OVERVIEW OF ACTIVITY

- Owl pellets are the undigested remains of an owl’s prey. Different from scat (a.k.a. poop) because they’re regurgitated, pellets contain mainly bones, fur and sometimes feathers. Ornithologists (bird scientists) and ecologists are able to understand many qualities by dissecting owl pellets, such as diet of owls, prey and predator populations, and biodiversity in different regions. By dissecting an owl pellet, we can understand a lot about these amazing birds of prey.

- 5 minutes to 1 hour

OBJECTIVE OF ACTIVITY

By doing this experiment, visitors will:
1. Understand how owl pellets are formed
2. Construct a skeleton and identify major bones and identify the prey species
3. Recognize the ecological role of owls as top predators
4. Employ aspects of inquiry in the process

TARGET AGES
Ages 6 and up

TEACHING POINTS / THEMES

- Predator/prey relationships of owls – pellets tell us what they eat
- Morphology (form and structure) of animals – putting together a skeleton from bones

EDUCATIONAL STRATEGIES

- Owl pellets are fascinating because so many discoveries come with the poking and prodding through the nugget of fur and bones. Some may be leery of interacting with “owl vomit” (and some may even think it’s scat), but if approached as an investigation that’s cool and interesting, visitors will become engrossed quickly. Stress that the pellets do not carry any diseases or smell because they are sterilized with heat and sometimes irradiated. If wearing gloves will help, then allow the visitors to do so. Also, let them get hands-on with the pellet, and don’t do it all for them. *Let it be their discovery!*
SET-UP

You will need:
- At least 1 un-dissected owl pellet
- Cookie Tray to dissect on
- Vole stick sheet to put on tray
- Wooden Probes
- Plastic Forceps
- Magnifying glasses
- Bone chart poster of prey
- Food chain poster
- Barn Owl mount (for reference)
- Owl/Raptor Books

What to do:
1. Set-up the table with Barn Owl skeleton mount, posters on the folding easels, a few books (Owl Puke plus a few more)
2. Set out up to 6 trays, each with: a vole stick sheet, a pair of forceps, one wooden probe, a magnifying glass, and half of a large pellet or a whole small one.
3. When visitors sit down, give some natural history of the Barn Owl (*Tyto alba*). For example, classification as raptors, habitat, prey, species, range, etc. Also, begin to incorporate aspects of inquiry by asking questions like: “What do you think this is?” “How do you think this is formed?” “Why does an owl make this?” or “What do you think might be inside?” See “Things to Think About” section for further question ideas.
4. Now begin to dissect the pellet by separating the fur from the bones with fingers, wooden probes and forceps. Place the fur/feathers in one pile and the bones in a separate pile. (*Remember to assure the pellets are clean but to still make sure to not touch face, to be safe*)
5. As distinct bones emerge, compare them to the bone charts of various prey to identify the prey type.
6. In addition to the prey species, point out the different names of the bones you are finding.
7. As the dissection is underway, ask to get participants to continue thinking about their discoveries. (See section below)
8. The dissection will garner attention from visitors as they pass by. Let visitors come and go as space opens, and just let the new participants jump in and pick up. As participants leave, offer a plastic bag to let them take some of the bones as a souvenir (though not all because you want to keep some to show the next participant).
9. Use each pellet until: a) most of the bone have been taken home; or b) they are completely taken apart and you can no longer squish them into a pile. Try to get 4-5 visitors out of 1 pellet.
10. Clean up: Fur, feathers, and left-over bones may be disposed of in the trash. Spray table with disinfectant. Put away all other resources. Make sure to restock any disposable materials.

Always ask a staff person before starting this activity. Make sure you have the time to properly set up, facilitate, and clean up this activity.
Things to think about/Questions to ask:

- *Are owls the only animals that form pellets?* Some biologists believe that most, if not all, birds may produce pellets in some fashion or at some time. Birds known to produce pellets include: grebes, herons, bitterns, cormorants, rails, gulls, terns, shorebirds, kingfishers, crows, jays, ravens, dippers, wagtails, shrikes, thrushes, flycatchers, warblers, swallows, and swifts.

- *Since many birds form pellets, what kind of items would you expect to find in the pellet of a sea gull? Or any other type of bird?* Remember, pellets are formed from the un-digestible remains of what birds eat, and from the food they find in their habitats. A gull, for example, might have fish bones or sea snail shells or anything hard like that. One interesting discovery might be finding human-created trash in the pellet of a gull! Conversely, if a robin eats a worm, we would find no evidence of this in a pellet, because a worm has no hard body parts!

- *Why do owls form pellets?* Owls are raptors, and therefore have a sharp beak to tear their prey into pieces or else swallow them whole, but it’s too weak to crush the bones. This means they have to swallow hard-to-digest parts, such as fur, feathers and bones. Unlike most other birds owls have no crop, and the food passes straight into the foregut (they do not posses a true stomach). The acid in the owls gut is rather weak with a pH of 2.2 - 2.5 which is the same as vinegar; compare that to diurnal birds of prey which have a pH of 1.3 - 1.8, which is approaching the pH of concentrated hydrochloric acid. This means that only the soft tissues are digested, the bones and even fur and feathers remain virtually intact.

- *How do owls form pellets?* There are three main steps –
  1. After an owl swallows a meal, it travels down the esophagus, then through the proventriculus, and finally into the gizzard. In the gizzard, the meal is separated into two parts - those that are digestible and those that are not. Digestible material continues to pass through the owl's digestive tract. Material that is not digestible are formed into a rounded pellet.

  2. After the gizzard has formed the pellet, it then pushes the pellet back up into the proventriculus. Here the pellet is stored for several hours. Before the owl eats another meal, it must regurgitate the pellet inside the proventriculus (since this would block the next meal from going to the gizzard).

  3. The final step for the owl is regurgitating the pellet. While the owl is regurgitating the pellet, it looks like it is having difficulty breathing. Once the pellet is ejected, the owl settles back into a comfortable position.

- *Why would ecologists/ornithologists want to study pellets?* What kind of information can we learn from pellets about owls in a particular habitat? Ecologists learn about how many owls might be in a particular area, the species of owl (size, shape and contents are the main indicators), and the types of prey species in that particular habitat. This is also an indication of species biodiversity in that habitat.
• **What can you say about the mammal/prey population in the area were the pellet was found?** Do we need more pellets to find out? In any given area, if many pellets are found, that indicates there is a healthy population of prey. If there are a lot in any area, there might also be many owls. The more prey, the more predators. If for some reason there are not many predators (for reasons such as no habitats for the owls, like trees/nesting habitats being removed), then the prey populations would get out of control.

• **Are owls beneficial in an ecosystem? Would people, like farmers, want to create owl habitats? Why or why not?** Owls mitigate and regulate the populations of rodents and other prey in a given habitat. If the rodent population in an ecosystem goes unchecked, their food resources will be over-consumed. Farmers would want to create owl habitats to regulate the rodent population, which will then protect their crops. Fake owls are already sometimes used to scare away small birds from consuming farmer’s crops.
Questions to Ask:
- Have you ever wondered how birds get rid of bones, fur or feathers of the animals they eat?
- Do you know what owls eat? How can you find out?
- What kind of information do you think you can discover when you dissect an owl pellet?
- Who would want to know what owls eat?
- Where do owls live?

Areas of Content:
- General Ecology
- Predator/Prey relationships
- Food Chains
- Owl Physiology
- Skeletal System

The distribution of Barn Owls in North America

Facts/Background info
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.

Owl Adaptations:

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, knifelike 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.

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.

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.

Other facts about Owls:

• 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.

Further research

• www.eagle-bluff.org
• http://www.owls.org/Information/pellets.htm
• Owl Myth and Folklore links - http://www.cdli.ca/CITE/owl_myths.htm
• Digital morphology of Barn Owls - http://www.digimorph.org/specimens/Tyto_alba/
• Virtual Owl Pellet dissection - http://www.kidwings.com/index.htm
• Barn Owls by Wolfgang Epple