinator for names and contact information for your local entomologist. Ask them to bring a nighttime insect sampling setup that your students can see and replicate, each student can take one home and conduct a nighttime insect sampling of their own.

In the Field:
Discover aquatic invertebrates with Master Naturalists. Invertebrates are able to live in all kinds of different habitats. Schedule a field trip to a local body of water where students will be able to sample and identify macroinvertebrates by species. All gear and instruction will be provided by your JNMN Coordinator or volunteer Nebraska Master Naturalist. A local wetland, pond or creek makes for a good destination. Many of these insects can live in somewhat polluted waters, others however require the water quality to be a bit more clean. Identifying which insects are caught, will indicate water quality.

In the Community:
One of the easiest ways to help our insect friends is by planting native plants. This helps create habitats for pollinators and other invertebrates. Take this one step further by creating an entire pollinator garden in your community. Research what native plant species are best for our native insects, then find a space (any size will do) and create some high quality insect habitat! Contact your JNMN Coordinator and ask for a Nebraska Master Naturalist to help guide your group in planning and completing the pollinator garden.

*COMPLETING ANY ACTIVITY FROM THIS SECTION WILL COUNT AS YOUR SECOND ACTIVITY REQUIREMENT FOR THE ZOOLOGY MASTER BADGE.

RESEARCH AND RESOURCES

For information on the endangered invertebrates in Nebraska, visit https://www.fws.gov/mountain-prairie/es/invertebrates.php

For information on ways to support and conserve pollinators, visit https://pollinator.org/.

Indicators: Benthic Macroinvertebrates: https://www.epa.gov/national-aquatic-resource-surveys/indicators-benthic-macroinvertebrates

Mimicry: https://www.sciencedirect.com/topics/earth-and-planetary-sciences/mimicry

Four Types of Camouflage

Blending

Disguise

Mimicry

Patterns

Camouflage Examples