

# How to Read a Skull Like an Open Book

Rangers in the Classroom—Presentation  
Lesson Plan



**Grade Level(s):** 3rd & 4th

**Setting:** Classroom

**Duration:** 45 min —1 hour

**Standards Addressed:**

3rd Grade

° Science—Life Sciences:

3.a

° Science—Investigation and Experimentation:

5.a, 5.b, 5.d, 5.e

° Listening & Speaking:

1.3

4th Grade

° Science—Life Sciences:

2.b

° Science—Investigation and Experimentation:

6.a, 6.c, 6.d, 6.f

° Listening & Speaking:

1.1, 1.2

**Vocabulary:**

3rd & 4th Grade

predator, prey, incisor, canine, molar, orbit, nasal passage, pelt, palate

4th Grade only

carnivore, omnivore, herbivore, auditory bullae, nocturnal

## Introduction:

Welcome to the Rangers in the Classroom—How to Read a Skull Like an Open Book presentation. This program introduces students to the concepts of predator and prey. Through an examination of animal skulls and teeth, students will understand what and how animals eat and what senses they rely on for obtaining food .

## Objective:

After completing this program, 3rd and 4th grade students will be able to:

1. Name at least three different animals living in Sequoia and Kings Canyon National Parks.
2. Identify incisor, canine and molar teeth in a skull.
3. Describe the purpose of incisor, canine and molar teeth.
4. Determine if an animal is predator or prey from orbit (eye socket) size, eye placement and teeth.
5. Find the ear holes (auditory bullae) on a skull.
6. Determine if an animal eats plants, meat or both from an examination of the animal's teeth and lower jaw movement.

## Materials:

- ° Laminated images of animals (bobcat, mountain lion, mule deer, coyote, black bear)
- ° Animal Materials:
  - ° Bobcat skull (two) and bobcat pelt (one)
  - ° Mountain lion skull (two)
  - ° Mule deer skull (two), Mule deer pelt (one) and antler (one)
  - ° Coyote skull (two) and coyote pelt (one)
  - ° Black bear skull (two) and Black bear pelt (two)
  - ° Real black bear skull (one)
- ° 3rd Grade Mystery Skull Worksheet—copies for students
- ° 4th Grade Mystery Skull Worksheet—copies for students
- ° Park maps and student fee waivers



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## Presentation:

### Introduction

Every skull has a story to tell. It can tell us what the animal ate, which senses it relied on for hunting or finding food, whether it was the predator/the hunter or the prey/the hunted. Through scientific investigation, we can unravel the mysteries in a skull and learn what that animal was like when it was alive. In order to solve the mystery and read the story of the skull, you need to be able to identify and analyze the clues left behind. To understand the clues, however, you need to know the language of skulls. Today, we are going to learn the language of skulls so we can solve their mysteries.

### A. Story of a skull

1. Every story needs a setting and characters. Our setting is Sequoia and Kings Canyon National Parks and the characters are some of the animals living in the parks.
2. Imagine you were walking through the park and came upon a skull. How could you tell what animal it was?
  - a. First, you need to know what animals live the park. It helps to narrow down the options.
  - b. Do you think you would find an elephant, crocodile or monkey skull in the parks?

### B. Animals found in Sequoia and Kings Canyon National Parks (The skulls are replicas; the pelts are real.)

1. Bobcat (picture, pelt and skull visual aides)
  - a. Solitary hunter: hunts mostly at dusk and dawn.
  - b. Carnivore (4th grade)/meat eater (3rd grade): eats rodents, rabbits and other small animals.
  - c. Size: males twenty-eight to forty inches long from nose to tail. Females are slightly smaller. Both adult males and females stand around twenty inches at the shoulder. This is about twice the size of an average house cat.
  - d. Weight: average around twenty-two pounds (some males get up to thirty pounds).
  - e. Distinctive feature: short “bobbed” tail that gives the cat its name.
  - f. Spotted coat and pointed ears with little black tufts or clumps of fur.
2. Mountain Lion (a.k.a. Cougar, Puma, Panther) (picture and skull visual aides)
  - a. Solitary hunter: hunts mostly at dusk and dawn.
  - b. Carnivore (4th grade)/meat eater (3rd grade): eats primarily mule deer, but will eat other, smaller animals including foxes, raccoons, coyotes and even porcupines.
  - c. Size: males six to eight feet long from nose to tail. Females are slightly shorter. Both adult males and females stand around two to two and a half feet at the shoulder.
  - d. Weight: males one hundred and ten to two hundred or more pounds. Females weigh eighty to one hundred and thirty pounds.
  - e. Distinctive feature: long tail tipped with black fur.
  - f. Very shy and secretive. It is rare to see a Mountain Lion.
3. Mule Deer (picture, hide, antler and skull visual aides)
  - a. Males: buck. Females: doe. Young (male or female): fawn.
  - b. Foragers: young mule deer forage together; bucks forage alone or with other bucks.

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- c. Herbivore (4th grade)/plant eater (3rd grade): have multi-part stomach. The first two chambers act as storage bins; they eat and then hide from predators to chew the cud.
- d. Size: average—forty one inches at the shoulder and eighty inches nose to tail.
- e. Weight: males one hundred fifty to three hundred pounds. Females are one hundred to one hundred seventy-five pounds.
- f. Distinctive feature: large, mule-like ears.
- g. Bucks have forked antlers. They are shed every year after the rut (mating) season and grow again in the spring.
- h. Antlers are not the same as horns. Horns are permanent. In some species, both the males and females have horns (e.g. bison).
- i. Why do the males have antlers? To fight other bucks for opportunity to mate with the females.

#### 4. Coyote (picture, pelt and skull visual aides)

- a. They travel in small packs, but usually hunt in pairs. A typical pack consists of six closely related adults, yearlings and young.
- b. Omnivore (4th grade)/plant and meat eater (3rd grade): prefers to eat meat (small animals and domestic pets) but will eat fruits, vegetables and even garbage.
- c. Opportunistic eater: it will eat what it finds.
- d. Size: forty-two to forty-eight inches nose to tail.
- e. Weight: average fifteen to fifty pounds.
- f. It has large ears. It can hear better than domestic dogs.
- g. Member of the canis/dog family.
- h. It can run up to forty-three miles per hour. Next time you are driving with your parents, ask them to let you know when they are going this fast, so you get an idea of how this speed feels. How great would it be to be able to run so fast?

#### 5. American Black Bear (picture, pelt and skull visual aides)

- a. They are solitary except during mating season and when a sow has her cubs for their first two years.
- b. Omnivore (4th grade)/plant and meat eater (3rd grade): not really hunters, bears prefer to eat plants and insects (berries, grasses, grubs, ants) but will take fawns in the spring and eat carrion (dead animals).
- c. Opportunistic eater (like coyotes): it will eat what it find, which can cause problems when bears develop a taste for human food.
- d. Weight: males up to two hundred and fifty pounds and females up to one hundred and fifty pounds in Sequoia and Kings Canyon.
- e. Coloration: blond, cinnamon, brown and black.
- f. They are smart and curious.

#### C. The Language of Skulls (pass out the Mystery Skull worksheets)

##### 1. Orbits/eye socket

- a. Size in relation to skull size
  - 1. Large orbits are generally indicative of sharp eyesight and hunting in dim light (dusk and dawn) or at night (nocturnal).
  - 2. Cats have large eyes in relation to the size of their skulls.
- b. Placement in the skull

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1. Forward or side facing. This helps determine if the animal is predator or prey.
2. Predator/Carnivore orbit placement is forward.
  - a. The overlapping field of view from both eyes gives the animals binocular vision, which provides excellent depth perception for hunting and killing prey.
3. Prey orbit placement is to the side.
  - a. The side placement gives the animals a wider field of view to see predators coming from all directions.
- c. Quick demonstration of the difference between forward and side facing orbits
  1. How big is your field of view?

## Directions:

1. You need three volunteer students—two will be the prey and one will be the predator.
2. Have the two prey volunteers stand back to back with each covering their right eye.
3. Have the predator stand facing the prey (encourage them to act as a predator with a menacing look, growls or stalking).
4. Tell the predator and prey that they cannot turn their heads during the activity.
5. Walk in a large circle around the predator and prey asking if they can still you at different points as you circle them.

\*\*The goal is to demonstrate how much larger the field of view is for prey/animals with orbits on the side of their skull.

2. How important are forward facing eyes and depth perception for predators?

## Directions:

1. Have the two prey volunteers take their seats and have the predator face you.
2. Take a crumpled piece of paper and have the predator try to catch it.
3. Have the predator cover one eye and toss the crumpled paper again. It should be harder to catch the paper with only one eye.

\*\*The goal is to demonstrate how predators/hunters need both forward facing eyes to judge distance/depth perception.

3. How does it feel to be the predator or the prey?

## Directions:

1. Ask volunteers how they felt as the predator or the prey. Threatened? Safe? Powerful?
2. Ask students which one they would prefer to be.

### 2. Nasal Passages

#### a. Size in relation to skull size

1. Large nasal passages are generally indicative of a keen sense of smell.
2. Inside the nasal passages look for bony, web-like structures called nasal turbinates. These provide the framework for the membranes that sense odor.
3. Dogs generally have long nasal passages with a complex turbinate bone structure giving them a keen sense of smell compared to cats.
4. Cats have shorter nasal passages and less complex turbinate bone structure, indicating that they rely more on other senses for hunting.
3. Compare skulls with our short, human noses.

### 3. Teeth—Incisors

- a. Close your eyes and imagine that I just handed you a big red apple, now

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imagine biting into it. Which teeth did you use? Front teeth = incisors.

b. Carnivore (4th grade)/meat eater (3rd grade): incisors are usually less developed and used for grooming.

c. Herbivore (4th grade)/plant eater (3rd grade): incisors are well developed and used for cutting plant material.

1. Some herbivores (mule deer for example) do not have upper incisors.

Instead, they have a hard palate on top that is used like a cutting board.

d. Omnivore (4th grade)/plant and meat eater (3rd grade): incisor development will depend on whether the animal prefers meat or plants.

1. Incisors will be well developed in animal that prefers plants over meat.

## 4. Teeth—Canines

a. Close your eyes and imagine that I just handed you a piece of beef jerky, now imagine biting into it. Which teeth did you use? Canine (vampire or pointy) teeth.

b. Carnivore (4th grade)/meat eater (3rd grade): canines are well developed. Long and pointed for piercing and holding prey.

c. Herbivore (4th grade)/plant eater (3rd grade): canines are usually less developed and resemble incisors in form and function.

d. Omnivore (4th grade)/plant and meat eater (3rd grade): canine development depends on whether the animal prefers meat or plants.

1. Canines will be long and pointed in animals that do any hunting.

## 5. Teeth—Molars

a. Close your eyes and imagine I just gave you an ice cube to chew on. Which teeth did you use to grind up the ice? Molars (back teeth or cheek teeth).

b. Carnivore (4th grade)/meat eater (3rd grade): molars are pointed.

1. Usually top molars overlap lower molars creating a shearing action like scissors. The overlap prevents side to side movement of the lower jaw.

2. Carnivores do not chew their food (no side to side movement of lower jaw); they tear meat to shreds and swallow it whole

3. The bite-tear-gulp style of eating without chewing leaves their teeth clean and unstained by food debris.

c. Herbivore (4th grade)/plant eater (3rd grade): molars are usually flat and are used for grinding and chewing up plant material.

1. Flat molars do not overlap. The lower jaw moves side to side for chewing action.

2. Result of chewing/grinding food on flat molars leaves teeth stained by food debris.

d. Omnivore (4th grade)/plant and meat eater (3rd grade): molar development depends on whether the animal prefers meat or plants.

1. Some animals that eat both meat and plants have some molars that have high crowns with sharp edges for shearing meat AND some with wider crowns for crushing bone and plant material.

## 6. Ear holes/Auditory Bullae

a. These are the bony portions of the skull that hold the inner and middle ear.

b. Generally, the larger this structure relative to skull size, the better the sense of hearing.

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- c. Cats have relatively large ear holes and very acute hearing.
- d. Mule deer have relatively small ear holes indicating more reliance on other senses to locate predators.
- c. Animals' ears move to pick up sound.
- d. Give a quick demonstration on how ears help pick up sound.

## Directions:

1. Have students shape their hands into the letter "C"
2. Have the students hold their hands in front of their ears with the "C" shape pointed backwards (essentially covering their ears) and ask them if they can hear better now or before they put their hands up.
3. Have the students switch the position of their hands with the "C" shape cupping their ears (essentially making their ears bigger) and ask them if they can hear better now or with their hands in front of their ears or without any hands involved at all.

\*\*The goal is to demonstrate how large ears can pick up sound

## Solve the Skull Mystery Activity

### Directions:

1. Divide the students into groups of about four to six students.
2. Have them flip over their worksheet to the chart entitled "Mystery Skull Worksheet."
3. The first skull the students solve will be their own—the human skull.
4. Have students write their answers for the human skull in line ten.
5. Work through the questions with the entire class .
6. Once you have worked through the questions using the students' own skulls, pass out one animal skull to each group.
7. Each group of students will examine their animal skull and work through the questions just like they did with their own skulls.
8. Using the clues/answers to each of these questions, the students should be able to determine whether their animal was predator, prey or both and figure out the kind of animal.
9. Once every group has solved their skull mystery, go around to each group and in front of the entire class, review one or two of the questions they answered that helped them determine what kind of skull they had.

### Conclusion

All of these features—orbital, nasal passages, teeth and ear holes—tell us about how the animal lived, hunted or obtained food, what senses it relied on and whether it was a predator, prey or both. Encourage the students to visit the park, explain the student fee waiver and leave the waivers and park maps for the teacher to hand out.

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## Vocabulary

### 3rd and 4th Grade

**Predator**—noun—an animals that kills other animals for food

**Prey**—noun—an animal that is eaten by other animals

**Predator and Prey**—noun—an animal that eats other animals, but can also be eaten by other animals (e.g. If a cat kills a mouse, it is the predator. If the cat is eaten by a coyote, the coyote is the predator and the cat is the prey)

**Incisor**—noun—teeth at the front of the jaw used for nipping

**Canine**—noun—located between the incisors and molars (cheek teeth); usually large and pointed in meat eating animals; used for holding and killing prey

**Molar**—noun— also known as cheek teeth; the rear teeth in the upper and lower jaw

**Orbit**—noun—the bony socket that holds and protects the eyeball

**Nasal Passage**—noun—nose; bones holding a web-like structure of smaller bones (nasal turbinates), which form the framework for the membranes in the nose that sense odor

**Palate**—noun—the roof of the mouth

**Pelt**—noun—the skin of an animal with the fur still on it

### 4th Grade only

**Carnivore**—noun—an animal that eats only meat; they do not have the ability to move their lower jaw from side to side in a chewing motion

**Omnivore**—noun—an animal that eats both plants and meat. They usually prefer one more than the other. For example, black bears are omnivores that prefer plants. Coyotes are omnivores that prefer meat.

**Herbivore**—noun—an animal that eats only plants

**Auditory Bullae**—noun—the bony structures in the skull that encase parts of the inner ear

**Nocturnal**—adjective—most active during darkness

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## Bibliography

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