TITLE	Owl Pellet Dissection
SUBJECTS	Science, Social Studies, Math
GRADES	Directly engages grades 4, 7, Biology, and Environmental Science; can be modified to fit grades 2-12
DURATION	One class period; approximately 35-45 minutes
GROUP SIZE	Up to 30 students
SETTING	Indoors or Outdoors
KEY VOCABULARY	Canines, incisors, molars, cranium, diastema, mandible, skull, food web, dichotomous key, carnivore, omnivore, herbivore
GEORGIA STANDARDS	**Grade 4:** S4L1a-d, SS4E1a **Grade 5:** S5L1a **Grade 7:** S7L1b, S7L4a-d **Biology:** SB5a-e **Environmental Science:** SEV1a, SEV2c-d, SEV4a-c **Mathematics:** MGSE2.MD.10, MGSE6.EE.9 Activity can be modified to meet Georgia Standards of Excellence for a variety of grades and subjects.
SKILLS	**IPS.1:** Compare similarities and differences **IPS.10:** Analyze artifacts **IPS.11:** Draw conclusions and make generalizations **IPS.12:** Analyze graphs and diagrams **IPS.14:** Formulate appropriate research questions
OBJECTIVES	Students will be able to: - Identify the origin of an object and its contents - Draw conclusions and make generalizations based on data collected - Analyze and interpret data collected through dissection - Think logically and express thoughts orally - Graphically represent data collected
MATERIALS	Items needed for this activity are: - gloves (1 pair per student) - goggles (1 pair per student) - owl pellets (1 per student or per pair)

	- tweezers (1 per student) - hand lens (1 per student) - napkin or paper towel (1 per student) - Bone Sorting Guide* (1 per student or per pair) * *Several versions of a chart can be found with an internet search.* - What Do Owls Eat? worksheet (1 per student) - Owl Pellet Dissection Procedure worksheet (1 per student) For differentiation: - Dichotomous Keys of Barn Owl Prey (1 per student or per pair)
BACKGROUND	Owls swallow their prey whole and are unable to digest some products such as bones, feathers, and fur. They regurgitate these indigestible materials in a compacted mass called an owl pellet. By dissecting an owl pellet, it is possible to determine the diet of the owl. Knowing this information gives clues to what species are living in a certain area and in what capacity. President Carter's family may have used owl pellets to study what type of rodents were living on the farm. The owl pellets used in this lesson are collected from common barn owls (Tyto alba). Barn owls are the most widespread species of owl and one of the most widely distributed vertebrate species on the planet. Barn owls hunt in open areas such as fields and grasslands. Owls eat a mix of small creatures that they catch in field areas. Most of their diet consists of small mammals, but they may also eat small birds, bats, and even small reptiles. Their diet varies regionally based on what is readily available to them. For example, owl pellets from Northwestern United States most frequently contain the remains of voles, which are abundant in the area. On the other hand, voles are absent from parts of the Southeast; in those areas, rats are more commonly found in owl pellets. On the farm where Jimmy Carter grew up, owl pellets would have been analyzed to understand what rodents and other small animals were living on and around the farm. Barn owls provide a service to the farm by removing pest species. Scientific Terms: • canines: the long, pointed teeth next to the incisors; general used for piercing and tearing. • incisors: the front-most teeth in the jaw; generally used for nibbling. • molars: the backmost teeth in the jaw; generally used by humans or rodents for grinding. • cranium: the part of the skull that surrounds and protects the brain. • diastema: the large space between the incisors and molars; found only in herbivores. • mandible: the lower jaw. • skull: the structure that includes both the cranium and the mandible together.

	• carnivore: an animal that eats the meat of other animals. • omnivore: an animal that eats both plants and other animals. • herbivore: an animal that eats only plants.
PROCEDURE	**Part 1: I observe, I wonder** Pass out owl pellets to each student or pair of students. Have them unwrap their pellet and set it down. All students should wear appropriate safety gear including gloves and goggles when completing this lesson. Using the *Owl Pellet Dissection Procedure* worksheet, have students complete the first section, "I observe, I wonder". Students should make observations about their owl pellet and then write questions that they have about them. This should take about 2-5 minutes. **Part 2: Background Information** Once students have completed their "I observe, I wonder" section, introduce students to background information on barn owls and how owl pellets are formed. Include information about how barn owls hunt in open fields and eat small animals. Go over the common prey species of barn owls. Explain to students that dissecting an owl pellet is a good way to collect data on what an owl has eaten. Be sure to address the misconception that owl pellets are "poop". Instead, instruct students that owl pellets are indigestible materials that are regurgitated. You may use the optional PowerPoint to instruct students. **Part 3: Owl Pellet Dissection** Inform students that they will be dissecting the owl pellets to identify what species the owl ate. Students will follow the procedures on their *Owl Pellet Dissection Procedure* worksheet. Go over these procedures as a class to ensure that students know what they will be doing. Inform students that these pellets have been heat-treated to sterilize them. However, to be on the safe side, they will have to wash their hands and clean their work area after the dissection. They should not eat, drink, or put their hands in their mouths during the activity. Show students the tools they will be using for the dissection, the tweezers and hand lens, and pass them out. Give each students a napkin or paper towel to place their bones on. Give students approximately 30-45 minutes to dissect their pellets either individually or with a partner. As they dissect, you should monitor and help to keep them on task. **Part 4: Analysis of Owl Prey** Tell students that they have collected the data of what owls eat by dissecting their owl pellets; now they need to analyze their data. To do this, students will need to identify the skulls and bones of the prey species in their owl pellets. Introduce the *Bone Sorting Guide* to students. Optionally, you may choose to utilize a dichotomous key as a form of enrichment (see the Differentiation / Extension section below). Go over vocabulary that students will use in identifying their prey (canines, incisors, molars, cranium, diastema, mandible, skull, carnivore, omnivore, herbivore). Using the *What Do Owls Eat* worksheet, students should record the number of skulls from each species that they find. As a class, create a data table on the board to show what number of each species was found by the class. Students should make tally

	marks for each species they found in their pellet. Depending on the level of students, calculate the fraction and percentage of each species found by the class. Students should record this data on the *What Do Owls Eat* worksheet. Once data is recorded, students should create a bar graph showing the percentage of each species found on their worksheet. Based on the class data, have students answer the question, "Which prey species was eaten the most by the owls?" Next, have students discuss the question, "Did each student find the same prey species in their pellet? Why or why not?" Students should recognize that each owl had a different diet based on what was available to it. Engage students in a class discussion about the data table and bar graph. Ask students if they notice any patterns in the data. Ask students to make a prediction, based on the pattern that they see in the data, which prey species might be the most common in the owl's environment.
EVALUATION	The instructor can conduct a formative assessment by evaluating the students as they work on their dissections as well as through discussion while collecting class data. The instructor could use the data tables and bar graphs created on the *What Do Owls Eat* worksheet as a summative assessment.
DIFFERENTIATION/ EXTENSION	The use of a dichotomous key to identify animals that the barn owl consumed may increase the level of rigor in this activity. - A dichotomous key is a tool used to identify different organisms, based the organism's observable traits. - In this activity, data from the owl pellet will be analyzed with a dichotomous key to identify the prey species found. For younger students or lower-level learners, instead of graphing the percentages of each species found, they could graph the total number of each species found. This eliminates the need to create fractions and calculate percentages. A pictograph can also be used in place of a traditional bar graph.

Owl Pellet Dissection Procedure

Part 1: I Observe, I Wonder

Spend 2-5 minutes analyzing your owl pellet without touching it. Record the things you observe and questions you have about the owl pellet in the space below.

I Observe…	I Wonder…

Part 2: Materials

- gloves (1 pair per student)
- goggles (1 pair per student)
- owl pellets (1 per student or per pair)
- tweezers (1 per student)
- hand lens (1 per student)
- napkin or paper towel (1 per student)
- *Bone Sorting Guide* (1 per student or per pair)
- *What Do Owls Eat?* worksheet (1 per student)

Part 3: Owl Pellet Dissection

Today you will be dissecting an owl pellet. You will find skulls and bones from the animals the owl ate inside the pellet. Place a check mark next to each step as you complete it.

_____ Step 1: Using your fingers, gently pull the owl pellet into two halves.

_____ Step 2: Use the tweezers to pull apart the soft material surrounding the skull and bones.

_____ Step 3: Place any skulls and bones you find on your clean paper napkin.

_____ Step 4: Observe the bones with your hand lens and try to match the mandibles with their craniums.

_____ Step 5: Using the *Bones Sorting Guide*, match the bones and skulls to determine what prey your owl ate.

_____ Step 6: Clean your work area according to your teacher's directions and wash your hands.

_____ Step 7: Record the number of skulls for each prey species you find on the *What Do Owls Eat?* worksheet.

What Do Owls Eat?

Part 1: Data Table

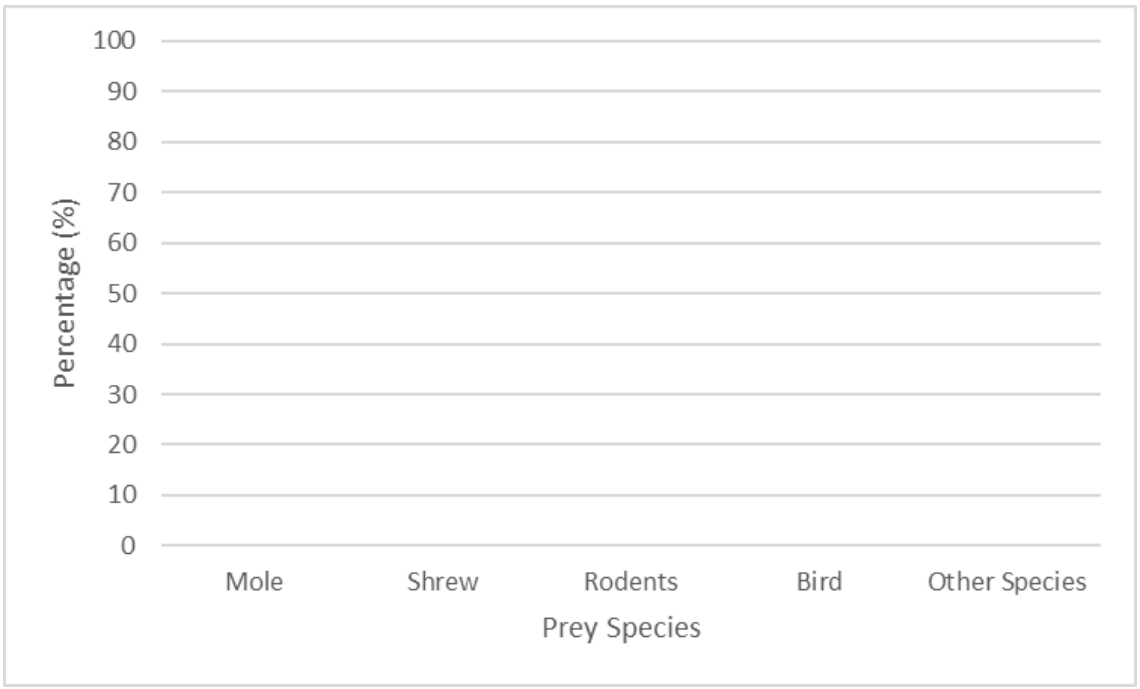
Record the number of skulls you find from each species in your owl pellet.

Prey Species	Number of Skulls
Mole	
Shrew	
Rodents	
Bird	
Other Prey	
Total	

Part 2: Class Data

Record your class data here and then calculate the percentage of each species found. Graph your results.

Prey Species	Total Number of Each Species	Fraction of Barn Owl Diet	Percentage of Barn Owl Diet
Mole			
Shrew			
Rodents			
Bird			
Other Prey			
Total			



What prey species was eaten the most by the owls? _____

Dichotomous Key for Identification

While closely observing your skull, follow the steps until you reach the species of prey found in your owl pellet. Make a decision at each step, choosing the answer that best describes the characteristics of your skull.

If you have the **cranium** or **mandible**, follow these steps to determine the identity of the prey:

Step 1:

If it has a beak and no teeth, it is a **bird**.

If it has teeth, go to step 2.

Step 2:
If it has a diastema (the large toothless space between the incisors and molars), go to step 3.

If it has no diastema, go to step 5.

Step 3:

Pull one molar. Look at the side of it with a magnifying lens.

If the molar looks the same from top to bottom and has no roots, go to step 4.

If the molar has cusps on the top and individual roots on the bottom, it is a **rodent**.
(If the skull is more than 25mm, it is a rat; if the skull is less than 25mm, it is a mouse.)

Step 4:

If there are no distinct canine teeth and, instead, 2 incisors at the front of the mouth, followed by a row on each side of sharp pointed teeth, go to step 5.

If the mandible has distinct canine teeth present, or if the upper jaw has distinct canine teeth with a notch or gap between the incisors, it is a **bat**.

Step 5:

If the teeth are reddish-brown on the tips, it is a **shrew**.

If the teeth are white, it is a **mole**.