A GUIDE TO
POCONO MAMMALS
FOR
EDUCATORS

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Purpose
The intention of this guide is to provide educators of all grade levels and settings with a concise resource containing information, activities, and community connections pertaining specifically to Pocono mammals. There are more scientifically-thorough books available on the mammals of Pennsylvania, and identification guides on the mammals of northeastern Pennsylvania, but none geared explicitly for educators. As a biologist and 25-year classroom veteran, I have tried to make this publication both scientifically valid and user-friendly. It is designed as a resource for your teaching; please pull it apart and use as much or as little of it as your needs dictate.

Acknowledgements
This project was undertaken with the guidance and enthusiasm of Dr. Howard Whidden, Department of Biological Sciences, East Stroudsburg University. He is both a dedicated mammalogist and a gifted educator.

References
To make this material more readily useable for both teachers and students, I have omitted all literature citations from the text. Throughout the guide, I have relied heavily on Guide to the Mammals of Pennsylvania by Joseph F. Merritt and The Mammals of Northeastern Pennsylvania by John Serrao. A list of additional references can be found at the back of this publication.
Introduction

Defining the Poconos

For purposes of this guide, the Poconos may be loosely defined as the approximate 2000 square mile area between the Pocono Plateau to the north, the Kittatinny Mountains to the south, the Delaware River to the east, and the Moosic Mountains to the west.

This area is extensively wooded upland habitat mixed with rivers, ponds, lakes, streams, and waterfalls.

Incidence & Importance of Mammals

Most species of mammals living in northeastern PA are nocturnal and secretive. For this reason, people tend to be unfamiliar with them. Sixty species of mammals are currently found in the Pocono region. They inhabit every environment from forests, backyards, and farmlands to rivers, ponds, and wetlands. They can be found in the trees, in the grass, under leaf litter, underwater, and in underground burrows. Their homes can be quite extensive and therefore may alter patterns of water flow or cause erosion.

While they are all consumers, their diet and feeding habits vary greatly. Some of our resident mammals are herbivores, feeding primarily on plants, others are omnivores and eat a wide variety of foods, both plant and animal, and some are carnivores, preying on fish, invertebrates, birds, or other mammals. In addition, within each of these categories, some mammals are generalists while others are specialists.
Due to the wide variety of niches occupied by mammals, they play an integral part of our Pocono ecosystems.

**History**

The natural history of northeastern Pennsylvania was influenced tremendously by the early settling of America and soon thereafter by westward expansion. In the 1800’s, logging destroyed huge tracts of extensive forest in the region and this also influenced the climate, making it warmer and drier. The result was a significant decline in the populations of some mammals. In addition, logging, trapping, and hunting resulted in the demise of some species. The collective result was the extirpation of species such as elk, beaver, fisher, marten, and lynx. The development of wide-scale agriculture then created suitable habitat for other mammals, such as foxes, rabbits, woodchucks, and mice, leading to increases in their populations. At least 2 species (the Norway rat and house mouse) have been completely introduced from elsewhere. Thus, the actions of one mammal species, humans, altered the natural history of the Pocono area for countless others.

In 1895, the Pennsylvania Game Commission was established to study, protect, and manage populations of wildlife. In the early 1900’s, programs were implemented to reintroduce extirpated species.

**POCONO MAMMALS EXTIRPATED &/OR REINTRODUCED**

<table>
<thead>
<tr>
<th>Species</th>
<th>Date extirpated</th>
<th>Cause of extirpation</th>
<th>Date reintroduced</th>
</tr>
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<td>Beaver</td>
<td>early 1900’s</td>
<td>trapping</td>
<td>1917</td>
</tr>
<tr>
<td>Fisher</td>
<td>early 1900’s</td>
<td>trapping, habitat destruction</td>
<td>1994</td>
</tr>
<tr>
<td>Mountain Lion</td>
<td>late 1900’s</td>
<td>hunting, trapping, habitat destruction, decimation of prey</td>
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**Taxonomy**

There are 7 orders of mammals present in the Poconos (out of 26 orders worldwide):

- Didelphimorphia – opossums
- Insectivora – shrews & moles
- Chiroptera – bats
- Lagomorpha – rabbits & hares
- Rodentia – gnawing mammals/rodents
- Artiodactyla – even-toed hoofed mammals
- Carnivora – carnivorans

**Characteristics of Mammals**

Mammals possess the following unique traits that differentiate them from other vertebrates:

1. **Mammary glands:** Mammals have special glands that, in females, produce milk to nourish young; these are non-functional in males.
2. **Hair:** The amount of hair varies considerably among mammals, but it is always present. Hair provides insulation, which aids in maintaining body temperature despite external conditions. It may also be important for camouflage and defense.
3. **Lower jaw bones:** Mammals possess a single lower jaw bone on each side, the dentary.
4. **Middle ear structure:** Mammals have 3 middle ear bones that help conduct sound: the malleus, incus, and stapes (hammer, anvil, stirrup).
5. **Secondary palate:** Mammals have a hard secondary palate separating the nasal passage from the mouth, thus allowing
mammals to breathe and chew simultaneously, and to suckle.

6. **Specialized teeth:** Mammal teeth occur in two developmental sets (baby and adult), and are specialized into incisors, canines, premolars, and molars.

7. **Diaphragm:** Mammals have a sheet-like muscle separates the lungs from the abdominal cavity.

8. **Four-chambered heart:** The heart has separate pulmonary (lung) and systemic (body) blood flow, which allows greater activity.

9. **Red blood cells:** Mammal red blood cells lose their nuclei as they mature, and are biconcave to increase surface area for oxygen transport.

10. **Cervical vertebrae:** Almost all mammals have 7 neck vertebrae.

11. **Skull articulation:** The mammal skull connects to the neck vertebrae through 2 occipital condyles (knobs), which give it extra support.

12. **Limb position:** In mammals, the limbs are oriented directly below the body, making the posture upright instead of sprawling.

13. **Brain:** The mammal brain is large and well developed, allowing for complex learning and behaviors.
Family Didelphidae - New World Opossums

There are 15 genera and 63 species of didelphids living today. Most of them are found in Central and South America, with only 1 species, the Virginia opossum, occupying North America.

Didelphids are a diverse family, varying in size, habitat, and diet. They are characterized by long snouts and long, prehensile tails. Their feet have five digits and their big toe is opposable. A marsupium or pouch is present in some genera.

In the Poconos, the family Didelphidae is represented by only one species, *Didelphis virginiana*. 
Virginia Opossum  
*Didelphis virginiana*

**Habitat:** lowland forests & wooded swamps

**Features:** length: 1-2 feet, cone-shaped head, pointed snout, naked scaly prehensile tail, thin ears, opposable big toe, abdominal pouch

**Habits:** primarily nocturnal; less active in cold weather but does not hibernate; arboreal

**Diet:** omnivorous: insects, carrion, berries, acorns

**Predators:** foxes, bobcats, dogs, hawks, great horned owls

**Defense:** growl, hiss, play dead, defecate, produce bad smell

**Reproduction:** 1-2 litters/year; up to 13 young

**Life Span:** up to 3 years

**Status:** common, hunted year round, no limits

**Cool Facts:**
- Opossums have the largest number of teeth of any North American land mammal (50).
- The opossum uses its prehensile tail to help it climb.
- Opossums are more resistant to rabies than any other mammal.
- Thirteen days after mating, the bean-sized babies crawl to the pouch and nurse for 2 months before emerging.
Order Insectivora

Family Soricidae – Shrews

The Soricidae is a large family of small mammals that is widespread and abundant in Africa, Eurasia, and North America. Shrews are specialized for insectivory and predation and are noted for being ferocious. They are characterized by long, pointed noses, small eyes, and a dense coat of fur. In the Poconos, the family Soricidae is represented by 6 species.

Family Talpidae – Moles

Members of the family Talpidae are found throughout the northern hemisphere world-wide. Moles are specialized for burrowing and have tiny eyes, no external ears, short legs, and spade-like forefeet used for digging. In the Poconos the family Talpidae is represented by 2 fairly common species, with a third found just south of here.
Northern Short-tailed Shrew
*Blarina brevicauda*

**Habitat:** forests, fields, brushy thickets and grasslands with lots of leaf litter, stumps and logs; prefer moist habitats

**Features:** 3-4”; plush gray fur, long snout, short tail, tiny eyes, hidden ears, musky odor

**Habits:** active year round day and night; long hours of sleep are interspersed with short periods of extremely high activity; venomous saliva helps paralyze prey; caches food

**Diet:** omnivorous; insects, spiders, centipedes, slugs, snails, amphibians, worms, mice, voles, seeds, roots, nuts, berries

**Predators:** raptors, snakes, opossums, raccoons, foxes, weasels, house cats

**Defense:** vocalizations, biting, strong musky odor

**Reproduction:** 2-3 litters/year; 4-8 young/litter

**Life Span:** up to 2 years

**Status:** very common throughout the Poconos

**Cool Facts:**
- *Blarina* is one of the few mammals that produces venom.
- This shrew uses its scent to mark territory and recognize each other.
**Masked Shrew**  
*Sorex cinereus*

**Habitat:** moist woods and bogs w/ shrubs, ferns, logs, stumps and rocks;

**Features:** 2-3 ½”; long tail, pointed snout, tiny eyes, hidden ears, brown/gray

**Habits:** active year round; mostly nocturnal; uses runways beneath leaf litter, soil, and snow

**Diet:** insects, worms, spiders, mice, salamanders

**Predators:** snakes, raptors, weasels, foxes, cats

**Defense:** musky odor

**Reproduction:** 1-3 litters/year; 2-10 young

**Life Span:** up to 2 years

**Status:** common and widespread, but secretive so rarely seen

**Cool Facts:**
- Mother and young form caravans, maintaining contact with the rump of the one in front.
- When frightened, its heart can beat 200 times/minute.
- The masked shrew is an important control predator of gypsy moth larva.
OTHER LONG-TAILED SHREWS

We have several other species of shrews in the Poconos, but they are rarely seen and are difficult to identify. Below is a short description of each.

**Smoky Shrew – Sorex fumeus**
- medium size: total length 4 ½-5”
- grayish brown
- similar to masked shrew but slightly larger and grayer

**Water Shrew – Sorex palustris**
- very rare locally
- large size: total length 5 ½-6 ¼”
- long, bicolored tail
- semi-aquatic
- large, broad hind feet w/toe hairs

**Pygmy Shrew – Sorex hoyi**
- tiny size: total length 3-3 ½”
- smallest land mammal by weight

**Long-tailed Shrew – Sorex dispar**
- rare locally
- small size: total length 4 ½-5 ½”
Hairy-tailed Mole
Parascalops breweri

**Habitat:** forests, grassy areas; prefers sandy loam soils w/vegetative cover

**Features:** 4 ½-5 ¾ “, short bushy tail, pink nose, spade-like forefeet, tiny eyes

**Habits:** active year-round day or night; burrows; solitary

**Diet:** insect larvae, worms

**Predators:** dogs, cats, foxes, snakes, raptors, skunks, weasels, large fish

**Defense:** subterranean habits

**Reproduction:** 1 litter/year; 4-5 young

**Life Span:** 3-4 years

**Status:** common

**Cool Facts:**
- This mole is a voracious eater and may consume up to 3 times its weight in food every day.
- Baby moles are born hairless and toothless, and their eyes are covered by skin.
- Moles are tolerant of high carbon dioxide levels and can sense slight changes in temperature and humidity in tunnels.
Star-nosed Mole

Condylura cristata

**Habitat:** swamps, marshes

**Features:** 4 ½ -6 ½”, long tail, dense coat, 22 fleshy nose tentacles

**Habits:** active year-round day and night; burrows and swims; social, colonial

**Diet:** worms, fish, insect larva

**Predators:** raptors, skunks, foxes, weasels, snakes, cats, large fish

**Defense:** subterranean habits

**Reproduction:** 1 litter/year; 4-5 young

**Life Span:** 3-4 years

**Status:** common

**Cool Facts:**
- This mole has 22 fleshy nose tentacles, loaded with special Eimer organs that are very sensitive to touch and help locate prey.
- Star-nosed moles can eat faster than any other mammal.
- This is our only semi-aquatic mole: it is adept at swimming and diving.
Order Chiroptera

Family Vespertilionidae – The Evening Bats

Bats make up the second largest order of mammals, with 17 families and 850 species worldwide. The Vespertilionidae is the only family of bats found in the Poconos.

The evening bats belong to a suborder of bats known as the Microchiroptera that are generally small with reduced eyes and one exposed thumb claw. They all use echolocation to find prey and have a small cartilaginous projection in their ear called a tragus. All of our local species are insectivorous.

In the Poconos, we recognize two general groups of vespertilionids: the tree bats which are migratory, and the hibernating bats which live here year round. Two species of special concern are the federally-endangered Indiana bat (*Myotis sodalis*) and the state- endangered small-footed bat (*Myotis leibii*).

Of special concern to bats throughout the northeastern United States is a deadly fungal disease called White-nose Syndrome. The fungus attacks hibernating bats and is threatening the very existence of several species in the Poconos.
BATS THAT HIBERNATE

**Little Brown Bat**
*Myotis lucifugus*

**Habitat**: widespread, especially near water; roosts in barns, attics, caves, umbrellas, shutters in summer; hibernates in caves and mines in winter

**Features**: small; brown fur w/ bare uropatagium (tail membrane); small eyes, short rounded ears w/ blunt tragus

**Habits**: nocturnal; feed at dusk near water; roost in buildings and barns

**Diet**: flying insects: beetles, mosquitoes, flies, moths; hunts using echolocation

**Predators**: humans, occasionally minks, raccoons, hawks, snakes, bass, cats

**Defense**: flight

**Reproduction**: mate in autumn (prior to hibernation), fertilization delayed until spring, 1 young

**Life Span**: up to 25 years

**Status**: currently threatened by White-nose Syndrome

**Cool Facts**:
- This is the most common bat found in the Poconos.
- They can reach flying speeds of 22mph.
- Bats are threatened by White-nose Syndrome, a new fungal disease.

**Other local *Myotis* bats**: Northern long-eared (*Myotis septentrionalis*)
Eastern small-footed (*Myotis leibii*)
Indiana bat (*Myotis sodalis*)
Big Brown Bat - *Eptesicus fuscus*
- one of our most common bats
- bare patagium
- large size
- long, thick dark brown fur
- short ears
- often bears 2 young

Eastern Pipestrelle - *Pipistrellus subflavus*
- a fairly common small bat
- bare patagium
- yellowish/brown fur
- hairs tricolored
- pink forearms
MIGRATORY “TREE BATS”

**Hoary Bat** – *Lasiurus cinereus*
- fully furred patagium
- largest local species
- silver-frosted fur
- short, rounded ears w/black rims
- long wings

**Red Bat** – *Lasiurus borealis*
- fully furred patagium
- orange fur
- short, rounded ears

**Silver-haired Bat** – *Lasionycteris noctivagans*
- partially furred patagium
- black fur w/slight silver frost
- longer ears than the hoary bat
Order Lagomorpha

Family Leporidae – Rabbits and Hares

There are 2 families, 12 genera and 62 species of lagomorphs living today. They occur naturally on all continents except Australia and Antarctica, with only 1 family being represented in the Poconos.

Lagomorphs are characterized by 2 pairs of incisors; the first being long with a second peg-like pair located directly behind them. They are strictly herbivorous, although have been known to practice coprophagy (eating their own feces to obtain extra nutrients). Their upper jaw bone is highly perforated, they have reduced tails, and the soles of their feet are densely furred.

In the Poconos, the family Leporidae is represented by 3 species: the eastern cottontail (*Sylvilagus floridanus*), the Appalachian cottontail (*Sylvilagus obscurus*), and the snowshoe hare (*Lepus americanus*).
**Eastern Cottontail**  
*Sylvilagus floridanus*

**Habitat:** brushy areas, open woods, farms, residential areas

**Distinguishing features:** large hind feet; white cottony tail; brownish gray fur w/white belly; rusty spot on nape of neck; usually white forehead spot; sparsely furred long ears

**Habits:** solitary; active year round

**Diet:** herbivorous; leafy vegetation in summer, woody vegetation in winter

**Predators:** humans, dogs, cats, skunks, raccoons, foxes, raptors, and snakes

**Defense mechanisms:** flee, camouflage, scratch, emit a piercing cry

**Reproduction:** multiple litters/year; 3-8 young born; females reach maturity in first spring, males later

**Life Span:** 2-5 years

**Status:** hunted/trapped seasonally

**Cool Facts:**
- Rabbits are known to practice coprophagy (reingestion of fecal material)
- Rabbits can attain speeds of up to 18 mph.

**Similar Species:** The Appalachian cottontail is a similar species rarely seen at higher elevations in our region.
Snowshoe Hare  
*Lepus americanus*

**Habitat:** mature forests with swamps and bogs

**Distinguishing features:** Larger body and bigger ears and much larger hind feet than cottontail; winter pelage white

**Habits:** nocturnal, secretive, active year round

**Diet:** omnivorous; succulent plants

**Predators:** foxes, bobcats, raptors, and weasels

**Defense mechanisms:** camouflage, flee

**Reproduction:** 1-3 litters/year; 1-7 precocial leverets born; reach maturity at 1 year

**Life Span:** 4-5 years

**Status:** listed as vulnerable by Pennsylvania Biological Survey

**Cool Facts:**
- Its fur turns white in winter for camouflage.
- This rabbit can separate its toes widely to travel better on top of snow.
Order Rodentia

Family Sciuridae – Squirrels
Family Castoridae – Beaver
Family Muridae – Mice, Voles, Rats
Family Dipodidae – Jumping Mice
Family Erethizontidae – New World Porcupine

Rodents comprise 43% of all mammals. There are 30 families, 400 genera, and 1,620 species known worldwide. Rodents exhibit a diverse array of lifestyles including terrestrial, arboreal, fossorial, semiaquatic, and volant. They are found nearly everywhere and owe their success to their prolific and adaptable nature, as well as to the fact that they are good dispersers and often highly adept at living with humans.

The rodent dentition patterns are characterized by 1 pair of ever-growing upper and lower incisors specialized for gnawing followed by a large space (diastema), and cheek teeth specialized for various diets. Rodents also exhibit unique jaw musculature that can be useful for identification purposes.

Representatives of 5 families of rodents may be found in the Poconos, including 18 naturally occurring and 2 introduced species.
**Eastern Chipmunk**  
*Tamias striatus*

**Habitat:** deciduous forests; lives in ground burrows

**Distinguishing features:** black and white stripes from shoulder to rump, pale facial stripes, reddish brown body

**Habits:** diurnal

**Diet:** omnivorous: acorns, nuts, seeds, berries, bulbs, fungi, insects, snails, worms, slugs, and bird eggs; gathers food in cheek pouches and stores for winter

**Predators:** hawks, weasels, foxes, and snakes

**Defense mechanisms:** run, escape to underground tunnels

**Reproduction:** 1-2 litters/yr of 4-5 young; reach maturity at 9 months

**Life Span:** 4-6 years

**Status:** common and widespread

**Cool Facts:**
- Chipmunks are extremely vocal, territorial, & unsocial.
- A chipmunk may live in the same burrow system its entire life.
Groundhog (Woodchuck)  
*Marmota monax*

**Habitat:** meadows, farms, brushy forest edges, roadsides, rocky ravines; lives in extensive burrow system

**Distinguishing features:** heavy bodied and low to ground; grizzled in color; white front incisors

**Habits:** diurnal; true hibernator

**Diet:** mainly herbivorous: green vegetation, fruits; may eat insects and snails

**Predators:** foxes, dogs, minks, weasels, large hawks and owls

**Defense mechanisms:** chatter teeth, retreats to den, can competently fight with teeth

**Reproduction:** mate in late winter; 2-9 young (typically 4 or 5) young born in April; reach maturity at 1 year

**Life Span:** 3-4 years

**Status:** year round hunting season (with a few exceptions)

**Cool Facts:**
- The groundhog is the largest local member of the squirrel family.
- It can climb trees.
Eastern Gray Squirrel  
*Sciurus carolinensis*

**Habitat:** forests, swamps, and inhabited areas with nut trees

**Distinguishing features:** mostly gray with white chin, throat, and belly; bushy tail

**Habits:** diurnal; very agile climber; prefers to forage in trees; hides nuts singly in fall; nests in trees; solitary; not aggressive

**Diet:** omnivorous: eats mainly nuts, fruits, buds, flowers, fungi, and insects

**Predators:** humans, raptors, foxes, bobcats, weasels, and snakes

**Defense mechanisms:** scurry and climb

**Reproduction:** 2 litters/year (April, August); 1-9 pups born after 45 day gestation; weaned 2 mos.; reach maturity at 1 year

**Life Span:** 9-13 years

**Status:** common and widespread; hunted seasonally

**Cool Facts:**
- Black and albino (white) individuals are sometimes seen.
- Gray squirrels will share their food stores with each other.
Red Squirrel
*Tamiasciurus hudsonicus*

**Habitat:** prefers coniferous forests

**Distinguishing features:** mostly reddish with white eye ring, chin, neck, and belly; bushy tail; ear tufts

**Habits:** diurnal; very agile climber; forages in trees and on ground; very vocal; stores food in piles; more aggressive than gray squirrel

**Diet:** omnivorous: cone seeds, nuts, fruits, buds, fungi, insects, bird eggs, nestlings, maple sap

**Predators:** humans, raptors, foxes, bobcats, weasels, and snakes

**Defense mechanisms:** vocal warnings, scurry and climb

**Reproduction:** 2 litters/year (April, August); 1-9 pups born after 45 day gestation; weaned 2 mos., reach maturity at 1 year

**Life Span:** up to 10 years

**Status:** hunted seasonally

**Cool Facts:**
- This squirrel is extremely vocal.
- The red squirrel piles food in middens and defends them vigorously.
FLYING SQUIRRELS

Southern  
*Glaucomys volans*

northern  
*Glaucomys sabrinus*

**Habitat:** The southern flying squirrel prefers deciduous forests and smaller home ranges, while the northern prefers coniferous forests at higher elevations.

**Distinguishing features:** gray/brown fur w/white underbelly; large dark eyes; flattened body w/loose skin from wrist to ankle (patagium); flattened tail; northern slightly larger w/darker belly

**Habits:** nocturnal and very active; will huddle in cold weather

**Diet:** omnivorous: nuts, acorns, buds, flowers, fruits, fungi, insects, bird eggs, & nestlings; northern eats more conifer seeds

**Predators:** larger mammals, raptors, snakes

**Defense mechanisms:** glide and hide

**Reproduction:** 2 litters/year in spring and fall; reach maturity at 1 year

**Life Span:** 4-6 years

**Status:** *G. volans* is very widespread, *G. sabrinus* is endangered in PA

**Cool Facts:**
- They can glide up to 300 ft.
- They use their flat tail to steer while gliding.
Beaver
*Castor canadensis*

**Habitat:** ponds, lakes, streams, rivers in wooded areas

**Distinguishing features:** flat, oval, and scaly tail; large yellow incisors; dense brown fur; webbed feet; double claws on inner hind feet; both sexes with cloaca (single opening for urinary, fecal, and reproductive products)

**Habits:** mainly nocturnal; builds lodge out of sticks and mud

**Diet:** herbivorous: leaves, twigs, roots, buds, inner bark of shrubs and trees; build a food stockpile underwater for winter

**Predators:** humans, coyotes, fishers

**Defense mechanisms:** body postures, tail-slapping, vocalizing, & escape

**Reproduction:** mate in winter; 9 fully furred kits (usually 3-4) born May or June; reach maturity at 2 years

**Life Span:** up to 11 years

**Status:** common; hunted seasonally

**Cool Facts:**
- Beavers use their tail for temperature regulation, fat storage, and communication.
- They produce a secretion (castoreum) from their abdominal gland for marking territory and waterproofing fur.
- Their lips close behind their incisors to allow for chewing underwater.
- Beavers can remain submerged for 15 minutes.
COMMON NATIVE MICE

White-footed Mouse
Peromyscus leucopus

Deer Mouse
Peromyscus maniculatus

Habitat: varied; prefer rocky deciduous woods

Distinguishing features: white belly, feet, large black eyes; white-footed more red brown w/shorter tail; deer mouse grayer w/longer tail

Habits: nocturnal; good climbers; carry food in cheek pouches; hoard food; nest in trees, logs, rocks; may huddle when cold

Diet: omnivorous: opportunistic

Predators: larger mammals, raptors, snakes

Defense mechanisms: run and hide

Reproduction: 3-4 litters/year; 2-6 young born; reach maturity at 2-4 months

Life Span: 1 ½ - 2 years

Status: abundant

Cool Facts:
- The white-footed mouse is the most abundant native mouse in PA.
- The deer mouse is the primary host for the tick that transmits Lyme disease.
JUMPING MICE

Meadow  
*Zapus hudsonicus*

Woodland  
*Napaeozapus insignis*

**Habitat:** wet meadows (meadow) and moist woodlands with understory (woodland)

**Distinguishing features:** very long scaly tail (white-tipped in woodland); big ears; very large hind feet; orange/red sides w/darker back; white belly

**Habits:** nocturnal; true hibernators; do not store food; hop and jump

**Diet:** omnivorous: insects, nuts, seeds, berries, roots, fungi

**Predators:** larger mammals, raptors, snakes

**Defense mechanisms:** hops or jumps and hides

**Reproduction:** bear 2 litters/year; 2-8 young; spring young will breed same year while summer young will breed following year

**Life Span:** 1-2 years

**Status:** abundant but rarely encountered

**Cool Facts:**
- These mice eat half their body weight daily.
- They may hibernate for up to 6 months.
- Males emerge from hibernation first.
- Mortality during hibernation may be up to 75%.
- The woodland mouse can jump up to 6 ft.
House Mouse
*Mus musculus*
*non-native species*

**Habitat:** urban areas and farms

**Distinguishing features:** overall grayish-brown; naked scaly tail; large naked ears; long pointed nose; small eyes; musky smell

**Habits:** active day and night indoors, but mostly nocturnal outdoors; colonial but aggressive

**Diet:** grain, seeds, plants, insects, garbage

**Predators:** humans, cats, raptors, snakes, foxes, weasels, skunks, rats

**Defense mechanisms:** vocalizations, body posture, fighting

**Reproduction:** up to 5 litters/year of 5-10 young after 19 day gestation; weaned at 3 weeks; reach maturity at 6-8 weeks

**Life Span:** 1-2 years

**Status:** common in agricultural and urban areas

**Cool Facts:**
- The house mouse was introduced into the western hemisphere by Spanish explorers in the 16th century.
- It has been known to eat glue on book bindings and even soap.
- The house mouse can run up to 8 mph.
Allegheny Woodrat  
*Neotoma magister*

**Habitat:** caves, cliffs, isolated rocky outcrops and ledges

**Distinguishing features:** grayish brown w/ white belly; hairy tail; rounded snout and ears

**Habits:** nocturnal; active year round; solitary

**Diet:** herbivorous; nuts (especially acorns), leaves, seeds, fruits, fungi

**Predators:** larger mammals, raptors, and snakes

**Defense mechanisms:** camouflage, flee, box with front feet

**Reproduction:** 1-3 litters/year of 2-4 young.

**Life Span:** up to 3 years

**Status:** threatened and declining

**Cool Facts:**
- The Allegheny woodrat is appropriately named a “pack rat” because it collects treasures such as bones, nails, feathers, eyeglasses, batteries, shotgun shells, bottle caps, etc.
- The Allegheny woodrat can jump up to 1 meter high.
- The Allegheny woodrat may ingest deadly raccoon roundworms by eating seeds in raccoon feces.
Norway Rat  
*Rattus norvegicus*

**Habitat:** barns, fields, farms, sewers, dumps

**Distinguishing features:** has coarse grayish-brown fur, scaly hairless tail, pointy snout, and large naked ears

**Habits:** nocturnal, active year round, colonial (up to 12 individuals)

**Diet:** omnivorous, may eat garbage

**Predators:** larger mammals, raptors, and snakes

**Defense mechanisms:** camouflage, hide, and flee

**Reproduction:** 3-6 litters/year of 6-20 offspring, breeds all year

**Life Span:** 2-3 years

**Status:** plentiful

**Cool Facts:**
- Native to Asia, the Norway rat was introduced to America by early explorers.
- This rat is a good digger, climber, swimmer, and jumper.
- It requires lots of water and has been reported to gnaw through pipes to obtain it.
Meadow Vole
*Microtus pennsylvanicus*

**Habitat:** meadows, bogs, orchards, farms w/ leaf and grass cover

**Distinguishing features:** shaggy dark brown fur w/ gray belly; long tail; dark beady eyes; ears concealed in fur

**Habits:** most active at dawn and dusk (crepuscular); uses a complex system of surface runways and fewer underground tunnels; caches food for winter

**Diet:** herbivore: grasses, sedges, clover, roots, seeds, tree bark

**Predators:** snakes, weasels, skunks, raccoons, foxes, opossums, birds

**Defense mechanisms:** Scurry under leaf litter to hide

**Reproduction:** up to 9 litters/year of 5-8 young after a 21 day gestation; weaned at 2 weeks, mature at 4-5 weeks; may occupy communal nests

**Life Span:** 1-1 ½ years

**Status:** one of the most abundant mammals in PA

**Cool Facts:**
- The meadow vole is an excellent swimmer and diver.
- Meadow vole populations undergo cyclic fluctuations in density, reaching maximum about every 4 years.
OTHER POCONO VOLES & LEMMING

**Southern Red-backed Vole**  
*Clethrionomys gapperi*  
> small (4 ½ - 6”)
> reddish back w/ gray sides
> short tail

**Woodland (Pine) Vole**  
*Microtus pinetorum*  
> tiny (3 ½ - 5 ½”)
> brown fur w/silver belly
> very short tail
> semifossorial, underground

**Southern Bog Lemming**  
*Synaptomys cooperi*  
> small (4½/2-6”)
> grayish/brown fur w/silver belly
> very short tail
> wet meadows, overgrown fields
> status undetermined
**Muskrat**
*Ondatra zibethicus*

**Habitat:** marshes, streams, lakes, ponds

**Distinguishing features:** 16-24 inches; 2-4 lbs.; long, scaly, black, knife-like tail; dark brown fur; tiny eyes & ears

**Habits:** excellent swimmer; uses tail as rudder; mostly nocturnal; builds cone-shaped house resembling small beaver lodge; hoards food; use musk glands to scent territory

**Diet:** omnivorous: aquatic plants, mussels, crayfish, frogs, snails

**Predators:** humans, raccoons, foxes, river otters, large hawks and owls, mink, snapping turtles, and large predatory fish

**Defense mechanisms:** swim

**Reproduction:** usually breeds twice (March, Oct); 4-8 kits born in May and again in late summer; reach maturity at 1 year in PA

**Life Span:** 3-4 years

**Status:** valuable fur-bearing mammal; trapped seasonally, unlimited

**Cool Facts:**
- Muskrats can remain submerged for 15 minutes.
- They can swim backwards.
- The young are able to swim even before opening their eyes at 2 weeks.
Porcupine
_Erethizon dorsatum_

**Habitat:** mature woods, rocky areas; dens in logs, rock piles and abandoned buildings

**Distinguishing features:** heavy body, short-legged, strong curved claws, stout tail; covered with quills, orange front teeth

**Habits:** nocturnal; excellent climber

**Diet:** leaves, stems, roots, bark, flowers, fruits, nuts & seeds; enjoys salt

**Predators:** fishers, coyotes, bobcats, foxes, and martens

**Defense mechanisms:** quills, vocalizations

**Reproduction:** breeds in fall, performs courtship dance where male urinates on female; bear 1 young in spring; reaches maturity at 1 ½ years

**Life Span:** up to 12 years

**Status:** common

**Cool Facts:**
- A porcupine is covered with hair and 30,000 sharp, hollow, barbed quills, each about 2-3 inches long.
- After being dislodged each quill is replaced.
- At birth these quills are soft.
Order Artiodactyla

Family Cervidae – Deer

Artiodactyls are commonly known as the even-toed ungulates. Ungulates are mammals that walk on their nails or hooves. This trait enables them to be fast-moving (cursorial). Living ungulates are divided into two orders: Artiodactyla (even-toed) and Perissodactyla (odd-toed). Today there are 9 families, 75 genera, and 185 species of Artiodactyla. Only 1 species is found in the Poconos, the white-tailed deer (*Odocoileus virginianus*).

The family Cervidae is characterized by a lack of upper incisors, a large diastema (gap) between the incisors and cheek teeth, and high-crowned cheek teeth that help them grind fibrous food. Their 4-chambered stomach houses microbes that also help in digesting plant material. Male cervids possess antlers which are used for defense and competition for mates.
White-tailed Deer
*Odocoileus virginianus*

**Habitat:** forests, fields, wetlands, farms, residential areas

**Distinguishing features:** Large, reddish/brown to tan coat with white underneath; long legs w/hooves; large ears; males grow antlers

**Habits:** most active at dusk and dawn; females and young form social groups; bucks are solitary during breeding season.

**Diet:** herbivorous: eating a variety of plants, such as leaves, buds, twigs, grain, nuts, acorns, and apples

**Predators:** humans, bobcats, foxes, coyotes

**Defense mechanisms:** snorts, stomps, flees

**Reproduction:** males compete for mates by marking area with scent and scrapings of antlers; breed in Oct/Nov; usually 2 fawns born May/June; reach maturity 6-8 months

**Life Span:** 3-8 years

**Status:** abundant, hunted seasonally

**Cool Facts:**
- White-tailed deer can run 40mph, jump 8ft high and 30 ft in distance.
- Growing antlers are covered with soft, highly vascular skin called “velvet”.
- Bucks shed their velvet in autumn and lose their antlers in winter.
- Rabbits and rodents will consume deer antlers for minerals.
The order Carnivora is a diverse group of mammals, comprising 11 families, 92 genera and 238 species. Carnivores vary considerably in size, method of locomotion, and even diet. All carnivorans are characterized by enlarged canines and a special set of shearing cheek teeth known as carnassials. The shearing function of these teeth is secondarily reduced in bears and raccoons. Carnivorans also have a unique jaw connection that ensures a tight fit for enhancing the shearing function of their teeth. Carnivorans have fused wrist bones which helps them run fast, and well-developed anal sacs and scent glands (best developed in skunks).

Representatives from 6 families of the order Carnivora may be found in the Poconos.
Coyote
Canis latrans

**Habitat:** forests, brushy woods, marshes, meadows

**Distinguishing features:** dog-like; bushy, black-tipped tail (which is held between legs when running); pointed nose, erect ears; color varies (brown, grizzly gray, red)

**Habits:** principally nocturnal

**Diet:** omnivorous; 90% of diet is flesh; eats mostly rabbits, rodents, sometimes livestock, reptiles, amphibians, insects, fruits; caches food in earthen holes

**Predators:** humans

**Defense mechanisms:** body postures, facial expressions, vocalizations, escape

**Reproduction:** mate in Feb; 5-7 whelps born spring; reach maturity at 2 years

**Life Span:** 6-8 years

**Status:** hunted year round with restrictions

**Cool Facts:**
- Coyotes are very fast runners, reaching speeds of 40 mph.
- They are also strong swimmers.
Red Fox  
*Vulpes vulpes*

**Habitat:** fields, brushy pastures, farmlands near water

**Distinguishing features:** small canid; large ears, pointed nose; long bushy white tipped tail; red coat w/white throat, cheeks, and belly; black stockings

**Habits:** nocturnal; pounces on prey; caches prey; marks territory w/scent glands; nests in earthen dens, caves, logs, and buildings

**Diet:** omnivorous: small mammals, birds, eggs, reptiles, insects, fruit

**Predators:** humans, dogs, large raptors

**Defense mechanisms:** proficient runner

**Reproduction:** pair for life; mate in winter; 4-6 pups born early spring; reach maturity at 1 year

**Life Span:** 3-5 years

**Status:** hunted & trapped seasonally; unlimited

**Cool Facts:**
- Red fox are very vocal, and produce a range of unusual vocalizations.
- They often use two dens close together when raising young.
Gray Fox
*Urocyon cinereoargenteus*

**Habitat:** hardwood forests and swamps

**Distinguishing features:** small canid; medium ears & nose; long bushy black-tipped tail; grizzled gray w/red ears, legs, & sides

**Habits:** nocturnal; secretive; good climber; caches food; nests high in logs, rocky outcrops & brush piles

**Diet:** omnivorous; more birds & berries than red fox

**Predators:** humans, dogs, coyotes, bobcats, raptors

**Defense mechanisms:** climb and run

**Reproduction:** pair for life; mate in winter; 4-6 pups born early spring; reach maturity at 1 year

**Life Span:** 5-6 years

**Status:** hunted & trapped seasonally; unlimited

**Cool Facts:**
- Gray foxes are good tree climbers.
- They are very vocal.
Black Bear
_Ursus americanus_

**Habitat:** forested areas

**Distinguishing features:** large, brown/black fur with tan snout; bobbed tail; short round erect ears

**Habits:** mostly nocturnal; do not practice true hibernation, but instead enter winter lethargy; good climber; generally solitary

**Diet:** omnivorous: berries, fruit, nuts, roots, leaves, honey, insects, mice, fish, carrion, fawns, eggs, frogs

**Predators:** humans

**Defense mechanisms:** posture, size, show teeth, charge, bite, claw

**Reproduction:** mate in late summer, with implantation delayed until winter; 2-5 cubs born mid Feb; bear young every 2 years; reach maturity at 3-5 years

**Life Span:** 5-8 years

**Status:** seasonal; limit 1/year

**Cool Facts:**
- Black bears are good swimmers.
- They den alone during winter.
Raccoon  
*Procyon lotor*

**Habitat:** woodlands near streams, lakes, ponds; residential and farm land

**Distinguishing features:** long, bushy, ringed tail; grizzly gray fur, black mask; white, erect ears

**Habits:** dexterous hands; nocturnal; good swimmer & climber; dens in trees, often in communal nests of up to 20

**Diet:** omnivorous (opportunistic): insects, fish, crayfish, frogs, eggs, rodents, fruits, nuts, garbage; may “wash” food in water

**Predators:** humans, large raptors

**Defense mechanisms:** vocalizations and fighting

**Reproduction:** breed once per year in PA in winter; male often remains with female during birth and sometimes after; 3-6 young born early spring; females reach sexual maturity at 1 year; males at 2 years

**Life Span:** 4-6 years

**Status:** hunted seasonally; no limit

**Cool Facts:**
- Raccoons can descend trees head first.
- Raccoons will gather in communal nests of up to 20 individuals in winter for warmth.
WEASELS

**Habitat:** forests and wetlands, farms

**Distinguishing features:** slender long body and neck; short legs; triangular head; brown fur above, white below, pelage may turn white in winter; strong musky scent

**Habits:** mainly nocturnal; active year round; secretive; solitary; can climb & swim; marks territory w/ scent glands

**Diet:** carnivorous: rodents, shrews, rabbits, birds

**Predators:** raptors, cats, foxes, snakes, other weasels

**Defense mechanisms:** run and hide

**Reproduction:** mate in summer, delayed implantation; 4-8 young born in spring; females reach maturity at 3 months, males at 2 years

**Life Span:** 2-7 years

**Status:** rarely seen, although long-tailed weasel may be fairly common

**Cool Facts:**
- In northern PA, 30% of *M. frenata* turn white in winter.
- These weasels are highly vocal, producing purrs, squeals, hisses, and screeches.
Mink
*Mustela vison*

**Habitat:** banks of streams, rivers, ponds, and marshes

**Distinguishing features:** larger than long-tailed and short-tailed weasels; brown fur w/white chin patch; long bushy tail, partially webbed toes

**Habits:** mostly nocturnal; solitary; great swimmer; may store winter food in large caches

**Diet:** carnivorous; crayfish, muskrats, frogs, fish, waterfowl, and small mammals; hunts mostly by smell

**Predators:** great horned owls, foxes, coyotes, bobcats, humans

**Defense mechanisms:** expels bad odor, hisses, snarls, and flees

**Reproduction:** mate in winter, delayed implantation; 4-9 young born spring; both parents rear young; reach maturity at 10 months

**Life Span:** 3-6 years

**Status:** trapped seasonally; unlimited

**Cool Facts:**
- The mink may swim underwater up to 100 ft.
- Its fur is water-repellent.
- The mink relies on its keen sense of smell to locate food.
Striped Skunk
*Mephitis mephitis*

**Habitat:** widespread but prefers brushy disturbed areas such as farms, fields, forest edges, & residential areas

**Distinguishing features:** black fur with 2 white stripes along back meeting on shoulders and head; bushy tail with white tip; small pointed head; long front claws

**Habits:** nocturnal; good digger; over-winters in dens, sometimes communally; rarely climbs; does not like water

**Diet:** omnivorous: grubs, beetle, grasshoppers, bees, mice, eggs, fruits, berries, nuts, garbage

**Predators:** humans, owls, occasionally dogs, coyotes, foxes, bobcats

**Defense mechanisms:** runs, stomps feet, raises tail, sprays chemical from anal glands

**Reproduction:** breed in late winter; 4-6 kits born spring; reach sexual maturity at 1 year

**Life Span:** 2-4 years

**Status:** hunted year round; unlimited

**Cool Facts:**
- A skunk may accurately spray up to 10 ft.
- Kits are able to discharge musk at 3 weeks old.
River Otter
*Lutra (=Lontra) canadensis*

**Habitat:** rivers, streams, lakes, marshes; dens in banks of waterways

**Distinguishing features:** sleek, brown body 3-4 ½ feet long; long tapered tail; long whiskers; webbed paws

**Habits:** mostly nocturnal; active year-round; excellent swimmer; very playful (slides on snow banks in winter); very social; live in family groups

**Diet:** carnivorous; fish, crayfish, amphibians, reptiles, mollusks, muskrats, mice, birds

**Predators:** humans, coyotes, dogs, foxes, and great horned owls.

**Defense mechanisms:** vocalizations, escape to water

**Reproduction:** mate in early spring; implantation may be delayed up to 12 months; 1-5 kits born late winter/early spring; male often helps raise young; reach sexual maturity at 2 years

**Life Span:** 8-10 years

**Status:** vulnerable; almost eliminated from PA in 1950’s (except Poconos); reintroduced in 1982

**Cool Facts:**
- Otter fur is nearly waterproof.
- Otters may dive up to 45 ft and remain submerged for up to 8 minutes.
Fisher
*Martes pennanti*

**Habitat:** extensive mature forests; dens in hollow trees or logs, abandoned porcupine dens, or under large boulders

**Distinguishing features:** large weasel; dark brown/black fur w/white neck patches; broad head, pointed snout, rounded ears; bushy tapered tail

**Habits:** mostly nocturnal; terrestrial; arboreal

**Diet:** carnivorous: squirrels, mice, rabbits, birds, & porcupines

**Predators:** few predators, at least on adults

**Defense mechanisms:** runs, bites, scratches, climbs trees

**Reproduction:** breeds in early spring; implantation delayed; total gestation 51 weeks; 1-4 kits born the following March

**Life Span:** up to 10 years

**Status:** endangered; extirpated 1900; reintroduced 1994; status uncertain but apparently expanding range in PA

**Cool Facts:**
- A fisher will eat porcupines by biting their neck to kill them, then turning them over to eat their soft unprotected underbelly.
- Fishers can climb trees easily.
Bobcat  
*Felis rufus*

**Habitat:** forests (including mountains & swamps)

**Distinguishing features:** twice as large as a house cat; short tail with dark bars; ruffs of fur from ears to cheeks; small dark ear tufts

**Habits:** nocturnal, elusive, & solitary; avid climber; builds dens on ledges, in rock piles, hollow trees, or cavities beneath tree roots; makes nest of leaves, grass, & moss

**Diet:** carnivorous: rabbits, rodents, birds, foxes, raccoons, rarely deer & porcupines

**Predators:** humans, dogs, foxes, coyotes, & great horned owls

**Defense mechanisms:** hisses, growls, spits, runs, climbs, fights

**Reproduction:** may breed throughout the year, but usually in late winter; 1-4 kittens born in spring; reach maturity at 1-2 years

**Life Span:** 10-12 years

**Status:** vulnerable

**Cool Facts:**
- Its dens can be easily identified by a strong cat odor.
- Bobcats are capable swimmers.
# ACTIVITIES

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Activity #1 – Public Images of Mammals

Objective – To develop an awareness of how mammals are portrayed in public images.

Directions – Have students think of and/or find examples of public images of mammals. Have students use worksheet to analyze their results. This can be done individually or in groups, as a homework assignment or in class. Process information through class discussion.

Materials – Newspapers, magazines, postage stamps, license plates, food packages, clothing labels, car models, sporting team items, business logos, photographs, games, etc.
## Public Images of Mammals

**Directions** – For each example you find, fill-in the information in the chart below. Following the chart are some conclusion questions for you to answer.

<table>
<thead>
<tr>
<th>Source of Example</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is realistic?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is not realistic?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is the message being portrayed?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Overall, are the mammal images you found realistic, or not?

2. Based on your analysis, do you think that these public portrayals are misleading the public or not? Explain your reasoning.

3. If you were starting a company or selling a product, what mammal would you use as an image and why?

4. What have you learned about public images of mammals?
Activity #2 – General Terminology: Card Game

Objective – To identify or review terminology and concepts associated with mammals.

Directions – Cut out cards from the following pages and have students use as a memory matching game, or “Go Fish” for matching cards. Copy enough sets so that students can work in groups of 3. If you wish, have the students glue the pieces to index cards (and laminate) for a permanent classroom resource. You can also modify this activity by creating full size sets, laminating them, and placing adhesive magnets on the backs for use on the chalk board.
Elementary

<table>
<thead>
<tr>
<th>Mammal</th>
<th>Animal that feeds its young milk</th>
<th>Hair</th>
<th>Body part that helps keep mammal warm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herbivore</td>
<td>Animals that eats plants</td>
<td>Carnivore</td>
<td>Animal that eats meat</td>
</tr>
<tr>
<td>Warm blooded</td>
<td>Animal that controls its own body heat</td>
<td>Habitat</td>
<td>Where an animal lives</td>
</tr>
<tr>
<td>Vertebrate</td>
<td>Animal with a backbone</td>
<td>Omnivore</td>
<td>Animal that eats plants and meat</td>
</tr>
</tbody>
</table>
# Middle/High School

<table>
<thead>
<tr>
<th>Mammalogy</th>
<th>The study of mammals</th>
<th>Monotremes</th>
<th>Mammals that lay eggs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marsupials</td>
<td>Mammals with a pouch</td>
<td>Mammary gland</td>
<td>Produces milk for babies</td>
</tr>
<tr>
<td>Hair</td>
<td>Skin structure that provides insulation</td>
<td>Vertebrate</td>
<td>Animal with a backbone</td>
</tr>
<tr>
<td>Omnivore</td>
<td>Animal that eats a variety of food</td>
<td>Herbivore</td>
<td>Animal that eats plants</td>
</tr>
<tr>
<td>Carnivore</td>
<td>Animal that eats meat</td>
<td>Nocturnal</td>
<td>Being active at night</td>
</tr>
<tr>
<td>Diurnal</td>
<td>Being active in daytime</td>
<td>Endothermic</td>
<td>Regulating body temp internally</td>
</tr>
<tr>
<td>Arboreal</td>
<td>Lives in trees</td>
<td>Wetland</td>
<td>Marsh, swamp, or bog habitat</td>
</tr>
<tr>
<td>Aquatic</td>
<td>Living in water</td>
<td>Terrestrial</td>
<td>Living on land</td>
</tr>
<tr>
<td>Subterranean</td>
<td>Underground</td>
<td>Gestation</td>
<td>Duration of pregnancy</td>
</tr>
<tr>
<td>Life Span</td>
<td>How long something lives</td>
<td>Habitat Range</td>
<td>The size of an animal’s home area</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------</td>
<td>---------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Predator</td>
<td>An animal that hunts another for food</td>
<td>Prey</td>
<td>The animal being hunted for food</td>
</tr>
</tbody>
</table>
## Additional High School

<table>
<thead>
<tr>
<th>Animal Trait</th>
<th>Description</th>
<th>Animal Trait</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crepuscular</td>
<td>Being active at dusk and dawn</td>
<td>Vibrissae</td>
<td>Sensory hairs, like whiskers</td>
</tr>
<tr>
<td>Keratin</td>
<td>A protein that forms hair</td>
<td>Countershading</td>
<td>Having dark dorsal, light ventral colors</td>
</tr>
<tr>
<td>Ventral</td>
<td>The belly side of an animal</td>
<td>Dorsal</td>
<td>The back/upper side of an animal</td>
</tr>
<tr>
<td>Lateral</td>
<td>The side of an animal</td>
<td>Epidermis</td>
<td>The upper cell layer or skin</td>
</tr>
<tr>
<td>Amniotic egg</td>
<td>Embryo with multiple membranes</td>
<td>Secondary palate</td>
<td>Roof of mouth that separates food from airways</td>
</tr>
<tr>
<td>Pelage</td>
<td>Coat/pelt</td>
<td>Precocial</td>
<td>Offspring that are furred &amp; eyes well-dev</td>
</tr>
<tr>
<td>Altrical</td>
<td>Offspring are not furred &amp; eyes not open</td>
<td>Fossorial</td>
<td>Living life underground</td>
</tr>
<tr>
<td>Cursorial</td>
<td>Fast moving</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Activity #3 – Traits of Mammals: True or False?

Objective – To assess knowledge of mammal traits

Directions – The following True/False worksheet may be used as a pretest or review of mammal traits. A single overhead transparency can be used as a class exercise.

Answers & follow up questions/answers:
1. True. How many species of rodents are there? ~2,000
2. False. How many species of mammals are there? ~5,000
3. True. Even whales/dolphins have a few hairs. What is the primary function of hair? Insulation.
4. True. Mammals have more kinds of teeth and more jaw muscles that enable them to chew more effectively.
5. False. Which mammals lay eggs? Monotremes, like the platypus.
6. True. All mammals have mammary glands. In females, they produce milk.
7. True. Can you name the 4 kinds of teeth found in humans? Incisors, canines, premolars, molars.
8. True. Fossils of early mammals show up about 320 million years ago.
9. True. Mammals have more facial muscles than most animals. Expressions help mammals communicate also.
10. False. How many sets of teeth do mammals produce and what are they called? Mammals produce two sets of teeth; primary or milk teeth and permanent ones.
11. True. Which mammals do not have 7 neck vertebrae? Manatees and sloths.
Traits of Mammals – True/False

_____1. The largest group/order of mammals is the rodents.
_____2. There are 500 species of mammals.
_____3. All mammals have hair.
_____4. Mammals are better at chewing than any other animals.
_____5. All mammals give birth to live young.
_____6. All mammals feed their young milk.
_____7. Most mammals have several kinds of teeth.
_____8. Mammals lived on earth before dinosaurs.
_____9. Mammals are the only animals that have facial muscles that allow them to show expressions.
_____10. Mammals continuously lose and replace teeth.
_____11. Almost all mammals have 7 neck vertebrae.
_____12. Almost all mammals have red blood cells that lose their nucleus.
Activity #4 – The Importance of Hair & Coloration in Mammals

Objectives:
1. To recognize mammals by their distinguishing physical features
2. To understand the importance of hair in mammals
3. To understand the importance of coloration to the survival of mammals

Directions:
1. Discuss the importance of hair and coloration with the class using background information provided. This can be done before or after the activity described below.
2. Download coloring book pages for mammals from PA game commission website.
3. Have students use the mammal information pages in this guidebook to help them color in their mammals.
4. On the back of their work, have each student write down the following:
   a. List the distinguishing physical features shown
   b. Is this mammal nocturnal?
   c. Is the coloration of their mammal camouflage or warning?
   d. If the mammals fur helps it blend in, describe how.
   e. Does this mammal seem to have long whiskers to help it sense touch?

Material Source: The Pennsylvania Game Commission website offers a free downloadable coloring book (entirely or individual pages) for the following Pocono mammals: beaver, otter, mink, deer, bear, coyote, fisher, woodchuck, rabbit, red fox, brown bat, raccoon, chipmunk, meadow vole, and gray squirrel. Pages can be found at the following web address: http://www.pgc.state.pa.us
   Click on Education tab, then scroll down to Wildlife for Kids and select Wildlife Coloring Book.

Background Information:
1. Hair is a feature unique to mammals.
2. Hair is derived from the epidermis layer of the skin, and strengthened with a protein material called keratin.
3. The primary function of hair is for insulation.
4. All mammals have hair, although some have very little, such as whales. These aquatic mammals have evolved a different strategy for insulation in the form of blubber.

5. Hair has many secondary purposes, such as camouflage, warning coloration, attraction of mates, and sensing touch.

6. Camouflage is when the coloration of an animal helps it blend in to their habitat.

7. Warning coloration announces that the animal is equipped with some sort of dangerous weapon.

8. The coat of hair on a mammal is collectively called the pelage.

9. The pelage of males and females may be slightly different in some mammals.

10. The pelage of some mammals changes seasonally (such as the snowshoe hare).

11. The vibrissae, or sensory hairs, are found mostly on the face, as whiskers, but in some mammals may be found on the head and lower legs.

12. The whiskers are controlled by a complex of facial muscles and attached to a cranial nerve.

13. In our temperate climate, many mammals molt, or shed their pelage once or twice a year. Typically the summer coat is shorter and therefore has less insulation ability.
Activity #5 – Brrrrr, It’s Cold Outside – Mammals in Winter

Objectives:
1. To identify and define the different strategies Pocono mammals use for winter survival
2. To compare the costs and benefits of each strategy
3. To identify local mammals that use each strategy

Directions:
1. Students may work individually or in groups for this exercise.
2. Briefly define each strategy below without using examples.
3. Have students read each animal description and then fill-in the strategies they think the animal might use for winter survival.
4. Have students list examples of local mammals that use each strategy.
5. Have students state conclusions.
6. Discuss results.

Background Information:
1. Different strategies: hibernation, migration, store food, increase fat stores, grow thicker fur, cuddle with others.
2. Hibernation is a seasonal torpor defined by a state of inactivity and a significantly depressed metabolism in mammals, including a drastic decrease in body temperature, heart rate, and breathing rate.
3. The duration of hibernation varies for species, and within a species by location.
4. Hibernation may be triggered by different factors in different species, but often is due to decrease in photoperiod (daylength).
5. Pocono species that are true hibernators:
   - Ground hog
   - Meadow jumping mouse
   - Woodland jumping mouse
   - Little brown bat
   - Big brown bat
   - Northern long-eared bat
   - Eastern pipistrelle
   - Indiana bat
   - Eastern small-footed bat
Answer Key – Answers may vary from those indicated below and still be correct. Teacher-guided instruction is critical in assessment.

1. T, C, F - Squirrel

2. T, M or H, possibly C - Bat species will either hibernate or migrate. Some migrators will cuddle, some are solitary.

3. T, H - Groundhog

4. T, F, H - Black bear (does not reach true hibernation, but does become lethargic in winter)

5. T, S, C - Voles

6. T - Mink, muskrat

7. T, C - White-tailed deer

8. T, S, possibly C and possibly H - Mice

9. T, C - Fox

10. T - Porcupine
Brrrr, It’s Cold Outside – Mammals in Winter

Directions – Read each animal description below. Write the letter(s) of the winter survival strategy you think the animal uses next to the description. Some animals may use more than one strategy. Give an example of a local mammal that you think is being described.

SURVIVAL STRATEGIES

<table>
<thead>
<tr>
<th>H – Hibernation</th>
<th>T – Thick fur</th>
</tr>
</thead>
<tbody>
<tr>
<td>M – Migration</td>
<td>S – Store food</td>
</tr>
<tr>
<td>C – Cuddle with others</td>
<td></td>
</tr>
<tr>
<td>F – Increase fat stores</td>
<td></td>
</tr>
</tbody>
</table>

_______ 1. A small arboreal mammal that eats nuts

_______ 2. A small mammal that eats flying insects

_______ 3. A medium-sized slow-moving mammal that eats grass

and leaves

_______ 4. A large mammal that requires enormous quantities of fresh food: both plant and animal

_______ 5. A small mammal that lives underground in family groups
6. A semi-aquatic mammal that eats a variety of foods

7. A large mammal that may live with others and can eat fungus as well as leaves

8. A small solitary seed-eating mammal that lives underground

9. A medium-sized fast predatory carnivore that lives in family groups

10. A medium-sized solitary mammal that eats nuts, fruit, bark, and conifer needles.

Conclusions – State three overall things you learned about winter survival strategies in local mammals:

1.

2.

3.
Activity #6 – Teeth Tell a Story – Dentition Patterns

Objectives:
1. To identify different types of teeth and their special purpose
2. To relate the dentition of a mammal to its diet and lifestyle

Directions:
1. Ask students what different types of teeth they have in their mouth.
   Discuss the purpose of each tooth type as described in the background information section.
2. Have students fill-in the diagram and chart (attached).
3. Have students analyze the various skull/dentition diagrams of mammals and decide what sort of diet/feeding behavior each mammal has.
   Discuss results.

Background Information:
1. The form of a tooth is directly related to the animal’s special diet/feeding behavior.
2. Most mammals have different kinds of teeth (called heterodonty).
3. Variations in the teeth of different kinds of mammals can help us identify them.
4. Incisors are the front teeth that are usually flattened and used for nipping or scraping. Gnawing mammals have long, ever-growing incisors (like groundhogs, squirrels, and beavers).
5. Canines are behind the incisors and are usually cone-shaped and used for stabbing, defense, and display. In carnivores, canines are usually quite enlarged.
6. Premolars are behind canines and usually have 2 cusps (bicuspids). People have 2 sets of these.
7. Molars are behind the premolars and are usually more complex in form.
8. A dental formula is a way to express how many of each type of tooth an animal has. Human dental formulae: \[2-1-2-3 = 16 = 32 \]
   \[2-1-2-3 = 16\]
   This tells us that each side of the upper mouth has 2 incisors, 1 canine, 2 premolars, and 3 molars. It also tells us that humans have the same lower dentition, for a total of 32 teeth.
**Teeth Tell a Story**

Name__________________________

**Directions** – With the guidance of your teacher, fill-in the labels and chart below to identify each tooth type and its’ special purpose/function.

<table>
<thead>
<tr>
<th>Tooth Type</th>
<th>Special Purpose/Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
</tbody>
</table>
**Directions** – Examine each skull/dentition below and try to match it with its feeding behavior/diet.

*The skull diagrams are not true to size relative to each other.*

**Answers:**

1. **Carnivore** – tears flesh
2. **Omnivore** – tears flesh and grinds plants
3. **Granivore/herbivore** – gnaws and grinds nuts/seeds
4. **Insectivore** – pierces and crushes insect exoskeletons
5. **Folivore/herbivore** – nips leaves and crushes them
Diet/Feeding Type Answers:

1) E – The carnivore has large canines and sharp premolars and molars for tearing and slicing flesh; bobcat.

2) A - The omnivore has incisors for nipping, canines for tearing flesh, and well developed premolars and molars for crushing and grinding plants; opossum.

3) C – The granivore/herbivore has well developed front incisors for gnawing through seeds and nuts, no canines, and well developed premolars and molars for grinding seeds; gray squirrel.

4) B - The insectivore has sharp incisors, and premolars and molars modified for piercing and crushing insect exoskeletons; shrew.

5) D – The folivore/herbivore has only lower incisors for ripping grass, no canines, and well developed premolars and molars for grinding tough leaves; white-tailed deer.
Activity #7 – What’s Their Favorite Food?

Objectives:
1. To recognize that many mammals have special diets
2. To define terminology associated with special diets

Directions:
1. Have students complete the attached worksheet by matching the special diet with the proper term.
2. Discuss answers, brainstorming examples of mammals for each answer.

Answers & Examples:
1. C – Insectivores eat insects; shrews & moles
2. J – Granivores eat grains, nuts, & seeds; squirrels & chipmunks
3. F – Carnivores eat meat; bobcat & mink
4. H – Herbivores eat plants; deer & groundhogs
5. I – Folivores eat leaves; deer
6. G – Nectarivores eat nectar and pollen; honey possum (none in Poconos)
7. A – Piscivores eat fish; mink & otter
8. D – Sanguivores eat blood; vampire bats (none in Poconos)
9. B – Frugivores eat fruit; fruit bats (no exclusive frugivores in Poconos)
10. E – Omnivores eat many things; opossum & bear
**What’s Their Favorite Food?**

Name_______________________

**Directions** – Match the term below to its description of diet preferences.

- ____ 1. Eating insects                  A. Piscivory
- ____ 2. Eating grains                  B. Frugivory
- ____ 3. Eating meat/flesh              C. Insectivory
- ____ 4. Eating plants                  D. Sanguinivory
- ____ 5. Eating leaves                  E. Omnivory
- ____ 6. Eating nectar & pollen         F. Carnivory
- ____ 7. Eating fish                    G. Nectarivory
- ____ 8. Eating blood                   H. Herbivory
- ____ 9. Eating fruits                  I. Folivory
- ____ 10. Eating all foods             J. Granivory
Activity #8 - “How Big Are They Really?”
Creating life size silhouettes

Objective – To compare sizes of mammals to one another and to humans.

Directions:
1. Arrange students in groups of selected size.
2. Assign each group a mammal (using the attached examples only).
3. Have students use the information sheets in this guide to investigate traits of their mammal. Create a worksheet or a list of what traits you want your students to focus on. Require each group to keep a written record of such information.
4. Make an overhead transparency of the silhouette sheet attached.
5. Cut apart the mammal overhead and distribute one to each group
6. Allow each group to project their overhead on to a large piece of mural paper (do not use black if you choose to have your students transfer their information directly onto the animal cut out) so that it is the actual size. Have them trace and cut out their animal.
7. You may have each group present their animal and their information to the class if you choose. Display the animals in the hallway or the classroom.
Beaver 4 ft  
Long-tailed weasel 22 in  
Coyote 4 1/2 ft  
Opossum 3 ft  
Muskrat 24 in  
Black Bear 6 ft  
Red Fox 3 1/2 ft
Activity #9 – Leaving Tracks

Objectives:
1. To relate the foot structure of a mammal to its function
2. To identify mammals by their tracks

Directions:
1. This activity may be done in groups, pairs, or individually.
2. Have students brainstorm and fill-in the attached worksheet part I.
3. Discuss/share answers
4. Have students visit the website: www.bear-tracker.com and complete the attached worksheet part II.

Background/Answers to part I:
1. An animal that catches its food in a stream or a pond would benefit from having grasping forefeet and webbed hind feet to swim with. An example of this would be a beaver, otter, or muskrat.
2. A climbing mammal would need all 4 feet to have grasping abilities, like a squirrel, opossum, or porcupine.
3. A mammal that lives in underground tunnels is said to be fossorial. It needs to have claws and forefeet specialized for digging, with blade-like claws. A mole is an example of this.
4. A mammal that walks on the ground, but eats underground insects would benefit from having long, flat feet and long claws in the front. An example of this is the skunk.
5. A predator that runs very fast would need claws that are retractable so they don’t interfere with their running. It is also helpful for the mammal to run on its toes to be faster. A bobcat would be an example of this.
6. A grazing mammal will have hooves to help it scrape at the ground upon which it feeds.
Part 1 – Mammals need to have feet especially designed to match their lifestyle and the habitats in which they live. Describe what special foot features you think the following animals would benefit from having.

1. A mammal that catches its food in a stream or pond

2. A mammal that climbs trees

3. A mammal that lives in underground tunnels

4. A mammal that walks on the ground but eats underground bugs

5. A predator that runs very fast

6. A grazing mammal that paws at the ground
**Part II** – Visit the website, [www.bear-tracker.com](http://www.bear-tracker.com) and select 3 mammals found in the Poconos. For each mammal complete the following chart.

<table>
<thead>
<tr>
<th>Mammal</th>
<th>Track drawing</th>
<th>Describe how foot matches habitat or lifestyle</th>
<th>3 additional facts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>
**Activity #10 - Do You Smell That?**

**Winter Scent-tracking**

**Objective** - To recognize the importance that the sense of smell is to mammals in finding prey and/or mates

**Directions:** * This activity must be performed with snow on the ground! A list of materials needed follows.

1. Discuss the background information below.
2. Students will work in groups for this activity (group size may vary).
3. Each group is given a scent marking bottle, a bag of colored flags, and a unique identification item (i.e., tennis ball, shoe, etc).
4. One person from each group will create a trail from a central starting point, leading roughly 100 paces to a place where they hide their identification item. Along the way, they should spray their scent (about 5 squirts) on the snow every 10 paces. Each group must perform this step separately so no one sees their trail.
5. After all scent markers are done, everyone convenes at the central starting point.
6. Each group is now given a different scent to follow (a cup of snow with a scent sprayed onto it for a reference) and told what identifying item is associated with that scent. Groups must stay together for the remainder of the activity.
7. Each group now attempts to follow a footprint trail until they see/smell a scent marking. At that point they must get down and smell the scent to see if they are on the right track. If so, they should mark the spot with their colored flag and proceed. Any time the trail leads to an incorrect scent, they must backtrack and find another trail to follow. Eventually they should follow the correct trail 100 paces, leaving marked flags every 10 paces at the scent marking, and find the identification item assigned to that scent.

8. Discuss the challenges, limitations, and benefits of using scent as a sense for following prey or mates.

Materials:
- Small spray bottles (as many as you have groups)
- Essence/oils – peppermint, coconut, vanilla, orange, etc.
- Torn material flags – 10 of as many different colors as you have groups (bandanas or t-shirts work great)
- Identification items – tennis ball, racquet ball, pair of socks, small gift box, etc. (as many as you have groups)
Activity #11 - Our Marvelous Marsupial

Objective - To identify some unique traits of the opossum

Directions - Use the background information below and the attached crossword puzzle(s) to introduce and discuss, or review traits of the Virginia opossum.

Background Information:
1. The Virginia opossum is the only marsupial in North America.
2. A marsupial is a mammal that gives birth to a newborn in a very early stage of development. The newborn continues development in a pouch.
3. The opossum belongs to the family Didelphidae of marsupials.
4. Didelphids are characterized by their long snouts, and long, naked, prehensile tails.
5. Each foot on an opossum has 5 digits. The big toe of the hind foot is opposable and clawless.
6. The scientific name for the Virginia opossum is *Didelphis virginiana*.
7. Opossums may experience frostbite to their ears and tail tip.
8. Opossums prefer to live on the edge of forests, but are also known to inhabit farmlands and residential areas.
9. Opossums are opportunistic omnivores, but eat mostly insects and carrion.
10. Opossums are mostly nocturnal.
11. Opossums can walk, climb, and swim well, but slowly.
12. Opossums hiss, display teeth and even do play dead when threatened.
13. Opossums have 50 teeth; the most of any mammal.
14. Foxes, bobcats, dogs, hawks, and owls may be predators of opossums.
15. A female opossum reaches sexual maturity in one year.
### Answer keys:

#### First puzzle/Elementary Level:

<table>
<thead>
<tr>
<th>Across</th>
<th>Down</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. fifty</td>
<td>1. night</td>
</tr>
<tr>
<td>4. opossum</td>
<td>2. forest</td>
</tr>
<tr>
<td>5. five</td>
<td>3. pouch</td>
</tr>
<tr>
<td>7. one</td>
<td>4. omnivore</td>
</tr>
<tr>
<td>8. tail</td>
<td>6. ears</td>
</tr>
<tr>
<td></td>
<td>7. owl</td>
</tr>
</tbody>
</table>

#### Second puzzle/Middle & High School Level:

<table>
<thead>
<tr>
<th>Across</th>
<th>Down</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. prehensile</td>
<td>1. pouch</td>
</tr>
<tr>
<td>3. fifty</td>
<td>2. nocturnal</td>
</tr>
<tr>
<td>4. owl</td>
<td>4. omnivore</td>
</tr>
<tr>
<td>6. five</td>
<td>5. marsupial</td>
</tr>
<tr>
<td>7. forest</td>
<td>8. opossum</td>
</tr>
<tr>
<td>8. one</td>
<td></td>
</tr>
<tr>
<td>9. Didelphidae</td>
<td></td>
</tr>
</tbody>
</table>
Our Marvelous Marsupial

Across
2. The number of teeth an opossum has
4. The only marsupial found in North America
5. The number of toes an opossum has on each foot
7. The age at which a female is able to have babies
8. This part of an opossum is long, naked, and scaly

Down
1. When an opossum is most active
2. The favorite habitat of an opossum
3. The place where a mother opossum carries her young
4. The word that describes the eating habits of an opossum
6. The parts of an opossum that might experience frostbite
7. An animal that might hunt and eat an opossum
Our Marvelous Marsupial

Across
1. A tail that can grasp things
3. The number of teeth an opossum has
4. A predator of an opossum
6. The number of toes an opossum has on each foot
7. The favorite habitat of an opossum
0. The age at which a female is able to have offspring
9. The family to which the Virginia opossum belongs

Down
1. The place where a mother opossum carries her young
2. The word that describes when an opossum is most active
4. The word that describes the eating habits of an opossum
5. A mammal that gives birth to an embryo in an early stage of development
8. The only marsupial found in North America
Activity #12 – Bats Need a Place to Live Too!

Objectives:
1. To identify what conditions bats need to survive
2. To recognize why bats are beneficial to have around
3. To construct a single chamber bat house

Directions:
1. Discuss the background information below
3. Build a bat house and install as specified below

Background Information:
1. Bats often lose their homes when trees are cut down or caves are disturbed.
2. Bats prefer to live near food and water in a place that is warm and dry.
3. The best home for a bat is within ¼ mile of a lake, pond, river, or stream.
4. Bat houses should be placed where they will receive at least 6 hours of sun a day and painted a dark color to absorb the heat.
5. Bat houses should be mounted on the side of a building or on a pole about 12 to 15 feet above ground. Bats do not like bat houses mounted on trees.
Activity #13 - Bat Anatomy

Objectives:
1. To identify bat body parts/structures
2. To compare bat anatomy to our own
3. To recognize the function of each bat structure

Directions:
1. Have students label their bat diagram as you guide them using the background information below. Discuss homologous features to our own (fingers, elbows, etc.).
2. Have students fill-in the structure/function chart to help them match parts with their jobs.

Background:
<table>
<thead>
<tr>
<th>Structure</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thumb</td>
<td>grasping and climbing</td>
</tr>
<tr>
<td>Ear</td>
<td>hearing and echolocation</td>
</tr>
<tr>
<td>Tragus</td>
<td>directs incoming echolocation</td>
</tr>
<tr>
<td>Nose</td>
<td>smell, echolocation in some species</td>
</tr>
<tr>
<td>Patagium</td>
<td>skin membrane for flight</td>
</tr>
<tr>
<td>Fingers</td>
<td>stretches skin membrane for flight</td>
</tr>
<tr>
<td>Knee</td>
<td>bends for climbing</td>
</tr>
<tr>
<td>Calcar</td>
<td>supports uropatagium</td>
</tr>
<tr>
<td>Tail</td>
<td>balance</td>
</tr>
<tr>
<td>Uropatagium</td>
<td>skin membrane between tail and legs for flight, also used to catch food</td>
</tr>
<tr>
<td>Toes</td>
<td>used for clinging and hanging</td>
</tr>
<tr>
<td>Elbow</td>
<td>bends for flight motion</td>
</tr>
</tbody>
</table>
Bat Structure & Function    Name____________________

Part I – Label the structures below with the guidance of your teacher.

Part II – Fill-in the chart below of the structures & functions

<table>
<thead>
<tr>
<th>Structure</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
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</table>
Activity #14 – Predator/Prey Relations
Owl Pellet Dissection

Objective – To determine the predator-prey relationship between small mammals and owls.

Directions:
1. Obtain owl pellets from a supply company. Keep in mind that these are not necessarily obtained from local species, so the bones are only an indication of prey in a general sense.
2. Help students construct a K-W-L chart like the one below. Begin with having students fill-in information they already know (K) about owls and small mammals.
3. Discuss background information below. Explain the objective of the activity and have students write questions that they want (W) to know in their chart.
4. For younger students, teacher may want to perform a demonstration dissection, otherwise order enough pellets for the students to work in pairs.
5. Give each pair of students a piece of blank paper, an owl pellet, forceps, a probe, a hand lens, and a copy of the bone chart attached.
6. Use the following guidelines for dissection:
   • Use the probe to loosen the fur/feathers on the outside of the pellet, slowly separating pieces and extracting bones of prey
   • Place bones aside on the white sheet of paper. Take extra care when handling complete skeletons
   • When completed, use the attached bone chart and key to identify the prey items eaten by the owl.
7. When completed, have students fill-in what they have (L) learned on their chart, and take time to have them share their findings.
**Background Information:**
1. Owls in Pennsylvania that eat mostly vertebrates include the Barn Owl, *Tyto alba*, and the Great Horned Owl, *Bubo virginianus*.
2. Owls eat their prey whole, but regurgitate what they can’t digest like hair, feathers, and exoskeletons.
3. Small mammals typically eaten by owls are moles, shrews, voles, mice, and rats.

**K-W-L Chart example:**

<table>
<thead>
<tr>
<th>What I Know</th>
<th>What I Want to know</th>
<th>What I Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

**Resource:**
- Source of information and owl pellets: [http://www.hawkmountain.org](http://www.hawkmountain.org)
Simplified Dichotomous Key to Skulls found in Owl Pellets

1.a) If the skull has teeth, it is a mammal - go to 2
   b) If the skull has no teeth it is a bird.

2.a) If the teeth are in a continuous row, it is an insectivore – go to 3.
   b) If there is a large space between the front teeth/incisors and the cheek teeth/molars, it is a rodent – go to 4.

3.a) If the tips of the teeth are reddish, it is a shrew.
    b) If the tips of the teeth are not reddish, it is a mole.

4.a) If the skull size is less than 32mm, go to 5.
    b) If the skull size is more than 32mm, it is a rat.

5.a) If the molars are flat, it is a vole.
    b) If the molars are rounded, it is a mouse.
Activity #15 - Small Mammal Identification and Trivia

Objectives:
1. To identify/distinguish between common small mammal groups.
2. To learn the basic life history/ecology of each small mammal group
3. To identify structural traits of each small mammal group

Part I – Small mammal Trivia – Directions:
Use the attached student worksheet as the basis for this activity. It can be filled-in first and used as a discussion tool, or a lesson on small mammals can be taught first using the information in this guidebook and the worksheet can be used as a follow-up.

Answer Key:
1. Mole
2. Shrew
3. Shrew, Vole
4. Mole
5. Jumping Mouse
6. White-footed Mouse
7. Jumping Mouse
8. Mole
9. Shrew
10. White-footed Mouse
11. Vole
12. Jumping Mouse

Part II – Dichotomous Identification Key:
The attached key may be used to identify common small mammals of the Poconos.
Small Mammal Trivia

Name ______________________

Directions: Write the letter of the small mammal group that each statement below applies to. Select your answers from the following list:

M – Mole       J - Jumping Mouse
S – Shrew      W – White-footed Mouse
V - Vole

_____1. Have flattened, spade-like front feet for digging
_____2. Some species have poisonous saliva
_____3. Travels mainly under leaf litter or under snow
_____4. Lives underground in extensive tunnels and burrows
_____5. Have enlarged hind feet and long tails
_____6. Most abundant rodent in our area
_____7. Hibernates in the winter
_____8. Eats mostly worms and beetle larvae in the soil
_____9. Can be quite aggressive towards other animals
_____10. Carries food in cheek pouches and hoards it
_____11. Mouse-like, but with a more blunt head
_____12. Can jump up to 7 feet high
Dichotomous Key to Common Small Mammals of the Poconos

1a. If the mammal has flattened, blade-like front feet, it is a **Mole**.
1b. If the mammal does not have flattened, blade-like feet, go to 2.

2a. If the mammal has 5 front toes, tiny eyes, and front pincher-like incisors, it is a **Shrew**.
2b. If the mammal had 4 front toes, normal size eyes, and a gap between its incisors and molars, it is a rodent. Go to 3.

3a. If the mammal has enlarged hind feet and a long tail, it is a **Jumping Mouse**.
3b. If the hind feet and tail are not greatly elongated, go to 4.

4a. If the molar surfaces have a triangular prism pattern, and the tail is shorter than the head and body, it is a **Vole**.
4b. If the mammal’s tail is as long as its head and body, it is a **White-footed Mouse**.
Activity #16 - Pocono Mammal Bingo

Objectives – To review the mammals of the Poconos

Directions:
1. Create a 5 X 5 blank grid for a bingo blank
2. Print enough bingo blanks for each student to have one.
3. Have the first class help you make the cards by filling in the blocks as you go over the clues. Subsequent rounds/classes can simply play bingo.
4. Write each clue on an index card for teacher use during game. Modify clues to make them more or less difficult as you wish.

Clues (w/answers):
1. A mammal with a pouch that rarely gets rabies (opossum)
2. A group of fossorial (digging) mammals with front feet enlarged for digging that eat invertebrates (moles)
3. A small mammal with venomous saliva (northern short-tailed shrew)
4. The most common bat in the Poconos (little brown bat)
5. A mammal with large feet that turns white in the winter (snowshoe hare)
6. A small diurnal mammal with stripes and cheek pouches (chipmunk)
7. Largest member of the squirrel family and a true hibernator (groundhog)
8. A small nocturnal mammal with large eyes that lives in tree cavities and glides from tree to tree (southern flying squirrel)
9. The largest Pocono rodent, having a large flat tail and living a semi-aquatic lifestyle (beaver)
10. A common small nocturnal rodent with large round ears and a long tail (deer mouse)
11. An endangered rodent that lives in isolated patches of rocky outcrops (Allegheny woodrat)
12. A group of small mouse-like rodents, but have smaller ears and rounder faces. They use runways and burrows beneath leaf litter, etc. (voles)
13. A medium sized semi-aquatic mammal with a long, scaly, black, knife-like tail (muskrat)
14. A small hibernating rodent with a very very long tail (jumping mouse)
15. The only Pocono mammal with quills (porcupine)
16. The only hooved mammal in the Poconos (white-tailed deer)
17. A small canine with red fur and a white-tipped tail (red fox)
18. A small canine with gray fur and a black-tipped tail (gray fox)
19. A medium sized mammal that is a successful generalist and has very dexterous forefeet, a mask, and a ringed tail (raccoon)
20. A member of the weasel family that is all brown with a small white chin patch (mink)
21. A medium sized mammal that uses a strong odor for defense (skunk)
22. A playful semi-aquatic mammal that was once almost gone from Pennsylvania, but has been successfully reintroduced (river otter)
23. A seldom-seen mammal that lives in forests and can eat porcupines (fisher)
24. The only wild feline found in the Poconos (bobcat)
25. The largest mammal found in the Poconos (black bear)
Activity #17 – Who’s Hangin’ Around?
Mammal Mobiles

Objectives:
1. To identify traits of a local species of mammals
2. To share information orally

Directions:
1. Have students work in partners
2. Have students select a mammal species to research
3. Distribute copies of mammal pages to each group or have them conduct their own research
4. Set criteria for information. For younger/lower level students you may ask for 5 facts. For older/higher level students you may require the following: habitat, habits, diet, predators, defenses, reproduction, etc.
5. Have students draw and cut-out their mammal from oak tag. Punch holes along the bottom from which to hang information cards.
6. Have students place information on separate cards and hang from animal cut-out using yarn. Encourage creativity.
7. Have students present their projects orally to the class.
Activity #18 – “At Risk” Species Wheels
Threatened, Endangered, or Extirpated Mammals

Objectives:
1. To identify local mammal species that are threatened, endangered, or have been extirpated in the Poconos
2. To identify the reasons for the species’ decline
3. To share information in a creative way

Directions:
1. Have students work in pairs or small groups
2. Have students do independent research to find the following information about their species: scientific name, reason for decline, habitat, food/diet, and reproduction. You may want them to find/draw a picture also.
3. Cut 2 large circles out of construction paper, one 2” smaller than the other, marking the center of both.
4. Divide the circles into 5 equal slices using a protractor. On the small circle, use light pencil only. On the large circle use marker to make the lines.
5. On the smaller circle, cut out one of the 5 sections.
6. Have students transfer each piece of information onto a separate section of their large wheel, labeling each section as shown.
7. On the front of the small circle should be the common name and picture of the mammal.
8. Have students attach the small circle to the front of the large one with a 2-pronged clasp as shown.
Species Choices:

Indiana bat
Northern flying squirrel
Southern bog lemming
Fisher
Elk

Small-footed bat
Allegheny woodrat
River otter
Bobcat
Activity #19 – Otter Survival
Carrying Capacity

Objectives:
1. To recognize the relationship between a predator and its food supply (prey)
2. To explain the effects of environmental changes on predator populations

Directions:
1. Have students work in groups of 4 or 5.
2. Copy enough animal cards so that each group has one set (47 total cards in a set: 4 turtle, 5 crayfish, 6 snake, 8 invertebrate, 12 frog, and 12 fish). You may permanently laminate them.
3. Copy enough instruction sheets to distribute one to each group.
4. Conduct a follow-up conversation with students about what they learned.

Background to share with students:
1. Carrying capacity refers to the size of a population that can be supported by the ecosystem.
2. One important factor in carrying capacity for a predator, is the prey available to it.
3. The carrying capacity of an ecosystem is constantly changing as factors in the environment change.
4. This game is a simple simulation of how carrying capacity works on a predator population: otters.
5. An otter’s favorite foods are fish and crayfish, but they are opportunistic feeders that will eat whatever is available.
Otter Survival Game Instructions

1. One group member is the dealer and the others must be “otters”.
2. This game is played in separate rounds. Round 1 should involve only the dealer and 1 otter. Each round thereafter should add one more otter into the population (until all otters are involved).
3. The dealer begins by spreading out the cards face up and having the otters familiarize themselves with the available food options.
4. It is winter, and each otter needs to gather 60 pounds of food to survive for one month.
5. The dealer should allow 15 seconds for the otter(s) to pick up one food card at a time, placing it in a pile, using one hand only.
6. At the end of 15 seconds, the otters should add up their food cards to see if they reached the 60 pounds necessary for survival.
7. Simulate pollution in the environment by removing 3 crayfish and 6 fish cards from the playing deck. Repeat the game as before, beginning with 1 otter, then adding more in during each round.
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Activity #20 - Mammal Conservation Issues

Objectives:
1. To recognize the complexity of conservation issues
2. To identify the pros and cons of conservation-based decisions

Directions:
1. Copy enough dilemma cards so that 3 or 4 students have the same scenario.
2. Hand-out a dilemma card to every student. Do not tell them that they share the same scenario with anyone else.
3. Have the students respond to their scenario in writing.
4. Upon completion, have the students find the others that share the same scenario and sit together. Have them share their answers through discussion.
5. Lead a class discussion, allowing each group to share their dilemma and their thoughts.
6. Discuss the complexities inherent in conservation-based decision making.
1 – Situation: You live in a development where white-tailed deer are eating all the shrubbery. Recently they have eaten most of your vegetables and flowers in your garden that you worked all spring and early summer to cultivate. You understand that the population of deer in our area is on the rise.

Do You...

a) Support a longer hunting season and perhaps even take-up the activity yourself?

b) Spend a large amount of money on fencing-in your entire property?

c) Replace your shrubbery with deer-resistant plants?

2 – Situation: You live near a beautiful stream, where your family can fish and enjoy nature. In the past you have seen muskrat, mink, and even an otter playing in the stream. You notice an oily residue washing up on the stream bank and suspect some sort of chemical run-off from your neighbors’ farm.

Do You...

a) Confront your neighbor directly about the issue, hoping that they will accept responsibility and stop polluting?

b) Call the local watershed or DCNR authorities to report the problem?

c) Wait until your neighbors are out and investigate the situation on their farm more closely?
3 - **Situation:** You need to have some trees removed from your property as they are dangerously overhanging your house. The tree removal specialist informs you that you have a family of flying squirrels nesting in one of the trees and that they most likely have young babies in the nest.

Do You...

a) Authorize them to remove the trees anyway?
b) Decide to leave the trees alone until later in the season when the baby flying squirrels are bigger?
c) Pay an animal removal expert to relocate the squirrels?

4- **Situation:** You are director of the PA Game Commission. The population of white-tailed deer in the Poconos has been increasing at an alarming rate over the past several years. The deer are causing many problems, such as: eating landscaping, causing vehicle accidents, and defoliating oak forests that support many other species of wildlife. In addition, because of their high numbers, many of them are suffering from starvation in winter.

Do You...

a) Authorize a longer hunting season or increase bag limits?
b) Begin an experimental “birth control” project for wild deer, spreading medicinal baits in areas with high deer populations?
c) Spread poison in late fall to cull the herds before winter and starvation set in?
5 – **Situation:** Your family owns a large piece of land that includes an isolated rocky slope. You are approached by the PA Game Commission and asked if you would allow them to reintroduce a small population of Allegheny woodrats into the area. You understand that this is an endangered species, but are afraid of bringing rodents into your area.

**Do You...**

a) Agree to allow the woodrats to be reintroduced?

b) Not agree to allow the animals to be placed on your property?

c) Do some research on the species and ask for time in making the decision.

6 – **Situation:** You and your friends are out hiking in the Delaware Water Gap National Recreation Area and come across a cave. There is a sign stating that the cave is closed due to the possibility of spreading a bat disease called White Nose Syndrome.

**Do You...**

a) Disregard the posting and go into the cave anyway?

b) Obey the sign and leave the area immediately?

c) Take your shoes off, then go into the cave hoping not to pick up any of the fungus on your shoes?
7 - Situation: Your family buys a piece of property and plans to build a house on it. The property has a lower flat pond area and a rocky hillside. Above that is a flat area with lots of trees. You need to help your family decide where to build.

Do You:

a) Suggest that your family fill-in the pond and build on the low, flat area?

b) Suggest that your family cut down most of the trees to build on the flat area up above the pond?

c) Suggest that your family spend extra money to excavate the rocky hillside and build on the slope?

8 - Situation: Your parents buy you a ferret for your birthday, but it turns out to be rather wild. You do not want to keep it anymore.

Do You:

a) Let it loose outside in your backyard, not knowing how it will survive or affect the ecosystem?

b) Try and find a rescue organization that will adopt it?

c) Give it to your friend even though his parents do not approve and will probably let it go in their yard?
Literature Cited/Photo Credits


Kansas Department of Wildlife and Parks.  http://www.kdwpstate.ks.us

Kids’ Inquiry of Diverse Species.  http://www.biokids.umich.edu


Pennsylvania Game Commission.  http://www.pgc.state.pa.us


Community Resources

Delaware Water Gap National Recreation Area
www.nps.gov/dewa/index.htm

East Stroudsburg University, Department of Biological Sciences.
Natural history museum with specimens of Pocono mammals. Can provide assistance with identification of local mammals.
Howard Whidden  570-422-3714

Monroe County Environment Education Center
8050 Running Valley Rd. www.mcconservation.org
Stroudsburg, PA  18360  570-629-3061

Penn State Extension Service
http://extension.psu.edu/

Pocono Wildlife Rehabilitation Center
361 Cherry Dr. www.poconowildlife.com
Stroudsburg, PA  18360  570-402-0223

Pocono Environmental Education Center
RR 2 Box 1010 www.peec.org
Dingmans Ferry, PA  18328  570-828-2319

State Parks – Beltzville, Big Pocono, Gouldsboro, Hickory Run, Jacobsburg, Lehigh Gorge, Tobyhanna
www.dcnr.state.pa.us/stateparks/
Suggested Resources

Publishes the Journal of Mammalogy and other resources on mammals. Provides information on scientific research in the field of mammalogy.

Carnegie Museum of Natural History.  www.carnegiemnh.org  
Home to one of the world’s largest collections of recent mammals, as well as an on-line resource of Pennsylvania mammals, including distribution, habitats, and food of each species. An excellent resource on Pennsylvania mammals.


Important Mammal Area Project (IMAP).  www.pawildlife.org  
The Pennsylvania state chapter of the National Wildlife Federation, providing information and activities for students and teachers.


Wilkes-Barre: Llewellyn and McKane. An excellent and concise field guide with good photos of Pocono mammals.

An excellent all-around resource, including information and activities for teachers and students.

Pennsylvania Biological Survey. www.altoona.psu.edu/pabs
Includes current information on the status and abundance of PA species. Home to the Mammal Technical Committee, the scientific advisory council to the Pennsylvania Game Commission.

Pennsylvania Department of Conservation and Natural Resources. www.dcnr.state.pa.us.
An excellent source of state and local information on wildlife for students and teachers, including local programs available.

Pennsylvania Game Commission. www.pgc.state.pa.us.
An excellent all-around resource of local species including fact sheets, activities for kids, photo archives, and information on the current legal status of Pennsylvania mammals.


A comprehensive source of information and educational resources on wildlife.

Whidden, Howard. Department of Biological Sciences, East Stroudsburg University. Teaches an excellent comprehensive course on mammals.