



Montana Natural History Center
Connecting People with Nature

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Wolves

Nature Discovery Trunk Curriculum

Wolf Trunk

Nature Discovery Trunk Content List

- 1 curriculum binder
- 1 Large Plastic Tote with Lid

Articles, Books & Pamphlets:

The Song of the Wolf by Kevin Strauss
Wolf Pack: Tracking Wolves in the Wild by Alice Aamodt
Wolves for Kids by Tom Wolpert
There's a Wolf in the Classroom by Bruce Weide and Patricia Tucker
Wolves by Gail Gibbons
Gray Wolf Red Wolf by Dorothy Hinshaw Patent
Baby Wolf by Beth Spanjian
Tales of Two Canines by Bruce Weide and Pat Tucker
Wolf Wars by Hank Fischer

Animal Pelts:

-Wolf

Skulls:

-1 Gray Wolf
-1 Domestic Dog
-1 Coyote
-1 Snowshoe Hare
-1 White Tail Deer Doe

Wolf Prey Bag:

-Beaver
-Big Horn Sheep
-Calf
-Elk
-Moose
-Mountain Goat
-White-tailed Deer
-Elk Hoof

Small Pelt Pieces Bag

-2 Wolf
-1 Coyote

Animal Track Molds:

-1 Wolf -1 Dog -1 Deer
-1 Coyote
-2 Snowshoe Hare
-2 Cottontail Rabbit

Additional Equipment

-Radio tracking collar
-Wooden Wolf Puppet
-2 Wolf Body Language Cards
-1 Wolf Body Language Adventures
Activity Instruction Card
-1 Wolf Body Language Adventures Card

Photographs:

4 wolf research cards
-Wolf wearing radio tracking collar
-Biologist carrying telemetry equipment
-Biologists transporting wolves for Yellowstone 1995 reintroduction
-2005 Denali Wolf Home Range Map example
-2011 Denali Wolf Population/Home Range map

Evolution, History, and Current Status of Wolves

Wolves once lived in most of North America. The only places they did not live were extreme deserts and tropical jungle-type areas.

Wolves and dogs evolved from another wolf-like creature called *Tomarctus* which lived during the Miocene era about 20 million years ago. Modern wolves evolved from descendants of *Tomarctus* during the Pleistocene era which extended from 2.6 million years ago until as recent as 12 thousand years ago. During the Pleistocene era, the gray wolf we see today had another relative on the landscape called the dire wolf, which was heavier set, but very similar in appearance and behavior. Dire wolves died out at the end of the Pleistocene, leaving the gray wolf the “top dog” in North America.

The wolf remained one of North America’s top predators until Europeans arrived in the 16th century. By the late 1700’s, wolves were gone entirely from the east coast. As Europeans began moving westward they killed bison, elk, and other prey of the wolf. While wolves do sometimes prey on livestock, the extermination of their natural prey aggravated the problem. In a 25 year period at the end of the 19th century, 80 thousand wolves were killed in Montana alone. By the 1940’s, wolves were essentially gone from the lower 48 states except northeastern Minnesota.

Efforts we made in the 1990’s to reintroduce the wolf back to Idaho and Montana that have been wildly successful, with healthy populations existing and growing across the West. Many wolves were allowed to migrate and re-colonize from Canada. Wolves can now be seen or heard in many parts of the state and helping ecosystems transition back to a more historical state.

Telling Wolves, Dogs, and Coyotes Apart

Wolves, coyotes, and dogs can look similar from a distance. Because of this, many people often misreport that they’ve seen a wolf. Keeping a few key characteristics in mind, it is easy to identify each one correctly. In case *you* ever see a large doglike creature, make sure you know how to tell these animals apart!

WOLF (*Canis lupus*)

Color: black, white, all shades of gray and tan, never spotted

Size: 80 to 100 lbs., 26-34 inches at shoulder

Tail: hangs straight down or straight out, never curls

Ears: rounded, small, upright

Muzzle: large and blocky

General: massive, long-legged, first impression is often of a deer or calf

COYOTE (*Canis latrans*)

Color: all shades of tan and gray, rarely black, never spotted

Size: 20 to 35 lbs., 16-20 inches at shoulder

Tail: hangs straight down or straight out, never curls

Ears: pointed, large, upright

Muzzle: long, narrow, pointed

General: delicate, medium size, fox-like face

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DOG (*Canis lupus familiaris*)

Color: variable, may be spotted

Size: variable

Tail: variable, may be curled

Ears: variable, may hang down

Muzzle: variable

General: variable

Many people wonder how many types, or subspecies, of wolves there are. Wolves were divided into 24 subspecies in North America in the early 1900's. However, many biologists now feel that wolves are so similar that at most there should be only 2 or 3 subspecies. The gray wolf, which lives in the western US, is so similar to the timber wolf, which lives in the eastern US, that they are classified as the same subspecies.

The red wolf used to live throughout the southeastern states. It is a smaller wolf and is a separate species *Canis rufus*. Red wolf populations are much lower today and their habitat has been fragmented and developed, making it hard for the wolves to easily colonize new areas. The red wolf was listed as an endangered species in 1967 and is one of the world's most endangered canids.

Mexican Gray Wolves *Canis lupus baileyi*, are subspecies of the gray wolf—the most rare subspecies in North America. They are gray with light brown fur on their backs and are often referred to as “El lobo.” El lobo was once quite numerous in the south west United States. By the mid 1970's they were mostly wiped out. A reintroduction effort that started in the late 1990's has increased their numbers in the wild. They are important to the southwest landscape because they help keep populations of deer, elk, and javelina in check. These prey animals can easily over graze their habitat, affecting lots of other species too. Currently these wolves can be found in small numbers in Arizona and New Mexico.

Lesson 1: Introduction to Wolves

Overview: set the stage for this unit of inquiry by displaying the materials from the trunk. Students will explore the trunk materials and consider what the materials can tell them about wolves.

Procedure:

1. Each learning station will center on a theme from the included lessons: wolf adaptations, pack and family behavior, predator/prey relationships and wolf research.
2. The following vocabulary can be introduced at the start of this unit or it can be explored as you move through the lessons: Carnivore, Predator, Prey, Adapt, Behavior, Camouflage, Canis lupus, Dominance, Pack, and Telemetry.
3. Set up the following stations:
Wolf Adaptations: skull, pelt, wolf track
Predator/Prey Relationship: fur and skulls from prey animals
Pack Behavior: wolf puppet, images of wolf behavior
Wolf Research: telemetry collar, images of research
4. Students will rotate through the four stations, exploring the different concepts that will be introduced in this unit. Stations can be introduced in a way that fits your classroom curriculum (all at once or one station per day).
5. Using the student journal, have students record notes from each learning station.
6. At each station, have the students explore the elements on the table. Encourage them to discuss what they see. With each station they should make a note in a square on their paper answering this question:
7. What do these items tell you about wolves?
8. After all students have visited the station, start a list on the board of what the students discovered at the station. It is ok at this point to include information that you know to be incorrect if the student has made scientific observations. If the students are sharing ideas from what they know (or think they know) about wolves that is not covered by the materials at that station, find another white board in the room to “park” that idea for further exploration later.
9. You may choose to introduce the vocabulary at this point.
10. At the end of the unit you can revisit these different stations or just this worksheet and begin to make changes to misconceptions or add more depth to identify what the students have learned.

Lesson 2: Skull Study

Background Information: Skulls provide a wealth of information about an animal's habits. By looking at such basic features as teeth, eye placement, eye size, and nose length, naturalists can determine much about an animal: if it was an herbivore, carnivore, or omnivore; if it was predator or prey; and sometimes the family to which the animal belongs.

See the diagram and notes for information on how to make such deductions.

Teeth are probably the most important clue within the skull to an animal's identity. The types present and their relative size are strong indicators of diet. The three main types are:

- Incisors: chisel-shaped teeth in front of mouth used for nipping and cutting. Incisors are long and sturdy in herbivores and small and weak in carnivores.
- Canines: large, pointed teeth in front corners of a carnivore's mouth used for grasping and killing prey. Most herbivores completely lack canines.
- Molars: teeth located in the cheek of the mouth used for chewing. Molars are the most important indicators of diet: sharp molars for cutting meat, flat or ridged molars for grinding vegetable matter.

Eye Placement can help you determine if an animal is primarily predator or prey.

- Prey species have eye orbits located on the sides of the skull to provide a wide field of vision to detect potential threats.
- Predators have eye orbits oriented forward to provide the depth perception (binocular vision) critical to hunting.
- Aquatic animals: eye orbits placed high on the head may indicate that the animal spends much of its time in water, like a beaver or river otter.

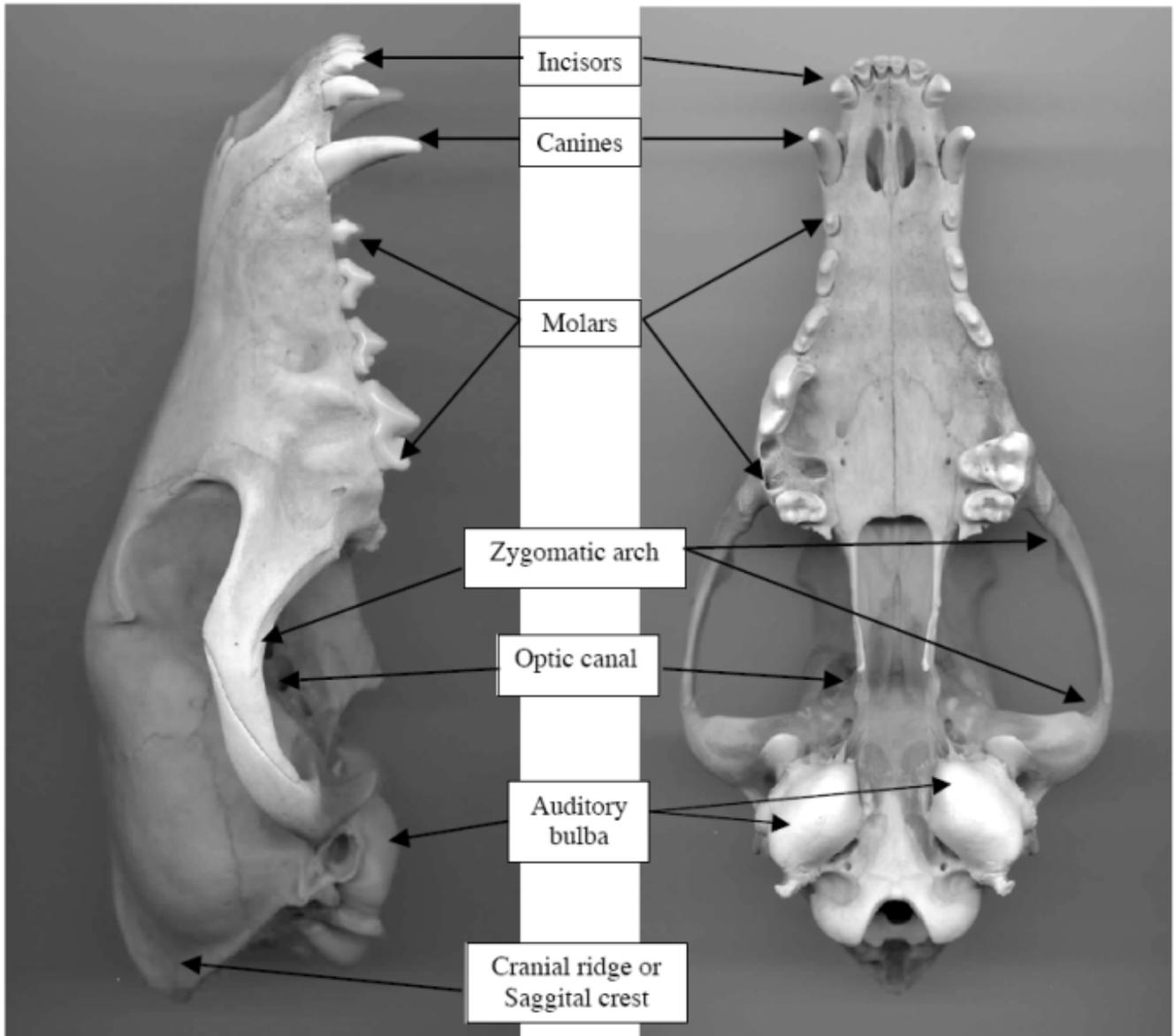
Eye Diameter: relative size of the eye orbits can suggest an animal's habits and feeding patterns.

- Large eye diameters relative to skull size suggest that the animal is nocturnal or relies heavily on vision to make a living.
- Smaller eye diameters relative to skull size suggest an animal with limited reliance on sight (bat) or an animal that lives underground (mole).

Auditory Bulba: two pea-shaped structures at the base of the skull that house the animal's inner ear. Auditory bulba that are rounded and inflated in size indicate hearing is important for that animal.

Sagittal Crest: the attachment point for the strong jaw muscles. A pronounced ridge indicates that the animal has a powerful bite.

Parts of the Mammalian Skull



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Overview: This lesson challenges students to apply the concepts of form and function to skulls. After learning how to decipher the clues a skull can give about an animal's identity, students will use that knowledge to

Procedure:

1. Set skulls out so that students are able to access them in small groups, before going into detail with the lesson. Ensure that each skull is labeled with a number for simple identification. Students can use the included journal to guide them through this exploration (Skull Study: Introduction page) or you can divide the class into groups to become experts on a specific identification clue (see description at the end of this lesson).
2. The following clues can be discussed as a class or through the student work:
 - Why do the skulls have different eye placements? What can that tell you about the animal?
 - What can the teeth tell you about what these animals eat?
 - What can you learn from the overall shape of the skull? Is it long? Round?
 - What interesting characteristics are you seeing on all of the skulls? What characteristics are you finding on individual skulls?

Try to resist identifying the skulls officially until the completion of the exercise. Sometimes, knowing the name of the animal will discourage students from finding clues in the skull and instead, encourage them to rely on their prior knowledge of that animal!
3. After students have had time to explore the skulls on their own or in groups, discuss these questions as a class.
4. Using the journals or the Wolf Identification page, or both, go through the identification of each adaptation or choose the most appropriate adaptations to explore with your class. Identify the function of each of these adaptations (in background information).
5. Now give students another opportunity to explore the skulls and using their deeper understanding of how to read an animal skull, have them respond to the following questions in their student journal :
 - Draw a picture of the teeth. What can the shape and orientation of the teeth tell you?
 - Find the incisors, canines and molars on the skulls. How many incisors does each animal have?
 - Look at the molars of the skulls of the predatory animals. The biggest teeth in the back are called carnassials teeth. What might be their function? (they act like scissors to shear meat)
 - What other skull clues can help you determine if you are looking at a predator or a prey animal?
 - Which animal has the largest sagittal crest, and why? (animals that need strong jaw muscles for eating their food)

Alternative Activity:

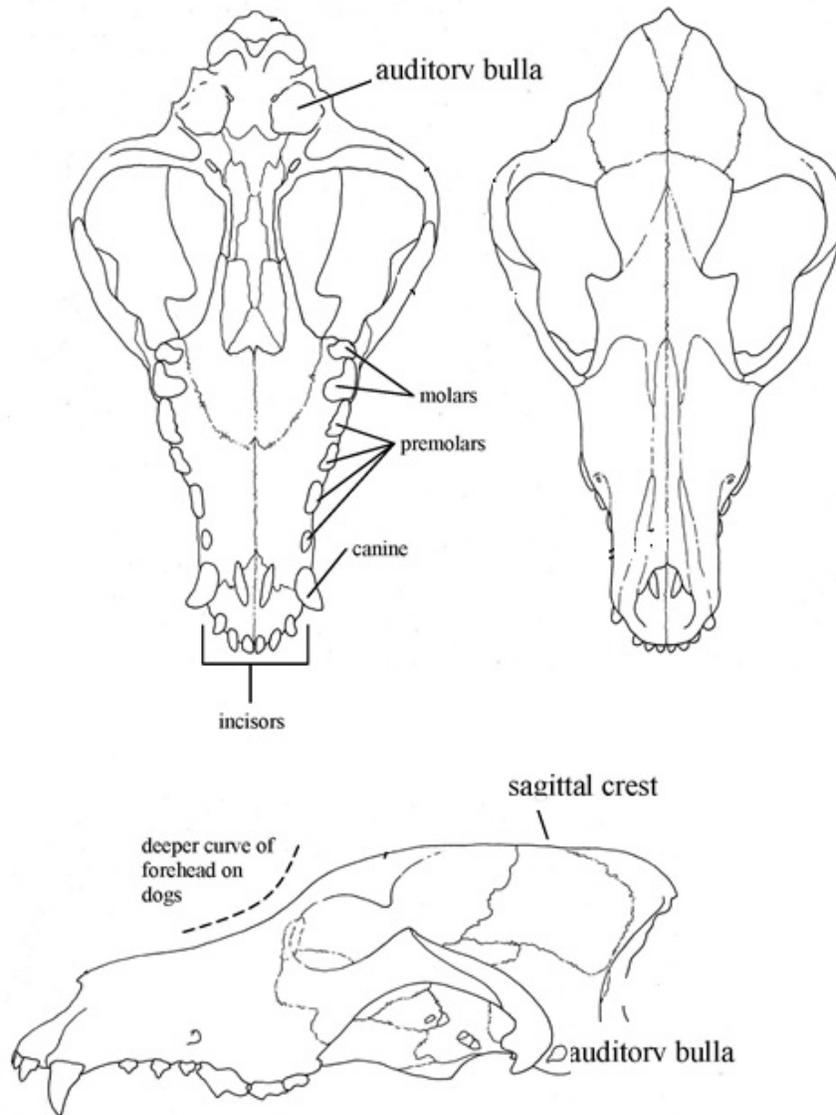
Create groups of students that will become experts on specific skull adaptations. They can be assigned the following adaptations to research and study:

Teeth
Eye Placement and Diameter
Auditory Bulba
Sagittal Crest

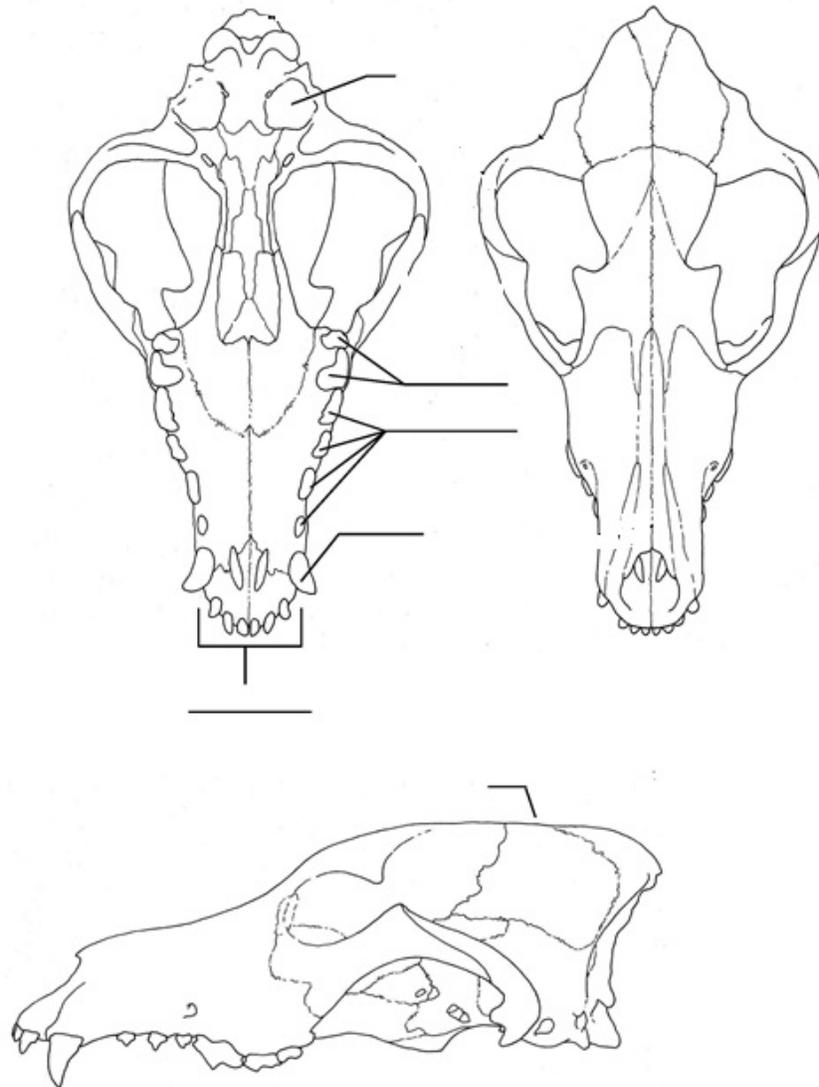
Each group will research their skull adaptation. They will learn about the function of these different adaptations and then apply their research to the skulls in the classroom. You can host a symposium or just a classroom discussion to hear about all of these clues and see whether the students were in agreement on the skull identification.

Assessment: Students can complete the skull identification quiz or you can review their independent lab responses to the questions for thoroughness and understanding. Once all students have responded to the questions, you can officially identify the skulls!

Wolf Skull Identification



Wolf Skull Identification Quiz



Lesson 3: A Howling Good Time

Background: While there are many stories about why and when wolves howl, we have only recently been able to understand some of the purpose of howling. Wolves often howl together before starting off to hunt; this may serve as a sort of rallying ceremony, rather like a football huddle. Wolves howl to warn other packs to stay away. They are especially likely to howl when they have killed a prey animal. Wolves howl to locate other pack members if they become separated. Wolves howl most often in February (during the breeding season) and in August and September (when pups are out of the den and learning to howl). Wolves never harmonize when howling; this makes it sound like there are more than there are and may intimidate other packs. Wolves howl more often at night than during the day. This may be because sound travels farther at night than during the day (sound waves travel farther when the humidity is low, and it is usually lower at night). Wolves howl as often when there isn't a full moon as when there is. In still weather on flat open ground, wolves can hear each other several miles away. Wolves respond to human imitations of howls more readily than to recordings of their own howls. It might just be that howling is fun for wolves too!

Overview: Students will listen to a recording of wolves howling and make some suggestions about why wolves howl and what the purpose of that behavioral adaptation might be.

Procedure:

1. Before discussing any details on howling, play recording of wolf howls.
2. https://archive.org/details/WolvesHowl_571
-U.S. Fish and Wildlife Service
3. Listen to the recording once or even a few times to give students an opportunity to listen to the different sounds. See if they can quietly try to count the number of wolves in this pack.
4. Following the recording, ask students:
 - a. why do you think these wolves were howling?
 - b. How many wolves do you think there are?
 - c. Have you ever heard a dog howl? When or why do dogs howl?
5. Following this discussion, share with them the variety of reasons that wolves howl. Draw a picture illustrating what the wolves might be howling for.

Lesson 4: Sign Language

Background:

Social Animals such as wolves and people need to have ways to communicate feelings and rules. If social animals had no way to communicate with each other, cooperation would be impossible, fights would ensue and society would break down.

Wolves communicate long distance through howling, and over time through scent marking, but most day-to-day communication is through body language. Positions of tails, ears, mouths, eyes, and legs all combine to create a language that is readily understood by pack members.

Fights leading to serious injury are rare in a wolf pack because of the wolves' ability to tell each other how they are feeling. For instance, dominant wolves hold their tails higher than subordinate animals. All the wolves in the pack know the status of every other wolf, and the alpha wolf seldom needs to prove its dominance by fighting.

Many of the gestures that wolves use to invite another wolf to play are similar to your dog's. These include "bowing," cocking its head from side to side, "smiling," and wagging its tail.

Procedure:

1. Make a list of facial expressions and body positions that people use to tell each other things. (Frowns, smiles, hunched shoulders, etc.)
2. Do we "listen" more to body language or verbal language? If someone smiles nicely and calls you a mean name, which do you believe? What if someone looks at you mockingly and says you're the most wonderful person in the whole world?
3. What are some advantages of having a silent language? (Can communicate without alarming your prey)
4. Take turns demonstrating different human body language in front of the class and see if the rest of the class can guess what you're "saying."
5. Use the wooden puppet and the wolf body language charts to complete the activity: Wolf Body Language Adventures (all are in the red flannel sack).
6. Select 4 or 5 students and assign them positions in a pack. Have them demonstrate wolf body language in front of the class and see if the rest of the class can guess what their "saying" and who the subordinate and dominant pack members are. Is any wolf body language similar to human body language?

Lesson 5: Family Ties

Background:

Most wolves live together in groups. A group of wolves is called a pack. A pack of wolves is not just a bunch of wolves that have somehow found each other. Rather, a pack is much like a human family or tribe. A pack is formed when male and female wolves that have dispersed (left the pack they were born in), find each other and breed. During the first year, the pack consists of them and their pups. When the parents breed the next year, the pack consists of them, that year's pups and the pups from the previous year, which are now young adults.

A pack of wolves usually has only one breeding pair even though there may be several adults. The breeding wolves are called the alpha female and male.

The number of wolves in a pack depends on the density of the prey in the pack's territory, the size of the primary prey species, and perhaps other factors such as the temperaments of pack members. Packs hunting large prey, such as moose and bison, generally number between 8 and 15, while those hunting primarily deer number between 2 and 5. An obvious reason for this is that it is easier for a large pack to kill the larger animals. Another reason is that dominant animals initiate hunting trips and eat first when an animal is killed. If the pack is large and the prey animal is small, some of the low-ranking wolves may not get enough to eat. Low-ranking wolves that are not eating well are likely to disperse.

When wolves are two years old and older, they may disperse and search for a new territory and a mate. These wolves often range over large areas and may travel as much as 500 miles from where they were born, though less than 30 miles is more common.

When an alpha animal is disposed by a younger, stronger or more intelligent pack member (often one of its offspring), it might remain in the pack as a low-ranking wolf, or it may be forced out of the pack. If it is forced out it becomes a lone or trailing wolf.

Procedure:

1. A wolf pack can look much like a human family. Discuss what your students already know about wolf packs. Wolves are social animals that have complex, highly organized social systems. Very similar to our society, wolves are social animals that live in packs with complex, highly organized social systems.
2. Assign students to research teams. They are going to spend some time figuring out how wolf packs are both similar to and different from human families.
3. If needed, students can be provided with guiding questions:
 - a. What is an Alpha wolf and what is its role? Omega? Are there other roles?
 - b. What does Hierarchy mean? What does it mean for a wolf pack?
 - c. How do wolves work as a team?
 - d. Describe the family structure of a wolf pack. How long do cubs stay with the adults?
 - e. Are wolves loyal to the pack?
 - f. How do wolves share food?
 - g. How do wolves raise their young?
 - h. Do you think packs of 100 wolves exist? Why or Why not?
4. After completing the research, students can compare how they are similar or different to human social groups. They can create a compare and contrast chart to illustrate their findings.

Lesson 6: To Eat and Be Eaten

Background:

Wolves are predators. Predators survive by killing and eating other animals. Wolves eat primarily ungulates, or cloven-hoofed animals that eat plants. Most of the wolf's prey is considerably larger than itself. Common prey species and average weights include: moose (900 lbs), elk (600 lbs), caribou (300 lbs), deer (100 lbs), bison (1300 lbs), and musk ox (800 lbs). In contrast, an average wolf weighs 80 to 100 lbs. A large wolf weighs 120 lbs. Wolves also eat beaver and less commonly big horn sheep and mountain goats. Mice and ground squirrels are not usually a major portion of their diet.

Wolves kill their prey with their teeth. When they attack a large prey animal they are vulnerable to being hurt or killed by the prey's hooves. Being practical animals, wolves try to find the weakest and littlest animals to attack. Often these animals are younger, older, sicker, or maybe just a little less agile than the rest of the population. Because prey is difficult and dangerous for wolves to kill, they usually eat all parts of the prey. Often all that is left is some hair and blood on the ground. But if conditions are difficult for prey and easy for wolves, they may kill more than they eat, and they may kill healthy animals.

Often wolves are unable to kill a large animal right away because it is too dangerous. To avoid being injured, wolves sometimes dash in, wound an animal and then wait until it weakens before they kill it.

Wolves' digestive systems are built for fasting and feasting. They often go for a week or two without eating. When they finally make a kill, wolves may eat 20 lbs or more of fresh meat. It takes a lot of energy to hunt and kill large animals, and wolves need a lot of food to keep going. To stay in good condition they need an average of 5 to 12 lbs of meat every day.

It is natural to have ups and downs in the number of predators and prey. These cycles may take place over a year or two, or over many years. Wolves are sometimes responsible for declines in prey populations, but prey populations also decline when their habitat deteriorates, when winters are severe, or when there are too many human hunters. When that happens, wolf populations decline as well. These interactions are very complex and are the subject of ongoing research.

Procedure:

1. Students will research different wolf prey animals and create an interactive presentation to share with the class.
2. As a group, make a list of different animals that wolves in Montana eat. Refer to the different skull, track, and fur samples included in the educational trunk as students identify prey. Stick with the native species, no domestic animals (livestock, family pets) should be included on this list.
3. Once you have a pretty complete list, assign prey species to different students or group of students. In their groups they will:
 - a. Research basic biology of their animal. Where does it live? What does it eat?
 - b. What interesting adaptations does it have? Physical or behavioral.
 - c. What physical or behavioral adaptations does their animal have to avoid being eaten by a wolf?
 - d. Figure out the average weight of their animal as an adult. If a wolf has to eat about 5 lbs per day on average, to stay healthy, how many adults would it take to feed a wolf?

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4. Now, using multimedia formats like Prezi <https://prezi.com/> or PowerPoint, or using just a display board, have students create a presentation on their animal.

If they use a multimedia format, they can search for short videos, audio clips of the animal sounds, images of tracks, etc. to add to the presentation. Images from magazines or printed from the computer can be used for a poster board style display.

5. Students can share their research with the class.

Lesson 7: Studying Wolves

Background:

Most field work with wolves involves animals with radio or GPS collars (collars with a radio or GPS attached that emits a signal and can be picked up and tracked with a receiver or satellites. The signals can be picked up 4 to 5 miles from the wolf. Radio and GPS collars enable researchers to track the movements of wolves they are studying, determine the size of their territories, and count pack numbers from aircraft. Wolves must be captured before they can be collared. Researchers catch wolves in the same type of leg-hold traps that fur trappers use, checking the traps at least once a day. When researchers find a wolf in one of their traps (which may be only once every 4 weeks) they give it a drug to anesthetize it. They then weigh and measure the wolf, check for injuries, radiocollar and release the wolf to rejoin the pack. Very little of the field researcher's time is spent capturing wolves. Much of the time is spent listening to signals from the radiocollar, tracking wolves through the snow to see what they've done, collecting scat to determine what they're eating and writing up field notes. Because wolves are secretive, the field researcher rarely sees or has any direct contact with them.

Materials needed:

- Graph paper with about 10 squares to the inch
- 100 ft tape measure

Procedure:

1. As a class, or in advance, make a map to scale of your school buildings and surrounding vicinity. Have each square equal 1 ft. Make sure you can identify specific buildings and streets on your map and that everything is situated the way it really is (you may need a compass). You might have to tape 4 pieces of graph paper together.
2. With groups of students you will create two teams of researchers and 1 small wolf pack. The groups will have minimal supervision on the school yard so discuss appropriate behavior, boundaries, etc. as needed.
3. Have the two teams of researchers decide where they should be stationed so that they'll be able to hear the wolves, wherever they are on the school yard.
4. Choose 3 or so students to be a small wolf pack. Secretly work with them to choose a spot on the school yard that will be a little out of site of the researchers. Have them go into the school yard ahead of your research teams. Have the wolf pack identify where they are on their copies of the map.
5. Have 2 teams of "researchers" go to the 2 different places in the school yard. Make sure each researcher can identify where they are on the map.
6. When the wolf howls, each researcher takes a sighting on a distant landmark in the direction the howls are coming from. (The landmark should be on the map.) They only need a general directional landmark.
7. When all groups return to the classroom, share a classroom version of the map.
8. Having the students follow you with their own maps, note where research team 1 was located. Make a note on the landmark in the direction that they heard the wolves. Draw a line connecting team 1 with the landmark.
9. Repeat for research team 2.
10. Note where the two lines cross (if they do). Where was this on the school yard?
11. Now have the wolves reveal where they were located. Was it near the intersection of the two lines? The wolves should be close to the intersection. Is it? (If it isn't, your map may be incorrect or the sound waves may have "bounced" off buildings; radio signals also do this.)

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Researchers locate animals the same way, except they listen to radio signals from one location, plot the direction on the map with a compass, go to another location and plot the next direction on the map. What would happen if the animal moved between locations? What else could cause errors in radiolocations?

Videos that describe how radio telemetry work:

Simple overview of locating an animal using radio telemetry data

<https://www.youtube.com/watch?v=Epj2fu1HRj8>

Using a map and compass to locate an animal with radio telemetry data

<https://www.youtube.com/watch?v=Jq1UlfHk-7c>