Owl Pellets

This hands-on classroom workshop introduces students to the “ins and outs” of barn owls.

They will have a chance to discover what’s inside the pellet that barn owls leave behind and why they do it!

Recommended Grade Level: 2- 5

liberty science center traveling science program

Owl Pellets

Program Information

NJ Standards:
2009 NJCCCS:
5.3 Life Sciences
- 5.3.4.A Organization and Development
- 5.3.2.B Matter and Energy Transformations
- 5.3.6.B Matter and Energy Transformations
- 5.3.8.B Matter and Energy Transformations
- 5.3.2.C Interdependence
- 5.3.4.C Interdependence
- 5.3.8.C Interdependence
- 5.3.2.E Evolution and Diversity

Learning Objectives:
By the end of the presentation, the audience will know and be able to:
- Learn about the different kinds of owls found in NJ.
- Understand the differences between an owl's senses (vision, hearing, smell) and ours, by mimicking an owl.
- Learn about how owls catch their prey through the observation of an owl skull, talon, and feathers.
- Learn about how owls digest their food and produce owl pellets.
- Dissect their own pellet and examine the remains of different animals consumed by owls.

Program Overview:

In this program students learn about native owl species and their habitats. They will be introduced to raptors and what makes them different from other birds. Students will learn that during an owl's normal digestive cycle their bodies create "owl pellets." The pellets allow the bird to pass parts of their prey they cannot digest, and allow the students a chance to identify the prey.

Special Instructions:

- Work surfaces for students is required
- A television monitor with video hookup
- Also see requirements next page

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Thank you for reserving Owl **Pellets…**

There are just a few things we will need:

1. Space

- This program is designed for a classroom setting and students will need work surfaces; they will work in pairs.
- We will need one large table set up prior to our arrival so we may begin promptly.
- Be advised this space must be available to us no less than 30 minutes prior to our first scheduled class session and for 20 minutes following the conclusion of our final class session.

  (For safety reasons, we cannot have students in the area while we are engaged in the set-up or breakdown of programs.)

2. Parking:

- Safe, legal parking with easy access to our vehicle must be provided.

3. Equipment

- A television monitor with video hook-up is required for this presentation.

4. Restrictions

- The audience size is limited to a maximum of 30.

5. Directions

- If you know that the online directions to your location are inaccurate, please see the next page.

Please contact 201.253.1310 if any of these outlined criteria present an issue.

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Our Traveling Science Educators normally use MapQuest for directions. Most times the directions are accurate. However:
If directions from online services to your venue are inaccurate or difficult to understand please use this form to clearly print or type directions to your location.
If there are any special instructions we must follow once we get to your location please note them below.

Please use this form only. Do not substitute!

Venue (program site): _____ Date of program: _____
Contact name: _____ Telephone: _____

Estimated driving time from Liberty Science Center: _____ Hours _____ Minutes
To ensure our timely arrival we MUST know how long it takes to reach you.

Directions—Must start from Exit 14B of the N.J. Turnpike or the Holland Tunnel

_____

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Please return via mail:

Liberty Science Center
Traveling Science Program
251 Phillip Street
Jersey City, NJ 07305-4699

Or by fax: 201.985.2376 Attn: Traveling Science Program

In case of inclement weather, call 201.253.1280 as early as possible. Please reschedule for the next working day at 201.253.1310
Please return this form no later than two weeks prior to our visit.

Owl Pellets

Pre-Visit Activity Guide

This packet contains some simple classroom activities utilizing everyday, inexpensive (or even free!) items. Please feel free to duplicate these pages as needed - they are sent on plain white paper to ensure the best quality of reproduction.

We suggest that these activities be conducted before our visit in order to familiarize students with some of the concepts we will explore together during our ***Owl Pellets*** presentation. However, they may be performed after our visit to serve as a reinforcement of the concepts covered in the program. It is entirely at the discretion of the individual teacher as to when and if he/she chooses to use these activities, and whether or not all of the activities are appropriate for his/her class.

If you have questions about any of the enclosed activity procedures please feel free to call our Science Educators Associate Director at: 201.253.1472.

We thank you for your interest in our program and eagerly look forward to visiting your school.

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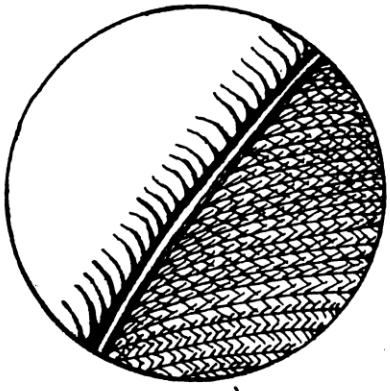
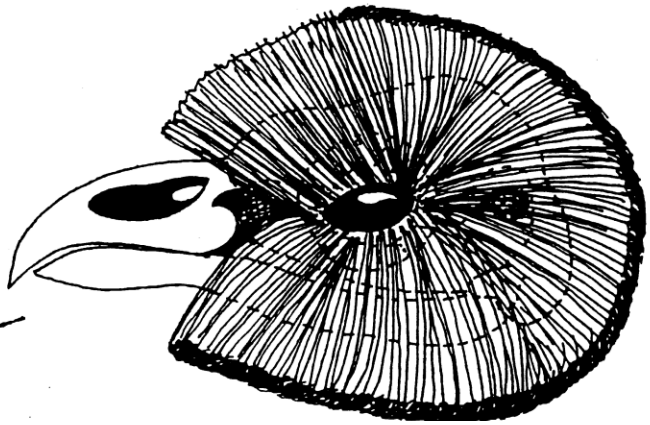
travelingscience program

BARN OWL WEAPONS

SPECIAL FEATURES THAT MAKE BARN OWLS DEADLY HUNTERS

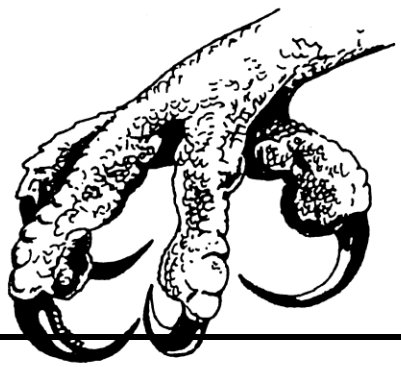


WING: The front edge of an owl's wing is covered with hair-like feathers. These feathers filter the air flowing over the wings and prevent them from whistling. This allows the owl to fly silently and "sneak-up" on its prey.



FACIAL DISKS: Special feathers around each eye form shallow funnels called facial disks. These funnel direct light into the eyes of the owl and allow it to see in almost total darkness.

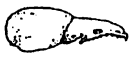
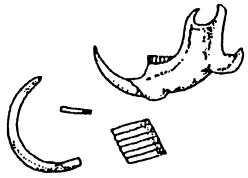
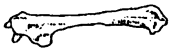
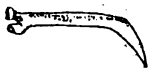
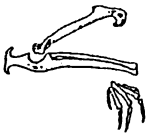
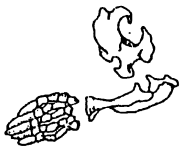
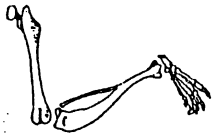
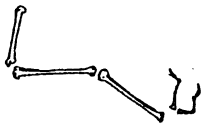
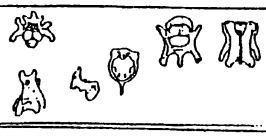
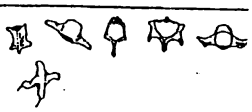
Facial disks also direct sound into the ears. This allows the owl to find its prey by following any noise it is making, even if the prey is hidden under leaves or snow.

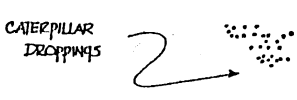


BEAK: The beak of an owl is very strong and dangerous. This is the weapon used to kill the prey by crushing its head or breaking its neck.

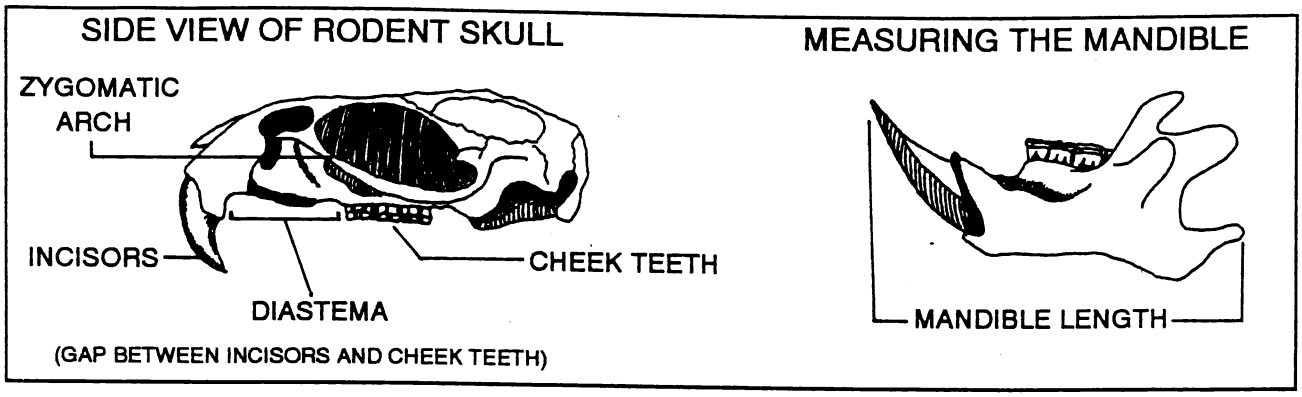
FEET: The feet of an owl are tipped with sharp claws called talons. These talons hook into the prey and prevent it from escaping. The feet are strong enough to kill small prey, or to hold larger prey that are killed with the owl's beak.

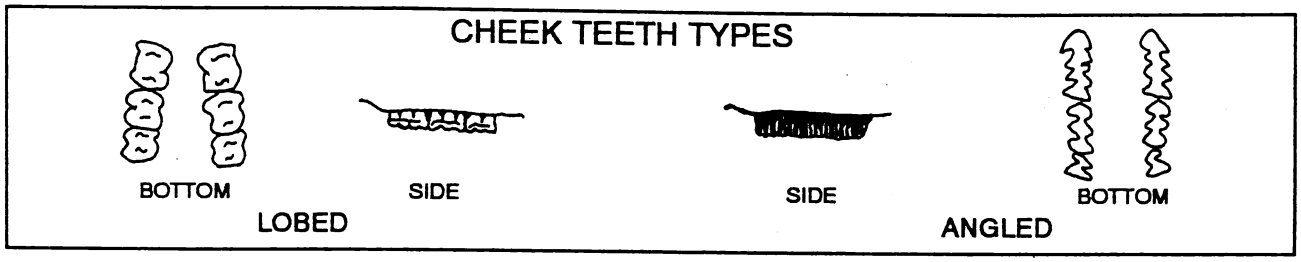
Bone Sorting Chart

	RODENTS	SHREWS	MOLES	BIRDS
Skulls				
Jaws	 Loose Teeth			
Shoulder Blades				
Front legs				
Hips				
Hind Legs				
Assorted ribs				
Assorted vertebrae				



KEY TO SKULLS OF COMMON BARN OWL PREY





1.a.Skull does not have teeth.....Bird
b. Skull has teeth.....go to 2

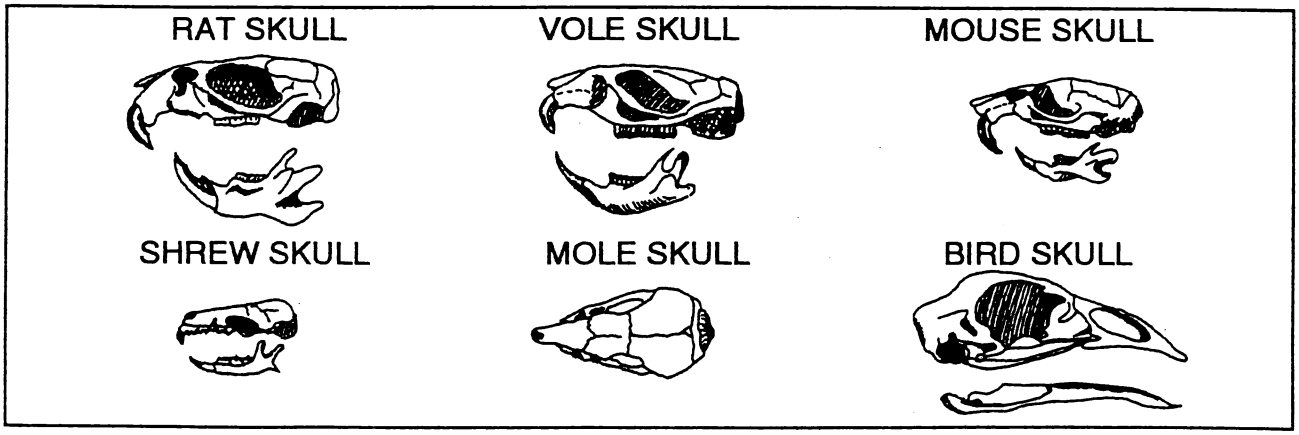
2.a. Skull does not have a diastema .....go to 3
b. Skull has a diastema.....go to 4

3.a. Skull does not have a zygomatic arch.....Shrew
b. Skull has a zygomatic arch.....Mole

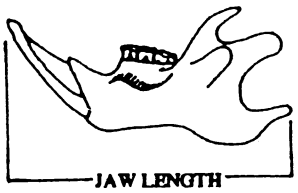
4.a. Cheek teeth are angled.....go to 5
b. Cheek teeth are lobed.....go to 6

5.a. Mandible length 15-20 mm.....Vole
b. Mandible length 25-35 mm.....Pocket Gopher

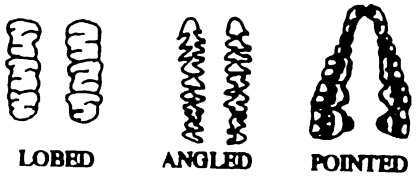
6.a. Mandible length 10-16 mm.....Mouse
b. Mandible length 17-30 mm.....Rat

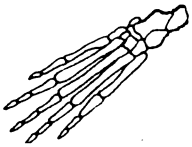


HOW TO MEASURE THE JAW

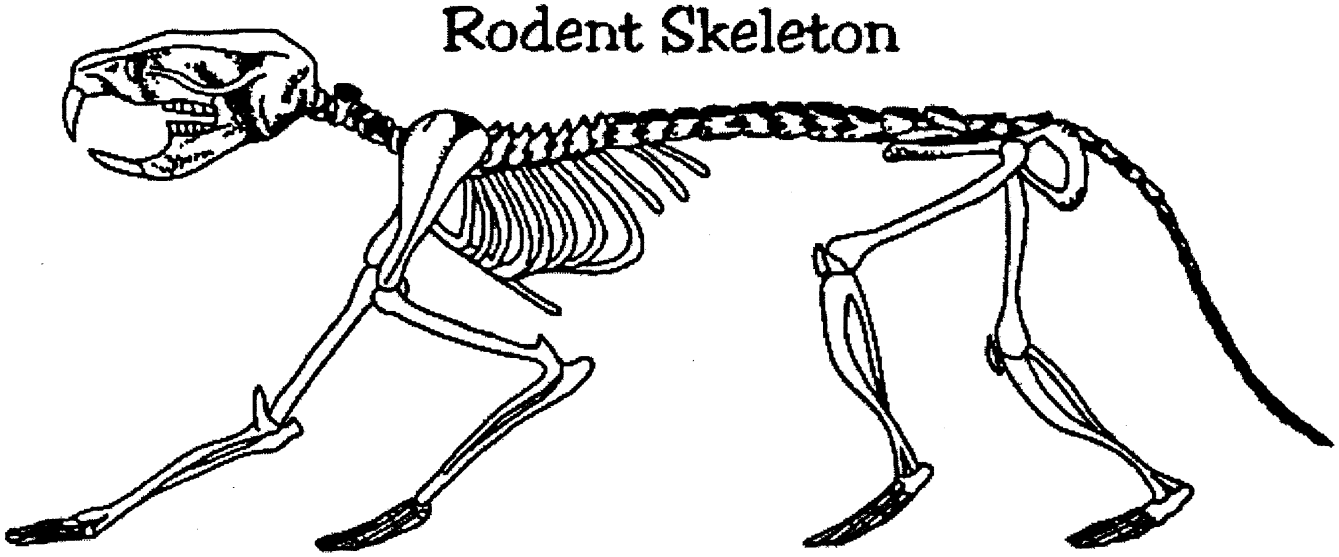


TOOTH TYPES

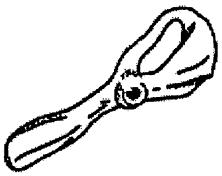


	RAT	VOLE	MOUSE	SHREW	BIRD
SKULL AND JAW					
JAW LENGTH MILLIMETERS	17-30	15-20	10-15	7-14	15-40
TOOTH TYPE	LOBED	ANGLED	LOBED	POINTED	NONE
SHOULDER BLADE					
HIP					
UPPER LEG					
LOWER LEG					
RIB					
BACK BONES					
FOOT					

Rodent Skeleton

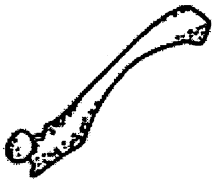


Large Bones found in Owl Pellets

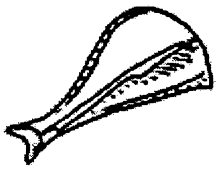


Pelvis

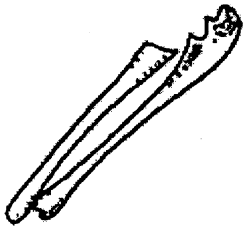
Humerus



Femur



Shoulder Blade

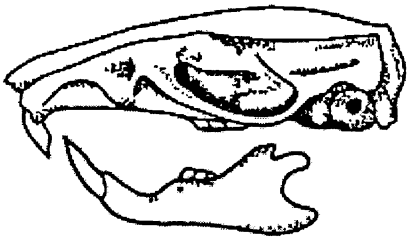


Ulna & Radius

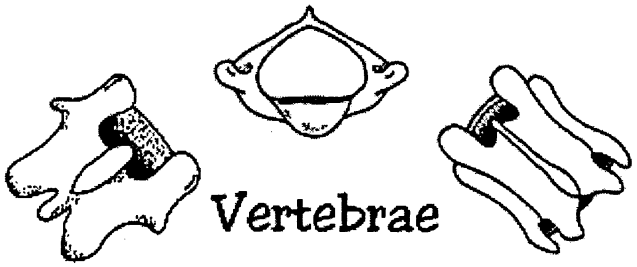
Tibia & Fibia

Ribs

Skull

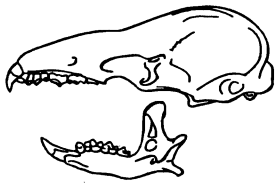


Lower Jaw

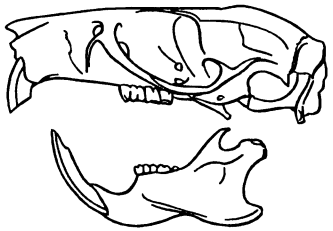


Vertebrae

Bone Chart



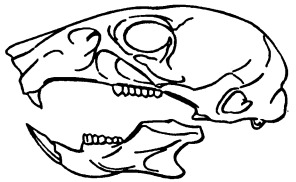
Shrew
skull and jaw



Brown Rat
skull and jaw

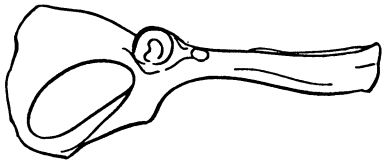
Red-winged Blackbird
skull and jaw

Meadow Vole
skull and jaw

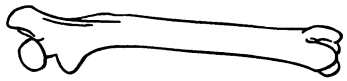


House Mouse
skull and jaw

Brown Rat Bones

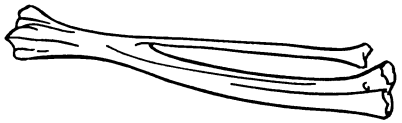


pelvic bone



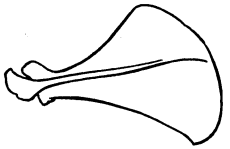
femur

humerus



tibia and fibula

rib

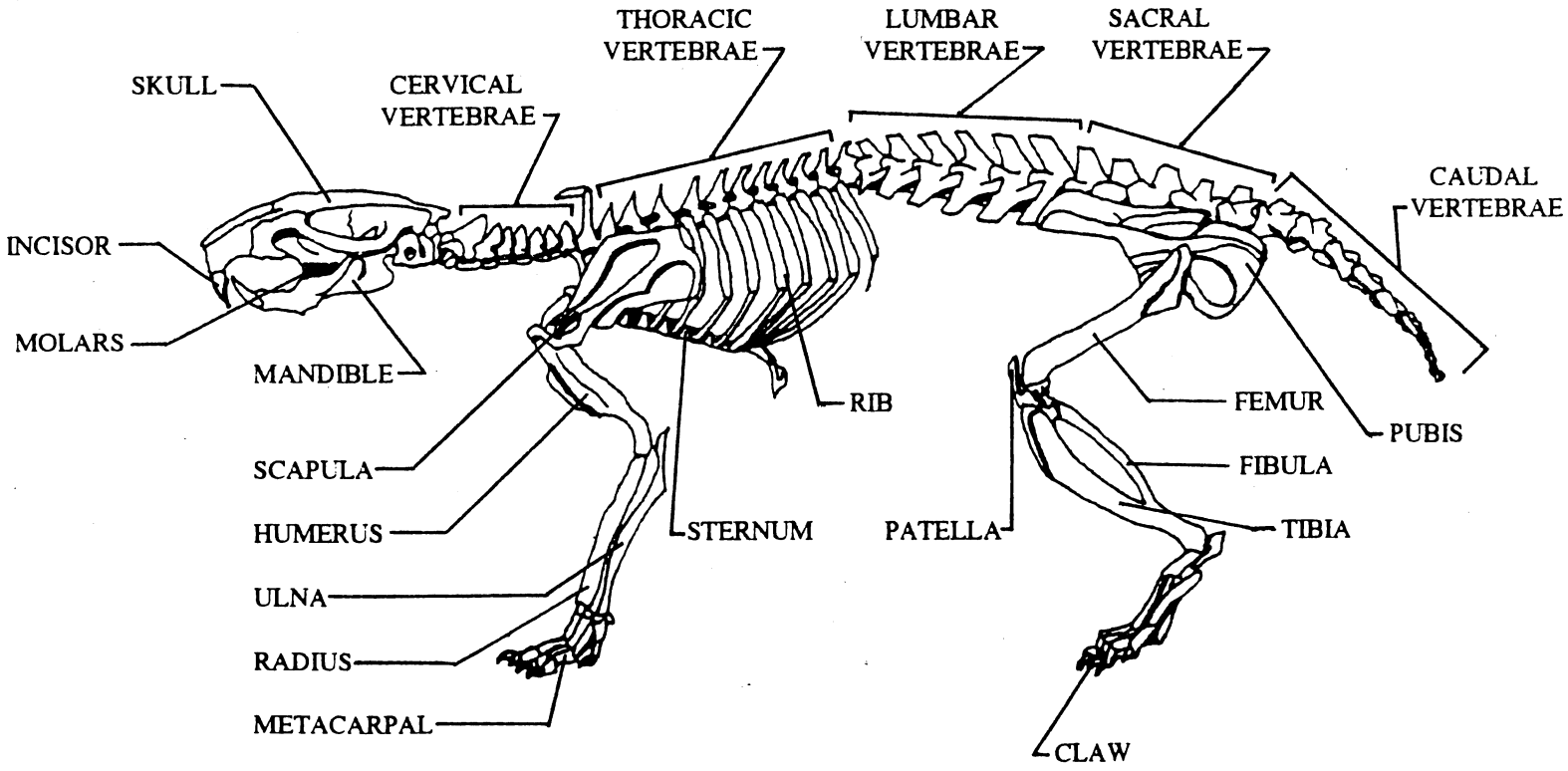


scapula

vertebrae

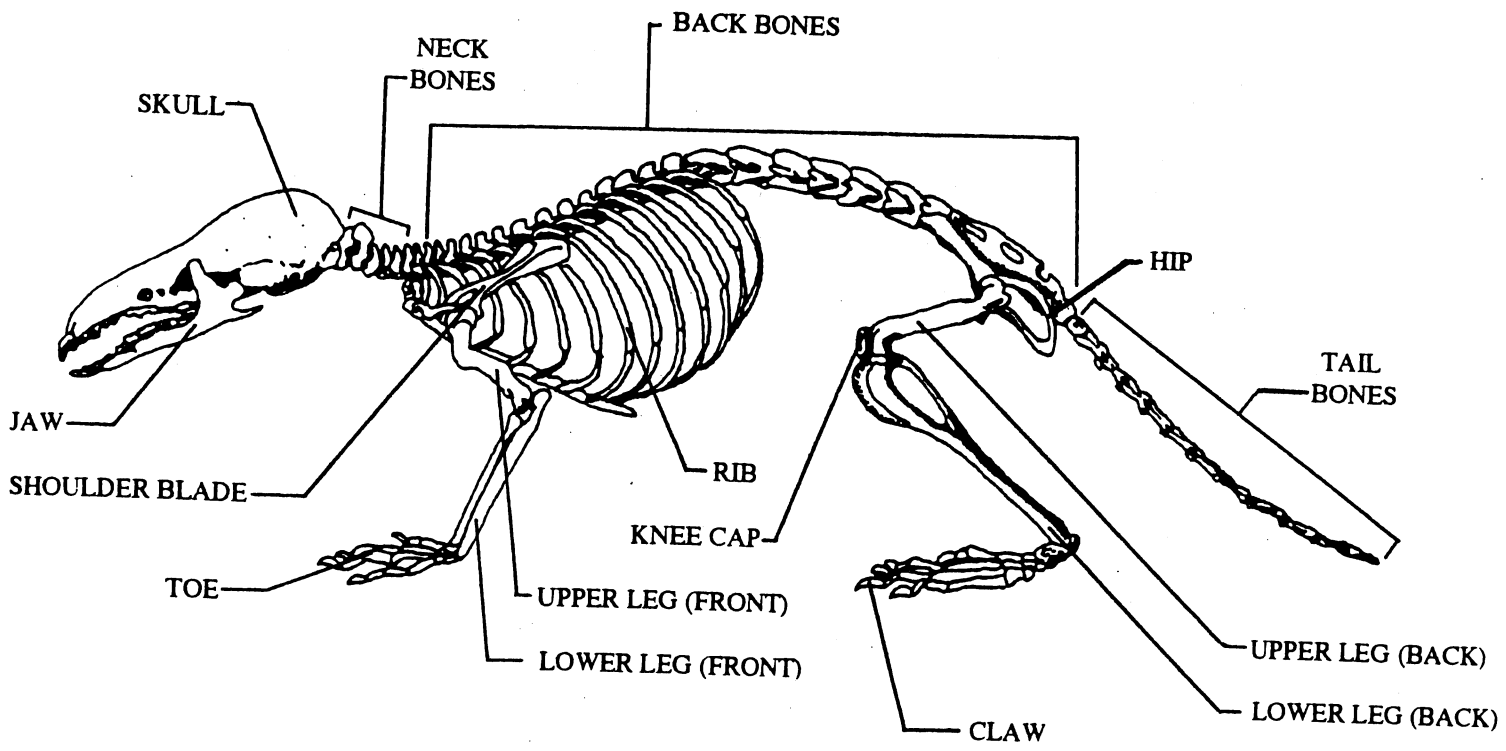
VOLE

SKELETAL ANATOMY



SHREW

SKELETON



liberty science center traveling science program

Owls

Owls are popular and mysterious creatures. There are about 162 different species of owls alive today, inhabiting a huge variety of ecological niches around the world, from rain forests to the tundra.

Smallest and Largest: The smallest owl in the world is the Elf Owl which is about 6.1 inches (16 cm) long, has a wingspan of 15 inches (38 cm), and weighs about 1.5 ounces (4g). The largest owl is the Great Gray Owl, about 33 inches (84 cm) long, with a wingspan of about 5 feet (152 cm), and weight of about 3 pounds (1450g); the Eurasian Eagle Owl; about 28 inches (71 cm) long, a wingspan of about 5.2 feet (160 cm), and weigh up to 9.8 pounds (4200 g); and the Great Horned Owl; about 25 inches (63 cm) long, a wingspan of about 5 feet (152 cm), and weigh about 4 pounds (1800 g).

Look for more owl stats for math class at http://www.owlpages.com, or for owls and raptors in general: http://www.idahoptv.org/dialogue4kids/birdsofprey/raptors.html and http://www.carolina.com/tips/01pdfs/October_2001_Tips.pdf

[these websites were current as of 10/05]

Binocular Vision

Eyes: Owls have a large head and large eyes that face forwards (unlike other birds, whose eyes are on the sides of their head). This eye placement gives them binocular vision and very precise depth perception. There are also circles of radiating feathers surrounding each eye, giving them a wide-eyed, alert look. Owls cannot move their eyes within their sockets as we can. In order to look around, they have to move their entire head, which has a range of movement of about 270°.

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.

Try this:

Down the middle of a piece of white paper use a ruler to draw a ***straight*** black line about 3mm wide and 20cm long.

Continued…

At about 4.5cm from the top of the line, draw a black circle 3.5cm in diameter. Place the paper on a flat book in front of your face, circle end away from you, black line up against your nose.
Focus both eyes *on the circle*. What pattern does the line make? This may take a few practice tries. The pattern that you see tells you about your binocular vision (the way your two eyes work together).

If you see an X crossing at the circle, you have good binocular vision. You can see the ball coming and hit it at the right time in tennis or baseball, for instance.

If you see a V coming to a point before the circle, you'll think an approaching ball is closer than it really is, and you may swing early.

If you see a V coming to a point beyond the circle, you're more likely to think an approaching ball is farther away and will swing late. You're not likely to see this if you're really focusing both eyes on the circle.

Aw, Mom, Mice for Dinner… Again?

Owls are **carnivores** (meat-eaters). Most are nocturnal and hunt at night. They use their keen sense of sight to find prey in the dark (owls see mostly in black and white). They have an acute sense of hearing which also helps to find meals. Owls are stealth hunters; they can easily sneak up on most prey as their fluffy feathers give them almost silent flight. Owls hunt and eat rodents, insects, frogs and birds. They're not very picky about their menu. However, there are other owls which are specialized feeders; the Flammulated Owl eats only insects. The owl is at the top of the food web; it has no major predators, although climbing omnivores (raccoons, possums) may prey on owl babies.

Owls have an unusual method of dealing with their food. 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.

After gulping down the whole animal and digesting the nutritious parts, they regurgitate all of the undigested parts in a small pellet. The pellet is composed of bones, fur and teeth.

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

Continued

Because owls don't tear their prey to pieces, there is always a complete skeleton of at least one rodent in every pellet. Every bone from the skull to the last tip of the tailbone can be found. A good observer with a little patience will be able to piece together a whole skeleton!

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

Feeding the Family

Owls must work constantly to keep their babies fed and to protect them from harm. Owls average 3-5 babies per year. In years when prey is plentiful, owls may lay more eggs. When it is scarce, breeding pairs produce fewer young or may not breed at all. There are limiting factors which will determine if a family will survive. If the owl family has more babies, or only one parent, or if one of the parents has a handicap of some kind, then they must work harder to get food. Each owl chick can eat up to four mice per day! Parent owls break up food for younger chicks. A larger owl must eat the equivalent of 12 mice per day (or a large groundhog) to survive. As raptors use their talons to grasp prey, we will use plastic forks to represent the sharp, curved talons of an owl.

Materials:

-2 plastic forks per “parent owl”. Some forks are whole, some may be missing tines to represent broken talons.

-Sticky tape or masking tape.

-Large pink erasers or small plastic animals may be used to represent the “mice” (If you have other plastic animals representative of those in the owl’s food chain, use them, too) Or, label the pink erasers with the names of the kinds of animals that owls eat. (Cat toys also make good prey – extra points if an “owl” can nab a wind-up mouse!).

There should be about three to four mice per owlet, plus several extra so the parents don’t go hungry.

Game Directions:

Students are grouped into owl families. Most families will have both a male and female parent. Some will only have one parent. One parent may even be handicapped in some way (a “broken” wing which impedes how quickly they can move, broken talons, etc.) This is entirely up to the teacher’s discretion. You can compare the results of a game where all the owls and families are equal to one where there are handicaps and inconsistencies in abilities. A harsh winter when the number of available mice is low might be one variable.

Continued…

Numbers of owlets will vary from group to group. Family groups should take up residence in a “nest” area – the corners of the room work well in the gym or in an outdoor play space. Jump ropes or chalk outlines might be used to delineate each family’s nest. This also gives the owls space to “fly” without interfering with other’s territory.
“Mice” can be dispersed around the space. Make sure to count the mice so that they’re all returned.
Tape a fork to each of the thumbs and index fingers of one hand of each parent. These are the talons.
Each family grouping must stay together to protect themselves from predators, and parent owls must go out in search of food. Only one “mouse” at a time can be carried back to the family using the talons provided. If a mouse is dropped, it must be left on the floor. The owl parents must then seek a new mouse. Time for gathering food is limited. It is important to move quickly, but carefully. Owlets shouldn’t be left alone for too long - you never know when there might be a predator lurking about!

One student may be a predator. Only terrestrial animals that can climb can get near babies, but they are very well protected by their parents. Raccoons and possums may try. If the predator can get near the nest without meeting up with the parent birds and tag a baby (with two hands gently) from the nest, the baby bird must go with the predator and stay outside the game.

Other Birds/Bird Beaks:

Bird families are formed with one or two parents. The parents must gather enough food to feed their families and protect them from predators. Tape popsicle sticks to the parents’ thumbs and forefingers. Again, they may be whole, broken or missing completely.

Place unpopped popcorn inside a gym hoop or loop of string three meters from the “nest”. (Note: students may have difficulty with the little popcorn kernels; use popped popcorn, larger seeds or beans or even foam packing “peanuts”)

Each bird family must have a cup (yogurt pots work well) to keep the seed in. Fly to the bird feeder and bring home your seeds.

When the feeder is empty, or after a time limit, each family must count the number of seeds they collected. Alternatively, each family must fill their cup up to a certain line in order to survive (clear plastic cups would help - draw on the inside of the plastic cup with a Sharpie marker).

Extension: Different colored seeds (large plastic beads) might represent different kinds of foods that must be collected, depending on the bird’s diet. One of the colors might be red, which indicates environmental toxins, automatically ending one bird family’s ability to survive!

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Popcorn Food Web Tag

Students simulate a food web where the owl is one of the top predators. This can be narrowed down for smaller groups to play using only the animals in a specific food chain.

Divide up the class: (Approximate numbers for a class of 25 students). Students should have a large nametag indicating which animal they are (even better if pictures of animals can be on them. Hang them with string around the students' necks so they can be used again).

Everyone should know their place in the food web!

Approximately: ten insects, etc: grasshoppers, worms, spiders, beetles, crickets

four amphibians, fish and reptiles: frogs, snakes, salamanders, turtles, fish

seven herbivores: mice, squirrels, rabbits, chipmunks, deer, moles

two omnivores: skunk, raccoon

two carnivores: owl, wolf, fox, hawk

Each student receives a plastic bag. If they don't get enough food to fill up most of the bag, they won't survive. The larger the animal, the more food they are expected to get. Smaller prey use snack size bags, medium ones use sandwich or quart and larger animals use the quart or gallon size. Or, all get the quart size with a line drawn on it to indicate how much food they must get.

Predators take food from the prey they tag and pour it into their own bags. "Food," which can be any combination of popped popcorn, or plastic tokens, math manipulatives, large beads, Styrofoam packing "peanuts", etc. should be distributed in several food stations around the gym or the outside playspace inside gym hoops or looped string.

Food stations are "safe"; no animal can have its food taken away while it is there. Ask students not to step into the food source and to limit the time they spend there to a good count of 10, then move on.

The game should have a time limit of about 15-20 minutes.

All animals start from the "primary shelter." The insects are released first, and they get 2-3 minutes to fill up their food bags, then the other groups are released to get their food. Carnivores are let go last, they have to give the other animals a few minutes to get started.

Continued…

To survive, predators attempt to capture prey, tagging only moving prey.

Prey have two ways to avoid predators. They may “freeze” any time a predator is within three feet or so of them or they may run to cover – to either the food sources or the primary shelter area. Frozen prey may blink, but otherwise should be basically still without talking. Making noise gives you away and you’re considered fair game by the predators.

Every animal has a limit for threat levels. If a predator is far enough away for the prey to feel reasonable safe, they may signal to others that a predator is near. If the predator comes closer, the prey may try to run away, or scurry to a hiding place. If the predator is so close that none of these alternatives is available, the prey may freeze in place. This occurs as a kind of physiological shock in the animal. Shelter or camouflage may also make them invisible to the predator when they freeze.

If students are unclear as to their place in the food web, tie them up first! Really!…

Divide up the class for a food web and include several students who are plants. Each student wears their nametag and has several long pieces of string.
They must then connect to their food source(s), keeping one hand on the string and giving the other end to their food. If there is more than one source or prey, they must give an end of a string to each one. Same goes for all the predators up the line!

It may be easier to start with the carnivores and work down the food web.
Draw a diagram using the animals and plants that you are using to see if they all chose correctly.

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Hooooos That?

Owls have large, oval-shaped ear openings. In front of each ear is a fleshy, raised flap called an *operculum*. This works like 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. This collects and directs 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. By moving its head back and forth until the sound is equal and balanced in both ears, the owl's "line of sight" is then right on target. Using this sound balancing technique, or *triangulation*, owls can pinpoint and capture a rodent under leaves, grass or even snow without possible even seeing it.

This kind of "3-D" hearing allows the owl to triangulate the position of its prey. Three students can demonstrate this triangulation.

Two students must take up a position in the room, about ten feet apart and close their eyes. They represent each of the owl's two ears. Another student is chosen as the "prey." The rest of the class must keep silent while the "prey" taps on a surface somewhere in the room. The students with their eyes closed point to where they think the sound is coming from. This will often result in a triangular formation among the three students.