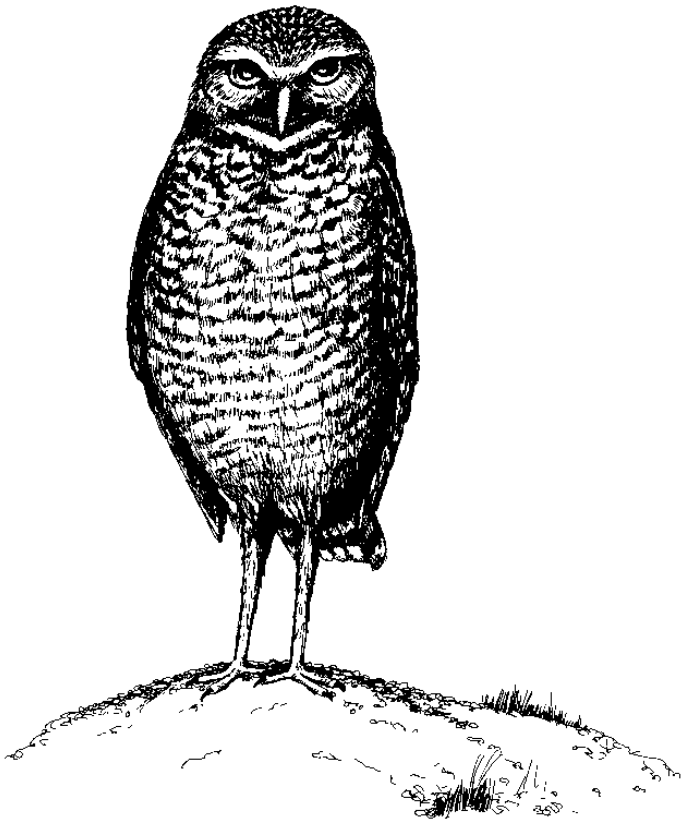
Birds of Prey Adaptations Lessons



U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

NATIONAL WILDLIFE REFUGE SYSTEM

Birds of Prey

Season:
All

Objectives:
Students will be able to...

- Make comparisons between raptors and humans using measurement and critical thinking skills

- Decipher which talon belongs to which raptor through measurement and interpretation

- Discover and analyze the different types of animals raptors eat

- Compare and contrast the similarities between animal and human bones

Key Concepts:
- Adaptations
- Binocular Vision
- Depth Perception
- Talons
- Pellets

Summary of Activities

This binder includes a variety of activities and background information related to birds of prey and their adaptations. The trunk also contains supporting materials for the activities in this binder as well as extra materials to use for additional activities at your own leisure. Feel free to use the lessons in this binder and materials in the trunk how it best fits your goals and needs.

Please be respectful with the artifacts and items. Handle skulls carefully and leave talons in their case.

Table of Contents (Binder)

State (SEEd) Standards

Second Grade

Standard 2.2, Living Things And Their Habitats

Standard 2.2.2, Plan and carry out an investigation of the structure and function of plant and animal parts in different habitats. Emphasize how different plant and animals have different structures to survive in their habitat.

Third Grade

Standard 3.2, Effects Of Traits On Survival

Standard 3.2.4, Construct an explanation showing how variations in traits and behaviors can affect the ability of an individual to survive and reproduce.

Fourth Grade

Standard 4.1, Organisms Functioning In Their Environment

Standard 4.1.1, Construct an explanation from evidence that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Standard 4.1.2, Develop and use a model of a system to describe how animals receive different types of information from their environment through their senses.

Seventh Grade

Standard 7.4, Reproduction And Inheritance

Standard 7.4.2, Obtain, evaluate, and communicate information about specific animal and plant adaptations and structures that affect the probability of successful reproduction.

Birds of Prey Trunk Materials List

Activity Books/Manuals
- Birds of Prey Lesson Plans & Handouts Binder
- Owl Pellet Activity Folder
- Birds of Prey Coloring Book
- Characteristics of Four Common Owls Sheet
- Typical Raptors in the U.S Sheet
- Food Web Sheet
- The Bald Eagle's Road to Recovery Sheet

Books
- Billywise (Fiction)
- The Eagle & the Wren (Fiction)
- My Side of the Mountain (Fiction)
- Owl Moon (Fiction)
- Owl Babies (Fiction)
- Barn Owls – A Carolrhoda Nature Watch Book (Non-Fiction)
- Barn Owls – Predator/Prey Relationships & Conservation (Non-Fiction)
- Bald Eagle (Non-Fiction)
- Eagle & Birds of Prey: Eyewitness Books (Non-Fiction)
- My First Pocket Guide: Birds of Prey (Non-Fiction)
- Owls: Whoo Are They? (Non-Fiction)
- Raptor: A Kid's Guide to Birds of Prey (Non-Fiction)
- Swoop Into the Nocturnal World of Owls (Non-Fiction)
- Zoobooks: Birds of Prey (Non-Fiction)
- Zoobooks: Eagles (Non-Fiction)

Artifacts
- Dissected & Undissected Owl Pellets
- Magnifying Glass (3)
- Dissecting Tools (2)
- Barn Owl Skull
- Bald Eagle Skull
- Great Horned Owl Skull
- Peregrine Falcon Skull
- Red-tailed Hawk Skull
- Barn Owl Wing
- Raptor Wing & Feather Bag

Display Cases
- Owl Pellets & Common Prey
- Birds of Prey Talons

Miscellaneous Items
- Bird Call Cards
- Build-A-Bird Pencil Craft
- Paper Eagle Craft
- Juvenile & Adult Bald Eagle Finger Puppets

What is a Raptor?

Background Information

Raptors, also known as **birds of prey**, include eagles, hawks, falcons, condors, vultures, kites, owls, and osprey. The word “raptor” is derived from the Latin word “raptare,” which means “to seize or take by force.” There are three main characteristics that differentiate raptors from other types of birds. These are…

1. Excellent Eyesight or Vision
2. Sharp Talons on their Feet
3. A Hooked Beak

All of these important characteristics that make up a raptor help them to hunt for live prey or food which accounts for the majority of their diet.

On average, **raptor vision** is about six times better than human vision. Their vision is extremely important when hunting live prey during flight. Part of the reason why their vision is much better than other animal species is due to the size of their eyes. The eyes of raptors are so large that they are unable to move their eyes within their skull or eye socket. Therefore, raptors are forced to always looking forwards. However, in order to combat this potential problem, raptors have developed another important adaptation. Raptors are able to turn their heads between 180-270 degrees using their flexible necks.

Raptor **talons** are essential when hunting live prey. Talons are used for catching, gripping, and killing prey. However, not all raptors have the same talon and toe arrangement. Most birds of prey have three toes facing forwards and one facing backwards. Every type of raptor species uses a slightly different technique in order to successfully hunt their prey. Eagles and hawks are able to dislocate the neck of their prey using their talons. Other species, such as osprey have a reversible front toe which helps to grip slippery fish better.

The **hooked beak** of a raptor enables the bird to tear its prey into pieces that fit easily into its mouth. While the talons act almost like a fork for raptors to easily hold onto their prey, the hooked beak acts like the knife allowing raptors to pull back and rip the meaty parts of their prey easier. For some raptors, the hooked beak also is designed to assist in dislocating their prey’s neck.

Raptor Vision

Time:
20 minutes

Season:
All

Objectives:
Students will be able to...

- Make comparisons between raptors and humans using measurement and critical thinking skills

Key Concepts:
- Binocular Vision
- Depth Perception
- Adaptations

Summary

Raptors depend on their advanced eyesight and depth perception in order to successfully hunt live prey or food. Because they rely on their vision so heavily, their eyes are much larger, relative to their head size, in comparison to many other species including humans.

In this activity, students will work together to measure a raptor's eye size in comparison to head size. Students will then compare their findings with their own eye and head size and discover the differences between raptor and human vision.

Materials Included

-Replica Raptor Skulls (5 Skulls)
-Raptor Vision Worksheet
-Raptor Head Diagram Sheet

Supplies You Will Need To Provide

-Rulers For Each Student
-Copies of the "Raptor Vision" Worksheet For Each Student (A Master Copy Is Provided)

Raptor Vision

Background Information (Vision)

Most bird species have their eyes located on the sides of their head. This type of vision is called **monocular vision**. This particular eye placement allows for birds to be able to see things on both sides at the same time as well as what is in front of them. Typically, prey species have monocular vision because it allows them to see potential danger from all sides. However, monocular vision lacks **depth perception**, or the ability to judge how far away something is.

Raptors have **binocular vision**. With binocular vision, eyes are located at the front of the head allowing for depth perception, or seeing objects in a three-dimensional picture, and a larger field of vision. This is the same type of vision humans have. Binocular vision is often found to be a predator adaptation allowing for easier hunting. One easy way to tell whether an animal is a predator or prey species is to look at their eye placement.

> **"Eyes on the side like to hide" (prey)**
> **"Eyes in the front like to hunt" (predator)**

In addition to their excellent depth perception, raptor eyes have **adapted** to be quite large relative to their body size. In many raptors, their eyes are so large that they fill up about 1/3 of the space in their skulls. Their large eyes are held in place by a ring of bone called the **sclerotic ring**. Because their eyes take up so much space, raptors are not able to move their eyes within their eye sockets like humans are able to. Therefore, raptors have developed another adaptation. The ability to turn their heads between 180-270 degrees!

Raptor Vision Activity

***You may want to set this activity up as a station-based activity where students rotate stations in order to see all of the raptor skulls without overcrowding.**

*** Please be gentle with the raptor skulls. They are replicas but are still fragile. Please leave them on the table or hold them gently above the table when working with them.**

Student Instructions

1. Label "Raptor Vision" worksheet with your name or team name if working in a group.

2. Using the "Raptor Head Diagram," locate where the sclerotic ring, eye socket, and beak are located on each raptor skull. Repeat this at each station.

3. For each raptor skull, measure the length of the eye socket using a ruler, and then measure the head from the back of the beak to the back of the skull. Record your findings on the "Raptor Vision" worksheet.

4. Repeat steps 2 and 3 for each of the raptor skulls.

5. After measuring all raptor skulls, carefully measure a partner or each of your team member's eye sockets (ruler should not have to touch your partner's eye) and heads from the forehead to the back of the head. Record your findings on the "Raptor Vision" worksheet.

6. Answer the reflection questions and talk with a partner or your team about your findings.

Raptor Vision Worksheet

Team:

Name:

Name of Raptor	Eye Socket Size	Head Size

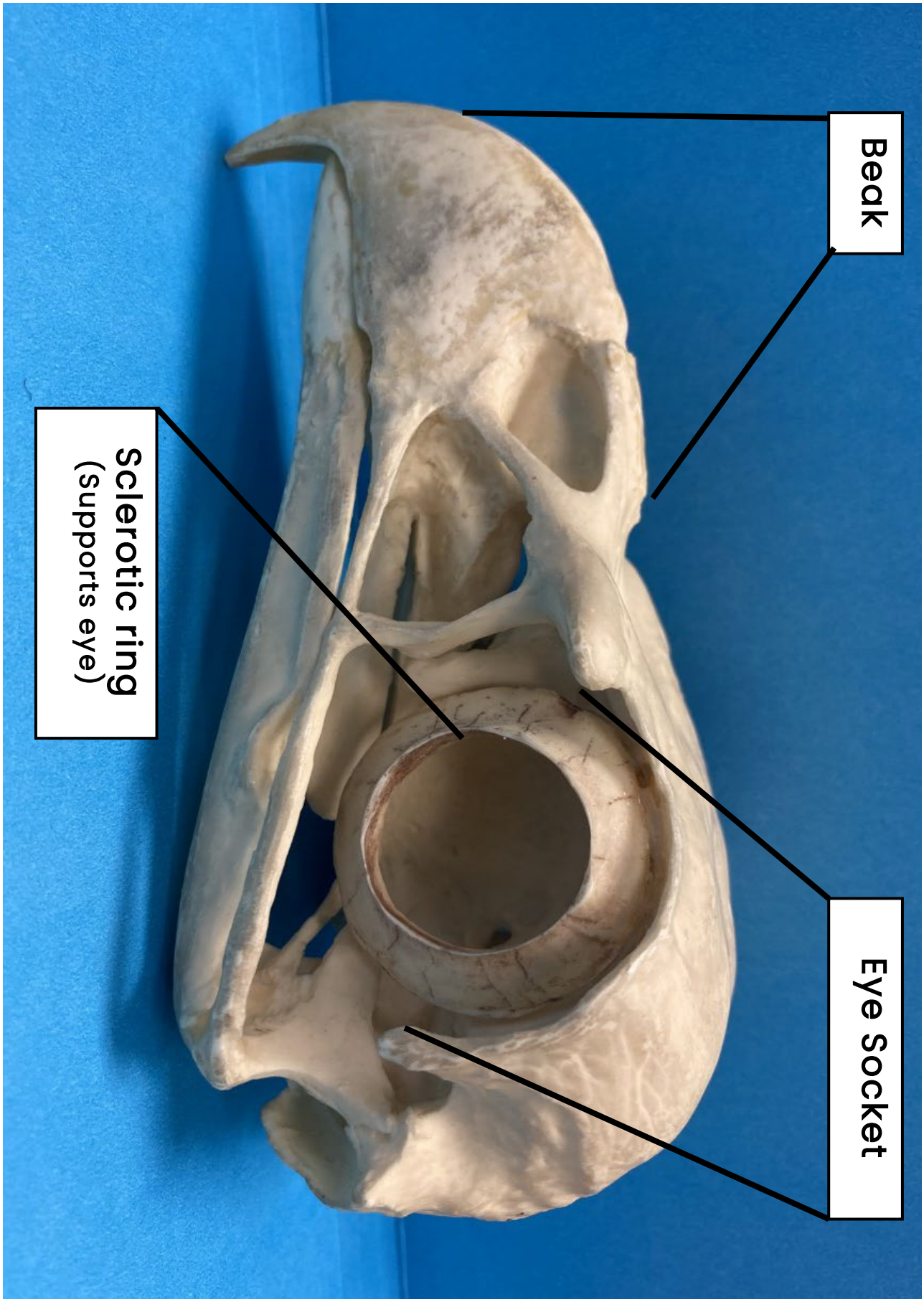
Name of Team Member	Eye Socket Size	Head Size

1. Which raptor had the biggest eyes in comparison to their head size?

2. Do raptors or humans have bigger eyes in comparison to their head size?

3. Do raptors or humans have better vision? Why do you think that is?

Raptor Vision (Raptor Head Diagram)



Totally Talons

Time:
15 minutes

Season:
All

Objectives:
Students will be able to...

- Decipher which talon belongs to which raptor through measurement and interpretation

Key Concepts:
- Adaptations

Summary

Talons are the primary tool raptors use in order to catch their food or prey. With that said, different types of raptors have various talon sizes and shapes depending on what they eat and how they hunt. These special adaptations allow raptors to successfully live and hunt in their natural habitats.

In this activity, students will work together to decipher which talon belongs to which raptor through a measurement test and by using their critical thinking skills.

Materials Included

-Birds of Prey Talons Display Case (8 Talons Included)
-Birds of Prey Talons Guide For Teacher & Students
-Photos of Raptors With Name & Description (7 Photos)
-Totally Talons Worksheet

Supplies You Will Need To Provide

-Rulers For Each Student
-Copies of the “Totally Talons” Worksheet For Each Student (A Master Copy Is Provided)
-Copies of the “Birds of Prey Talons Guide” For Each Student (A Master Copy Is Provided)

Totally Talons

Background Information (Talons)

One of the ways in which scientists classify or group birds together is by the type of feet they have. For example, waterfowl, such as ducks and swans, have webbed feet for paddling in water. Wading birds, such as egrets and herons, have long toes, feet, and legs for keeping their balance while walking through muddy conditions. Songbirds have feet designed for perching and gripping onto branches. Like other birds, raptors also have specially designed feet. However, their feet are specifically **designed for hunting**.

Raptor feet have heavily padded toes and large, strong, curved claws or **talons**. Talons are the primary hunting tool raptors use in order to catch their food or prey. Raptor talons are extremely powerful. To put this into perspective, bald eagles have a grip strength of 400 psi (pounds per square inch). This means that bald eagles have ten times more grip strength than the average human!

Because raptors are constantly using their talons to hunt for food, talons do get worn down with time. However, just like humans, talons are made of keratin, which is the same material human fingernails are made of, and continue to grow throughout a bird's life.

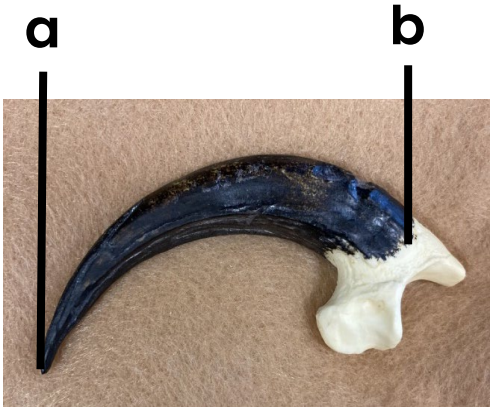
Not every type of raptor has the same toe and talon arrangement. While most birds of prey, including eagles, hawks, falcons, condors, vultures, and kites, have their toes arranged with three facing forwards and one facing backwards, owls and osprey are actually able to move one of their front toes backwards, allowing them to have two toes facing forwards and two toes facing backwards. These different toe **adaptations**, allow different types of raptors to specialize in different types of food and hunting techniques. For example, eagles and hawks have developed larger talons in the front allowing them to grab onto larger prey. This differs from falcons which typically have smaller talons demonstrating that they rely more on the speed of attack in comparison to grip strength.

Totally Talons Activity

Student Instructions

1. Label “Totally Talons” worksheet with your name or team name if working in a group.

2. Use Paper Copy of “Birds of Prey Talons” worksheet and a ruler to measure each of the talon’s sizes. Measure talons from Point A to Point B as shown in the image.



3. Record findings on “Totally Talons” worksheet.

4. After recording measurement findings, look at the pictures of the raptors with their names and descriptions. Record each raptor’s size and weight on the “Totally Talons” worksheet.

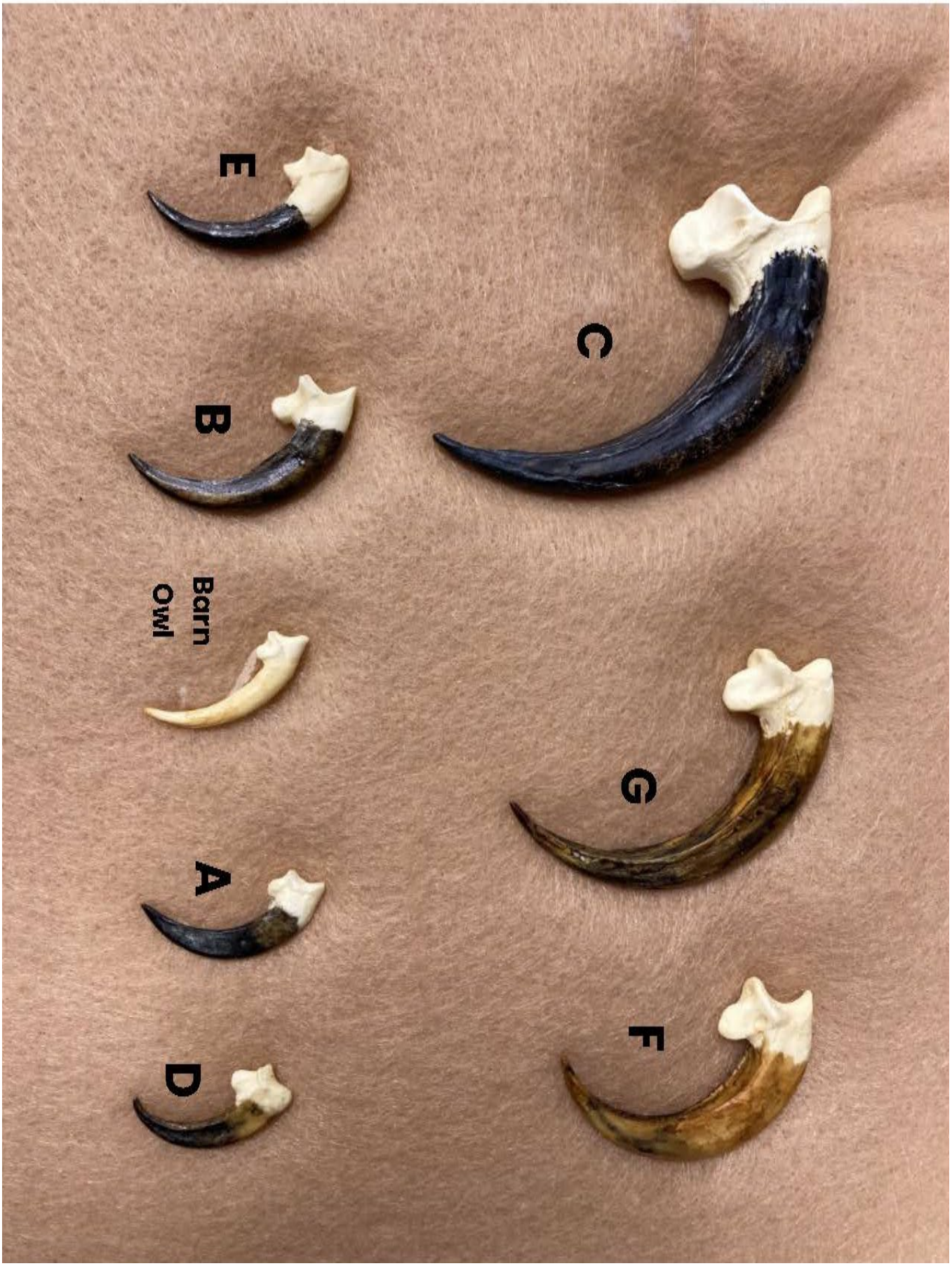
5. Using context clues, decide which talon from earlier belongs to which raptor, and record your decision.

6. Answer the reflection questions, and list your reasoning as to why you partnered specific talons with raptors.

7. With extra time take a look at the real talons in the “Birds of Prey Talons Display Case.” **Please leave talons inside the case**.

Totally Talons (Teacher Copy)

Totally Talons (Student Copy)



Totally Talons Worksheet

Team:

Name:

Talon	A	B	C	D	E	F	G
Size							

Bird Name	Size of Bird	Weight of Prey	Which Talon?
Harpy Eagle			
Golden Eagle			
Bald Eagle			
Red-tailed Hawk			
Peregrine Falcon			
Great Horned Owl			
Common Raven			

1. What were your reasons for deciding which talon belongs to which bird?

2. Were there other features besides talon size that helped you decide which talon belonged to which bird? What were they?

Totally Talons (Raptors & Descriptions)

Peregrine Falcon
Body size = 20 inches (51 cm)
Prey weight = 1.25 lbs. (0.6 kg)

Totally Talons (Raptors & Descriptions)

Harpy Eagle
Body size = 40 inches (101.6 cm)
Prey weight = 14 lbs. (6 kg)

Totally Talons (Raptors & Descriptions)

Bald Eagle
Body size = 37 inches (94 cm)
Prey weight = 5 lbs. (2.3 kg)

Totally Talons (Raptors & Descriptions)

Great Horned Owl
Body size = 25 inches (63 cm)
Prey weight = 3 lbs. (1.4 kg)

Totally Talons (Raptors & Descriptions)

Red-tailed Hawk
Body size = 25 inches (63.5 cm)
Prey weight = 0.6 lbs. (0.28 kg)

Totally Talons (Raptors & Descriptions)

Golden Eagle
Body size = 36 inches (91.4 cm)
Prey weight = 7 lbs. (3.1 kg)

Totally Talons (Raptors & Descriptions)

Common Raven
Body size = 24 inches (61 cm)
Prey weight = 1.75 lbs. (0.79 kg)

*Common Ravens are not raptors; however, they do have sharp, curved beaks and talons similar to other birds of prey. They are also scavengers eating other animals and meat if available.

Pellets & Prey

Time:
30 minutes

Season:
All

Objectives:
Students will be able to...

- Discover and analyze the different types of animals raptors eat
- Compare and contrast the similarities between animal and human bones

Key Concepts:
- Pellet
- Adaptations

Summary

Because raptors eat live prey, many of the parts of their food are difficult to fully digest. Therefore, raptors cough up pellets made up of the difficult to digest materials. These pellets contain the bones of the animal they ate making it easy to tell which types of animals they recently ate.

In this activity, students will work together to decipher which type of animal(s) a raptor recently ate through the dissection and exploration of a raptor pellet.

Materials Included

-Owl Pellets
-Bones Sorting Guide (Found In The Green Owl Pellet Folder)
-Pellets & Prey Worksheet
-Dissecting Tools
-Magnifying Glasses

Supplies You Will Need To Provide

-Copies of “Pellets & Prey” Worksheet For Each Student (A Master Copy Is Provided)
-Gloves If Students Want Them
-Dissecting Tools (Toothpicks)
-Extra Owl Pellets If Needed

Pellets & Prey

Background Information (Pellets)

Unlike many types of animals, birds do not have teeth. Because of this, birds are not able to chew their food. One **adaptation** that many birds have formed, in order to still effectively swallow their food, is a **crop**. A crop is a loose sac in the throat of a bird which stores and softens food before it passes through to the bird's stomach.

However, not all birds have a crop. Owls, which eat live prey, similar to other types of raptors, do not have a crop. Because of this, owls have no method to break down their food inside of their body. Therefore, they will cough up a **pellet** instead. However, even though other types of raptors do have a crop, they will also cough up pellets as well in order to help pass hard to digest food items.

Pellets are made up of a variety of body parts raptors are unable to digest. While raptors are able to swallow the muscle and meaty part of an animal, they are not able to digest other parts including the bones, fur, teeth, and feathers of their prey. Because of this, these indigestible parts get coughed back up in a pellet.

The forming and regurgitation of pellets happens in a regular cycle. After hunting and eating several prey animals, the indigestible parts of the prey are consolidated into one pellet. The pellet is then regurgitated or coughed up.

Pellets & Prey Activity

Owl pellets are masses of bones, teeth, fur, and feathers. They are produced by all raptors several hours after eating a meal. Because owls swallow their prey whole, their pellets contain almost complete skeletons of the animals an owl ate.

Student Instructions

1. Label “Pellets & Prey” worksheet with your name or team name if working in a group.

2. Collect an owl pellet, a toothpick or other dissection tool, and a plate or piece of paper to dissect the pellet on.

3. Using the dissecting tools you collected, separate the bones of animals from the fur and feathers making up the pellet.

4. Use a “Bones Sorting Guide” to sort out the bones according to their types (skulls, vertebrate, femurs, etc.). Remove as much of the fur and feather debris as possible to get a clearer look.

5. Using the “Bones Sorting Guide,” identify the prey or animal species skulls you have found within the pellet. Examine the teeth to help you identify which prey animal skull you have.

6. Record your findings on the “Pellets & Prey” worksheet.

6. Answer the reflection questions when you are finished filling out the data table.

Pellets & Prey Worksheet

Team:

Name:

Prey Animal	How Many?	Percent of Total Prey
Vole		
Mouse		
Mole		
Shrew		
Bird		

1. Which animal did your raptor eat the most of based on your findings?

2. How are bones of prey animals, found in the pellet, similar to human bones?

3. Why is it so important for raptors to cough up pellets?

Hooked Beak

Background Information (Beaks)

Bird beaks often reflect a bird's lifestyle. Where a bird lives, or their habitat, and what a bird eats is often reflected in the way a bird's beak is adapted. For example, shorebirds are often found with long, tweezer-like beaks in order to successfully retrieve food found within muddy areas. Waterfowl, such as ducks, have wide, flat beaks which help them to strain and separate their food from water. Raptors, on the other hand, have strong, sharply curved or **hooked beaks** helping them to tear apart live prey or food.

Similar to their talons, not all raptors have exactly the same beak size and shape. For example, falcons and kites have an extra feature behind their beak called a **tomial tooth**. The tomial tooth allows for these smaller raptors to quickly sever their prey's spinal cord which helps them to kill their prey much faster. This is an important adaptation for smaller raptors because their beaks are not as defined and strong as the larger raptors.

Similar to humans, all bird beaks have nostrils located on the upper part of the beak. For birds, these nostrils are called the **nares**. Birds that spend most of their time flying through the air, including raptors, typically have an underdeveloped sense of smell and therefore rely on their vision heavily. However, one exception to this is the turkey vulture which actually does rely on its sense of smell to locate carrion or food.

Owl Wings & Hearing

Background Information (Owls)

Owls are one of the more unique types of raptors found throughout the world. To start, while most raptors are active during the day (**diurnal**), owls are predominantly active at night (**nocturnal**). Because they are more often active at night, owls have some special adaptations allowing them to successfully hunt and survive when it is dark outside.

Owl Wings

When most birds fly, their wing flapping mixed with the surrounding air produces sound. Typically, the larger the bird, the more sound is created when flying. However, owl wings are adapted in a way allowing for them to fly almost silently. On the leading edge of an owl's flight feathers a comb-like pattern can be seen. These **fringes** help to dampen and absorb the sound by allowing small streams of air through which helps to break up air turbulence. These fringes on the leading edges of the flight feathers are not found on other bird species.

Silent flight allows for owls to track and hunt prey without detection. It also allows owls to remain hidden from potential predators as well.

***Take a look at the Raptor Wing and Feather Bag to compare the differences between an owl and hawk feather**

Owl Hearing

Some owls have **asymmetrically positioned ears**. This is more typically found in the strictly nocturnal owl species such as the barn owl. An owl is able to tell if a sound is higher or lower just by using their asymmetrically positioned ear openings.

All owls have a pronounced **facial disk**, or flatter face, relative to other bird species. The facial disk of an owl helps to guide sound into the ear openings on the sides of an owl's head. While some owls have ear tufts located on the top of their head, these ear tufts are not part of the actual ear. Instead, they act as another sound reflective surface allowing owls to hear even better. In fact, the great horned owl can hear sounds from up to 10 miles away!

Raptor Wing & Feather Guide

Reflection

Ask Students...

1. In your opinion, which raptor adaptation is the most important to their survival? Why do you think that is?

2. Why are raptors so important? What is their role in the food chain?

3. If you could be any raptor, which raptor would you be and why?