Lesson Four:
PREDATOR/PREY RELATIONSHIPS

This lesson will provide students with an opportunity to examine predator/prey relationships by dissecting owl pellets.

Part I. LESSON OVERVIEW

A. Learning Objectives

Upon completion of this lesson students will be able to:

- Perform an owl pellet dissection.
- Identify owls' prey through the use of bone charts and mammal field guides.
- Solve a multi-step mathematical problem to determine how much prey an owl will eat in one day, one week, and one year.

B. Correlation to State and National Standards and Guidelines

See chart

C. Textbook Compatibility

See chart

D. Materials

- Bone charts (laminated)-1 per pair
- Dissecting (tin) trays-1 per pair
- Forceps--1 per group
- Mammal field guides-1 per pair
- Hand lens-1 per pair
- Owl pellets-1 per pair
- Owl poster,
- Soap or hand sanitizer
- Surgical gloves (optional)
- Owl photographs, specific to where you live (optional)
- Recording of owl calls (optional)

E. Advance Preparation

Owl pellets provide a way to see the diet of owls. Owl pellets need to be ordered in advance. A reputable biological supply for owl pellets is Niles Biological. Owl pellets that are not cleaned

properly could, theoretically, contain Hanta Virus, a rare and dangerous disease. Students should wash their hands after the exploration. Strictly enforce no eating/drinking during this lesson.

Owl pellet bone charts and owl food chain posters are available from Niles Biological Supply Company. Laminate these materials prior to use.

Find and laminate images of owls specific to where you live. You may wish to do some background reading on the different species of owls in order to excite students with some fun facts about these predators. Also, if you want to play owl calls you must either provide your own AV equipment or communicate with the classroom teacher prior to the lesson.

F. Key Vocabulary

HYPOTHESIS An educated guess.

OWL PELLET A combination of fur and bones (and sometimes feathers) from prey that an owl coughs up.

PREDATOR An animal that hunts, kills, and eats other animals.

PREY An animal that predators hunt and eat.

G. References

Brewer, Richard. *The Science of Ecology*, 2nd ed. Ft. Worth: Saunders College Publishing/Harcourt Brace College Publishers 1994, 310-313.

Campbell, Neil A. *Biology*, 4th ed. Menlo Park, CA: The Benjamin/Cummings Publishing Company, Inc., 1996, 10-11, 1145-1148, 1150-1152.

Miller, G. Tyler. *Living in the Environment*, 10th ed. Belmont, CA: Wadsworth Publishing Company, 1998, 105.

PHASE II: LEARNING CYCLE APPLICATION

Phase One: Exploration (E)

1. Introduce the lesson and explain the exploration activity to the class. For example:

   In groups of two, you will dissect owl pellets. The owl pellets that you will dissect today are clean and safe to touch. These pellets are dry, very hard, and feel kind of like a combination of dried grass and mud.

2. Explain the different tools that they will use in the exploration.

   - ***Owl pellet:*** *An owl pellet comes from the forest floor. Through today's exploration, you'll begin to understand what an owl pellet is. In the meantime, I am going to tell you that an owl pellet is not poop! You will use your hands and other dissecting tools to explore the owl pellets. Remember*

that as with anything you explore with your hands, it's important to keep your fingers out of your eyes, mouth and nose as well as your partners' eyes, mouth, and nose. (Everyone giggles again.)

Note: *We recommend that you clearly state that owl pellets are not owl poop (the class will giggle) because this is an assumption many of them will make. If they think it might be owl poop, they will not want to touch the pellet.*

- ***Forceps****: This is a forcep; a tool that scientists use to perform careful dissections. Your fingers will work well for a lot of the dissecting you will be doing today. The forceps are tools to remove delicate and small treasures from your owl pellets. This is a sharp tool and must not be pointed or poked at anyone or anything other than the owl pellet.*
- ***Hand lens:*** *This tool can be used to look more carefully at and identify the delicate and small treasures found in your owl pellets.*
- ***Tin tray:*** *You will break apart and dissect the owl pellet in the tray.*
- ***Construction or scrap paper:*** *You can place the treasures you uncover from the owl pellet on the paper for easier observations.*

3. Divide the class into pairs and designate a place for each pair of students to work.

4. Distribute an owl pellet, forceps, a hand lens, and tin tray to each pair of students.

5. At first, students will probably be afraid to touch the owl pellets. They will be more likely to engage in the exploration if you circulate through the class and model how to begin the process.

6. When the students have discovered bones inside the owl pellets, hand out the bone charts and mammal field guides.

7. Explain the following to the children:

   Match the bones you have found in the owl pellet with the pictures on the charts. Determine what type of animal or animals you found in the owl pellet. When you figure out what type of animal you have found you can use the field guide to see exactly whose bones you found. Follow the written directions in your journals.

8. Circulate through the classroom to observe, answer questions and help where needed. Students will likely need help with the mammal field guides. Remember: this is the student-centered phase of the learning cycle! The best way to respond to students' questions at this point is with guiding questions that will move them towards further exploration.

9. Show groups individually how to use the mammal guides.

   - Show the students the skull photo plates beginning on page 248 and instruct them to find the skull photo that perfectly matches the skull they found in their owl pellet.

   - Next, show them that the numbers under the skull photos corresponds to the list of names on the opposite page. Pick a random example and guide them through the process, but let them do it for their own skull.

   - Next, show them that the number after the name refers to the page in the guide that describes the animal (ignore the actual text).

- Finally, show the students that on the first line of the descriptive paragraph at the far right margin is a Pl. # that refers to the illustrated plate where they will find a picture of the animal they are holding.

8. After you have allowed 30 minutes for exploration, have the children place their bones in a small bag or envelope if they want to keep them. Instruct the students to place all other materials in the tray and choose a few folks to collect the equipment.

9. Ask students to wash their hands thoroughly and finally, to return to their seats.

Phase Two: Concept Introduction (CI)

1. Discuss the students' observations from the exploration by reviewing their responses to the questions posed in their journals. Remember to wait 5-10 seconds before calling on anyone in order to give everyone an opportunity to process the question asked.

2. Define key vocabulary. Write the terms on the board and have the class read the definitions out loud.

3. First, define PREDATOR. *A predator is an animal that hunts, kills and eats other animals.*

4. Next, define PREY. *Prey is an animal that predators hunt and eat.*

5. Define OWL PELLET. *An owl pellet is a combination of fur and bones from a prey that an owl coughs up.* Use the owl pellet poster to explain how the pellet is formed.

6. Explain to the class that during the exploration activity they encountered evidence of predators and prey. Ask the children questions specific to the predator/prey relationship they explored:

   - *In the exploration activity, were owls an example of predators or prey?*
   - *What types of prey did you discover in the exploration activity?*

   Note: Some groups may find insect parts in the owl pellets. These parts represent food eaten by the prey that was eaten by the owl. Use this to illustrate the fact that some animals are predators and prey. Ask the class for examples of such.

7. Explain the math activity to the class:

   Today we dissected owl pellets. Now we're going to use mathematics to estimate how much prey an owl might eat in one year. Math is an important tool for all areas of science. We will use the owl pellet you examined as a way to help us figure this out.

8. Use the journal to help you guide this activity.

9. First, ask the children to record how much prey they found in their owl pellets.

10. After they have determined the number of prey they found in their owl pellets, ask the students to hypothesize how much prey this owl might eat in a year. Remind students a hypothesis is an educated guess.

11. Next, ask the students to calculate how much prey this owl might eat in one day. Use the following chart to aid you in facilitation.

12. After the children have calculated how much prey this owl might eat in one day, ask the children to calculate how many prey this predator might eat in one week. Use the following chart to aid you in facilitation.

13. Finally, ask the students to calculate how much prey this owl might eat in one year. Use calculators where appropriate.

14. Discuss the results with the students. Were their hypotheses correct?

    Note: This is an excellent opportunity to bring in the needs of all animals: food, water, and habitat (or space). The students will be surprised at how much prey an owl might eat in a year. Use this to illustrate that predators have to eat LOTS of prey to survive. Ask the students what the prey (the animals they found in the pellets) need to survive. Ask them if the prey could survive in a parking lot, in their school, on the side of a highway. You can lead the students to realize that the prey need suitable habitat and, thus, so does the predator. They need space to carry out their relationship (owls need a large healthy forest that can produce food for the small animals that the owls feed on).

15. If time allows, show pictures of owls that live in your area and listen to their calls.

Sample Owl Pellet Calculation Chart

How much prey might this owl eat in one year?

Number of days in a year	365	365	365	365	365
Number of prey found in pellet	x 1	x 2	x 3	x 4	x 5
Number of prey eaten each year	365	730	1095	1460	1825

Phase Three: Concept Application (CA)

EcoTeam Application Lesson and *Roots & Shoots Service-Learning Project*, please see corresponding sections of website.

PART III. BACKGROUND INFORMATION FOR FACILITATOR

A. General

Energy is sometimes described as the basic currency of ecosystems. Energy enters most ecosystems as sunlight. (The only exception to this that we know of are the newly discovered ecosystems associated with deep sea hydrothermal vents in which chemical energy in hydrogen sulfide is utilized by chemosynthetic bacteria.) For those systems dependent on sunlight, the sun's energy is stored in the bonds of carbohydrates produced by photosynthesizing producers which consist mostly of plants.

The sequence of organisms through which energy flows is a FOOD CHAIN. Ecologists assign each of

the organisms in a food chain to a feeding level, or TROPHIC level, on the basis of their main source of nutrition. The trophic level that ultimately supports all others consists of AUTOTROPHS (self-feeders), or the PRIMARY PRODUCERS in an ecosystem. Most producers are photosynthetic organisms that use light energy to synthesize sugars and other ORGANIC COMPOUNDS such as cellulose and protein. All other organisms in an ecosystem are HETEROTROPHS (other-feeders), or CONSUMERS that directly or indirectly depend on the photosynthetic output of producers. For example, HERBIVORES eat algae and/or plants and are thus PRIMARY CONSUMERS. The next trophic level of SECONDARY CONSUMERS consists of CARNIVORES that eat herbivores. Other carnivores are tertiary consumers and may in turn eat these carnivores. Some consumers, the DECOMPOSERS, feed on the dead bodies of plants and animals.

Energy is transferred from one trophic level to another. The length of food chain, and the total biomass of each trophic level is limited by the amount of energy that gets transferred from one level to the next. In general, each step in the food chain is only about 10% efficient. That is, only about 10% of the energy in the chemical bonds of plants is passed on to the primary consumers. The rest is lost as heat. Thus, as a rough rule of thumb, the biomass of each level of the trophic pyramid is only about 10% of the previous level. Thus, top-level carnivores are rare.

So, energy enters ecosystems, usually as sunlight, then flows through it. With each step in the food chain, much of the energy is lost as heat, and the process ends with decomposers. Energy flow, then, is not cyclical like water, carbon, or nitrogen. Ecosystems are always dependent on new energy entering the system.

B. Humans and Energy Flow

Humans have an unusual place in the ecosystem feeding at multiple levels in the food chain. In the course of human history, it is only recently that humans have manipulated energy flow in ecosystems so dramatically through agriculture. For 500,000 years humans have been hunters and gatherers. It's only in the last 4,000-10,000 years that humans made the gradual switch from hunting and gathering to farming. Humans are continually finding ways to increase efficiency through mechanization, chemical use, and higher-yield varieties of plants. Increasing food yields by these methods usually requires higher energy inputs.

C. Environmental Citizenship

The single most important ecological concept, and THE guiding concept of the EcoTeam is that everything is connected to everything else. TROPHIC CASCADING is the idea that direct effects at one trophic level indirectly affect trophic levels below. An entire community structure may be affected. For example, OVERFISHING often removes top-level carnivores (PISCIVOROUS fish or fish-eating fish) from aquatic ecosystems. Indirectly, piscivorous fish may determine the presence or absence of algal growth. An abundance of piscivorous fish in an aquatic ecosystem may depress the population of PLANKTIVOROUS fish (fish that eat zooplankton). As a result, ZOOPLANKTON populations may increase while PHYTOPLANKTON crops decrease. See the chart below.

Humans have an unusual place in the food chain because they feed at multiple levels. As the overfishing example illustrates, humans also have an exceptional ability to exert influence over entire food chains. One of the greatest threats to all species is the reduction of habitats as humans increasingly occupy and often degrade more of the planet.