

Owl Pellet Food Webs: A Model of Energy and Mass Transfer

A Carolina Essentials™ Activity

Student Worksheet



Overview

Owls are birds of prey. They hunt at night and swallow their prey whole or in large pieces. Once swallowed, the prey moves to the owl's stomach. The specialized stomach includes an upper region called the **proventriculus** and a lower portion called the **ventriculus** or **gizzard**. Prey is partially digested by acids and enzymes in the upper stomach. The remains move to the gizzard. Indigestible parts of the prey—hair, bones, teeth, and feathers—are compressed into a matted pellet. The pellet re-enters the proventriculus and stays there until the owl regurgitates it. The common barn owl produces 1 or 2 pellets per day.

Rodents such as rats, mice, and voles are the main food source for barn owls. Because rodents are most active at night and barn owls are nocturnal hunters, they are perfect prey for the owls. Barn owls are such efficient rodent predators that farmers and ranchers in some areas use artificial nests on their farms to attract the owls.

Owl pellets can be used to construct a food web. Scientists study pellets to discover regional, seasonal, and habitat differences in owl prey. Pellets also reveal information about the relative numbers of small animals found in an owl's feeding area. One study of 200 pellets from a barn owl found 454 mammal skulls, which included 225 voles, 179 house mice, 20 rats, and 20 shrews.

Essential Question

How do energy and mass flow through a food web?

Activity Objectives

1. Use owl pellets to model a food web.
2. Calculate energy transfer and biomass at each trophic level of a barn owl food web.

Activity Procedures

1. Using the information in the overview or the owl pellet dissection results, construct a simple food web for a barn owl. Label the trophic levels and class of consumer. Include the sun as the energy source for plants.
2. A barn owl's diet is about 50% voles, 40% mice, 5% rats, and 5% shrews. Assume the barn owl is regurgitating 2 pellets a day and each pellet contains 4 skulls. Determine the number of each type of animal the owl consumes during a 24-hour period. Use only whole numbers. Place the numbers on the data table. **If you completed the owl pellet dissection, record the actual number and type of animal consumed. Get data from another group to represent the second pellet.*
3. Use the diet chart and complete the calculations for the table below.



SAFETY REQUIREMENTS



MATERIALS (PER PAIR)

- For owl Pellet dissection**
- Owl pellet
 - Wooden probe
 - Forceps
 - Hand lens
 - Disposable plate, tray, or newsprint to cover the work surface
 - Gloves
- For food web activity**
- Calculator
 - Colored pencils (optional)

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Primary Diet of Barn Owls

Barn owl average mass = 400–700 g

Food source	Consumer classification	Food consumed	Average mass	Consumption requirements
VOLE	Herbivore	Plants, roots, tree bark, tubers, nuts, and fruits	28 g	Voles eat 100% of their body weight daily.
MOUSE	Omnivore (primarily herbivore but will occasionally eat invertebrates and carrion)	Seeds, grain, invertebrates, and carrion	45 g	Mice eat 15% of their body weight daily.
RAT	Omnivore	Grains, fruit, vegetables, invertebrates, vertebrates, and carrion	300 g	Rats eat 8% of their body weight daily.
SHREW	Carnivore	Insects, slugs, spiders, worms, amphibians, and small rodents	10 g	Shrews eat 250% of their body weight daily.

Data

Barn Owl Food Web					
Animal consumed	Number consumed	Average mass of animal (g)	Total mass (g)	Percentage of diet	Food consumption required
		Grand Total		100%	

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Data Analysis

1. What is the total daily mass of food consumed by the owl (grand total)?
2. Calculate the percentage of mass each type of animal contributes to the owl's total daily consumption and write it in the table above.
3. Assume the owl weighs 550 g. What percentage of the owl's body weight did the owl consume?
4. Use the consumption requirements column in the table above and calculate the mass of food each animal the owl consumed needs to eat.
5. Write the total mass of food consumed at each trophic level on the food web.

Analysis and Discussion

1. Use the food web to identify the pattern in food mass consumed for the primary and secondary consumer trophic level.
2. The sun provides 100% of the energy needed by plants. Only 10% of energy is transferred from a lower to higher trophic level. What percentage of the initial energy does the owl receive? Show the calculations.
3. Using the laws of conservation of matter and conservation of energy, how can the pattern be explained?
4. If an owl were in a setting where it could consume only rats, how would that change the food web, the number of trophic levels on the web, and the percentage of initial energy that is transferred to the owl?