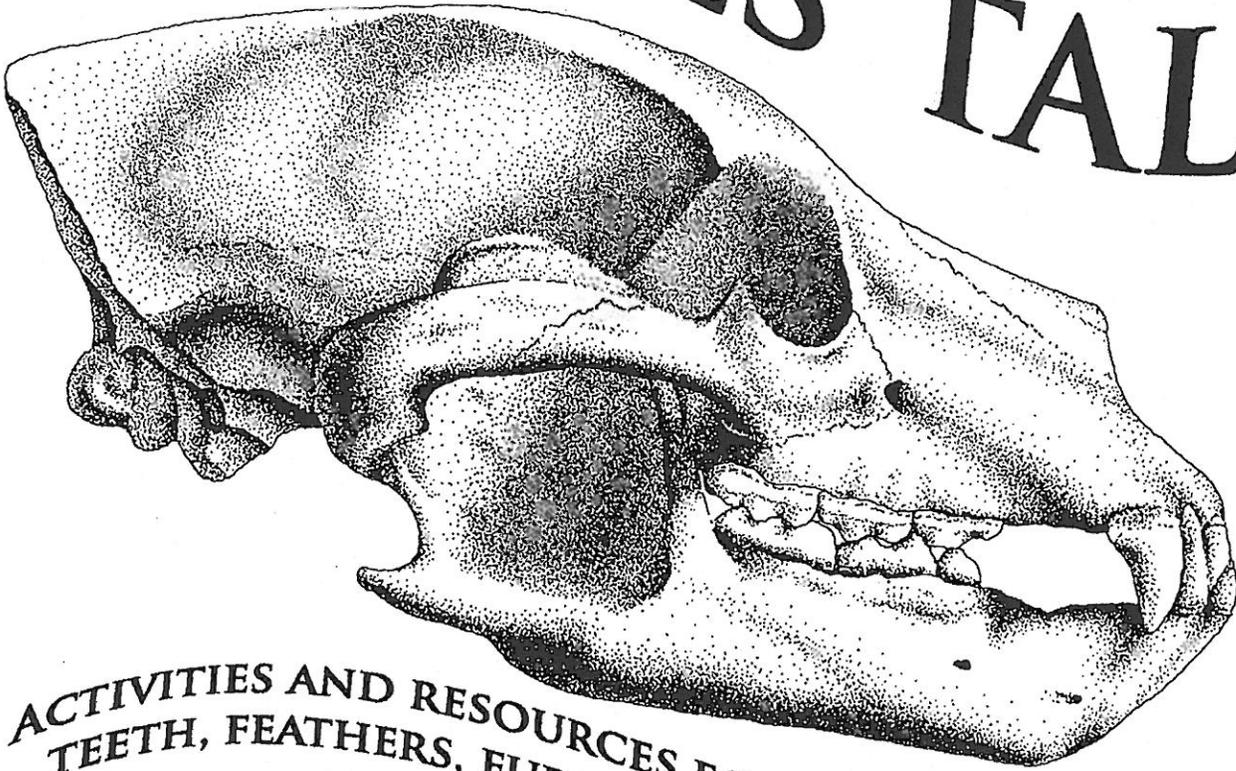


# SKULLS TALK



ACTIVITIES AND RESOURCES FOR TEACHING WITH SKULLS,  
TEETH, FEATHERS, FURS, BONES, SHELLS, TRACKS, SCATS,  
AND OTHER NEAT STUFF.

WRITTEN, ADAPTED, AND COMPILED BY JEN DENNISON



OHIO  
DIVISION OF WILDLIFE



# Skulls Talk

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## Activity

### SKULLS TALK

**OBJECTIVE:** Students will be able to surmise various adaptations of selected wild animals by examining skulls.

**METHOD:** Students examine preserved skulls and compare skull features among several animals to explore associated adaptations.

**BACKGROUND:** Preserved skulls provide a fascinating look at adaptations of a "real" wild animal. Skull features associated with the senses and processes such as eating can be compared with what is known about an identified animal.

**MATERIALS:** A variety of preserved animal skulls including deer, coyote, opossum, and black bear.

**PROCEDURE:** Use the following narrative to guide a student discussion of skull features and adaptations as preserved skulls are examined. This procedure or the narrative should be modified for the age of the group and the skulls that are available.

*By looking at a skull, can you tell what kind of animal it belonged to? You might not be able to tell if it is from a coyote or a deer, but if we look closely at some of the features of a skull, we might be able to tell if the skull belonged to a predator or a prey animal.*

*Let's start with predators. A predator is an animal that hunts and*

*catches other animals for food. How might we tell if an animal is a hunter by examining its skull? What features would it need to catch prey? Let's think of a few. Maybe good eye sight? How about a good sense of smell? When we look at a skull, the eye socket, or the space that holds the eye, can tell us something about how well an animal can see. The larger the eye socket, the better the animal's vision. This might also indicate if the animal was active at night. Nocturnal animals usually have larger eyes to see better in the dark. Similarly, the size of the nasal cavity, or the space where the nose is, tells if the animal had a good sense of smell. The size of the auditory bulla, or the bones that cover the hearing organs, is indicative of how well an animal can hear.*

*But don't prey animals need all of these things too? A rabbit needs a good sense of smell and keen eye sight to avoid the fox coming down the path. So lets look at other features of the skull that might tell us if the animal was a predator or prey. What about teeth? What kind of teeth would a carnivore or meat-eater have? Sharp teeth would help a predator catch its prey as well as aid in eating meat. What kind of teeth would a herbivore or plant-eater have? Flat teeth help herbivores grind up the tough leaves and stems of plants. What about omnivores, those animals that eat both meat and plants? Omnivores have both types of teeth, sharp in the front, and flat, grinding teeth in the back.*

*Another feature to look for is the placement of the eyes. A predator is always on the lookout for food. So the eyes of a predator are usually up front and facing forward. However, an animal being hunted is always on the*

lookout for predators. So the eyes of a prey animal are on the sides of the skull and provide a broader field of vision. This helps them avoid the sneak attack! Now see if you can guess which of the skulls belong to predators and which belong to prey.

You can also somewhat determine the intelligence of an animal by the size of its brain. Compare the size of the brain cavity of the skulls you examine. How large or small is the brain cavity in relation to the size of the skull? Which animal has the largest brain cavity? Which has the smallest? Let's take a close look at the bear skull. The brain cavity is fairly large in relation to the size of its head. So we can guess that bears are fairly intelligent. Now look at the opossum skull. Have you ever heard the expression "pea brained"? The opossum has a very small brain cavity in relation to the size of its head. The opossum's small sized brain is one indication of its intelligence.

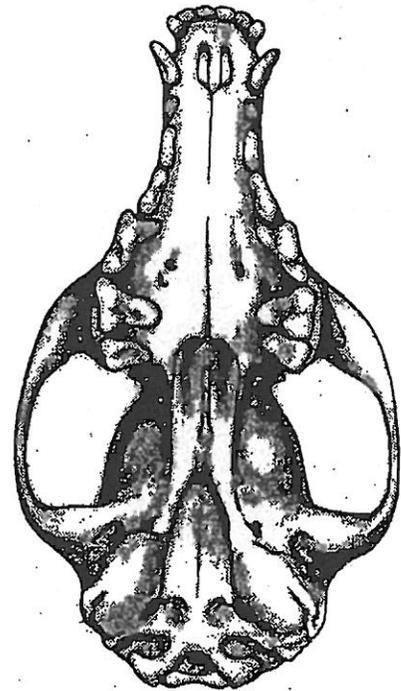
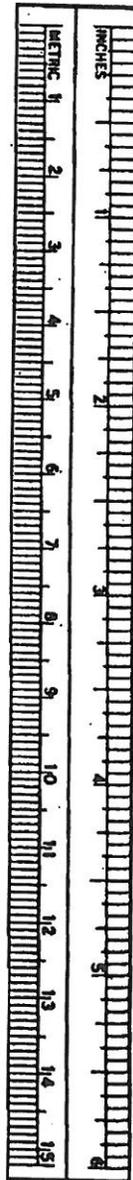
The features of each skull help us to understand the characteristics of the animal that help it survive. These characteristics are called adaptations. Good eyesight, hearing, and a sense of smell, as well as intelligence are adaptations that help animals survive.

Let's take another look at each skull and compare the features we have identified and see how they might indicate a survival adaptation.

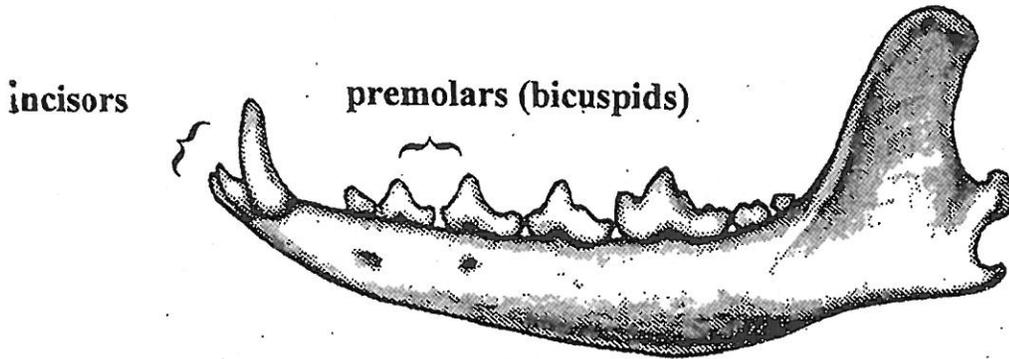
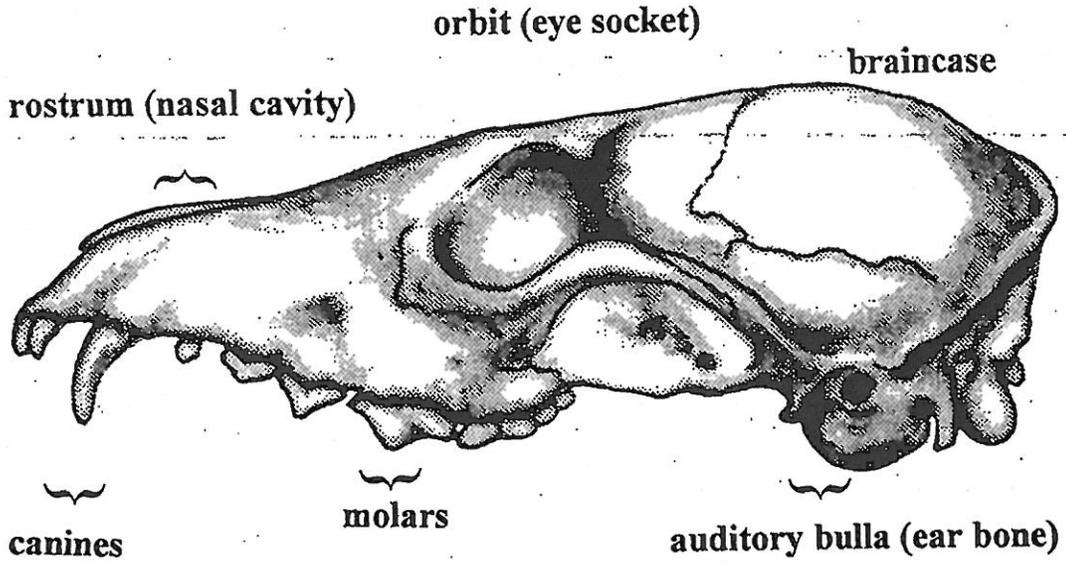
## EVALUATION:

- 1.) Invent an imaginary animal. Determine what it might eat and how it might capture or gather its food. Make a drawing of its skull showing adaptations for these processes.

- 2.) Examine illustrations of a human skull. Make observations and inferences about the features you observe.



# Skull Features



## SKULLS TALK

- The size or length of the *rostrum* and associated nasal cavity indicates the significance of the sense of smell.
- The relative size and location of the eye sockets (*orbit*) is indicative of vision adaptations.
- The size and development of ear bones and the skull feature that protects them, the *auditory bulla*, is relative to the sense of smell.
- Structures for muscle attachment, ridges and jaw surface area, can provide information on eating habits and types of food.
- Openings for nerves and blood vessels indicate adaptive significance of some head features and senses.
- The size, shape, density and suture patterns of the skull and skull bones provide information about other lifestyle adaptations.
- The size and relative capacity of the brain cavity indicates brain development and suggests intelligence.
- The type, size, number and shape of the teeth are related to eating habits and food sources.
- Teeth may also indicate an evolution from one lifestyle to another.

# Mammal Teeth

Of all the identifying skull features, Teeth have the most to say about a mammal and its lifestyle.

There are four basic types of mammal teeth:

## **Incisors**

Incisors are the front teeth. They have sharp edges for cutting and are generally simple in structure. They may be modified for grooming, cropping, cutting and other functions.

## **Canines**

Canines are the conical, pointed teeth located between the incisors and the premolars—they grip and tear food and are the “stabbing teeth” in some carnivores. Some mammals lack canines (particularly herbivores).

## **Premolars, or bicuspid**

Premolars have two conical points and follow the canines. They are also used for gripping and tearing.

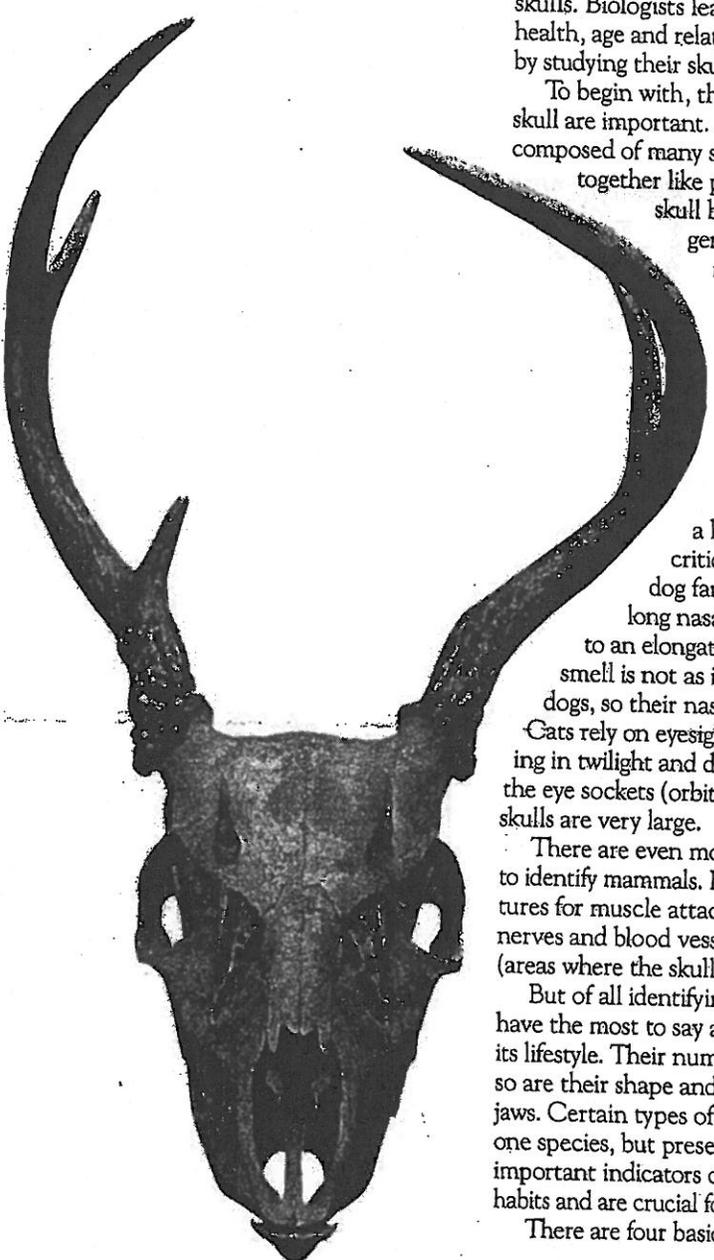
## **Molars**

Molars are the back teeth, and they vary in surface shape depending on the lifestyle of the mammal. Mammals that grind food have flat molars, while those that cut food have serrated ones.

# SKULL SESSIONS

The features of a skull reveal a lot about an animal's needs and habits.

written by Mary Kay Clark ©1997  
photographed by Melissa McGaw



Of the bleached bones that she brought back to her desert studio, the artist Georgia O'Keeffe said, "They are as beautiful as anything I know."

The beauty that O'Keeffe saw in bones is perfectly illustrated in the elegant curves of the whitetail's antlers and the complex architecture of his skull. But there are other reasons to take a closer look at mammal skulls. Biologists learn much about the health, age and relationships of mammals by studying their skulls.

To begin with, the size and shape of the skull are important. All mammal skulls are composed of many separate bones that fit together like pieces in a puzzle. The skull bones, as well as other general features of the mammalian skull, are relatively constant among the mammals, but the size and shape of the bones vary according to the animal's particular lifestyle.

For example, because a keen sense of smell is critical to members of the dog family (canids), they have long nasal bones that contribute to an elongated skull. Among cats, smell is not as important as it is for dogs, so their nasal bones are reduced. Cats rely on eyesight and hearing for hunting in twilight and darkness; consequently the eye sockets (orbits) and earbones in cat skulls are very large.

There are even more specific skull features to identify mammals. Biologists look for structures for muscle attachment, openings for nerves and blood vessels, and suture patterns (areas where the skull bones grow together).

But of all identifying features, the teeth have the most to say about a mammal and its lifestyle. Their number is important, but so are their shape and their location in the jaws. Certain types of teeth may be absent in one species, but present in another. All are important indicators of the animal's eating habits and are crucial for identifying the species.

There are four basic types of teeth: incisors,

canines, premolars and molars. Incisors are the front teeth. They have sharp edges for cutting and generally are simple in structure, but are modified in many mammals for grooming, cropping, cutting and other functions.

Canines are the conical, pointed teeth located between the incisors and the first premolars—they grip and tear food and are the "stabbing teeth" in some carnivores. The tusks found in many mammals are usually modified canines. Some mammals lack canines (particularly herbivores—rodents, horses and deer) and have a gap between the incisors and premolars.

Premolars, or bicuspid, have two conical points and follow the canines. They are also used for gripping and tearing.

Molars are the back teeth, and they vary in surface shape depending on the lifestyle of the mammal. Mammals that grind food have flat molars, while those that cut food have serrated ones. These are generally the most elaborate teeth in the dentition, and they are extremely variable in pattern.

Why do mammals have so many different kinds of teeth? Because the diets of mammals are diverse, and different types of teeth are needed to process the various foods that mammals eat. Biologists reduce the number, type and location of a mammal's teeth to a "dental formula." For instance, here's what the dental formula of an opossum, the only North American land mammal with 50 teeth, looks like.

$$I \frac{10}{8} \quad C \frac{2}{2} \quad P \frac{6}{6} \quad M \frac{8}{8} = \frac{26}{24}$$

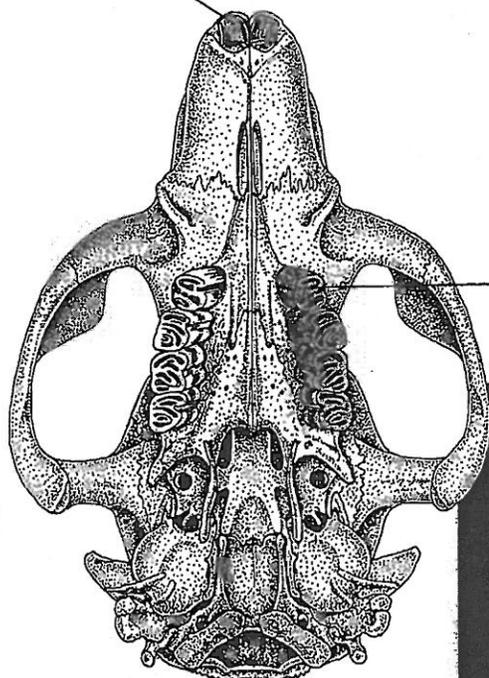
or 50 total teeth

The letters refer to the different kinds of teeth: incisors (I), canines (C), etc. The numbers refer to the total number of teeth of each kind in both the upper and lower jaws. For example, the formula above shows that the opossum has six premolars (P) on each of its upper and lower jaws (12 altogether) and eight molars (M) on each jaw (16 altogether).

Mammals can be divided into three groups based on their feeding habits—herbivores (plant eaters), carnivores (meat eaters) and omnivores (plant and meat eaters). In the following pages try to discover what makes them herbivores, carnivores or omnivores. The answer, you'll find, lies in their teeth.

Herbivores, such as the white-tailed deer and the beaver, must chew their food well before swallowing, since plant material is difficult to digest chemically. Generally, herbivores' cheek teeth (premolars and molars) are broad and flat to grind plant material to a pulp. Most herbivores don't have canines because they don't need to grab moving prey. In deer, beaver and other herbivores, the back of the lower jawbone (mandible) is wide and deep, providing a large area to anchor the strong chewing muscles.

Prominent incisors



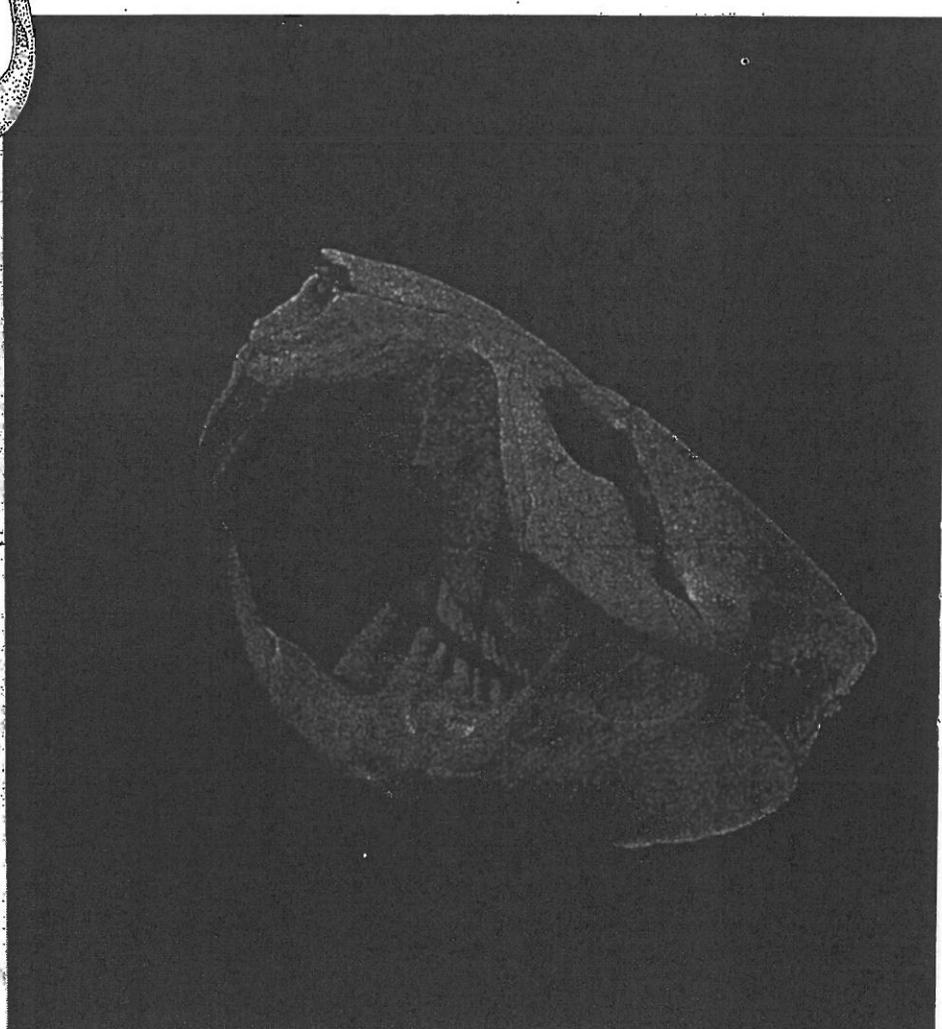
Molars for grinding



The beaver, like other members of the rodent family, has very long, chisel-like front teeth in the upper and lower jaw for gnawing. The teeth are deeply rooted in a dense, robust skull that provides a strong foundation for the teeth. The skull must be rugged to withstand the physical stress of cutting and chipping hardwoods like oaks. The large, sharp incisors continually grow, otherwise they would quickly wear down from constant use. The incisors are sharpened by grinding the uppers against the lowers. Since beavers eat hard food such as twigs, chip the bark from trees, and chew through smaller trees to create short pieces for their dams and lodges, they also need large areas for muscle attachment. The molars are designed for grinding.

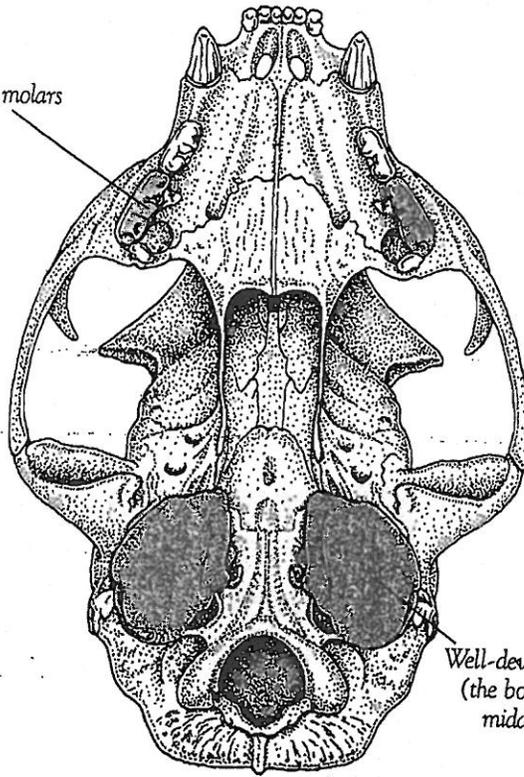
$$I \frac{2}{2} \quad C \frac{0}{0} \quad P \frac{2}{2} \quad M \frac{6}{6} = \frac{10}{10}$$

or 20 total teeth



Carnivores, such as bobcats and otters, have thick, heavy jaws with large surface areas and other features (such as a crest on the top of the head) for muscle attachment. Muscles are needed for the powerful, gripping bite that meat eaters need for grabbing and holding prey. In general, the teeth are pointed and sharp for catching and killing prey and for slicing and shearing meat. Cheek teeth are not as complex as in herbivores; less chewing is required because meat is easier to digest than plants. In true carnivores the cheek teeth are modified into sharp, shearing teeth called carnassials.

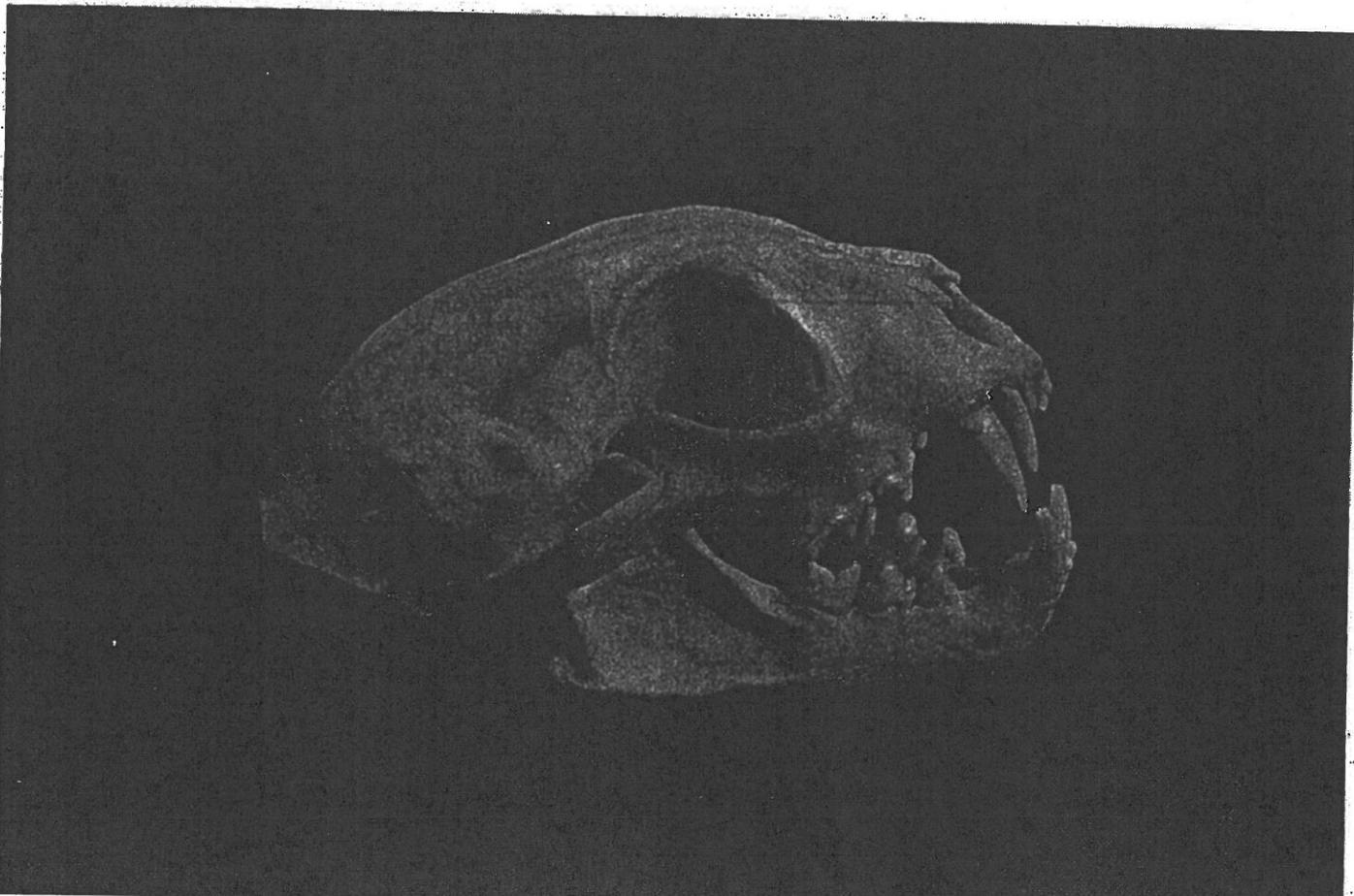
Elongated molars



Well-developed auditory bulla  
(the bones that protect the middle and inner ear)

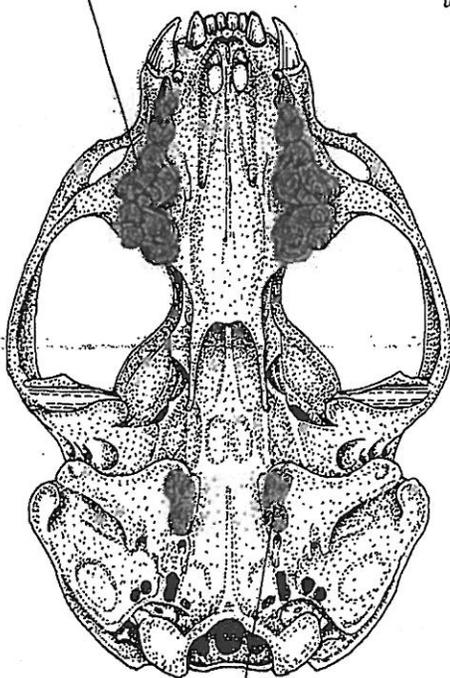
Bobcats, like all members of the cat family (felids), are true carnivores. Felids have a short-faced appearance, resulting from reduced nasal cavities, and a shortened jaw. Bobcats rely on their sight and hearing when hunting. The bones that protect the middle and inner ear are well-developed and prominent orbits (eye sockets) are present because cats often hunt in twilight and in darkness. The first molars and premolars are specialized teeth, called carnassials, that are designed for gripping and tearing. The skulls of members of the cat family all have a high, rounded appearance.

$$I \frac{6}{6} \quad C \frac{2}{2} \quad P \frac{4}{4} \quad M \frac{2}{2} = \frac{14}{14} \text{ or } 28 \text{ total teeth}$$





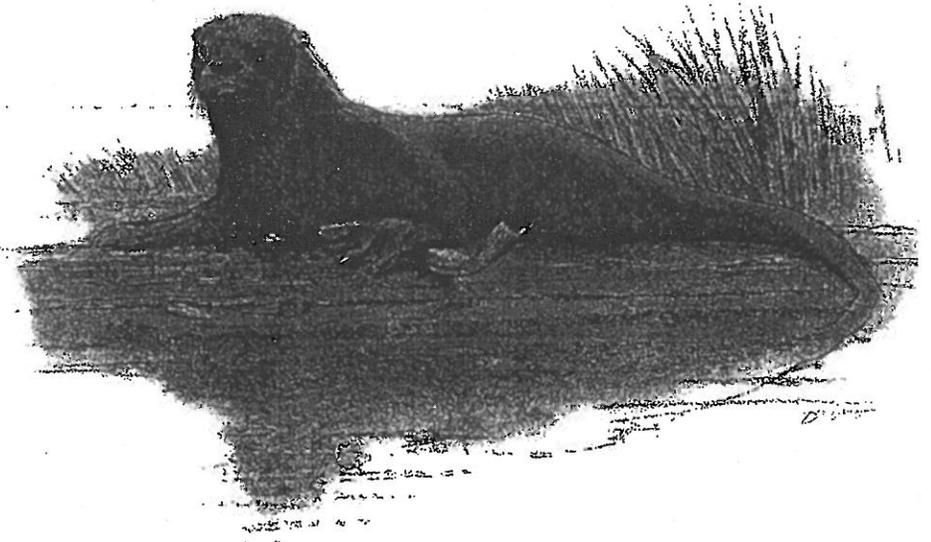
More cheekteeth than bobcat  
and more variety in size and  
shape of cheekteeth



Auditory bulla not  
well-developed

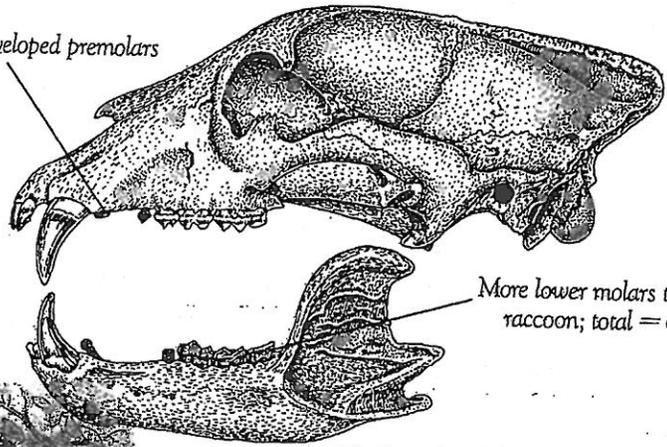
The otter, a member of the mustelid family (weasels and allies), is also a true carnivore with well-developed carnassials. The long and flattened shape of the skull is much different from the bobcat's high, round skull, and the otter's skull is much denser. This amphibious mammal catches frogs, crayfish, crabs and fish and consumes them immediately, crushing bones and hard exoskeletons with sharp teeth and strong jaws. The flattened shape of the skull contributes to the streamlined shape of the otter, a body plan that makes it an efficient swimmer.

$$I \frac{6}{6} \quad C \frac{2}{2} \quad P \frac{8}{6} \quad M \frac{2}{4} = \frac{18}{18} \text{ or } 36 \text{ total teeth}$$

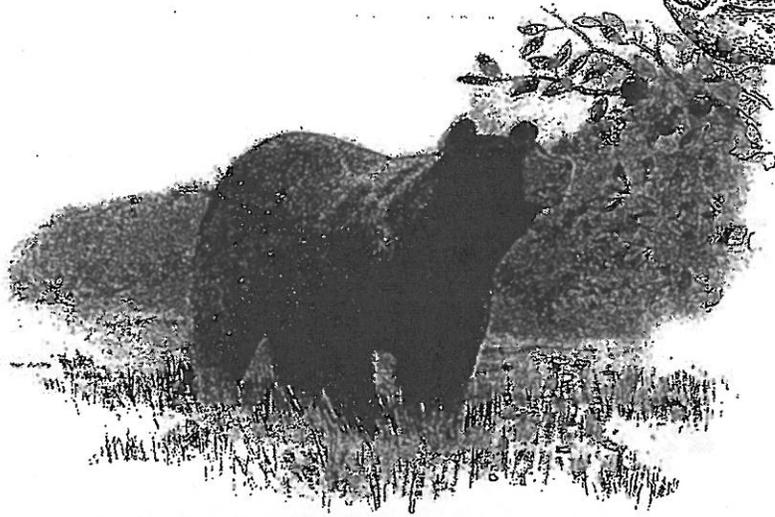


Omnivores eat both plant and animal food, and their dentition and other skull characteristics exhibit a combination of features of herbivores and carnivores. In order to handle such a varied diet, they usually have the full complement of teeth (incisors, canines, premolars and molars), but their jaws and teeth are generally less specialized than those of carnivores or herbivores.

Poorly developed premolars



More lower molars than raccoon; total = 6

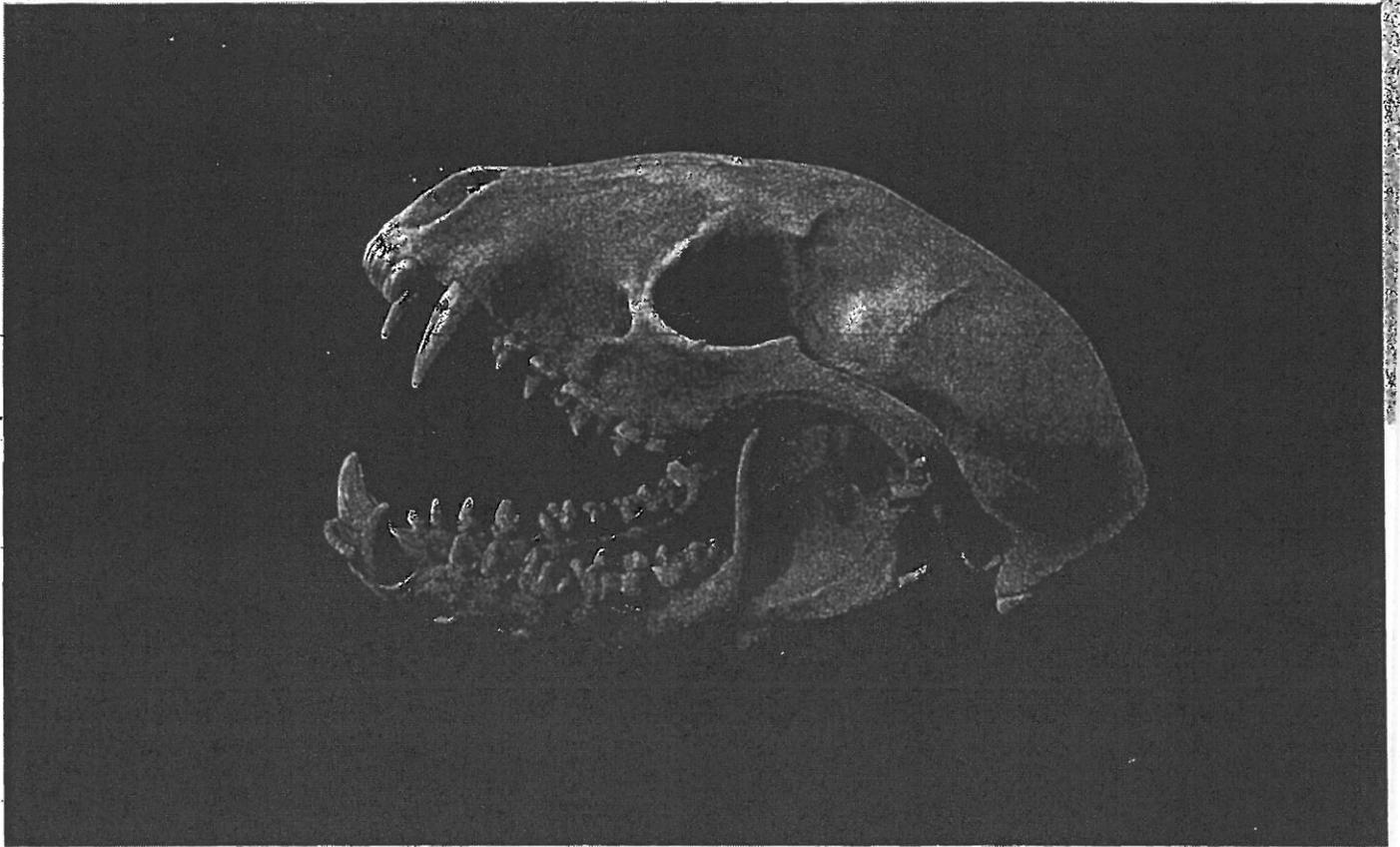


The bear family has evolved from being chiefly carnivorous to omnivorous. Black bears feed on almost any succulent vegetation and also on grubs, carrion, fish and other small animals. They have incisors that are unspecialized, and the canines are long, as they are in true carnivores. The premolars are not well-developed and the molars are designed for crushing plant matter. Bears have a massive skull with a long rostrum (nasal area) similar to that seen in the dog family.

$$I \frac{6}{6} \quad C \frac{2}{2} \quad P \frac{8}{8} \quad M \frac{4}{6} = \frac{20}{22}$$

or 42 total teeth

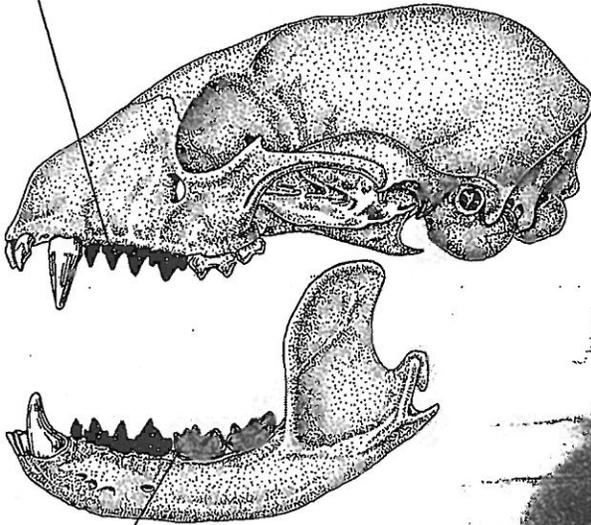




*In contrast to the teeth of black bears, raccoon's teeth are generalized to accommodate a varied diet of frogs, crayfish, fish, birds, small mammals, fruits, nuts and insects. A raccoon's skull is more rounded than the black bear's. It has well-developed premolars and more lower molars than the black bear.*

$$I \frac{6}{6} \quad C \frac{2}{2} \quad P \frac{8}{8} \quad M \frac{4}{4} = \frac{20}{20} \text{ or } 40 \text{ total teeth}$$

*Well-developed pre-molars*



*Fewer lower molars than black bear; total = 4*



color illustrations by David Williams ©1997  
 technical illustrations by Renaldo Kuhler ©1997

# TOOTH TYPES

## Dentition Determines the Diet

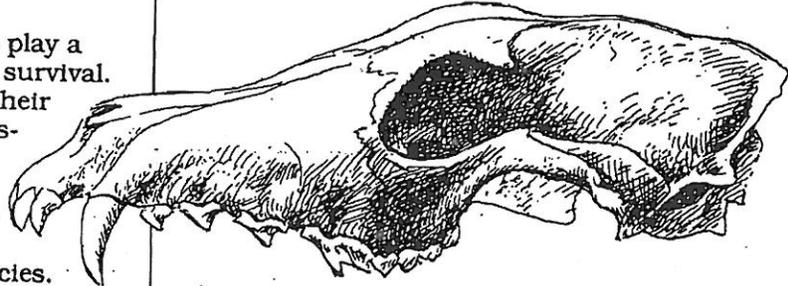
**F**or those who possess them, teeth play a vital part in the game of success and survival. Over time, a clear plan and pattern for their size, shape, position, number, and distribution, related closely to each animal's diet, has developed. In fact, dentition (tooth arrangement) is so distinctive that it is a clear key to identification of a particular mammal species.

Creatures have a variety of food preferences ranging from the extremely limited food choices of the pandas, which eat mainly bamboo, to the general diets of opossums, skunks, and humans, who can and will consume just about anything. Dentition is a clear reflection of these eating habits.

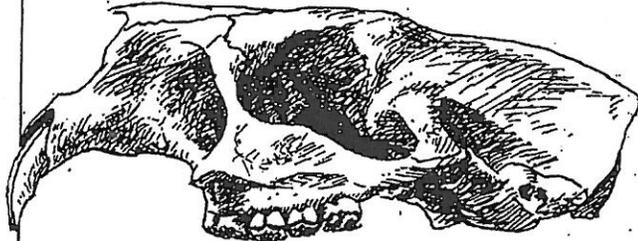
In relation to their diets, animals can generally be broken into four main groups: **carnivores**, eating meat; **herbivores**, eating plants; **insectivores**, eating insects; and **omnivores**, eating a variety of foods. Specific kinds of teeth are correspondingly arranged and shaped to fit the needs of individuals in each of these groups: **incisors**, in the front of the mouth, used for cutting, dagger-like **canines**, next to the incisors, used for tearing and shredding meat, and **molars**, in the back of the mouth, used for grinding.

Omnivores have a mixture of all three kinds of teeth, none of which is particularly specialized. While humans and opossums both belong to this group, human teeth (thirty-two adult teeth) are considerably less effective than those of the opossum (who has an impressive mouthful of fifty sharp ones). By cooking their food and using sharp utensils to cut it, humans have, over time, become less dependent on their teeth.

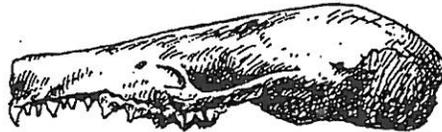
Carnivores, who are largely meat eaters, depend only marginally on their incisors for nipping and biting. Their success as hunters is attributable to sharpened molars for cutting and tearing their food and dagger-like canines for grabbing, puncturing, and holding onto their **prey**. Powerful sets of muscles control the jaws and provide the force for the use of these specialized sharp teeth. All members of the cat family are carnivorous, from the Meow-Mix-loving domestic cats to the great lions, as are most members of the dog family.



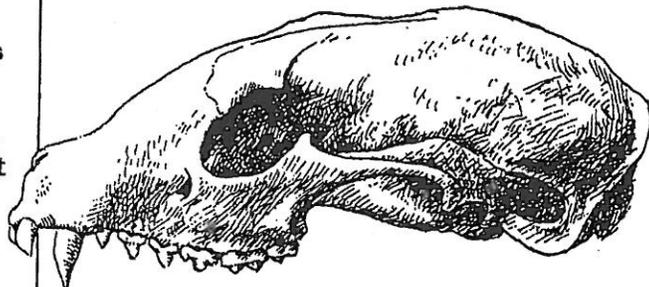
Coyote



Porcupine



Mole



Raccoon

On the other side of the dietary coin are the plant eaters, or herbivores. These animals often serve as food for the carnivores and are an important link in the **food chain**. They include a wide variety of animals from deer, cows, horses, sheep, and goats to the smaller mice, rats, woodchucks, rabbits, and beavers. They lack canines entirely and possess only clipper-like incisors and grinding molars with which to bite off their food and grind it up. Squirrels and other nut-eating rodents use their incisors as a vice to grip and pressure open or to puncture the hard shells of nuts.

The beaver, whose work may be seen in the pointed, chewed-off stumps of trees cut down for dam building and food, is the most exceptional of the rodents. Rodent incisors are ever growing and must be used continually to remain trimmed and sharp. The outer layer of enamel is harder than the inner layer of dentine; the dentine thus wears away faster, leaving the slightly extended enamel as the cutting edge. Situations where the upper and lower incisors do not meet, due to a broken tooth or some other malformation, allow the continual curved growth of the teeth to go unchecked, and may eventually cause the animal's death.

Moles, shrews, and bats are best known among the insectivores and have a mouthful of sharp little teeth, which are used in seizing and crushing hard-shelled insects and other small animals. Although bugs of various descriptions make up a sizeable portion of their diet, shrews are well-known for attacking and eating small mammals often larger than themselves.

Each of these animals would be lost without its teeth, particularly the wild ones who, unlike humans, cannot buy another set, nor shop for prepared foods.

#### **Suggested References:**

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Hamilton, William J. Jr., and J.O. Whitaker. *Mammals of the Eastern United States*. Ithaca, NY: Cornell University Press, 1979.

Schwartz, C. W., and E. R. Schwartz. *The Wild Mammals of Missouri*. Columbia, MO: University of Missouri Press, 1981.

# TOOTH TYPES

Season: SP S F W

**Focus:** There are different types of teeth that are shaped to get hold of and chew different kinds of food. The kind of teeth an animal has helps determine the food it eats.

| ACTIVITIES   | MATERIALS  |
|--|--|
| <p><b>Initial Question:</b> Why do the kinds of teeth an animal has make a difference to what it eats?</p> <p><b>PUPPET SHOW</b></p> <p><b>Objective:</b> To introduce tooth variations in plant-eating animals (herbivores) and meat-eating animals (carnivores).</p> <p>Perform, or have the children perform, the puppet show. Discuss the terms used.</p> <p><b>TOOTH TYPES</b></p> <p><b>Objective:</b> To point out the kinds of teeth commonly found in different groups of mammals.</p> <p>Show drawings of herbivore, carnivore, omnivore, and insectivore skulls with teeth. Discuss the kind of teeth each has and/or does not have.</p> <p><b>SKULL STUDY</b></p> <p><b>Objective:</b> To notice differences in skulls, and to relate size and tooth type to animal type.</p> <p>Divide the children into groups, giving each a skull to inspect closely. Try to decide which group of animals the skull might belong to. Once they have had time to investigate their skulls, each group passes on its skull to the next group. How is the new skull different? Continue passing skulls until each group has its original skull. If possible, count the number of teeth. Next, show the animal pictures and ask them to choose which one they think represents the animal whose skull they have and to explain why. Which group of animals has the least number of teeth?</p> <p><b>Note:</b> State Fish and Wildlife Departments, high schools or colleges will often lend skulls.</p> | <ul style="list-style-type: none"><li>• script, p. 48</li><li>• puppets</li><br/><li>• skull drawings of the following (showing teeth): herbivore, carnivore, omnivore, insectivore</li><br/><li>• skulls</li><li>• pictures of animals whose skulls are studied</li></ul> |

## ACTIVITIES

## MATERIALS

### MENU MATCHING

**Objective:** To show how foods eaten relate to tooth arrangement and animal type (carnivore, herbivore, omnivore, insectivore)

Give each group from preceding activity one of the following menus:

#### *Main Courses*

1. Squirrel Stew
2. Baked Buds
3. Fried Flowers
4. Toasted Toads
5. Boiled Bats
6. Steamed Stems

#### *Side Dishes*

1. Roasted Roots
2. Toasted Tails
3. French Fried Feet
4. Grilled Grass

#### *Drinks*

1. Tadpole Tea
2. Moose Milk
3. Pond Water Punch

#### *Desserts*

1. Baked Berries
2. Chocolate Chipmunk
3. Petal Pie

Have them decide which foods their animal would choose. Ask each group to explain what their animal might pick from the menu and how its teeth are important for its eating habits.

### TOOTH TOUCH

**Objective:** To become aware of how human teeth are adapted to eating a variety of foods.

Ask the children to feel their own teeth with their tongues. How many different kinds of teeth do they feel? Give each child something to eat. How do the different teeth help in eating? (Front incisors bite, back molars chew.) Ask the children to figure out where their canine teeth are. Can humans tear a hunk of raw meat with their canines as effectively as a carnivore?

• *skulls & pictures* from preceding activity

• *crackers*  
• *carrots*  
• *apples*

## ACTIVITIES

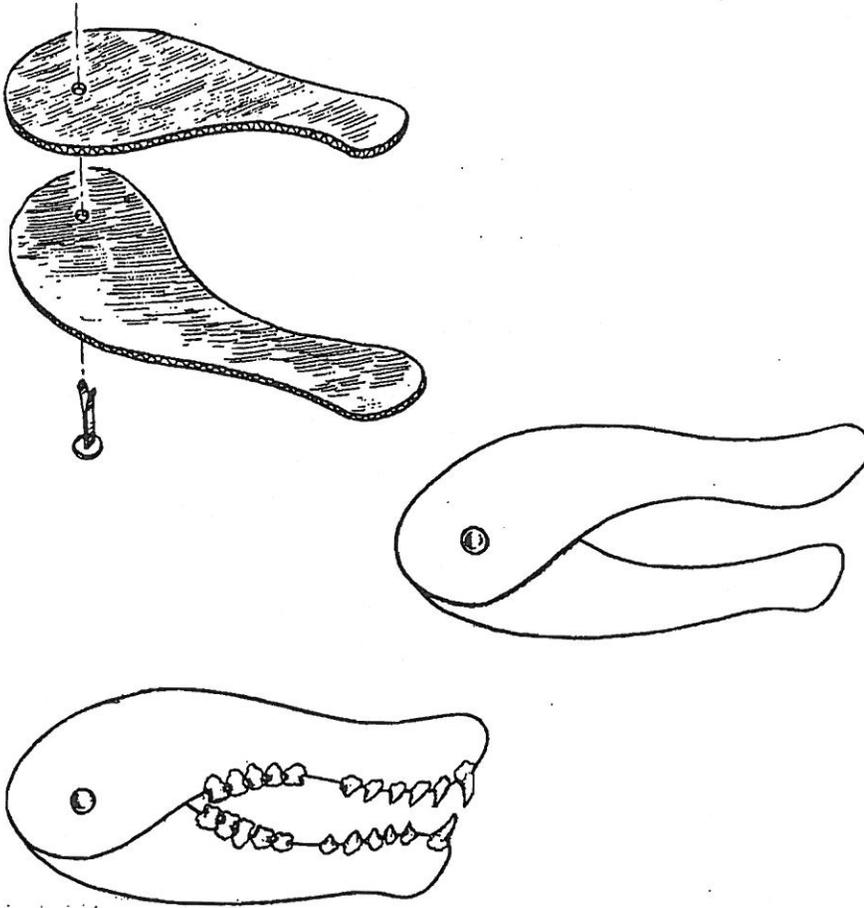
## MATERIALS

### COMPLETE A JAW

**Objective:** To design a set of teeth to fit a particular animal's diet.

Give each pair or group of children a cardboard jaw and some clay. They should make a set of teeth specialized to eat a diet of their choice. With younger children, a direction may help, such as "Create teeth for a meat-eating animal or a plant eater." Also, younger children may do better just drawing jaws and teeth. Jaws for a fictional animal are fine as long as the children can explain what the teeth do.

- drawings of jaws and teeth from tooth types
- cardboard jaws
- clay



### SHARING CIRCLE

**Objective:** To appreciate our own teeth and how we use them to eat our favorite foods.

Form a circle, and have each child finish the sentence, "My favorite food is \_\_\_\_\_, and I use my \_\_\_\_\_ teeth to eat it."

## TOOTH TYPES PUPPET SHOW

**Characters:** Herbert Hare  
Marsha Mouse  
Francie Fox

**Herbert Hare:** Oh, it's so wonderful to munch away in this nice sunny field. (sniff, sniff)  
What's that funny smell? It's not the grass. (sniff, sniff)

**Marsha Mouse:** Don't eat me, don't eat me, *please* don't eat me! I didn't mean to come into your grassy field. I'll never bother you again if you *just* don't eat me!

**Herbert:** So, you're what I was smelling. Mouse smell is very different from grass smell.

**Marsha:** Oh yes, and mouse *taste* is different too! Mice aren't as tasty as grass.

**Herbert:** Well, I wouldn't know about that. I don't eat mice.

**Marsha:** Please spare me, don't eat. . . did you say you don't eat mice?

**Herbert:** Of course I don't eat mice. Why, I couldn't eat mice even if I wanted to.

**Marsha:** You couldn't? Why not?

**Herbert:** Have you ever seen a hare's teeth? They're not made for biting into mice or other animals.

**Marsha:** Then what are they made for?

**Herbert:** They're made just right for chomping on grass, leaves, and other plants.

**Marsha:** I never knew that. If I don't have to worry about you eating me, maybe I will come back to this field to run around.

**Herbert:** Oh, you're welcome to. Maybe I'll run into you another time. Bye, bye.

**Marsha:** So long.  
(Marsha leaves)

**Herbert:** Gosh, maybe I should have warned that mouse about the fox that comes wandering in this field. I know that fox would love to have me for dinner. She might just like that little mouse for dessert. Perhaps I better try to find that mouse and warn her.  
(Herbert leaves; mouse and fox appear on opposite sides of stage)

**Marsha:** Now that I don't have to worry about being eaten, I'll just stay in this field a little longer. What's that I see up there? Oh, it's a fox. I'm not afraid of her anymore. She probably can't eat me either. I'll go over and say hello.  
(walks up)

**Francie Fox:** Hey, what are you doing walking up here. How come you're not afraid of me. I could eat you, you know.

**Marsha:** You couldn't eat me even if you wanted to. Herbert Hare just told me how teeth are made for munching on plants, not animals.

**Francie:** *His* teeth are made for munching on plants. My teeth are made for biting into animals — animals like hares and mice.

**Marsha:** You mmmmean you cccould eeet mmmme? YIKES! (runs away)

**Francie:** Ha, ha, ha. That little mouse is lucky. I'm not hungry right now. Imagine thinking my teeth aren't fit for eating an animal.  
(walks off; Marsha and Herbert enter)

**Herbert:** Oh, I'm so glad I found you. I was looking for you. I have to tell you something.

**Marsha:** Yeah, well I have to ask *you* something. Why didn't you tell me your teeth were different than a fox's?

**Herbert:** I was going to tell you. Most animals know that already.

**Marsha:** How was I supposed to know that?

**Herbert:** 'Cause foxes are *carnivores* and hares are *herbivores*, that's how.

**Marsha:** Carnivores, herbivores. What are you talking about?

**Herbert:** Carnivores, like foxes, eat other animals. So their teeth are sharp and pointy, made to bite through skin. Herbivores, like us, just eat plants. We don't need sharp and pointed teeth. So, our teeth are wide and flat, perfect for chewing up leaves and grasses.

**Marsha:** Oh, I get it now. All I have to do is look at an animal's teeth, and then I'll know if he can eat me or not.

**Herbert:** Well, it might be a bit safer if you just ask me. I know my herbivores and carnivores pretty well, without looking at their teeth.

**Marsha:** O.K. I'll do that. But right now we both better get out of here. There's a certain fox carnivore back there that just might stick her sharp pointy teeth into us.

**Herbert:** Let's go!

## FOLLOW-UP ACTIVITIES

### 1. Human Teeth

Borrow a set of human teeth from a local dentist and have the children notice what sort of teeth we have. Are we carnivores, herbivores, or omnivores? Invite a dentist to talk with the children.

### 2. Animal Teeth

If the children have pet animals, ask them to watch what foods they eat, what teeth they use to bite off portions, and what teeth they use to chew the food.

### Skills

Science Process: Observation; Inferring, Brainstorming, Communicating, Predicting, Comparing, Sorting and Classifying

Integrated Curriculum: Art, Drama, Social Studies, Reading, Language Arts, Math

### Suggested Reading For Children:

Friedman, Judi. *The Biting Book*. New Jersey: Prentice-Hall, 1975. (y — why animals bite)

Gallant, Roy A. *Me and My Bones*. Garden City, NY: Doubleday, 1971. (o — human vs. other animal bones)

Livandais, Madeline. *The Skeleton Book*. New York: Walker, 1972. (y/o — good photographs)

Merrill, Margaret W. *Skeletons That Fit*. New York: Coward, McCann & Geoghegan, 1978. (o — evolution of skeleton)

## BONES IN A BOWL

Place a small dead animal or bird in a plastic container or margarine tub with holes pierced in it. Fill the container with soil, seal it with a lid, and bury it about 8 inches underground. (Don't forget where you buried it!) Dig it up four weeks later.

Macro- and microorganisms in the soil will have consumed all the fleshy parts of the animal. Extract the skeleton carefully. Add the skull to a collection or see if you can reassemble the skeleton.

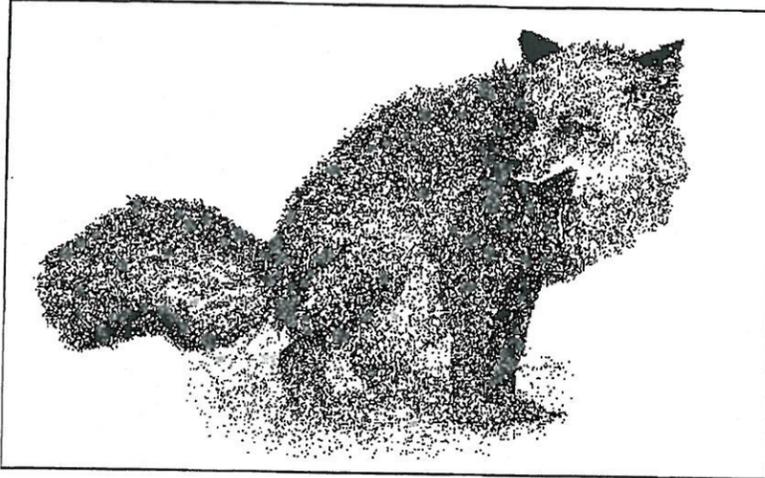


Ohio Division of Wildlife  
Life History Notes  
**Red Fox**

Scientific Name: *Vulpes vulpes*



Publication 91  
(1099)



### Introduction

The red fox is one of two fox species in Ohio and one of four in North America. The state's other fox is the gray fox. The Arctic and swift foxes are the other species found in North America. North American foxes inhabit a wide range of habitats from deserts to forests to snow-covered tundras. This isn't completely surprising as the red and other foxes are members of the same family of adaptable animals that includes the wolves, coyote, and domestic dog--*Canidae*.

The red fox inhabits almost all of the United States and Canada. There are only a few areas where this species isn't found in the two countries: the West Coast, southwest Oklahoma and northwest Texas in the states and small portions of Alberta and Saskatchewan, Canada.

### Description

The red fox is likely the one that comes to mind when you think of a fox. Although it can have several color variations, the red fox takes its name from its most common color phase: a rusty-red or reddish yellow coat from its face down its back and sides. Its undersides, throat area, and cheeks are white. The legs, feet, and outside of the ears are black; its long, bushy tail has black hairs mixed with the red and ends in a white tip. This feature can be used to help identify it; the gray fox's tail has a black tip. The tail of the red fox is usually between 14 and 16 inches long.

The red fox may appear in two other color

phases. Variations in color include solid black and silver. In all of its color phases, however, the red fox's tail is white-tipped.

The red fox is similar in appearance to a dog, with a slender body, long legs, and a long pointed muzzle.

### Habitat and Habits

The red fox likely arrived in Ohio in the mid-1700s. Prior to that time, its range extended to just north of Ohio. But as Ohio was settled and forests were opened and farmlands established the red fox began to inhabit the state. The red fox prefers a mixture of forest and open country. Farmland with woodlots and brushy areas near marshes and swamps are ideal for this species. But the red fox isn't limited to residence and activity in such areas. The species is adaptable and can be found in many other habitat types, including the suburbs.

Red foxes are solitary creatures during the fall and early winter. Their range is one to two miles, but if food supplies dwindle within this area, the animals will extend their normal range to search for food. These foxes do not hibernate; under extreme winter weather conditions they will reduce activity levels and take shelter for a day or two.

The red fox has a distinct call, not like those of its cousins the wolf, coyote, or dog; males yelp and females yap.

Red foxes are nocturnal creatures, meaning that they are most active at night, feeding and

moving from place to place. Nonetheless they are often found hunting during daylight hours.

The red fox is known for its speed, excellent senses of sight, smell, and hearing, and exceptional use of cover when pursued.

## Reproduction and Care of the Young

The red fox's solitary wandering comes to a close in Ohio as early as December, but typically in January or February when courtship and mating rituals begin. A male will seek an unmated female and form a pair bond. Females then seek out an abandoned groundhog burrow as a den for her kits. Both the male and female will work on expanding this site that is later lined with grasses. Females that need to dig their own dens from scratch usually do so by selecting an area of loose, sandy soil with a southern exposure. A natural rock shelter may also be used. It is not unusual for the foxes to have a reserve den prepared nearby or for several families to share a den. Most fox dens are about four feet below ground.

Female red foxes carry their young for nearly two months (51-53 days); as such most kits in Ohio are born in March or April. Litters typically are made up of five or six kits. While the female is below ground nursing her offspring, the male will bring her food. He continues in this role until the young are weaned and can go with their parents on hunting trips where they learn a basic survival skill. By fall of the same year, the family unit breaks up; the young are mature enough to go on their own and their parents split and live independently until the start of the next breeding season. Red foxes are monogamous during the reproductive and pup-rearing stages. It is unclear as to whether or not the same male and female will reunite in following years.

## Management Plans

The Ohio Division of Wildlife doesn't manage habitat specifically for the red fox. However, the red fox can be found on many of our state wildlife areas where suitable habitat exists. The habitat management activities that occur on these areas and elsewhere around the state are designed to benefit the red fox and a host

of other wildlife species. Each year wildlife biologists evaluate data and establish hunting and trapping season dates and bag limits for taking the red fox.

## Viewing Opportunities

Red foxes are found in all 88 counties of Ohio. The best chances of seeing them are in rural areas where open space is interspersed with woods. Four of Ohio's officially designated "Watchable Wildlife" areas are good places to catch a glimpse of the elusive red fox: Blacklick Woods Metro Park, Delaware State Wildlife Area, Fowler Woods State Nature Preserve, and Ottawa National Wildlife Refuge.

## Do Something Wild!

The Ohio Division of Wildlife manages for wildlife diversity in the state. We attempt to create and/or conserve the habitat that will support as wide a diversity of wildlife as possible. Many species like the red fox are hunted in the state, but many more are not. The Division has a special program to manage and research non-game species that is supported by the generous citizens of the state of Ohio. With money either donated through the state income tax checkoff, by the purchase of wildlife license plates, or direct contributions to the Endangered Species Special Account, the Division is able to purchase critical habitat that is essential to sustaining many species of wildlife and to implement special efforts like the reintroduction of the osprey and the trumpeter swan to the state.

Contributions to our Wildlife Diversity Program are accepted throughout the year. To make a donation, please send a check to: Endangered Species Special Account, Ohio Division of Wildlife, 1840 Belcher Drive, Columbus, Ohio 43224-1329. All contributions, whether made on your income tax return or directly, are tax deductible.

## At a Glance

Mating: Monogamous

Peak Breeding Activity: January-February

Gestation: 51-53 days

Young are Born: February-April

Litter Size: 5 or 6 kits

Young Leave Parents: In the fall, about 6-8 months after birth

Number of Litters per Year: 1

Adult Weight: 8-15 pounds

Adult Length: 22-25 inches

Life Expectancy: 6-8 years; oldest known 12

years

Migration Pattern: Year-round resident

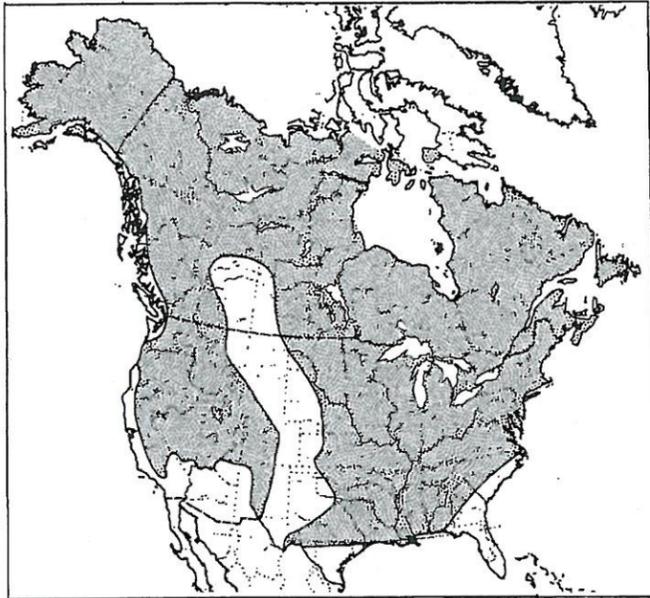
Typical Foods: Mice, rats, rabbits, ground-hogs, and other small mammals; also birds, fruits, and some grasses.

Native to Ohio: No, arrived following European settlement



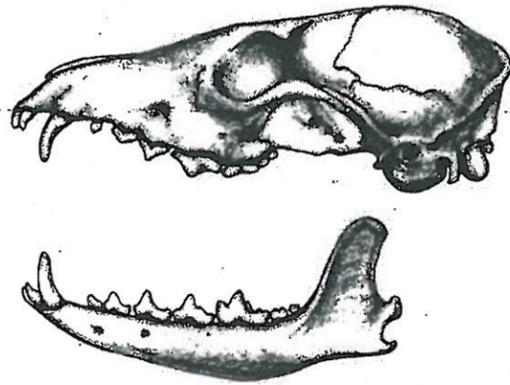
This species is a prime recreational resource in Ohio. Although the value of its fur is subject to the whims of the fashion industry, it is consistently one of the most challenging quarrys of the sport hunter and trapper. In spite of the sometimes high demand for red fox furs and the inroads on the population by domestic dogs, Reynard's adaptability ensures it will be a welcome part of the Ohio scene far into the future.

RANGE OF THE RED FOX



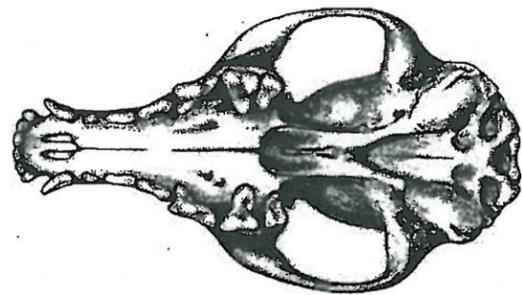
NORTH AMERICAN DISTRIBUTION

SKULL



DENTAL FORMULA (42 teeth)

|       | Incisors | Canines | Premolars | Molars |
|-------|----------|---------|-----------|--------|
| Upper | 3        | 1       | 4         | 2      |
| Lower | 3        | 1       | 4         | 3      |



HIND



2 x 1 3/4 in.

FRONT



2 1/4 x 2 1/8 in.

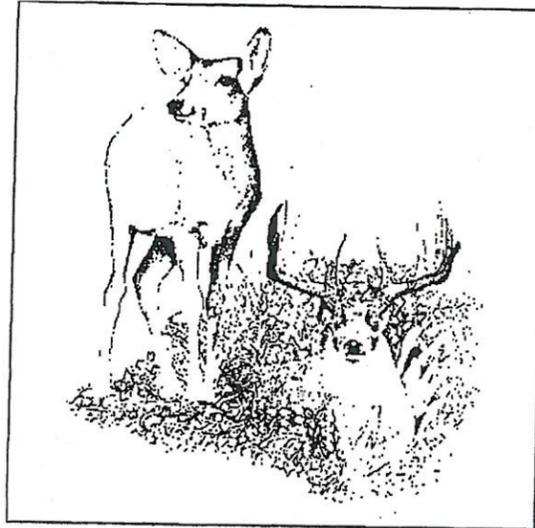
TRACKS



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 Fountain Square, Columbus, Ohio 43224

Ohio Division of Wildlife  
Life History Notes  
**White-tailed Deer**

Scientific Name: *Odocoileus virginianus*



Publication 101  
(399)

### Introduction

The white-tailed deer, commonly referred to as the whitetail, is perhaps Ohio's best-known wildlife species. It is seen in the state's wildlife areas, parks, and nature preserves as well as in the backyards of rural and suburban residents. The state's only big game animal, it has provided table fare for generations of the state's inhabitants from Native Americans to thousands of sportsmen and women today. However, the white-tailed deer hasn't always been as abundant in the state as it is today. As a matter of fact, there was a period of time (1904 to 1923) when the deer was absent in the state. As Ohio was settled, habitat was eliminated and hunting was unregulated. By the early 1900s white-tailed deer were extremely rare in the state. Between the 1920s and 1930s, limited stocking combined with the natural movement of deer from neighboring states into Ohio, and the establishment and strict enforcement of hunting laws allowed the development of a herd that today occupies all 88 counties.

### Description

The whitetail has two seasonal coats. The spring/summer coat is reddish tan, and relatively short, with a thin and wiry hair texture. The winter coat is more grayish or even bluish tan with heavy, long guard hairs and a thick

undercoat that provides excellent insulation. White patches are found around the eyes, on the throat, belly, tail (underside), and insides of the legs. When in flight, the large white tail or *flag*, flipped up in the air can be the easiest way to spot the deer. Whitetails, especially in Ohio, are also well known for their antlers. The whitetail buck grows its first set of antlers when it is a year old. Each year, a buck's antlers begin growing in the early spring. The developing antler is covered with a thick velvety skin rich with blood vessels and nerves. Decreasing day length in the late summer and early fall triggers many physical changes in the buck, including termination of the blood supply to the antlers. The antlers begin to harden soon thereafter and by August or September, the velvet is shed as the buck rubs his antlers against trees and other solid objects in the fields and woods. The buck is left with a rack of hard polished antlers. In a sound environment—abundant and nutritious food and water—racks can grow to massive size. Deer in poor habitat will not only appear thin, but have small antlers as well. Unlike horns of cattle, antlers are not a permanent part of a male deer's body. In Ohio, bucks typically shed or drop their antlers in December and January, following the fall breeding season.

## Habitat and Habits

Whitetails are active around the clock, but less so during daylight hours. Most often, white-tailed deer are on the move at dawn and dusk. This behavior can prove hazardous to humans during the breeding season in the fall. Commuters to and from work often encounter deer on the move at this time of year which can result in serious accidents. Drivers should pay special attention October through December when traveling through zones marked with deer crossing signs.

White-tailed deer are often admired for their graceful movement. People enjoy watching them run across a field or clear a fence or other barrier from a virtual standstill. Deer have been recorded leaping heights of as much as eight feet to clear a fence or barrier.

Whitetails are not very vocal, but scientists have identified at least 13 different sounds they make that are associated with various activities and behaviors.

Hearing, sight, and smell are well developed in the white-tailed deer as any hunter will verify. Individually these senses are impressive; in combination they go a long way in helping deer survive. Hearing is used to identify the presence of other animals, including human beings, nearby. Smell is also used for this purpose and to help the deer select food. The whitetail's eyes are set to the side of its head allowing it to see almost all the way around its body.

Whitetails prefer an area with diverse food and cover types, including mixed-aged timber stands. Ideal habitat will provide a mixture of forest, brushland, and cropland in blocks of one to two square miles.

Deer in Ohio eat a wide variety of items; among them are: wild crabapple, corn, sumac, Japanese honeysuckle, grasses, greenbriar, clover, soybeans, jewelweed, acorns, dogwoods, and miscellaneous woody plants.

## Reproduction and Care of the Young

Courtship activities among deer begin in mid-October. Bucks will chase does over a period of five or six days prior to mating. The buck will mate with a doe several times and remain with her for a few days keeping other males away. Eventually the two will separate and the male will go on to breed more does before the breeding or *rutting* period ends.

The buck provides no assistance to the female in caring for the fawn(s). In good habitat, many fawn does will be bred their first fall and give birth to a single fawn the following spring when they are only a year old. Most adult does will have twins and occasionally triplets. Fawns are born quickly with the doe either standing or lying down. Does may return to the same place each year to give birth. When born, male fawns weigh between 4 and 14 pounds, and females 3-8 pounds. Fawns are born with their eyes open and they are able to walk within an hour or two. Fawns will nurse two or three times a day for the first few days after birth and then return to thick cover after each meal. At about one month the fawns begin to accompany their mother when she goes to eat. The family group of mother and fawns will stay together until the following spring. At that time, the doe will return to her favorite fawning territory, excluding all deer, including her fawns, from this preferred area. Her doe fawns will remain in the general area and rejoin her sometime mid- to late summer. They will remain in proximity of their mother their entire life. Buck fawns, in most cases, will leave their birth area in the spring and travel great distances to set up new home ranges. Those bucks that don't leave in the spring will be forced to do so in the fall, both by their mother and other related females.

## Management Plans

Whitetail deer are perhaps the most intensively managed wildlife species in the state. Deer are many things to many people. They may be viewed as superb game fare and a trophy by sportsmen and women, a prized addition to the landscape by the nature enthusiast, a threat to crops by the forester and farmer, or a road hazard for the motorist. Accommodating these diverse interests has been the responsibility of the Ohio Division of Wildlife since deer began returning to the state in 1923.

The Division's official deer management goal is to maintain county deer populations at a level that provides maximum recreational opportunity including hunting, viewing, and photography, while minimizing conflicts with agriculture, motor travel, and other human activities. Each year wildlife biologists evaluate deer herd population numbers and establish appropriate hunting season dates and bag limits for white-tailed deer.



### Viewing Opportunities

You usually don't have to go far in Ohio to see a white-tailed deer. They are present in all 88 counties and are often seen along the road. In local parks, and sometimes your own backyard. Twenty-nine of Ohio's 80 Watchable Wildlife sites are recommended as places to see white-tailed deer. Among them are: Deer Creek, Killdeer Plains, Spencer Lake, Funk Bottoms, Killbuck Marsh, Salt Fork, Egypt Valley, and Waterloo wildlife areas; Palnt Creek and Hueston Woods state parks; Mohican-Memorial, Hocking, and Shawnee state forests; and Fowler Woods and Tinkers Creek state nature preserves.

### Do Something Wild!

The Ohio Division of Wildlife manages for wildlife diversity in the state. We attempt to create or conserve the habitats that will support as wide a variety of wildlife as possible. Many species like the white-tailed deer are hunted in the state, but many more are not. The Division has a special program to manage

and research non-game species that is supported by the generous citizens of the state of Ohio. With money either donated through the state income tax checkoff, by the purchase of wildlife license plates, or direct contributions to the Endangered Species Special Account, the Division is able to purchase critical habitat that is essential to sustaining many species of wildlife and to implement special efforts like the reintroduction of the osprey and the trumpeter swan to the state.

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**At a Glance**

Mating: Polygamous

Peak Breeding Activity: Early to mid-November; begins as early as mid-October and runs through mid-January

Gestation: 187-222 days; average 200 days

Young are Born: Mid-May through July; peak in late May through mid-June

Litter Size: 1 in first year; 2 and sometimes 3 in later years

Young Leave Parents: Weaned at 10-12 weeks

Number of Litters per Year: 1

Adult Weight: Males-130-300 pounds; females-90-210 pounds

Adult Body Length: 52-95 inches

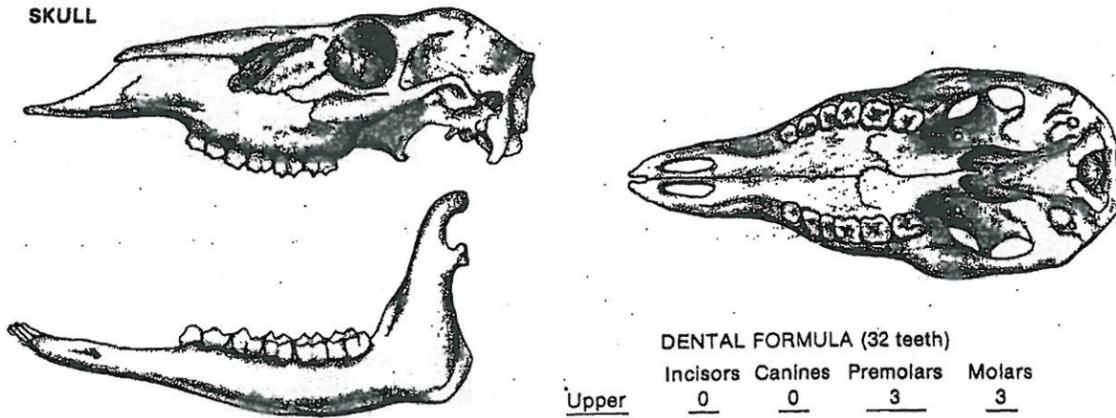
Life Expectancy: Up to 15 years, but the average is 2 years for males and 3 years for females in the wild

Migration Pattern: Year-round resident; home range is 1/2 -2 square miles

Typical Foods: Include wild crabapple, corn, sumac leaves and stems, grasses, clover leaves, jewelweed leaves, acorns, and dogwood fruits and stems

Native to Ohio: Yes.

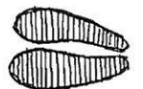
**SKULL**



**DENTAL FORMULA (32 teeth)**

|       | Incisors | Canines | Premolars | Molars |
|-------|----------|---------|-----------|--------|
| Upper | 0        | 0       | 3         | 3      |
| Lower | 3        | 1       | 3         | 3      |

← 3" →



HIND

← 2½" →



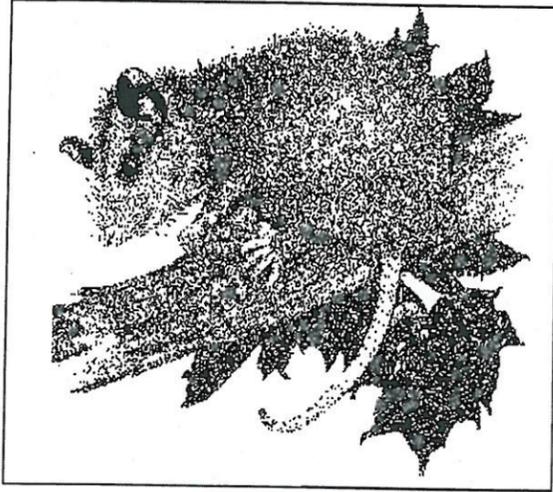
FRONT

**TRACKS**



# Opossum

Scientific Name: *Didelphis marsupialis*



Publication 96  
(1099)

## Introduction

The opossum is North America's only marsupial—a mammal that carries its underdeveloped young in a pouch until they are capable of living independently. It is also one of the oldest and most primitive species of mammal in North America. This animal is little changed from its ancestors of 70 million years ago.

Opossums were probably rare in the vast forests of unsettled Ohio, but began to take hold as the land was cleared for agriculture. Today they are found in every county of the state, and slightly more abundant in southern Ohio.

## Description

An adult opossum is about the size of a large house cat, with coarse grizzled grayish fur. It has a long, scaly tail, ears without fur, and a long, pointed snout that ends in a pink nose.

## Habitat and Habits

Farm land is the preferred habitat for the opossum, especially wooded pastures adjacent to a lake, stream, marsh, or swamp. This affinity contributes to the recent outbreak of *Equine Protozoal Myelitis (EPM)*. Horses across the country, and particularly in the Midwest and South have contracted the disease which results in neurological problems including lack of coordination and awareness of limb placement. The opossum is the carrier of the protozoa, passed through its feces, causing this ailment. There is no cure for this disease which is often left undiagnosed as its symptoms mimic other problems and ultimately it can be fatal

to the horse. Horse owners should consider allowing hunters and trappers permission to take these animals on their property during legal seasons as a precautionary effort.

Opossums are quite adaptable and can also be found in suburbia and the city. Their ideal habitat, however, is an area with woods, wetlands, and farmland interspersed. The den is usually situated in a wooded area near water. The opossum is an opportunist that will take shelter anywhere it can stay dry and safe from predators. It often uses the deserted dens of other animals, brush piles, tree holes or openings under old buildings as shelter.

The opossum's best known behavior is that of "playing possum." When threatened, the opossum may hiss and bare its teeth. More likely, though, it will roll over and lay motionless, appearing to be dead. When the danger is past, the possum "revives" and resumes its activities.

## Reproduction and Care of the Young

Opossums are polygamous, meaning males mate with more than one female and play no role in rearing the young. A female opossum carries her young approximately two weeks before they are born. Opossums are undeveloped, and tiny (1/15 ounce) at birth. The offspring must crawl to a nipple in the mother's pouch to survive. The nipple will swell in the offspring's mouth, providing a secure attachment and constant food supply for two months. At about three months of age, young possums emerge from the pouch for short periods and



will hitch a ride on the mother's back to get from place to place. In several days to a week the young leave the "nest" for good.

### Management Plans

The Ohio Division of Wildlife doesn't manage habitat specifically for opossums. However, opossums can be found throughout the state and at many wildlife areas where suitable habitat exists. The management activities that occur on these areas and elsewhere around the state are designed to benefit opossums and a host of other wildlife species. Each year wildlife biologists evaluate data and establish hunting and trapping season dates and bag limits for opossums.

### Viewing Opportunities

Opossums are found throughout Ohio. The best chance of seeing them is where farmland, wetlands, and woods merge. Five of Ohio's officially designated "Watchable Wildlife" areas are good places to see opossums: Lake Isaac Waterfowl Sanctuary, Delaware Wildlife Area, Irwin Prairie State Nature Preserve, Ottawa National Wildlife Refuge, and Spencer Lake Wildlife Area.

### Do Something Wild!

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diversity in the state. We attempt to create and/ or conserve the habitat that will support as wide a diversity of wildlife as possible. Many species like the opossum are hunted and trapped in the state, but many more are not. The Division has a special program to manage and research nongame species that is supported by the generous citizens of the state of Ohio. With money either donated through the state income tax checkoff, by the purchase of wildlife license plates, or direct contributions to the Endangered Species Special Account, the Division is able to purchase critical habitat that is essential to sustaining many species of wildlife and to implement special efforts like the reintroduction of the osprey and the trumpeter swan to the state.

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### At a Glance

Mating: Polygamous

Peak Breeding Activity: February-March, but can run from January-October

Gestation: 12-13 days

Young are Born: Peak is March-April, but can be as long as February-November

Litter Size: 5-25; average is 9

Young Leave Parents: At 3 months

Number of Litters per Year: 1-3; 1 is typical in Ohio

Adult Weight: 4-15 lbs.; 5 is average

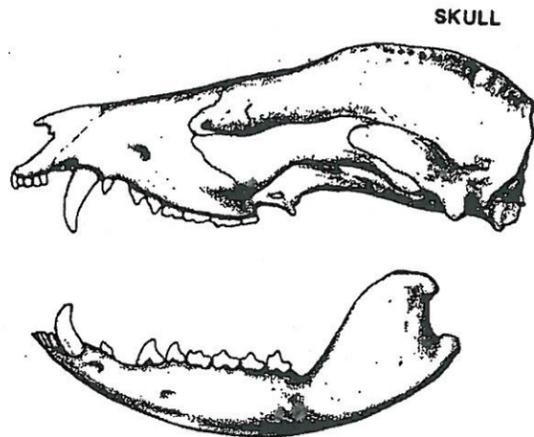
Adult Length: 15-20 inches

Life Expectancy: 1-2 years; 7 is maximum known

Migration Patterns: Year-round resident; individuals wander widely with a home range of 15-40 acres

Typical Foods: Omnivorous. Will eat carrion, insects, fish, reptiles, eggs, fruits, vegetables, and nuts

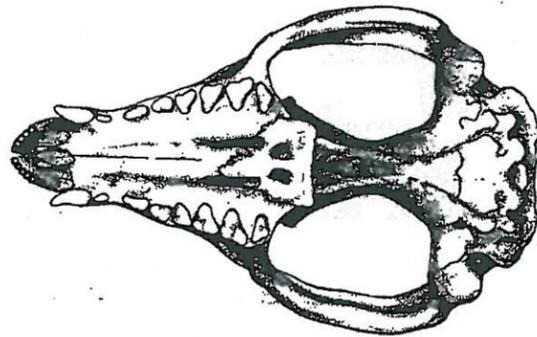
Native to Ohio: Yes



SKULL

DENTAL FORMULA (50 teeth)

|       | Incisors | Canines | Premolars | Molars |
|-------|----------|---------|-----------|--------|
| Upper | 5        | 1       | 3         | 4      |
| Lower | 4        | 1       | 3         | 4      |



2"



FRONT



HIND

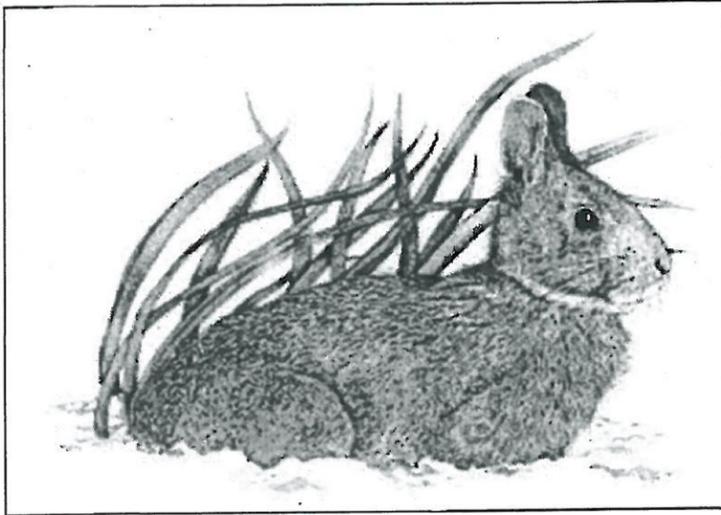


TRACKS



# Eastern Cottontail Rabbit

Scientific Name: *Sylvilagus floridanus*



Publication 93  
(1099)

## Introduction

The Eastern cottontail rabbit is one of the most common wildlife species in the state of Ohio. Although native to the state it was not as nearly widespread prior to European settlement. As with several other species of wildlife, the Eastern cottontail was a beneficiary of settlement; the clearing of woodlands and the establishment of more open areas along wooded borders provided an ideal environment.

Cottontail rabbits are found in all 88 counties of Ohio. They are also distributed throughout much of the continental United States, found as far west as the Plains states and into parts of New Mexico and Arizona. They can also be found in southern Manitoba and Saskatchewan, Canada.

Cottontail rabbits are also prolific. It has been estimated that if no young rabbits were lost from a litter, one pair of rabbits could produce 350,000 offspring in five years. This is unlikely to ever occur as rabbits also have a high mortality rate—few live more than a year.

## Description

The Eastern cottontail rabbit is a small mammal with a brownish-gray body, long ears, and a small white tuft of a tail that resembles a cotton ball—the feature it derives a part of its name from. There is also a rusty colored patch of fur on the nape of the neck. The feet can be whitish.

## Habitat and Habits

Eastern cottontail rabbits prefer open areas bordered by thickets or brush areas. Preferably the open area is an old field with tall grass. Nearby burrows are used as protection from predators and harsh weather. Open woods with nearby brush piles or near fields are also utilized. Still rabbits are found inhabiting suburbs and cities using lawns and nearby borders of shrubbery and other boundary plantings for food and cover.

Rabbits prefer to eat near cover, and rely on "travel lanes" not only for safe haven, but as a relatively safe way to get from place to place. A travel lane may be a brushy fencerow, multiflora rose hedges, immature pines, corn rows, stream banks or dry drainage ditches—cottontails are reluctant to get into water although they are capable of fording water, but only if necessary.

The cottontail rabbit has an unusual courtship display. The male and female will sit and face each other. The male then moves towards the female and leaps straight up into the air, making a 180 degree turn. In the meantime, the female has run under the male and will sit facing him when he lands. This behavior will continue for a period of time with both sexes making the leap and spin into the air. Mating immediately follows this "dance." Rabbits are polygamous meaning that the male will mate with more than one female. Male rabbits will play no role in rearing the young.

The nest is a shallow depression made in the ground that is four to six inches deep and



four to five inches wide. A variety of field types ranging from pastures to pine plantations to mowed lawns are used as nesting sites. As long as there is suitable cover and food nearby, a site is acceptable for nesting. The nest is lined with dry grass and fur from the female's body. Female rabbits carry their young for about a month. Litters average five members, although there can be as many as seven and as few as two young rabbits born. The young are born with their eyes closed, deaf, and without hair. The female doesn't stay on the nest however; most of the time she is away from it returning only to feed the young. At just over three weeks (26 days) the young will leave the nest and begin life on their own. Most female rabbits will produce three litters in a year; if conditions are favorable five litters may occur.

### Management Plans

The Ohio Division of Wildlife doesn't manage habitat specifically for cottontail rabbits. However, rabbits can be found throughout the state and on most of our state wildlife areas where suitable habitat exists. The habitat management activities that occur on these areas and elsewhere around the state are designed to benefit a host of wildlife species, including the Eastern cottontail. Each year wildlife biologists evaluate data and establish hunting season dates and bag limits for the Eastern cottontail rabbit.

### Viewing Opportunities

Rabbits can be found and seen throughout the state, possibly as close as your own backyard. The best location to see cottontails is at an open field adjacent to brush piles or other dense cover. Should you venture out to see cottontail rabbits, several of the state's designated "Watchable Wildlife" areas are good choices: Delaware Wildlife Area, Woodbury Wildlife Area, Pickerington Ponds Wetland Wildlife Refuge, Big Island Wildlife Area, Ottawa National Wildlife Refuge, and Funk Bottoms Wildlife Area.

### Do Something Wild!

The Division of Wildlife manages for wildlife diversity in the state. We attempt to create and/or conserve the habitat that will support as wide a diversity of wildlife as possible. Many species like the Eastern cottontail rabbit are hunted in the state, but many more are not. The Division has a special program to manage and study non-game species that is supported by the generous citizens of the state of Ohio.





*Rubus idaeus*

With money either donated through the state income tax checkoff, by the purchase of wildlife license plates, or direct contributions to the Endangered Species Special Account, the Division is able to purchase critical habitat that is essential to sustaining many species of wildlife and to implement special efforts like the reintroduction of the osprey and the trumpeter swan to the state.

Contributions to our Wildlife Diversity Program are accepted throughout the year. To make a donation, please send a check to: Endangered Species Special Account, Ohio Division of Wildlife, 1840 Belcher Drive, Columbus, Ohio 43224-1329. All contributions, whether made on your income tax return or directly, are tax deductible.

### At a Glance

Mating: Polygamous

Peak Breeding Activity: April-May

Gestation: 29 or 30 days

Young are Born: Early March-late September; May-June is peak

Litter Size: 2-7, average 5

Young Leave Parents: 3+ weeks

Number of Litters per Year: 2-5, 3 is average

Adult Weight: 2-4 pounds, 2.5 pounds is average

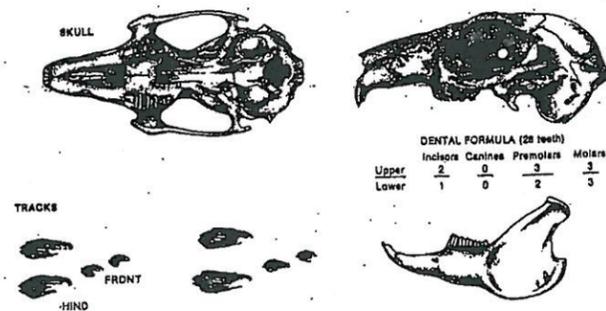
Adult Length: 14.5-16.4 Inches

Life Expectancy: Usually less than a year, some live to 4 or 5 years

Migration Pattern: Year-round resident

Typical Foods: Clover, dandelion, plantain, lamb's-quarter, and ragweed. Winter foods may include ear corn, dry hay, and bark of tree saplings, raspberry, blackberry, and multiflora rose.

Native to Ohio: Yes



## **Skulls on the Internet**

**Skulls Unlimited International**  
**[www.skullsunlimited.com](http://www.skullsunlimited.com)**

**Acorn Naturalist**  
**[www.acornnaturalist.com](http://www.acornnaturalist.com)**

**Carolina Biological Supply**  
**[www.carolina.com](http://www.carolina.com)**

**The Bone Room**  
**[www.boneroom.com](http://www.boneroom.com)**

**American Hunters Specialty and Wildlife Skulls  
of Texas**  
**[www.wildlifeskulls.com](http://www.wildlifeskulls.com)**

**There are likely more resources than those  
found here. Feel free to research for additional  
information.**

**Contact your local taxidermist as a possible  
source of skulls as well.**

## Activity

### HIDE N HAIR

**OBJECTIVE:** Students will be able to 1) infer the adaptive significance of the characteristics of mammal fur, and 2) identify some historic and present day uses of animal hides and fur.

**METHOD:** Students examine a variety of preserved animal hides and consider open ended questions to help guide their observations.

**BACKGROUND:** While we may be somewhat familiar with common mammals, it's unlikely that many of us have had an opportunity to actually handle them. By examining preserved animal parts such as bones, study skins, or hides we may discover additional relevance to many of the things we have learned about wild animals.

**MATERIALS:** Preserved fur and hides from several mammals, including if possible: black bear, deer, beaver or muskrat, and any others available.

**PROCEDURE:** Allow the students to freely examine the study skins. Ask individual students or small groups of students to propose a question based on their observations of the furs. The questions need not have a right or wrong answer, nor should they be answered with yes or no, rather they might begin with, "Why do you suppose...?"

*Note: This exercise not only encourages keen observation skills, it teaches the art of asking and answering questions. Questioning often leads to*

*new thoughts and new discussions while opening the mind to things that might otherwise be overlooked. It exercises critical thinking skills because a good question requires fully developed thoughts to achieve an answer or conclusion. It's not always important that the answer is right; what's important is what is learned while trying to answer. Don't rush an answer; allow time for the students to discover possible answers for themselves, and perhaps come up with a new idea.*

Introduce the idea of utilizing animal skins for clothing and other human needs. Ask again that the students develop the questions that will guide a discussion of this topic.

#### **EVALUATION:**

- 1.) Make a list of the metabolic processes in which fur or hide play a role.
- 2.) Generate a list of human wants and needs. For each item on your list, discuss in what way an animal might have historically contributed or presently contributes to satisfying that need.



## The Science of Fur

Just as you might wear a heavy coat or a light T-shirt, depending on the weather, mammals rely on their fur coat to keep them warm in winter and cool in summer. *Thermoregulation*, or maintaining a constant body temperature, is one of the most important functions of fur or hair. Hair also performs a variety of other functions. These include protective coloration or camouflage, a line of defense (such as the spines of a porcupine), attracting a mate, and the sense of touch.

Two types of hair fibers make up the *pelage* (pel'ij) or fur of mammals. *Overhairs*, also called *guard hairs*, are coarse, variably rigid, and pigmented. They represent the outer protective layer of the pelage of most mammals and receive the most abrasion from the environment. They can be erected to increase the thickness of the coat and trap air for warmth or also as a warning to other mammals. They also function to shed water droplets, keeping the deeper fur layer dry. A good example is the coat of a deer. The overhairs are the long tawny hairs on the deer's back and the white hair on the underside of its tail and belly.

*Underhairs* are short, thin, and also pigmented. They represent the main insulating layer of fur in most mammals. Underhairs correspond to the longer hairs of humans and wool of sheep.

As the seasons change, the insulating value of fur in most arctic and temperate mammals also changes, mainly because of changes in fur depth and density. For example, in voles, a small mouse-like mammal that tunnels under the ground, the number of hairs per unit area of skin is greater in the winter than in the summer.

All hairs, in particular guard hairs, are finer during the winter. In the fine winter coat, the hairs are close together, trapping air that acts as an insulator helping to conserve body heat and keep the animal warm. In the coarser, sparser summer coat, the hairs are further apart so heat can escape more easily from the skin helping keep the animal cool.

All mammals strive to keep their fur dry. Dry fur provides the most effective insulation. Next to each follicle is a *sebaceous* gland that secretes an oily substance that helps waterproof the fur. If this waterproofing were missing, an animal like a muskrat would not be able to maintain its body temperature in cold water.

Mammals actually seem to "know" when it's time to grow their winter coat; however, the winter coat actually occurs because of a chemical or hormonal change in the animal's brain. Data suggests that the brain responds to a decrease in the number of hours of daylight. As the days get shorter in autumn, these hormones stimulate the growth of a winter coat.

*Adapted from an article by David Kocka, Virginia Dept. of Fish and Game.*

# Tricky Tracks

**Identify mammal tracks, then solve some snowy track mysteries.**

**Objectives:**  
Identify the tracks of several different types of mammals. Explain how people can use tracks to find out more about mammal habits and behaviors.

**Ages:**  
Intermediate and Advanced

**Materials:**

- copies of pages 50, 51, and 52
- questions on page 47
- reference books and field guides
- pencils and paper
- chalkboard or easel paper
- plaster of Paris
- rulers

(continued next page)

**E**xcept for a chattering squirrel or fleeing whitetail deer, you may rarely see mammals in the wild. That's because many mammals are active only at night, and quickly take cover when people come near. But you can often find evidence that mammals have been around by looking at the tracks they leave behind in moist sand, soft soil, or snow.

And by studying these tracks, you can often figure out what these mammals were doing, where they were going, what they preyed upon, and what preyed upon them.

In the first part of this activity, your kids will learn to recognize the tracks of some common mammals. And in the second part they'll use this knowledge to answer some questions about a track-filled scene.



## PART 1: WHOSE TRACK IS IT?

List the following mammals on a chalkboard or large piece of easel paper: raccoon, whitetail deer, snowshoe hare, beaver, red fox, red squirrel, black bear, house cat, muskrat, porcupine, weasel, and skunk. Then pass out a copy of page 50 to each child. Explain that each set of mammal tracks shown on the page matches one of the mammals you listed.

Tell the kids that they'll be using reference books and field guides to identify tracks. (See page 75 for some suggestions of reference books you can use.) Before the kids begin their research, use the information below to talk about what to look for when studying mammal tracks.

**Paws or Hooves:** The shape of the track can tell you if it was made by a mammal.



metal cans without lids or cardboard rings  
 paint and brushes  
 (optional)

subject:  
 science

with paws or hooves. Some pawed mammals, such as foxes and bobcats, walk on "tiptoes," so only the center pads and toes on their feet show in their prints.

Mammals with hooves, such as horses, deer, cows, and elk, are also tiptoe walkers. A hoof is like a thick toenail.

Other mammals, such as raccoons, skunks, and porcupines, walk flat-footed, forming a print of the entire paw.

**Claws or No Claws:** Small triangular marks in front of paws are made by claws. Raccoons, skunks, coyotes, foxes, and dogs often leave claw marks. But most cats, such as cougars, lynx, and house cats, sheathe their claws when they walk or run, leaving no claw marks.

**Different Patterns:** The pattern of a set of tracks can help you figure out what animal made the tracks. Some mammals that live in trees, such as squirrels, hop or bound along when they're on the ground. And as they bound, their larger hind feet land ahead of their smaller front feet. If you look carefully at the prints made by the front feet, you will see they are side by side.

The tracks of hopping mammals that live on the ground, such as rabbits and some mice, are a little different. Although the hind feet still land ahead of the front feet, the front-feet tracks are usually found one in front of the other—not side by side.

Most bounders that live on the ground, such as weasels, leave paired prints as they run. (Check field guides for more track patterns.)

**Slow and Fast:** Most mammals' track patterns change as their gaits change. For example, a walking skunk leaves a pattern of single prints that changes into a diagonal line of prints when it breaks into a run (see illustration).

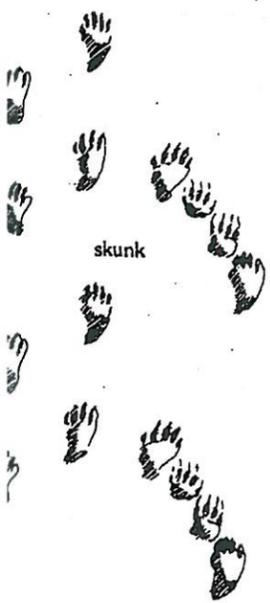
**Direction:** Tracks also tell in which direction a mammal was headed. Claw marks point in the mammal's forward direction, just as your toes point in the direction you're going. If claws aren't visible in the tracks, look for soil or snow pushed back by the movement of the mammal's feet. (The soil or snow will be pushed back in the direction the mammal came from.)

**Snow, Soil, and Sand:** Tracks will look different depending on what type of surface the mammal was walking on. Distinct tracks with well formed claw and paw shapes will show up in mud, moist earth, and in freshly fallen, relatively shallow snow. But tracks become blurry in deep snow and don't show up well at all in hard sand and dirt.

As the kids research each of the mammals to find out about its tracks, have them write the name of the correct mammal in the blank underneath the drawing. Also have the kids take notes on where each mammal lives and what it eats. (This information will help them in Part 2 of the activity.) When everyone is done, go over the correct answers (see below).

**Answers:**

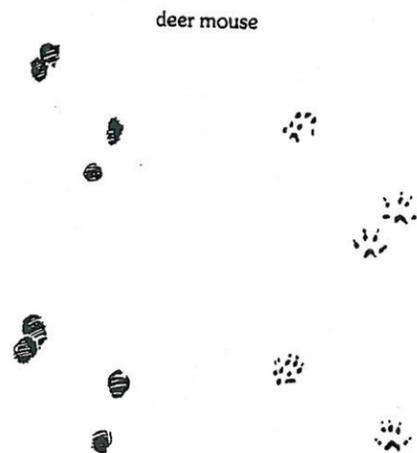
- 1—raccoon; 2—snowshoe hare; 3—porcupine; 4—house cat; 5—black bear; 6—red squirrel; 7—striped skunk; 8—beaver; 9—muskrat; 10—red fox; 11—whitetail deer; 12—weasel



WALKING      RUNNING



CLAWS      NO CLAWS



DEEP SNOW      WET SAND

## PART 2: THE TALES TRACKS TELL

Now that they can recognize some tracks, see if your kids can “read” track clues to solve some mysteries in the snow. Copy the questions under “What Happened Here?” on a chalkboard or large piece of easel paper. Then pass out a copy of page 51 and a blank piece of paper to each person. Explain that page 51 illustrates a snow-covered scene in the northern Midwest, and the tracks of nine of the mammals that the kids identified in Part 1 appear in the scene.

The circles on the page contain

close-ups of the tracks and the number beside each set of tracks corresponds to one of the questions you listed. Have the kids answer the questions to figure out the story behind each set of tracks. (They can write their answers on the blank pieces of paper.) When everyone has finished, pass out copies of page 52 and go over the kids’ answers using the information we’ve provided in parentheses after each question. *Note:* As you discuss the page, explain that all these mammals would not be in the same area at the same time.

### WHAT HAPPENED HERE?

1. Why do these tracks end at the tree? (A porcupine climbed the tree.)
2. What mammal made these tracks? (house cat)
3. Why do these tracks stop so suddenly? (A large hawk swooped down, grabbed the red squirrel, and then flew off to eat it.)
4. What mammal made these tracks and what could it have been looking for? (A raccoon crossed the creek twice looking for food.)
5. Why do these two sets of tracks both go to the brushpile, then separate and go in different directions? (A fox followed the trail of a snowshoe hare to the brushpile. The hare hid inside while the fox circled around. Finally the fox wandered off, and when the coast was clear, the hare hopped away unharmed.)
6. Why do these tracks cluster near this bush? (A deer was browsing on its twigs.)
7. What mammal came out of its den here and headed away from the creek? (black bear)
8. Why did one of these mammals stop and turn around so suddenly? (A person turned around and ran when he saw a skunk—and then tripped over a fallen branch!)

### BRANCHING OUT: TAKING TRACKS HOME

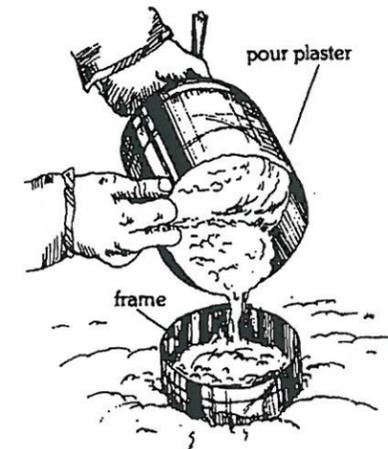


Take your group on a track walk to see if they can discover which mammals have been out and about. Muddy stream banks, sandy spots, and areas with freshly fallen snow are good places to look for tracks. Bring a ruler to measure the tracks and a field guide to help with identification.

If you find well formed prints, the kids can make plaster casts of the tracks to take home. Here’s how to do it:

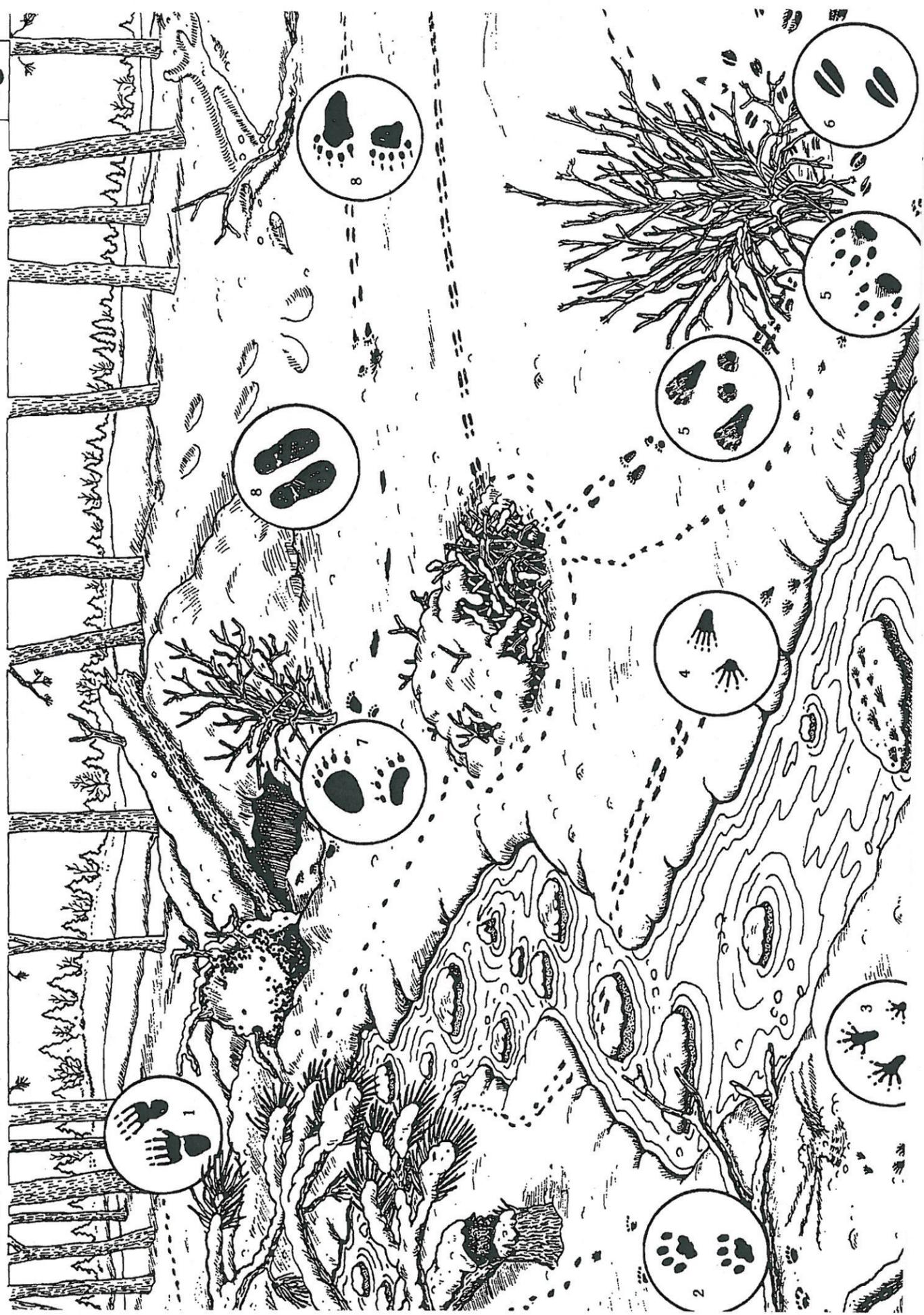
1. Mix the plaster with water according to the directions. (The mixture should be of about the same consistency as pancake batter.)

2. If the track is in snow, spray it lightly with water. (The water should freeze which will harden the track and form a better cast.)
3. Make a frame around the track by placing a can or circle of cardboard around it (see illustration).
4. Pour the plaster into the frame until the surface is completely covered.
5. When the plaster has hardened, remove the frame. You might want to have the kids paint the track so it will stand out against the “frame” of the plaster surrounding it.

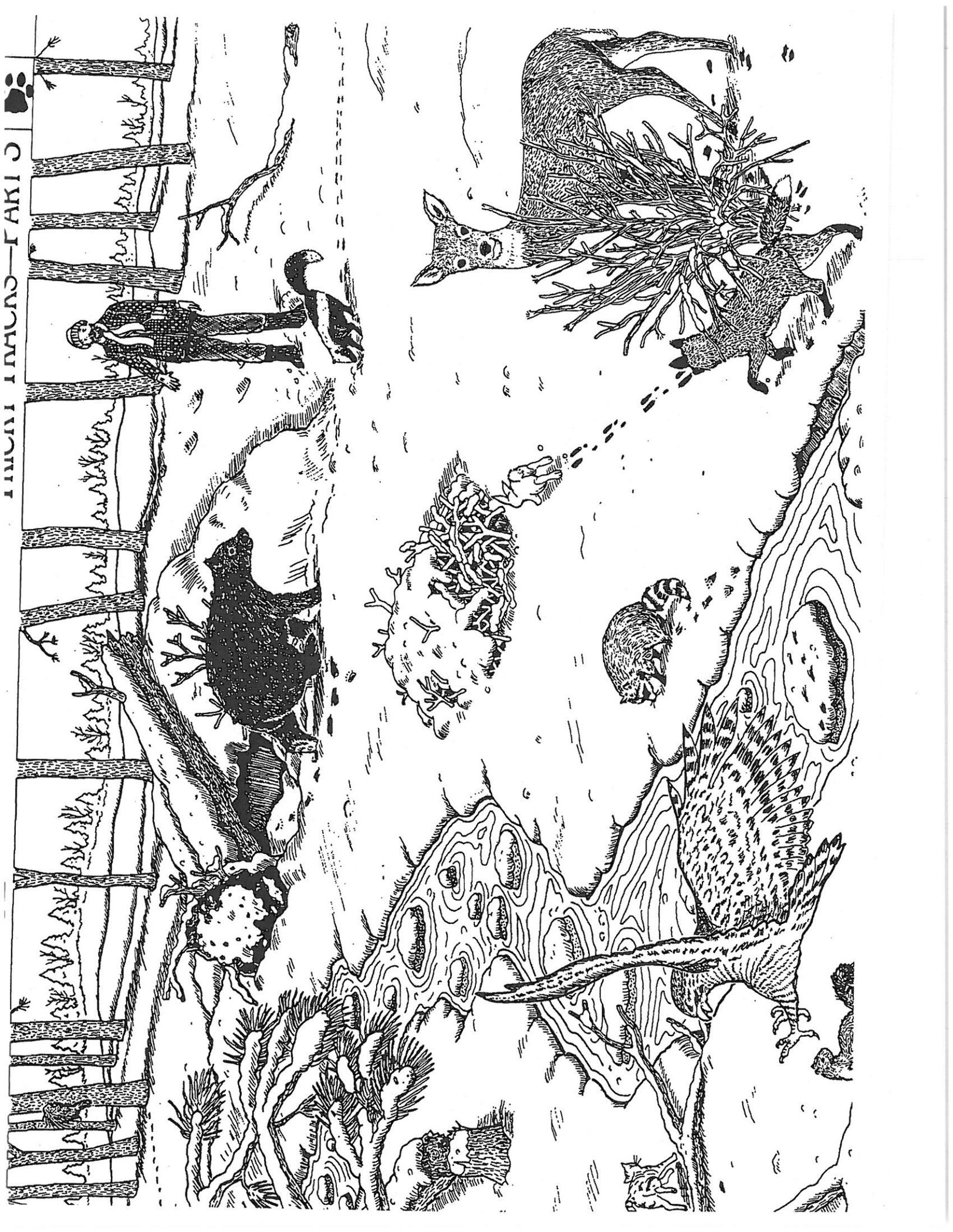




|                                       |  |                                       |
|---------------------------------------|--|---------------------------------------|
| <p>1</p> <p>F 3"<br/>H 3 3/4"</p>     | <p>2</p> <p>H 2 3/4"<br/>F 2 1/2"</p>      | <p>3</p> <p>F 2 3/4"<br/>H 3 1/2"</p> |
| <p>4</p> <p>F 1 1/8"<br/>H 1 1/8"</p> | <p>5</p> <p>H 8"<br/>F 8"</p>              | <p>6</p> <p>H 1 3/4"<br/>F 3/4"</p>   |
| <p>7</p> <p>F 1 1/2"<br/>H 2 1/2"</p> | <p>8</p> <p>H 6"<br/>F 3"</p>              | <p>9</p> <p>F 1 1/4"<br/>H 3"</p>     |
| <p>10</p> <p>F 2 1/2"<br/>H 2"</p>    | <p>11</p> <p>F 2 1/2-3"<br/>H 2 1/2-3"</p> | <p>12</p> <p>H 1"<br/>F 7/8"</p>      |



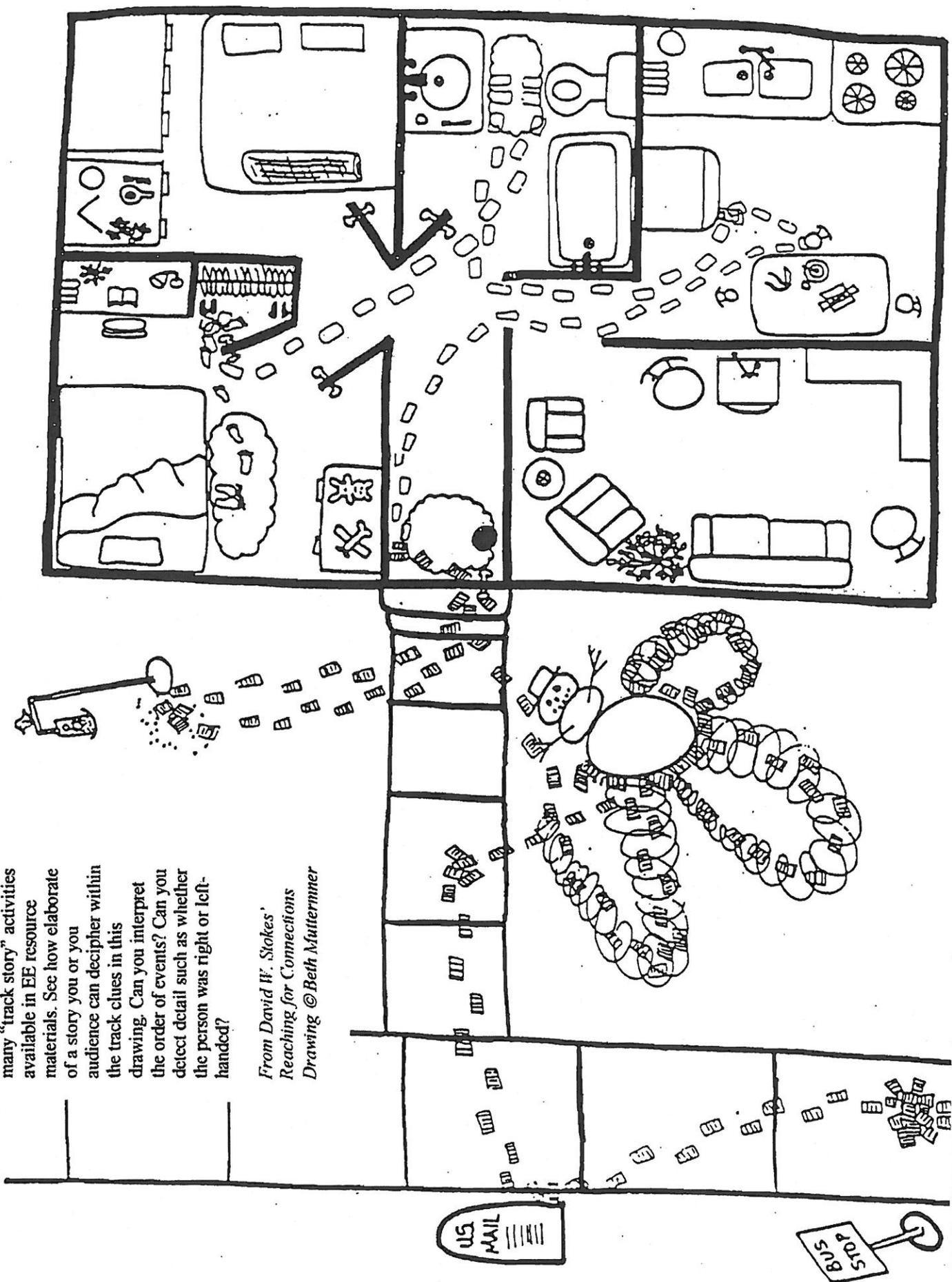
A series of horizontal lines for writing, consisting of a solid top line, a dashed middle line, and a solid bottom line, typical of a primary school writing template.



A "Tracks" Story

Here is a supplement to the many "track story" activities available in EE resource materials. See how elaborate of a story you or you audience can decipher within the track clues in this drawing. Can you interpret the order of events? Can you detect detail such as whether the person was right or left-handed?

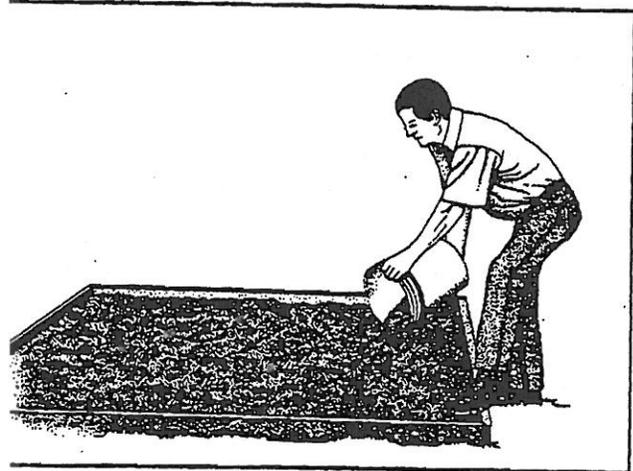
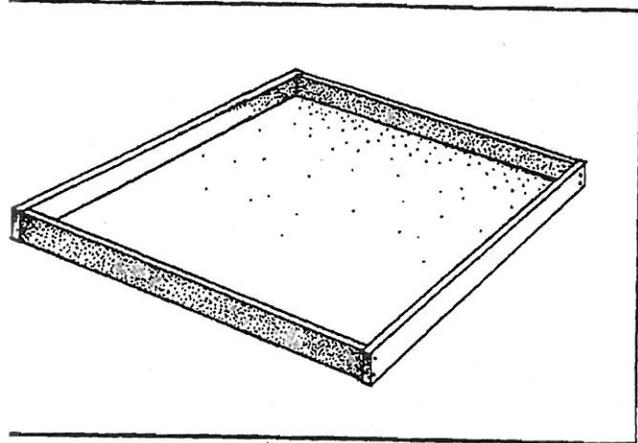
From David W. Stokes' *Reaching for Connections*  
 Drawing © Beth Muttermer



# ANIMAL TRACKING PLOT

## sk:

Clear an appropriate area three feet by three feet or larger of all grass and vegetation and fill with clay soil. Use a variety of baits to attract wildlife to the area.



## ult:

Regardless of where your school is located, you can attract many species of wildlife that will leave their tracks for you to study.

## ussion:

Students will be surprised by the variety of wildlife that might leave their tracks in the moist earth of a baited tracking plot.

Even students at urban sites can study the tracks of birds, mice, squirrels, rabbits, opossum, raccoons, and sometimes deer.

The simplest tracking plot requires no actual construction. A cleared area should be covered with clay soil two to three inches deep. The clay should be raked smooth and moistened so that it is soft enough that visiting animals leave a clear impression.

Food scraps, grain, dog or cat food, or other suitable "bait" should be placed near the plot regularly to attract wildlife to the area.

You may have to experiment with locally available clay, clay/soil or clay/sand to see which is easiest to handle and works well to retain an impression. It takes quite a lot of clay to fill a tracking plot; you can figure on about three gallons per square foot.

The tracking plot will have a neater appearance and be more easily maintained if it is "framed" with suitable lumber. Treated two by four inch or four by four inch deck lumber can be nailed together and buried level with the surface of the ground. The area within the frame is then dug out and filled with clay.

If your school site has, or is near a field or stream, you can go track hunting without the benefit of a tracking plot. Any spot that's fairly level with soft, fine-textured soil could be a place to check for tracks. The best places to look are near water or along a well-worn trail. Larger animals will use more open areas, while a very small cleared spot under some bushes may reward you with many different little tracks of mice, shrews or chipmunks.

## Extensions:

1) Tracks may be "collected" and a permanent record made of wildlife visitors. To collect a track, use plaster of Paris to fill a temporary mold form constructed around the track

2) Permanent tracks for comparison can be a part of this feature. Pour a three by three

foot concrete pad next to the tracking plot. Before it hardens, make various tracks in the concrete using preserved animal feet or rubber or plaster casts of tracks. The casts may be purchased through biological supply houses.



# Pitter Patter



## Objective:

Students will learn to observe animals by studying their tracks and will understand how animals can be grouped according to the way they move.

**Grade Level:** 1-5

**Groupings:** Entire class

**Materials:** Track pattern cards (see step # 5); index cards showing various animal footprints; *Track Pattern Cards* (page 161); string, rolls of paper or window shades (see step #6).

**Time Allotment:** 20 minutes

## Directions:

1. *Pitter Patter* is the key activity to a unit on tracking. Show the class your *Sherlock Holmes Track Detective Card* (see page 170) and explain that you went to a special animal tracking school and learned to be a track detective. Ask the students whether they would like to become track detectives. Tell them you can initiate new detectives if they can discover and learn the secret tracking formula.
2. Gather the class around you. Explain that the secret tracking formula will help them focus on important outdoor tracking clues in the woods and fields. Explain that the formula is top secret, and so it is necessary to whisper.
3. Caution the students to listen carefully as you will be giving important clues to the formula. Give the following clues slowly and see whether the students can guess the three words in the secret formula. Pause to let them fill in the italicized word. The tracking formula consists of three words that all begin with the letter *P*. The first clue students should look for when tracking is the animals' *footprint*. Once they discover a *footprint*, they need to determine the design that the footprints make in the snow. This design keeps repeating itself and is called a track *pattern*. The last thing they need to discover in tracking is where the animal lives or if it has a secret hiding *place*.
4. Have the students repeat the secret formula: *pattern, print, place*. Explain that it is important to use this formula to identify and study animals when they're outdoors tracking. When they find a trail, they should first identify the track pattern. This can help to narrow down the possible animals that might have made the track. Next look for a good, clear, detailed footprint. This is one of the best tracking clues but often is difficult to find. Last, students should be sure to notice the place where the tracks are found. They should try to discover where the tracks are going to or coming from. These places give the last important clue to the animal's identity.
5. Explain to the students that animals walk in four basic track patterns. You will teach the class to recognize these patterns. They will need to learn these before they go outside tracking. Make the track pattern cards from twelve 3" x 5"

### Extensions:

a. While outdoors, use a ruler to measure the tracks. When you find an animal's trail, measure the **stride**, or the distance between two tracks; some trackers also measure the distance between the first and third track because it tells you its approximate overall length. Also measure the **straddle**, the distance across the tracks, from the outside of the first to the outside of the second. This measurement can tell you how wide the animal is. Use a field guide to compare these measurements with the animal's true dimensions.

b. Make your own tracks in the snow. Compare walking and running tracks. Measure the stride. What happens to the distance between footprints when you start to run? Have the students create their own track patterns while others try to guess how they were made.

c. Play track charades. Have the students act out stories about different animals. Remind them to try to move in the track patterns appropriate for their animals. Use the following stories, or have the students make up their own.

- You are an owl. Swoop down to catch a mouse, leaving your wing prints in the snow.
- You are a rabbit nibbling on some low branches. You hear a gunshot. Quickly hop into the woods, stopping often to listen for danger. Hide under a low bush.
- You are a mouse hopping through the forest. You leave a long track behind you as your tail drags on the snow.

### Directions: (continued)

index cards. Draw a single large oval on eight of the cards, and then cut four cards in half and draw single small circles on them, giving you a total of sixteen track-pattern cards. You will use these cards to demonstrate the four track patterns.

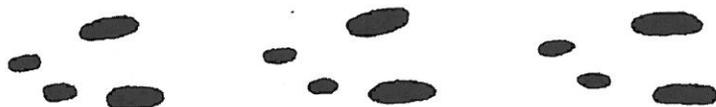
6. Begin with the perfect or straight-walking pattern. Place six cards on the floor in the correct pattern. With older students you might lay down the first two or three cards correctly and then see if they can complete the pattern.



Ask for a volunteer to try to walk in this pattern with feet on the first two prints, and hands on the next two. To walk in this pattern, the students will have to move their right hand and left foot at the same time (and likewise their left hand and right foot). As their hand moves forward, their foot goes onto the card where their hand was. Show the students the footprints of all the animals who walk in this pattern and have them guess who they are. Use a roll of paper or a white window shade stamped with various animal footprints in rows (see *Moving Along*, page 160).

7. Give all the students a chance to imitate this pattern. Have them imagine they are one of the straight-walkers and let them practice walking around the room in the straight-walker pattern.

8. Using the track pattern cards, lay out the hopper pat-



tern on the floor. Ask the students what animal might move in this pattern. Explain that hoppers have one pair of feet that is larger than the other pair. Can they guess which tracks are made by the front feet and which by the rear? Which way is this animal headed? Point out that the

**Extensions: (continued)**

- You are a raccoon waddling along a stream. Stop and go down to the stream to look for food.
- You are a weasel bounding through the snow with long strides. Suddenly you tunnel under the snow in search of mice.

**Directions: (continued)**

hopper's pattern is interesting because the larger hind feet land in front of the smaller front feet. Ask the student how an animal might do this. Have a volunteer demonstrate. On all fours, the volunteer hopper places the hands between the widespread legs. Moving, the arms swing ahead first to take the body's weight. The back feet follow, swinging around to the outside of the hands and landing slightly forward of them. Again, show the class footprints of other hoppers and let the students hop around like one of these animals.

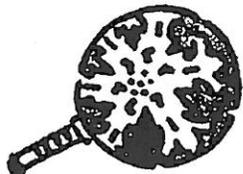


- You are one of a small herd of deer walking single-file through the deep snow. Stop to graze. Suddenly, one of the herd hears a sound – danger!! Flick up your tail and run for cover.
- You are a dog out alone on a sunny afternoon. Run around and explore the neighborhood, sniffing as you go.
- You are a lone coyote on a hilltop at night. Give a howl and head out across a field in search of your inner.

9. Next, lay out the waddler pattern. This is one of the more difficult patterns to imitate. See whether the class can figure



out the waddler's method of walking from its track pattern. Ask for a volunteer waddler. The waddler's weight shifts to the right as both the left hand and foot move forward at the same time, then shifts to the left as the right hand and foot move in their turn. When done slowly and with some exaggeration, waddling can give a clear impression of an animal slowly lumbering along. Show the class footprints of waddlers. Explain that they are usually slow-moving animals that don't need speed because they have other means of



## MOVING ALONG

### PERFECT or

**STRAIGHT WALKING** is the most common gait for felines (house cat, bobcat), canines (dog, fox, coyote), and ungulates (cow, sheep, deer, moose).

**HOPPING** is the gait used by cottontail rabbits, snowshoe hares, squirrels, chipmunks, mice, voles and shrews.

**WADDLERS** are mostly heavy-set mammals such as beaver, porcupine, muskrat, raccoon, skunk, opossum and bear.

**BOUNDING** is the common gait for most of the weasel family — short and long-tailed weasel, mink, otter, marten and fisher.

### Directions: (continued)

defense (e.g., the skunk has its smell, the porcupine its quills, the bear its size, and the raccoon its sharp teeth). Have the class slowly waddle about, pretending they are one of the waddlers.

10. Lay out the last track pattern, that of the bounders. (These tracks are seldom seen in urban or suburban areas, so you might decide to omit this pattern.)



Explain that all members of the weasel family except the skunk are bounders. These animals have long, narrow bodies and very short legs. Moving, they look like a spring or a Slinky. Have a volunteer bouncer place his or her hands and feet together in one spot, then leap or bound forward so that all fours land together. Show the class a typical weasel footprint. Explain that in order to identify tracks of the several different members of the weasel family, one would need to look closely at the size of the print and at the place it was found. Let the students bound around like weasels.

11. Review the four track patterns briefly. Pass out copies of the *Track Pattern Card* to your students. Have them fold it in half along the dotted line and protect it for outdoor use by covering it with contact paper, laminating it or simply placing it in a plastic baggie. Punch two holes in the top and add string so it can be worn around the neck. Then take the class outside in search of real animal tracks. Have them use their *Track Pattern Card* to help them identify the tracks they find.

## Home Range

The wild things that live on my farm are reluctant to tell me, in so many words, how much of my township is included within their daily or nightly beat. I am curious about this, for it gives me the ratio between the size of their universe and the size of mine, and it conveniently begs the much more important question, who is more thoroughly acquainted with the world in which he lives?

Like people, my animals frequently disclose by their actions what they decline to divulge in words. It is difficult to predict when and how one of these disclosures will come to light.

\* \* \* \*

The dog, being no hand with an axe, is free to hunt while the rest of us are making wood. A sudden *yip-yip-yip* gives us notice that a rabbit, flushed from his bed in the grass, is headed elsewhere in a hurry. He makes a beeline for a woodpile a quarter-mile distant, where he ducks between two corded stacks, a safe gunshot ahead of his pursuer. The dog, after leaving a few symbolic toothmarks on the hard oak, gives it up and resumes his search for some less canny cottontail, and we resume our chopping.

This little episode tells me that this rabbit is familiar with all of the ground between his bed in the meadow and his blitz-cellar under the woodpile. How else the beeline? This rabbit's home range is at least a quarter-mile in extent.

The chickadees that visit our feeding station are trapped and banded each winter. Some of our neighbors also feed chickadees, but none band them. By noticing the furthest points from my feeder at which banded chickadees are seen, we have learned that the home range of our flock is half a mile across in winter, but that it included only areas protected from the wind.

In summer, when the flock has dispersed for nesting, banded birds are seen at greater distances, often mated with unbanded birds. At this season the chickadees pay no heed to wind, often being found in open wind-swept places.

The fresh tracks of three deer, clear in yesterday's snow, pass through our woods. I follow the tracks backwards and find a cluster of three beds, clear of snow, in the big willow thicket on the sandbar.

I then follow the tracks forward; they lead to my neighbor's cornfield, where the deer have pawed waste corn out of the snow, and tousled one of the shocks. The tracks then lead back, by another route to the sandbar. *En route* the deer have pawed at some grass tufts, nuzzling for the tender green sprouts within, and they have also drunk at a spring. My picture of the night's routine is complete. The over-all distance from bed to breakfast is a mile.

Our woods always harbors grouse, but one day last winter, after a deep and soft snow, I could find neither a grouse nor a track of one. I had about concluded that my birds had moved out, when my dog came to a point in the leafy top of an oak blown down last summer. Three grouse flushed out, one by one.

There were no tracks under or near the down top. Obviously these birds had flown in, but from where? Grouse must eat, especially in zero weather, so I examined the

droppings for a clue. Among much unrecognizable debris I found bud-scales, and also the tough yellow skins of frozen nightshade berries.

In a thicket of young soft maple I had noticed, in summer, an abundant growth of nightshade. I went there and, after a search, found grouse tracks on a log. The birds had not waded the soft snow; they had walked the logs and picked the berries projecting here and there within their reach. This was a quarter-mile east of the down oak.

That evening, at sunset, I saw a grouse budding in a popple thicket a quarter-mile west. There were no tracks. This completed the story. These birds, for the duration of soft snow, were covering their home range a-wing, not afoot, and the range was half a mile across.

\* \* \* \*

Science knows little about home range: how big it is at various season, what food and cover it must include, when and how it is defended against trespass, and whether ownership is an individual, family, or group affair. These are the fundamentals of animal economics, or ecology. Every farm is a textbook on animal ecology; woodsmanship is the translation of the book.

Aldo Leopold  
December  
*A Sand County Almanac*

# Home Range

## Key Quotes

*"The wild things that live on my farm are reluctant to tell me, in so many words, how much of my township is included within their daily or nightly beat."*

*"Every farm is a text book on animal ecology; woodsmanship is the translation of the book."*

## OBJECTIVES

The students will be able to:

1. Interpret the evidence of "signs" left by at least three different animals using natural settings or pictures.
2. Define the term "home range" and identify the approximate size of the home range for at least three local animals.

## BACKGROUND

Leopold describes the area of land used by rabbits, chickadees, deer, and grouse, and the plants used for food and shelter. He learned about the home range of animals by observing them directly and by finding evidence of their behaviors.

## MATERIALS

### Outdoors

- Animal identification books

### Indoors

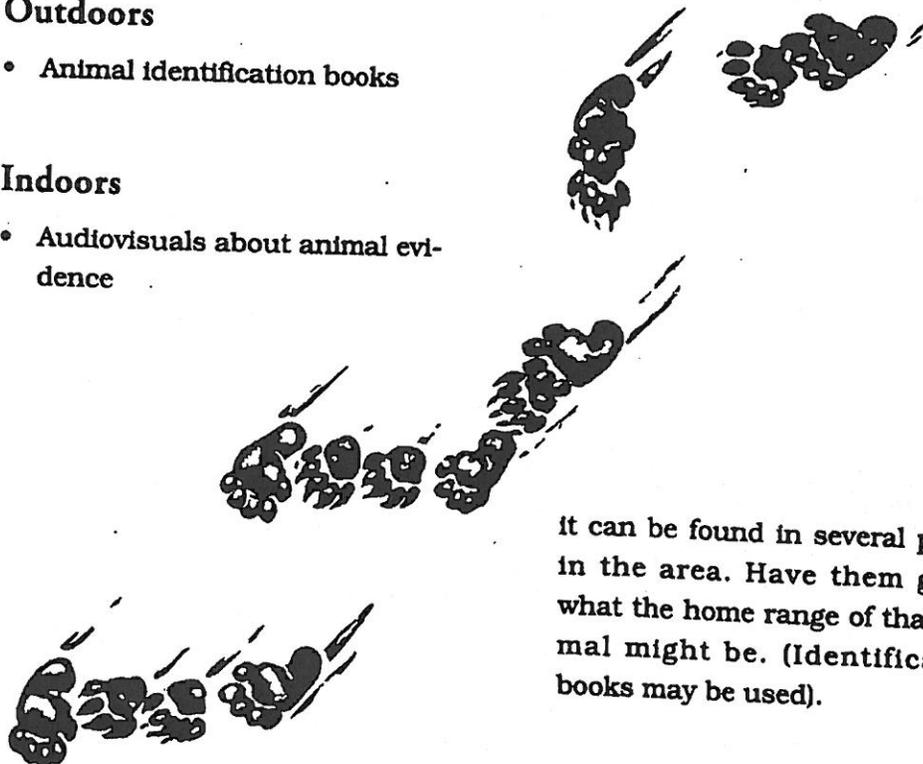
- Audiovisuals about animal evidence

- Sketches of animal evidence
- Animal identification books

## PROCEDURES

### Outdoors

1. Discuss some of the possible animal evidence that might be found outdoors and the size of the area needed for particular animals to find food, shelter, water, and adequate space.
2. Take the students outside to a suitable area. In teams of two to three, direct them to locate animal evidence and make sketches of their findings on 5x8 cards (one sign/card).
3. Ask them to choose one animal sign they can identify and see if



it can be found in several places in the area. Have them guess what the home range of that animal might be. (Identification books may be used).

- 
4. Direct each group of two to three students to pair up with another group and have them try to guess the name of the animal that left each sign, using one card at a time.

### Indoors

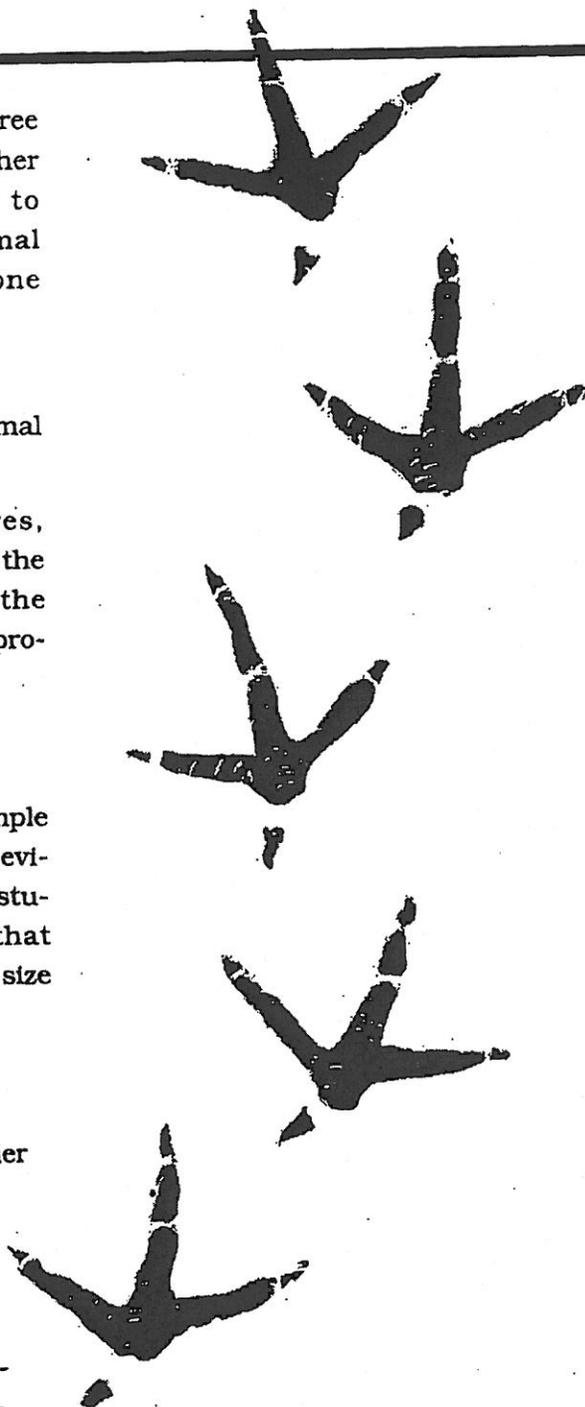
1. Show audiovisuals about animal evidence.
2. Refer to outdoor procedures, substituting audiovisuals for the outdoor experience or use the sketches of animal evidence provided.

### EVALUATION

The teacher could select an example of one animal sign (the actual evidence or a sketch), and ask the students to identify the animal that caused it and the approximate size of its home range.

### EXTENSIONS

1. Invite a biologist or bird bander into class to talk about animals signs and home range.
2. Have the students try to duplicate animal signs outdoors, and have other students attempt to identify the animals that made them.
3. Find out what scientists have learned about home range since Leopold wrote this essay in the 1940s.



**Subjects**  
science (ecology)

**Key Words**  
home range, bud  
scales, budding, pop-  
ple, woodsmanship,  
ecology

**Related Essays**  
"65290"  
January Thaw

# Home Range

## Student Worksheet

Name \_\_\_\_\_

Date \_\_\_\_\_ Period \_\_\_\_\_

### INTRODUCTION

The essay briefly describes some of the activities of rabbits, chickadees, deer, and grouse as they find food, shelter, water, and adequate space within their home-range areas.

### WHAT TO DO

Review the sections in the essay "Home Range" that describe the home ranges of the animals on Leopold's farm.

Record the names of at least three local animals, and sketch an example of the evidence they leave. Estimate the size of their home range based on what you discover.

| Animal | Evidence | Home Range Area |
|--------|----------|-----------------|
|        |          |                 |
|        |          |                 |
|        |          |                 |
|        |          |                 |
|        |          |                 |

Read about each animal you studied and find out more information about each, especially their home ranges.

1. What animal did you choose?

2. What types of evidence could be found if you studied the animal in more depth?

3. How have humans affected the home range of the animals you investigated?

## Scat Rap

Written by Rodd Pemble, Mary Keebler, Andy Bennett  
1988 GSMIT Music and the Environment Workshop

### Chorus

Starts with an "S" and ends with a "T".  
It comes out of you and it comes out of me.  
I know what you're thinking. It could be called that.  
But be scientific and call it scat.

If you want to find out what animals eat  
Take a good long look at what they excrete.  
Stuck in the scat are all kinds of clues  
Parts of the food that their bodies can't use.

### Chorus

Down by the creek on a hollow log  
Scat full of berries and bones of frogs  
Fresh last night, out with the moon,  
Hunting crawdads it was a big raccoon.

### Chorus

You park your car by a woods or field,  
Gonna find scat on your windshield.  
Full of seeds, purple and white  
You just got bombed by a bird in flight.

### Chorus

If you wanna know what's in the woods or around,  
Take a good long look at the scat on the ground.  
It tells us what they eat and tells us who they are.  
And that's what we know about scat so far.

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