August 2017

Owl Pellets

Theme: Dissecting owls pellets is a fascinating way to learn about owls and ecology.

Concepts:

1. Owls have acquired physical and behavioral adaptations to be successful in their environments.
2. Dissecting owl pellets provides information about owls' food preferences and their role in nature.
3. Encountering owls in the wild increases our awareness and appreciation for them and their nocturnal lifestyle.

Outline:

I. Preparation Before Activity (20 min.)

II. Introduction (10 min.)

- A. Greeting, Grabbing, and Purpose
- B. Names and Introductions
- C. Activity Description
- D. Behavior Guidelines
- E. Task Analysis/Learner Assessment

III. Owl Adaptations (10 min.)

IV. Owl Pellets (45 min.)

- A. Dissecting a Pellet
- B. Owl Pellet Dissection Data Sheet
- C. Creating a Skeleton

V. Calling Owls (20 min.)

- A. Practice
- B. Hike to the Site
- C. Calling Owls

VI. Conclusion (5 min.)

VII. Optional Activities

- A. Story Writing
- B. Small Mammal Review

VIII. Clean Up (15 min.)

IX. Fact Sheet

X. Appendix

- A. Equipment
- B. Glossary
- C. Activity and Safety Management
- D. References/Resources
- E. Data Sheets

Owl Pellets

I. Preparation Before Activity

In Owl Pellets, you will be educating the students about owls and examining their roles in nature by dissecting owl pellets. Read through the lesson plan prior to the activity and talk to your liaison if you have any questions or concerns.

Your liaison will set out the activity in the scheduled room. He or she will set out a mouse skeleton, wing, and talon. The posters will be in the front of the room and there will be a container of glue, Owl Pellet Dissection Data Sheet, Bone Sorting Chart, Skull Identification Key, and a 3x5 note card for each group. The pellets, pencils, dissecting probes, and tweezers will be ready to distribute when it is time to dissect the pellets. Each group gets one of each.

Owl pellets are $3.00 each. Talk to your liaison or the lead teacher from your school to determine how many you will need. The students may work in pairs to dissect a pellet, but any more than two students per group is not recommended. Please record the number of pellets the class used for billing purposes.

II. Introduction

A. Greeting, Grabbing, and Purpose. Greet the students as they enter the classroom and encourage them to examine the posters and displays. When they are done, instruct them to sit with a partner. You may choose the groups or, if you are comfortable with it, allow the students to choose their own. Use the "Owl Trivia – Fact or Fiction" sheet to introduce the students to some general owl information. (The kit contains a laminated copy.)

1. The Screech Owl's call sounds like a loud "screech."

   Fiction. Despite its name, the Screech Owl's call does not sound like a "screech." Its primary call sounds like a horse's mournful whinny.

2. Owls can turn their heads all the way around.

   Fiction. All owls have eyes that are fixed in their sockets, so they must be able to turn their heads to see in different directions. However, they can only turn their heads about 270 degrees, or ¾ of a circle.

3. Owls can't smell.

   Fact. Owls, like most other birds, do not have a well developed sense of smell. That comes in handy for Great-horned Owls when they hunt skunks!

4. All owls hunt at night.

   Fiction. Northern Hawk Owls and Great Gray Owls hunt primarily during the day.

5. If owls were the size of humans, their eyes would be the size of golf balls.

   Fiction. Owl eyes would be the size of grapefruits.

6. Owls have about 2,000 feathers.

Fiction. Owls have about 7,000 feathers.

7. Owls have 3 eyelids.

Fact. Owls have a nictitating membrane that covers their eyes to protect them from branches and twigs when they dive down for their prey.

8. Owls don't have very good hearing.

Fiction. Owls have the best hearing in the bird world. They have one ear higher than the other to allow them to pin point the source of the noises around them.

9. Like myths and legends imply – owls are very wise.

Fiction. While owls are not "dumb," they are not very wise. Because of the space their eyes take up in their skull, there is not much room for a brain.

10. Owls have 2 stomachs.

Fact. When owls eat, their food goes to a glandular stomach (also called the proventriculus) first that dissolves and breaks up the prey, then the food moves up to the muscular stomach (also called the gizzard). The gizzard catches claws, bones, teeth, fur, and feathers; the animal parts that owls cannot digest. The gizzard will also grind up the meat of the prey and pass it on to the small intestine. The gizzard will then press the hair, fur, and feathers around the bones to form a pellet.

B. Names and Introductions. Introduce yourself and tell the class a little about yourself. Learn the names of the students by a method that works for you. Explain that you will be teaching the class and that the adult chaperones may be assisting at times.

C. Activity Description. In this activity, students will learn about owls and spend time dissecting an owl pellet. The first 10 minutes will be spent learning the physical and behavioral adaptations that make owls successful nocturnal predators. The next 45 minutes will be spent dissecting owl pellets and investigating what is found inside. The students will identify the bones found in the pellet and construct a skeleton of the owl's prey on a 3x5 card. In the time remaining the students will listen to and practice owl calls prior to going outside to try and attract an owl. For a one-hour class, you may only have time to quickly review owl adaptations and then supervise the students as they dissect a pellet.

D. Behavior Guidelines. Discuss clearly and specifically which behaviors you expect from your students during class. Explain the need for respect: for you, each other, ideas, Eagle Bluff itself, and the equipment.

E. Task Analysis/Learner Assessment. How can owls hunt successfully in complete darkness?

III. Owl Adaptations

Owls are a type of carnivorous bird called raptors. Other raptors include hawks, eagles, falcons, and ospreys. Most raptors hunt small mammals, birds, amphibians, reptiles, and larger invertebrates. All raptors possess similar adaptations that allow them to hunt: they are strong and agile fliers, they have keen eyesight to locate prey, strong legs and talons for capturing prey, and hooked bills to tear flesh. Although owls share these characteristics, they have adapted to their nocturnal lifestyle. Other species of raptors are active primarily during the day so they have not evolved these specialized adaptations to be active at night.

Explain the unique physical and behavioral adaptations that allow owls to survive in darkness. Use the owl mount and displays to emphasize your points.

1. **Eyesight.** The size and structure of owls' eyes allow for amazing visual ability. Owls' eyes are so large that there is little room for muscles inside their eye sockets needed to move their eyes. To compensate, owls are able to turn their heads 270 degrees. Larger eyes allow for more light to enter the pupil, which is the round center of the eye. The owl "sees" when light contacts rod and cone cells at the back of the eye. Rod cells gather light and are needed when trying to see in low light conditions, but they do not distinguish color. Cone cells allow for color vision. Since most owls hunt at night, their eyes contain mostly rod cells; therefore, they can only see in black and white.

   Owls focus on prey with binocular (two-eyed) vision, which means that each eye sees an object from a slightly different angle. The two views overlap, triangulating the object in the owl's sight, and allowing them to judge exact distance. Their sight is so focused that an owl could read a newspaper a mile away by the light of a candle (if it could only read). Although owls can see distant objects clearly, they can not see close objects well. Owls will bob and turn their heads to change their viewpoint when focusing on close objects. This behavior makes near objects stand out from the background so they can judge the object's location more accurately.

2. **Hearing**. Owls have large, oval-shaped ear openings bordered in the front with a fleshy, raised flap called an operculum. This is similar in function to a hand cupped over the front of a person's ear to capture and amplify sounds from the rear. Many owls, such as the Barn Owl, have facial feathers shaped similar to a satellite dish that collect and direct even the lowest intensity sound waves down the ear channel into the ear. The unusual positioning of owls' ears also allows them to locate sounds. One ear is higher and points slightly more forward than the other. This asymmetrical positioning of the ears produces a difference in the time that it takes for a sound to reach each ear. Owls can detect the exact distance and location of sounds by analyzing the time difference between sounds. For example, if a sound arrives to the higher ear first, the owl knows that it came from above.

3. **Silent Flight**. Not only can owls see and hear their prey, their prey cannot hear them coming. The owl has a lightweight body and a large wing area, which allows it to fly using a slow, controlled wing-beat. Soft, comb-like serrations on the wing feathers and frayed edges on the tips of the tail feathers break up the air flow and muffle sound, enabling nearly silent flight. Most other bird species have a smooth, knife-like edge on their wings, which creates noisy friction as they cut through the air. Many owl species also have feathers extending down their legs, which muffle sound during flight. Show the students the wing and the talon. Point out the serrated feather ends.

4. **Talons and Beak**. Talons are used for capturing and grasping prey. The toes of an owl extend to the sides to prevent small mammals from moving sideways and escaping. Many owl species have feathers extending down their legs, which insulate their feet during winter. A strong, sharp, curved beak allows owls to tear up prey if it is too large to swallow. Owls normally kill their prey by grasping it with their talons and then biting its neck.

5. **Behavior**. Most owl species will migrate if the winter is harsh enough, but they will continually return to the same area. Owls develop an intimate knowledge of their territory and hunting ground through their methodical behavior. They will use the same trees as lookout perches to search for and ambush prey.

6. **Diet**. Owls hunt small mammals, birds, and invertebrates like insects and worms, and most owls will swallow their prey whole. However, some owls have a varied diet. The Great Horned Owl eats rodents, pheasants, quail, small birds, fish, amphibians, reptiles, scorpions, and even larger mammals like skunks. Other owls are specialized feeders; the Flammulated Owl eats only insects.

Assessment: Owls have acquired physical and behavioral adaptations to be successful in their environment.

- After explaining the adaptations, have the students summarize them. Decide if they completely understand how each adaptation helps owls live their lifestyle.
- Are physical adaptations more important than behavioral adaptations? How is each type used with the other?
- Compare and contrast the adaptations of an owl and a hawk.

IV. Owl Pellets

Owl pellets provide important information to ornithologists about owl adaptations and habits. Scientists can determine what owls are eating at various times and places by finding and dissecting owl pellets. Owl pellets also provide information about the approximate numbers of prey animals in the owl's feeding area, which is valuable information to scientists studying animal populations. Pellets are often found at the base of a perching tree.

Owls can digest only the soft muscles and organs of their prey. The bones, teeth, fur, feathers, scales, or insect skeletons are too dense and cannot be converted into energy. The harder parts may also puncture an owl's soft, curved intestines if passed through its digestive tract. Instead, the waste material is formed into a pellet by the gizzard muscles and passed back up the esophagus to be cast out (thrown up) about twelve hours later.

Although other birds, like eagles and hawks, also regurgitate pellets, owls are more efficient at it and they regurgitate more frequently. Owls swallow their prey whole, ingesting the entire skeleton. Other raptors selectively tear at their prey, eating only the soft digestible parts and leaving the indigestible bones. Also, unlike other birds, owls do not have a crop, which is an organ that holds food until the stomach is ready to receive it. Other species of raptors do not need to regurgitate pellets as frequently as owls because some of the food remains in the crop, preventing food from passing up through the mouth for several hours.

Although pellets are waste material, they provide food and shelter for other organisms. Pellets sometimes provide homes for clothes moths, carpet beetles, and fungi. You may find droppings, cocoons, or exoskeletons from these animals in the pellets.

A. Dissecting a Pellet. Pass out a pellet, dissecting needle, and tweezers to each group. The pellets you are dissecting are collected in Washington from wild Barn Owls (Tyto alba). They have been autoclaved (sterilized) so they are free from bacteria and diseases. Instruct the students to use their fingers, tweezers, and dissecting needles to carefully separate the bones from the soft material in the pellet. As they dissect the pellets, divide your time evenly between the groups. Ask questions to stimulate their imaginations and thoughts. Point out any interesting and unusual remains found in the pellets. Support your previous information about adaptations and the

necessity of owl pellets from the remains that the students find. Any group will have a mix of different reactions to the pellets; many find dissecting pellets amazing and interesting while others may think it is disgusting. Discuss with students individually about their thoughts about dissecting owl pellets. Even though dissecting pellets may seem disgusting, explain that it is an important scientific procedure to learn about owls and their habits.

B. Owl Pellet Dissection Data Sheet. The Owl Pellet Dissection Data Sheet can be worked on before and after the dissection of the owl pellet. First they will measure the length and width of the owl pellet and record its general color. As the students dissect their pellet they should use the Bone Sorting Chart and Skull Identification Key to identify as many bones and skulls as possible. The Skull Identification Key is a simplified dichotomous key. Examine each skull to determine if it has teeth. If there are no teeth, it is a bird skull. If teeth are present, read the statements on the key to determine which statement is more correct about the skull, then follow the arrows to the conclusion. Once the students have identified the bones and skulls, they should record the data and complete the questions on the Owl Pellet Dissection Data Sheet. Class wide skull information can be recorded on the chalkboard to assist in completing the data sheet.

C. Creating a Skeleton. Instruct the students to choose and identify one of the skulls from their pellet. They should build a skeleton of that animal, using the skeleton/bone-sorting chart to help find the correct bones and their placement on the skeleton. Glue the bones in place on an index card. The students should write their name and the kind of animal on the card and give the skeleton a name. They can share their discoveries when the class has completed the dissection.

Assessment: Dissecting owl pellets provides information about owls' habits and their role in nature.

- As students dissect the pellets, listen carefully for their comments and reactions. Are they amazed at what they find or are they disgusted?
- Have the students explain why owls need to regurgitate owl pellets. Specifically, what can owl pellets tell people about the way owls behave?
- What remains are they finding in their pellets? Is anything unusual or unidentifiable?

V. Calling for Owls

If there is time, spend the remainder of the class outside attempting to locate an owl with calls. This is a rewarding activity that allows students to experience owls in the wild. Owls are often difficult to locate and many students may not have seen or heard one before. Although owls do not always respond, it can be exciting when they do. The kit room CD player and the owl calling CD may be used during the hike to call owls only if the liaison or another Eagle Bluff staff member is leading the activity, and if the weather is not extremely cold or wet outside. Otherwise, these should not be taken outside.

A. Practice. Listen to the CD of owl calls in the classroom and practice each one. The Barred Owl is the most common owl heard in this area. It can be compared to the phrase, "Who cooks for you....Who cooks for you all." Great Horned Owls and Eastern Screech Owls are also commonly heard at Eagle Bluff. In order to be successful at calling, it is important that the group remains as

quiet as possible during the hike. A loud group may scare away owls and it is difficult to hear owls call if there is competing noise.

B. Hike to the Site. Talk to your liaison to find the best place to call owls. The overlook is a common place to hear owls calling. Remind the students that the slower and quieter they are, the more wildlife they may see. Early dusk (as the sun is setting) is a good time to hear owls. Sometimes owls can be heard as the group hikes to the site. If the group hears one, stop and point it out. Listen for it to call again.

C. Calling Owls. After the group arrives at the site allow one student at a time to call for owls. Wait 40-60 seconds after each call for a response. If there is none, call again and continue until all students have had a chance. Go to another location and try again if you are not successful. When an owl does call back, it may fly very close and land in a nearby tree to investigate. It is important that the group remains quiet so that the owl is not scared away. Remind the group to be patient. Sometimes it may take many calls before an owl returns the call.

Assessment: Encountering owls in the wild increases our awareness and appreciation for them and their nocturnal habits.

- Have the students mimic the calls of four owls.
- As the group calls for owls, closely notice their responses. Are they excited, scared, apprehensive, etc? Notice their reaction when an owl returns their call. How has their reaction changed?
- If the group hears an owl, ask questions about its activities. How far away is the owl? Is it moving? Is it calling for a mate? Is it hunting?

VI. Conclusion

The thought of owls brings many images to people. Owls are commonly thought of as wise, all-knowing birds. Other people imagine owls as solitary night creatures, mysterious in their ways. Owls are not especially wise or mysterious; they have simply adapted to live and hunt at night. Owls are so proficient at hunting, they are commonly known as "flying mousetraps." Many owl species prey on enough rats, mice, voles, shrews, and other rodents to control these populations. Without owls, rodent populations could grow unchecked. The larger populations could destroy crops, spread disease, and become a nuisance to humans.

Dissecting owl pellets is a fun and easy activity that provides information about owl adaptations and habits. Owl pellets provide a clue to owls' diet and the role in their ecosystem. Scientists can calculate the population of rodents and other prey in the area by finding and dissecting owl pellets. We can also understand the basic anatomy of an owl's digestive system by examining and dissecting owl pellets.

Hearing an owl call reminds us that we share the night with owls. As we become more aware of their presence, we understand their adaptations and nocturnal lifestyle. A creature, once mysterious to many people, now becomes appreciated for their unique lifestyle. Share your knowledge about owls!

Review the concepts with the students. Have the students list the adaptations that owls possess, allowing them to be successful within their environment. Have the students recall what they found within their pellet, and have them review why owls are important to the environment. What would Eagle Bluff be like without owls? What can people do to preserve owl species?

VII. Optional Activities

A. Story Writing. Have the students write a story about the animal they found in the pellet and the owl that ate it. Have them focus on the animal's life, habits, range, death, and its importance to the ecosystem it lived in. Allow the students to be as creative as possible with this exercise.

B. Small Mammal Review. Owls eat many small mammals. Here are some facts about the prey that your owl may have eaten.

1. **Deer Mouse**: The only native mouse that commonly enters homes, has cheek pouches and is very social. They will feed on various foods, including seeds and nuts, small fruits and berries, insects, centipedes, and the subterranean fungus *Endogone.*

2. **Meadow Jumping Mouse**: Can jump 6 feet. If it were the size of a human, it could jump 150 feet. The long tail is used for balance while jumping. It feeds on invertebrates, especially caterpillars and beetles, and grass seeds.

3. **Woodland Jumping Mouse**: Burrows more than the meadow jumping mouse. It hibernates about one half of its life.

4. **Red-backed Vole:** An extremely common small mammal in Minnesota, it is very nervous and may faint or die if handled excessively.

5. **Meadow Vole:** Uses communal toilets, extensive runways, and can have 17 litters per year in captivity. This widespread vole is the mainstay diet of many carnivores, such as foxes, coyotes, snakes, hawks, and owls.

6. **Short-tailed Shrew:** Only poisonous mammal in the world. It possesses a neurotoxin similar to cobras. Its bite is deadly to its prey, usually snails, earthworms, centipedes, beetles, and occasionally mice and smaller shrews. The shrew's neurotoxin is not lethal to humans but its bite will hurt for several days.

7. **Northern Water Shrew:** It uses stiff hairs on its hind feet for propulsion through water. It is never found further than 30 feet from the water.

8. **Pigmy Shrew:** This mammal weighs no more than a dime and is thought to be one of the rarest North American mammals. It has such a high metabolism that it cannot sleep for any length of time or it will starve. It has a heart rate of 782 beats per minute and breathes 300 breaths per minute.

VIII. Clean Up

Students should help the chaperone clean up the classroom and put all equipment away. The aluminum foil can be recycled at the recycling center in the dorm. All other pieces of the pellets, including the fur and extra bones, should be placed in the garbage container in the classroom. Vacuum the floor and erase the chalkboard. The skull and bone keys go into their appropriate folders and the dissecting utensils go back into their containers. Count each item for inventory

purposes. Count the number of pellets used and report it to the liaison. Clean the room so it looks as it did when you arrived.

IX. Fact Sheet

- There are nearly 150 species of owls worldwide.
- Nineteen species of owls are found in North America, north of Mexico.
- Owls live everywhere except Antarctica and a few remote islands.
- The Elf Owl of the southwestern desert is the smallest owl, standing only 6 inches tall and weighing two ounces.
- Snowy Owls can stand about 2 feet tall and have a wingspan of over 5 feet.
- Although most owls only eat small mammals and birds, the Great Horned Owl will eat skunks, groundhogs, and porcupines.
- A single owl may catch up to 2000 rodents a year. That's 5 or 6 a night.
- One study of 200 Barn Owl Pellets found 454 mammal skulls, among which were 225 voles, 179 house mice, 20 rats, and 20 shrews.
- Pellets are not exclusive to owls. Kites, hawks, falcons, eagles, harriers, and even some robins also regurgitate undigested remains.
- Some Great Horned Owls in the wild have lived up to 27 ½ years.
- A captive Common Barn Owl has lived up to 51 years.

X. Appendix

A. **Equipment** (per kit)

- Owl Pellets lesson plan
- Data Sheets in folder
- Trivia Sheet in folder
- Owl Pellet Study Folder
  - Bone Charts (10)
  - Skull Keys (10)
- Owl wing
- Owl talon
- Skeleton display
- Sample hawk pellets
- Sample owl pellets
- Owl Pellets (22 – Pellets are $3.00; one pellet per two students is recommended.)
- Owl calls CD
- Glue (12) in small tub
- Tweezers (25)
- Probes (25)
- 3 x 5 index cards
- Pencils (25)
- Owl Book
- Owl Pellet Poster (not in kit)

B. Glossary

Binocular: A kind of vision in which both eyes see the same scene so the animal can judge distance and speed.
Clutch: A group of eggs laid by one bird.
Cone cell: A light sensitive cell in the eye that distinguishes color.
Crop: An avian organ, located after the esophagus, that acts as a storage chamber until the stomach is ready to accommodate food. Owls do not have a crop.
Dichotomous Key: A series of statements that helps to identify objects.
Esophagus: The thick, straight, muscular tube down which food passes from the mouth to the stomach.
Facial disc: Saucer-shaped disc of moveable feathers around the hidden ears of owls that direct sound into the ears.
Gizzard: The muscular, first part of the birds stomach, which often contains gravel to help digest food.
Habitat: The place where an animal lives.
Niche: The job and place of an animal in its habitat.
Nocturnal: Active at night.
Ornithology: The study of birds.
Owlet: A young owl.

Pellet: Compressed, undigested parts of prey regurgitated through the mouth.
Regurgitate: Cough up material through the mouth.
Rod cell: A light sensitive cell important for seeing in low light, it cannot distinguish color.

C. Activity and Safety Management. Students will be working with sharp probes and tweezers; stress that they must be responsible and practice safety. Anyone not doing so will not be allowed to dissect an owl pellet. Students who are asthmatic or strongly allergic to animal hair may not want to participate in dissecting because owl pellets contain animal hair, which may cause a reaction. The Owl Pellets activity is a potentially messy activity because of the hair and small bones contained in the pellets. Have the students separate the bones onto one piece of paper and the hair onto another piece for easy cleaning. When hiking to the site to call owls, appoint one chaperone for the front of the group and one for the rear to keep the group together. At least one chaperone should bring a flashlight when the group goes owl calling. You may not want to use it during the hike but it will be available if you need one.

D. References/Resources

Carolina Biological Supply Company; Owl Pellets Study Kit. 1993.

Central Wisconsin Environmental Station; Who Gives a Hoot.

Cooper, Ann C. 1994. Owls On Silent Wings. Denver Museum of Natural History.

Eagle Bluff ELC; Owls Naturalists Program; 1998.

Pellets, Inc. P0 Box 5484, Bellingham, WA 98227.

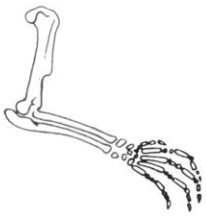
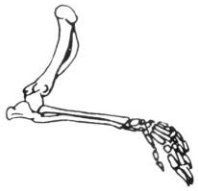
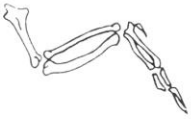
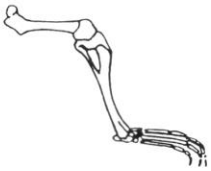
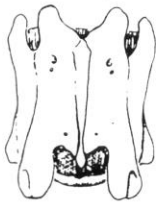
The Atlantic Monthly; November 1992; Owl Pellet; Volume 270, No.5; page 124.

Wolf Ridge ELC; Owl Pellets Activity; 1995.

E. Data Sheets

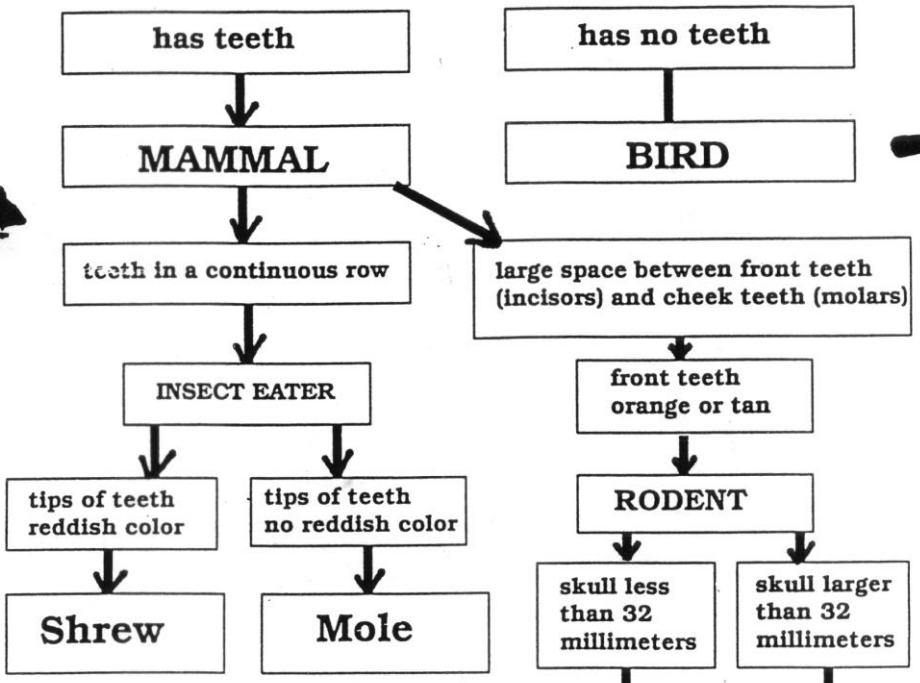
1. Owl Pellet Bone Chart
2. Skull Identification Key
3. Owl Pellet Dissection Data Sheet

OWL PELLET BONE CHART

	RODENT	SHREW	MOLE	BIRD
SKULL				
JAW				
SCAPULA				
FORE LIMB				
HIND LIMB				
PELVIC BONE				
RIB				
VERTE-BRAE	      			

Skull Identification Key

Identify the prey consumed by examining the skulls found in your pellet. First, determine if the skull has teeth. If there are no teeth, then it is a bird skull. If the skull has teeth, then read the statements on the key to determine which is more correct. Follow the arrows to the answer.



Owl Pellet Dissection Data Sheet

STOP! Before dissecting your pellet record the following data:

1. What is the size of your pellet in inches? Length _____ Width _____

2. What is the general color of your pellet? _____

Now, dissect your pellet and record the following data:

Record the number of skulls:

_____ Rodent
_____ Shrew
_____ Mole
_____ Bird
_____ Other

Total

4. Record the number of other bones:

_____ Ribs
_____ Jaws
_____ Pelvis
_____ Scapula
_____ Humerus
_____ Vertebrae
_____ Other

5. Assume that an owl forms one pellet each day. Using the total number of skulls found in your pellet, how many animals would your owl eat:

…in a week? _____

…in a month? _____

…in a year? _____

Hint: 7 days per week, 30 days per month, and 52 weeks or 365 days in a year.

Record the following from the whole class:

6. Total class skulls:

_____ Rodent
_____ Shrew
_____ Mole
_____ Bird
_____ Other

Total

7. Now calculate the percentages of the owls' diet:

_____% Rodent
_____% Shrew
_____% Mole
_____% Bird
_____% Other

Example: If your class had 50 skulls total and 10 were from shrews, then 20% of the owls' diet was made up of shrews.