

# MAMMALOGY



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Drawings by Aleta Holt  
Courtesy of the  
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## CHAPTER GOALS

After completing this chapter, volunteers should be able to:

- Describe the distinguishing characteristics of mammals
- Understand skull features used to identify mammals
- Discuss the range of habitat and niches filled by mammals
- Identify the major groups of mammals in Kansas and their unique characteristics
- Describe the success stories of mammal reintroductions and range expansion in Kansas
- Know the threatened and endangered mammals of Kansas
- Understand how to increase chances of observing mammals in Kansas



# INTRODUCTION

What ranges in size from a tenth of an ounce to 1,800 pounds? The mammals of Kansas! From the pygmy shrew to the bison, Kansas mammals come in a variety of shapes and sizes. They are active during the day, at night, and in those fuzzy times in between - dusk and dawn. They can live in water, on land, underground, or in trees. They can walk, swim, climb, and some even fly. Clearly, mammals are extremely diverse.

Worldwide there are 5,416 described species of mammals within 29 taxonomic orders and 153 families. Here in Kansas, there are 86 species of wild mammals within 8 orders and 23 families. Rodents are the most numerous, representing almost 42% of all the mammalian species in Kansas, followed by bats (20%), carnivores (18%), and shrews and moles (11%).

## A. CHARACTERISTICS OF MAMMALS

The following characteristics are found only in the animals of the Class Mammalia:

1. **Hair** – the amount of hair varies, but all mammals possess some hair at some time in their lives.
2. **Mammary glands** – all mammals nourish their young with milk produced by mammary glands.
3. **Mouth with specialized teeth** – mammals also have two sets of teeth (diphyodont – milk teeth and permanent teeth), and teeth differentiated to their feeding style (heterodont).

Other characteristics of Class Mammalia, that other classes of animals possess:

1. **Endothermic and homeothermic** – a body that is capable of generating and maintaining its own body heat.
2. **Internal fertilization**
3. **Four-chambered heart** – oxygenated blood is kept completely separated from deoxygenated blood which allows the body to efficiently produce heat and be endothermic.

## B. MAMMAL CLASSIFICATION

Kingdom Animalia

Phylum Chordata

Class Mammalia

Subclass Prototheria

Subclass Theria

1. **Subclass Prototheria** = egg-laying mammals that occur in Australia, Tasmania, and New Guinea. There are only three genera and five species that make up this subclass. Often referred to as **monotremes**, this group includes echidnas (spiny anteaters – 4 species) and the duck-billed platypus (1 species).





2. **Subclass Theria** = mammals that give live birth. They are further subdivided into the **Metatheria** (Meta = many, theria = birth) and **Eutheria** (Eu = true, theria = birth).

**Metatherians** are marsupials that have a pouch. Offspring are “born” approximately 2 weeks after fertilization and are extremely undeveloped. They use their arms to pull themselves up into their mother’s pouch. Here they receive nourishing milk from a mother’s nipple and can safely complete their development. Examples of metatherians include the Virginia opossum and the kangaroo.

**Eutherians** are placental mammals and include humans, deer, and mice. Eutherians use the placenta membrane to nourish offspring inside a protective womb until they are well-developed. Offspring of placental mammals may be born in a very advanced stage where they may be able to stand and run very soon after birth. All mammals native to the United States, except for the Virginia opossum, are eutherians.

### C. DIET

Mammals can be herbivores, carnivores, or omnivores. **Herbivores**, such as deer and rabbits, eat plant material. Their digestive systems are specialized to process all kinds of plants, even grasses. **Carnivores**, such as coyotes and mink, predominantly eat the flesh of other animals. Their digestive systems are specialized to digest meat. **Omnivores**, such as raccoons and opossums, eat both vegetation and flesh. They cannot digest all plant material, but they are able to digest fruits and vegetables.

Some types of mammals eat only very specialized diets; several dietary classifications are listed below:

**Insectivores** – eat insects and other invertebrates

**Granivores** – eat seeds and nuts

**Frugivores** – eat fruit

**Piscivores** – eat fish

**Sanguinivores** – feed on blood

**Nectarivores** – feed on nectar

### D. A SPECIALIZED ADAPTATION: HIBERNATION

Hibernation is a prolonged state of torpor (low activity and slow metabolism) and is induced by sustained cold weather and a reduction in food sources. **True hibernators** include small mammals, such as rodents and bats, that have a high metabolic rate, large surface area to volume ratio, and diets consisting of insects and plants that are scarce during the winter. During true hibernation, an animal’s body temperature is reduced to near ambient temperature, its metabolism is slowed dramatically, and its heart rate is





dropped to the point of just sustaining life and preventing freezing. True hibernation allows an animal to survive on minimal cached (stored) food or even on the fat stored in the body.

Although bears can sleep all winter without eating, they do not actually hibernate, since they cannot lower their body temperature or heart rate as drastically as true hibernators. Scientists refer to the dormant state entered by bears as *winter lethargy*.

Aside from hibernation, there exists a daily torpor that is used by bats and some birds and small mammals. This form of torpor allows them to survive during short periods of time when food may be unavailable, such as during cold spells or rainstorms.

## E. PHYSICAL NICHES: LAND, AIR & WATER

Although mammals first evolved as terrestrial animals, they have diverged to take advantage of a range of niches. The following terms describe the habits of specific groups of mammals:

*Arboreal* = mammals that live in trees. E.g. flying squirrels (who don't truly fly, but rather glide from the top of the tree down to lower branches)

*Fossorial* = mammals that live underground. E.g. moles

*Aquatic* = mammals that live in the water. E.g. dolphins and whales

Of course there are mammals that are only partially arboreal, fossorial, or aquatic, such as gray squirrels, woodchucks and beavers, respectively.

## F. TEMPORAL NICHES: DAY, NIGHT, & IN BETWEEN

Just as mammals have evolved to take advantage of various physical niches, they have adapted to different temporal niches as well.

*Diurnal* = mammals are active during the day. These are the mammals that are most familiar to people, such as deer, and many squirrels.

*Nocturnal*, = mammals that are active at night. This includes bats, mice, and skunks. Indeed, approximately 67% of all of Kansas mammals are nocturnal. Nocturnal mammals are most active during the night, although they may occasionally be seen during the day.

*Crepuscular* mammals are most active at dawn and dusk, but they may also be seen during the day or night. An example of a crepuscular mammal in Kansas is the eastern cottontail rabbit.

## G. MAMMALS AS GAME/FUR BEARERS

Throughout history, mammals have been identified as prime sources of meat and fur. Even though many mammalian predators have been intentionally exterminated through bounties, populations of some mammals have exploded. Thus, hunting and trapping seasons have been enacted to control the population of certain, problematic species.





According to the Kansas Department of Wildlife and Parks, furbearing mammals include mink, muskrat, raccoon, striped skunk, long-tailed weasel, least weasel, opossum, beaver, red fox, gray fox, badger, bobcat, river otter, and coyote. Some furbearers are trapped and some may also be hunted. Game mammals that can be hunted include the woodchuck, gray and fox squirrels, deer, and rabbits. Specific dates for hunting and trapping seasons vary annually and can be obtained in a brochure from the Kansas Department of Wildlife and Parks, or on the web at <http://kdwp.state.ks.us>.

## H. DISEASES & MAMMALS

There are a variety of diseases that can be present in wild mammals that may pose a risk to humans. These diseases include: chronic wasting disease, lyme disease, Tularemia, Hantavirus, and rabies. The following description of the diseases is only meant to introduce them and is in no way exhaustive.

***Chronic wasting disease***, found only in deer and elk, is a fatal neurological disease caused by a prion. The disease affects the behavior of the infected animal, causing it to behave abnormally, lose extreme amounts of weight, lose coordination, and ultimately die. Transmission of the disease from animal to animal is still not entirely understood. At this time it does not appear that the disease can be transmitted from infected animals through contact or consumption; however, more research is needed. Because this disease is induced by prions that occur in nerve tissue the following parts of the deer should not be eaten: brain, eyes, spinal cord, lymph nodes, tonsils, and spleen.

***Lyme disease*** is transmitted to mammals by deer ticks infected by the bacteria *Borrelia burgdorferi*. Deer, mice and ground-feeding birds can act as reservoirs of the bacteria; uninfected ticks that feed on infected deer and mice become infected and infect future hosts. In humans, the bite can result in a “bull’s-eye” like rash and flu-like symptoms. If not treated early, serious problems can develop affecting the joints, heart, and central nervous system. Antibiotics can be used to treat the disease.

***Tularemia***, or rabbit fever, is a bacterial-disease most commonly found in rodents, rabbits, and hares. The disease can be passed to humans in a variety of ways, including getting bitten by an infected tick or by eating rabbit meat that wasn’t fully cooked. Symptoms depend on the way a person got infected. If infected by handling the carcass of an infected animal, a person may develop a sore on the entry wound, and their lymph nodes may swell. A person may develop symptoms similar to pneumonia if the bacteria are inhaled. If the bacteria are eaten, a person may develop flu-like symptoms. Because it is induced by bacteria, antibiotics can be used to treat the disease.

***Hantavirus Pulmonary Syndrome***, caused by a virus, is a rather rare disease, but it has about a 40% mortality rate. The disease is carried predominantly by the deer mouse and is spread to humans via contact with the mouse’s urine, feces, or saliva. A person may contract the disease by inhaling particles while cleaning up mouse droppings or nests, or they may contract it by living or working in areas infested by the mice. Symptoms are





similar to the flu, but they are followed with respiratory problems. Antiviral treatments are still being developed, but antibiotics are ineffective.

**Rabies** is a virus transmitted by the bite of an infected animal. Rabies can occur in all mammals, though it is not very common in rodents or rabbits. The wild animals most likely to be infected by the disease are raccoons, skunks, foxes, coyotes, and bats. Bats are exceptional in that they do not display the aggressive type behavior normally associated with rabies (i.e. “mad dog”). Rather, bats become lethargic (the paralytic form). If you believe you have been exposed to rabies, it is extremely important to wash the wound with soap and water and quickly seek medical attention. If possible, the animal should be given to the health department to be assessed for rabies. Postexposure prophylaxis (PEP) can be used to successfully treat people exposed to rabies. PEP consists of a series of shots that are given within a 28-day period. These shots are given in the arm and are no more painful than a flu shot. Symptoms of rabies are similar to the flu in the beginning and progress quickly to affect the central nervous system, causing agitation, abnormal behavior, hallucinations and eventually, death. It is extremely rare for a person to survive rabies without pre- or post-exposure rabies shots.

## I. THREATENED & ENDANGERED SPECIES

States may designate species within their borders as “Threatened” (threatened of becoming endangered), or “Endangered” (in danger of becoming extinct). In addition the United States Fish and Wildlife Service also lists species as Threatened or Endangered when there is sufficient scientific evidence to warrant federal protection. Therefore, a species may be “Threatened” within a state but may not be listed as Threatened by the U.S. government.

**Table 1.** Threatened and Endangered Mammal Species of Kansas

### ***Threatened***

<b>Common Name</b>	<b>Scientific Name</b>
Eastern Spotted Skunk	<i>Spilogale putorius</i>

### ***Endangered***

<b>Common Name</b>	<b>Scientific Name</b>	
Black-footed Ferret	<i>Mustela nigripes</i>	
Gray Bat**	<i>Myotis grisescens</i>	** Federally endangered





## J. EXTIRPATED & INCIDENTAL MAMMALS

Over the course of the last 150 years or so, two mammals have been extirpated (locally extinct) from the state of Kansas (Table 2).

**Table 2.** Extirpated Mammals of Kansas.

<b>Common Name</b>	<b>Scientific Name</b>
Gray Wolf	<i>Canis lupus</i>
Grizzly Bear	<i>Ursus arctos</i>

Incidental occurrences of mammals considered extirpated in Kansas can and do happen. Incidental mammals verified in Kansas include the cougar and wolf. One difficulty with these sightings is determining if the animal in question was truly wild. Sometimes legal or illegal captive exotic animals escape or are released into the wild. Documenting a sighting of an extirpated species requires a photo, definitive foot print/track or some other indisputable evidence. However, to prove the animal is wild, DNA evidence, examination of stomach contents, and/or other proof would be needed.

An intriguing mammal story in Kansas is the recent range expansion of the nine-banded armadillo. Expanding north from Central America, the armadillo was first documented in southern Texas in 1849. Since that time, its range has been increasing to the north and east. There have been a many reports of armadillos in Kansas since the 1970s. However, sightings have increased in frequency since 1999. Most of these sightings were roadkill. Since armadillos eat carrion as well as invertebrates, they are frequently hit while eating roadkill. Thus it is not surprising that they are referred to as “Texas speed bumps.”

## K. FERAL MAMMALS

There are several species of feral (wild but of domestic descent) mammals that occur in Kansas. Cats that are feral or free-ranging (farm or house cats that roam free outside) can be found throughout the state. They prey upon birds and small mammals, significantly impacting the populations of their prey. In addition, they also limit the availability of prey for native predators.

Feral hogs are a problem in southern Kansas. They could be domestic swine, European wild boar, or a hybrid. Pioneers used the hogs for food and let them roam free until the discovery of barbed wire, which allowed the pioneers to put the hogs in an enclosed pen. Their rooting and wallowing behavior is harmful to vegetation and loosens the soil, causing erosion and the siltation of streams. In addition, hogs consume acorns and other mast (= fruit of the trees), limiting their availability to native animals.





## L. OBSERVING MAMMALS

Most of the mammals in Kansas are small; over 50% are smaller than a rat. Many of these small mammals live underground or hide in dense vegetation. In addition, as mentioned in the Introduction to this chapter, many mammals are most active when it is most difficult to observe them directly, at night.

The best times to look for wildlife are at dusk and dawn, when many animals are most active. Remain quiet and still to avoid alarming the animals. To increase chances of observing some wildlife, you might consider baiting a site with food or a salt lick. Also remember that mammals may be associated with specific habitats. For instance, you would want to go by a river or pond to see a beaver. Bats can be observed around dusk and early evening circling street lights that attract insects. A good location to see captive mammals native to Kansas is Wildlife Prairie State Park in Peoria, Kansas.

Even when animals are not directly visible, one can also find evidence of them. For example, you may see tracks, scat, otter slides, scrapes on trees, or the remains of their prey. It is also possible to see where mammals live, such as beaver and muskrat houses, different size burrow holes for various mammals, or "beds" in the vegetation. Smaller mammals may create tunnels in the ground, in the vegetation, or under the snow. One may find evidence of their feeding in such things as gnaw marks on old bones, stumps and standing trees, or bites out of leaves or twigs, or a browse line in the woods.

## M. IDENTIFICATION BY SKULL DENTITION

Scientists learn a great deal about mammals by studying their skulls and teeth, and the naturalist interested in mammals may want to become familiar with some of the techniques they use.

One of the most important characteristics of the skull to examine is dentition. Teeth vary in type, appearance, and number.

There are four types of teeth: **incisors**, **canines**, **premolars**, and **molars**.

**Incisors** = are the teeth at the very front of the mouth. In many mammals, incisors are used to clip or pinch food. However, rodents, rabbits, and hares have developed incisors that are used like chisels.

**Canines** = are used to pierce, hold, and kill food. They are immediately behind the incisors and are especially large in carnivores, like dogs.

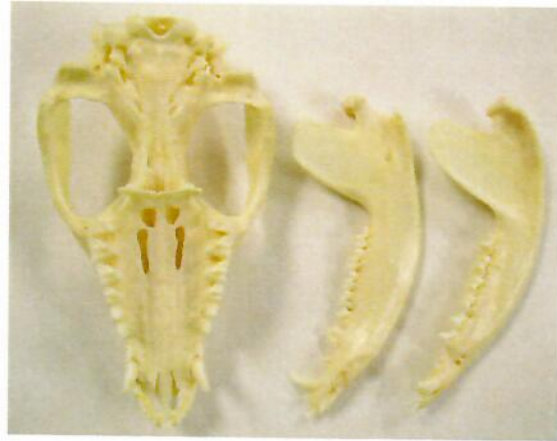
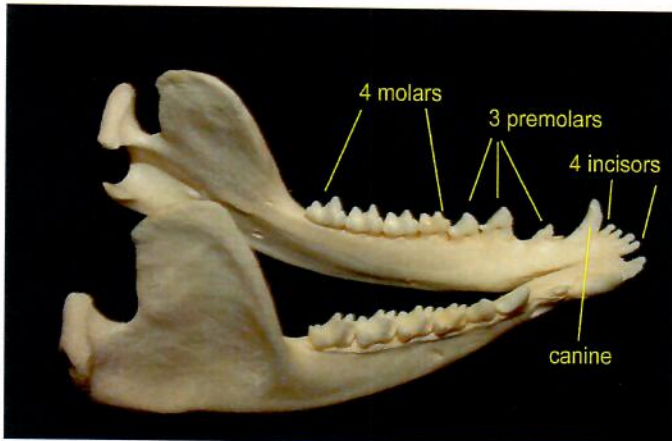
**Premolars & Molars** = behind the canines are the *premolars* and then the *molars*, though molars are found only in adults. Premolars and molars, also referred to as cheek teeth, are used to grind or slice food so that the food is more easily digestible. The structure of the premolars and molars varies according to the diet of the animal, thus vegetarian cheek teeth are better adapted to break down plant material while the carnivore's cheek teeth are adapted to tear meat.





## N. DENTAL FORMULA

The dental formula is a useful tool for mammal identification. It shows the number of each of the four types of teeth on one side of the mouth in both the upper and lower jaws. The formula lists the teeth in order from front to back with the upper jaw listed first and followed by the lower jaw. The number of each type of tooth on the top and bottom jaws can be the same or different.



The mammal with a dental formula most similar to primitive mammals is the omnivorous opossum. The dental formula of the opossum is the following: I 5/4, C 1/1, P 3/3, M 4/4. The formulation indicates that on one side of the upper jaw there are 5 incisors, 1 canine, 3 premolars and 4 molars and 4 incisors, 1 canine, 3 premolars and 4 molars on one side of the lower jaw for a sum of 25 teeth. The number of teeth is doubled to account for both sides of the mouth for a total of 50 teeth.

## O. SKULL IDENTIFICATION BY FAMILY

Many obvious characteristics of the skull can be used to ascertain the order or family of mammal it represents. In general, one can look at the relative size and shape of the skull and the dental formula to identify mammalian skulls.

**Armadillo** skulls possess no incisors or canines. In fact, their primitive teeth are peg-like and have no cusps.

**Opossums** have a narrow braincase and 50 teeth – more than any other Kansas mammal. Their dental formula is I 5/4, C 1/1, P 3/3, M 4/4.

A key diagnostic feature of a **shrew** skull is red-tipped teeth. In addition, their small skull lacks a zygomatic arch, which is the bone that arches out from the main structure of the skull and delineates the outside of the eye socket. The shrew's dental formula is I 3/1, C 1/1, P 3/1, M 3/3.





In **moles** the anterior/front-most incisor is tilted both down and back into the mouth. In addition, the cusps of the premolars and molars have a “V” or “W” shape. The dental formula of the mole is I 3/2, C 1/0, P 3/3, M 3/3.

**Bats** have small skulls with a zygomatic arch and sharp-cusped white teeth. Most bats have 1-2 upper incisors and 0-2 small, single-cusped teeth behind their canines.

**Rabbits** possess four upper incisors with a unique pattern; there are two large incisors in front of two small incisors. The incisors have enamel on the front side. Rabbits do not have canines. The lack of canines creates a diagnostic gap between the incisors and premolars; this trait is shared by rodents. The dental formula of the two species in Kansas is I 2/1, C 0/0, P 3/2, M 3/3.

**Rodents** have 4 incisors with enamel on the front side only and no canines. The lack of canines creates a diagnostic gap between the incisors and premolars; this trait is shared by rabbits. In addition, some rodents possess yellow enamel on their teeth. They have a maximum of 22 teeth.

**Carnivore** skulls range in size from small to large. They possess large, cone-shaped canines. Many carnivores also have carnassials, a unique pairing of the last upper premolar and the first lower molar that are highly specialized for shearing food. The dental formula varies for species within this order.

**White-tailed deer** skulls may possess antlers, which are shed annually. Their dental formula is I 0/3, C 0/0, P 3/3, M 3/3.

## P. TRACKS

Naturalists may also be interested to learn what they can about mammals by studying their tracks. While some mammals, such as the white-tailed deer, may be identified by a single print, a series of tracks may be needed to identify other mammals. A single track may not be very discernible based on the type and quality of substrate in which it was made (mud, dust, snow, etc). In addition, the pattern of the tracks may also help determine its maker. Do the prints of the front and back feet overlap? A series of prints allows a person to determine the gait used by an animal, whether it was walking, running, hopping, etc.

Another hint for identifying tracks is to look at the habitat in which the track is found. Some mammals do not use certain habitats. For example, you wouldn't find a badger track in the middle of a dense forest. One should also keep in mind the range of the animal; some mammals only occur in certain portions of the state. In addition, the season may be important; tracks of hibernators would not be found in the snow in winter. Mammal tracks are most easily observed along the muddy banks of rivers, streams and ponds, and also in the snow. Tracks in wet snow are best viewed in early morning or late afternoon when the sun casts shadows on them and accentuates their features.





## Q. MAMMALS OF KANSAS

### **ORDER DIDELPHIMORPHIA - Opossums** **FAMILY DIDELPHIDAE**

#### Opossums

Didelphimorphia is one of seven orders of marsupial mammals. Marsupials are distinguished by the fact that females give birth to tiny young at a very early stage of development. In many cases the female then carries and nourishes offspring for some time in a pouch of skin (marsupium) on her abdomen. Marsupials are most numerous in Australia and neighboring islands, but many representatives inhabit South and Central America, including opossums in the order Didelphimorphia and its single family, Didelphidae. Only one member of this order, the Virginia opossum, occurs in the U.S.



### **ORDER SORICOMORPHA – Shrews and Moles**

In Kansas this order is represented by four species of shrews and one mole. Soricomorphs are relatively small, terrestrial or fossorial insectivores.

#### **FAMILY TALPIDAE**

##### **Moles**

The eastern mole is the only species of mole that occurs in Kansas. Possessing short, dark, velvety fur; a naked snout; large forelimbs with well-developed claws; and lacking external eyes and ears; the mole is highly adapted for fossorial life. The forelimbs of moles are highly specialized for digging, and tilt out to the side; this allows the mole to push the loosened dirt behind it in the tunnel so it can continue digging. Moles have sharp, white teeth and a complete zygomatic arch, which is the bone that arches out from the main structure of the skull and delineates the outside of the eye socket. These insectivores have well-developed senses of smell and touch to aid in finding food, consisting predominantly of earthworms. Moles are well-known for digging tunnels just below the surface of the ground. While moles may mar the appearance of a manicured lawn with their tunnels, they are also aiding in the aeration and turning of the soil.

#### **FAMILY SORICIDAE**

##### **Shrews**

Shrews have short, velvety fur; pointed snouts with conspicuous whiskers; and minute eyes and external ears. The skull lacks zygomatic arches and North American shrews have red-tipped teeth, which are colored by iron deposits. These features differentiate shrew skull from those of bats or small rodents. On each side of the shrew's upper jaw the first incisor is large and notched and projects forward. The lower incisors are long and procumbent. The incisors are used like tweezers to grasp small prey. Behind the incisors there are four or five simple teeth called unicuspid. Because of their small body size, shrews have high metabolic rates. Some species consume up to two times their body weight daily. Shrews have poor vision, but their tactile, auditory, and olfactory senses are acute. Males have large glands on their sides that secrete a fluid with a strong, musky odor. Short-tailed shrews of the genus *Blarina* have a toxin in their saliva that paralyzes prey.





**ORDER CHIROPTERA - Bats**  
**FAMILY VESPERTILIONIDAE**

**Bats**

Bats are the only mammals capable of true flight. The 13 species that occur in Kansas belong to a single family, Vespertilionidae (plain-nosed bats). Their wings consist of thin, highly elastic skin supported by long fingers and are attached to the body from shoulder to hindfoot. A clawed thumb protrudes from the front edge of each wing. An interfemoral membrane (uropatagium) connects the hind legs, enclosing the tail. Vespertilionid bats have small eyes (but good vision) and a narrow flap of skin, the tragus, at the base of each ear. Their skulls are easily distinguished from those of rodents or shrews; bat skulls have a short rostrum, complete zygomatic arches, a U-shaped gap at the front of the upper jaw, unpigmented teeth, and enlarged canines.

Kansas bats are entirely insectivorous and are the major predators of night-flying insects, including crop and forest pests. They are voracious eaters; an adult male little brown bat consumes half its body weight in insects nightly, a lactating female more than her body weight. Kansas bats usually capture insects in flight. They use echolocation for navigation and finding prey; their echolocation calls are ultrasonic (20-130 kHz).

Kansas bats are *heterothermic*, i.e. capable of altering their body temperature. Heterothermic mammals can lower their body temperature and become torpid, thereby conserving energy, when their food supply is reduced. Bats go into torpor on cold or rainy nights when insect activity is low. During winter, most Kansas bats enter true hibernation. To survive the winter they must have sufficient energy reserves. When bats enter hibernation about 25% of their body mass is fat. Metabolism and body functions slow dramatically and the temperature of a hibernating bat may drop to 4°C (40°F), compared to 35-40°C (95-104°F) for an active bat. However, bats arouse occasionally during the winter and may even be seen flying on warm days. Bats hibernate five to seven months (with individuals entering hibernation between mid-September and November) and lose about half of their body mass by spring. Disturbance by humans during hibernation is a serious threat to bats because additional arousals can deplete their vital energy reserves before spring. Bats typically hibernate in caves or abandoned mines with fairly stable temperatures that remain just above freezing. Each species has specific requirements for temperature and relative humidity, and not all caves and mines are suitable for hibernation. Bats sometimes need to migrate long distances to reach hibernation sites, and some bats that spend the summer in Kansas may hibernate in other states. A cave or mine where large numbers of bats congregate each winter is called a hibernaculum.

Kansas bats exhibit delayed fertilization, an extremely rare reproductive pattern in mammals. Mating takes place during fall, but sperm is stored in the uterus and ovulation and fertilization do not occur until the following spring when the female emerges from hibernation. The length of pregnancy varies with environmental conditions. Fetal





development is slow and bats have long gestation periods compared to other small mammals (often up to 60 days).

*Echolocation* is the use of sound, rather than or in addition to sight, to find food and move through the environment. Mammals possessing this ability include marine mammals, soricids (e.g. shrews), and bats. Bats use high frequency and high intensity sound to discern their environment. Most of their echolocation calls are ultrasonic – at frequencies above human hearing. They emit a pulse of sound through their mouth or nose and the pulse is altered when it goes through, around or is echoed back by an object. Bats can determine the relative size and shape of an object, whether or not the object is moving, and how far away it is. Using echolocation bats can locate an insect perched on a leaf or flying in the air. They can differentiate between a beetle and a moth. Their echolocation is so acute, they can discern an object the width of a single human hair!

Several types of insects have evolved the ability to detect a bat's echolocation call. This ability gives the insect prey an opportunity to evade capture. Some moths have developed fuzzy wings that do not echo the bat calls. The tiger moths (family Arctiidae), have gone one step further. It can rub parts of its exoskeleton together to make a high frequency clicking sound that is similar to a bat's echolocation call. The purpose of the clicks is not entirely understood; the possibilities of the clicks include surprising or puzzling a bat, warning the bat that the moth does not taste good, or possibly altering the signal of the bat's reflecting calls.

## **ORDER CINGULATA – Toothless mammals**

### **FAMILY DASYPODIDAE**

#### **Armadillos**

The order Cingulata contains only one family -- Dasypodidae, the armadillos. They are restricted to the New World and only one of the 21 species occurs in the United States. The nine-banded armadillo has greatly expanded its range northward and there recently have been numerous reports of this species in Kansas. Armadillos feed primarily on invertebrates, many of which they dig from the soil with their long claws. They exhibit delayed implantation.



Fertilization occurs shortly after mating, but embryos become dormant early in development and float in the uterus for long periods before implanting in the uterine wall and resuming development. Armadillos typically give birth to a set of identical quadruplets. This phenomenon, referred to as monzygotic polyembryony, is a unique way to increase reproductive output in a species which produces only one ovum per year. Galbreath speculated that the uterus had become specialized to optimize the implantation of a single blastocyst. Thereafter an increase in litter size could only be achieved by splitting the blastocyst into multiple embryos.





**ORDER LAGOMORPHA – Rabbits and Hares**  
**FAMILY LEPORIDAE**

**Rabbits**

This order contains two families, but only the family Leporidae (rabbits and hares) occurs in Kansas. Lagomorphs are herbivores and resemble rodents in having a pair of large, chisel-shaped upper incisors. However, they have a smaller, peg-like tooth directly behind each of these incisors. Rabbits and hares are easily recognized by their short tails, long ears, large hind legs, and hopping gait.



**ORDER RODENTIA - Rodents**

Comprising more than 2200 species, Rodentia is the largest order of mammals. Rodents are mostly herbivorous and have two pairs of large incisors (the fronts of which are sometimes yellow or orange) and no canines. The incisors grow throughout a rodent's life, and gnawing on food or other objects prevents them from becoming dangerously long. Rodents also grind their incisors together to keep them at the proper length. The enamel on the front of the incisors is harder than the dentine on the back side and differential wear of the two surfaces produces a sharp, chisel-shaped edge. There are a few fairly large rodents (capybara, beavers, and porcupines), but most are quite small. Rodents cause billions of dollars in economic damage annually, primarily through losses of crops and stored food, and some species are vectors of diseases transmissible to humans. On the other hand, rodents are an important link in food chains. Some species are valued as game animals or furbearers and others have played a major role in medical research or are kept as pets.



Almost half the mammal species in Kansas are rodents. Six families are represented: Sciuridae (squirrels, chipmunks, and marmots), Castoridae (beavers), Geomyidae (pocket gophers), Cricetidae (rats, mice, and voles), Muridae (Old World rats and mice), and Dipodidae (jumping mice).

**FAMILY SCIURIDAE**

**Squirrels**

This family includes tree squirrels, Thirteen-lined ground squirrels, flying squirrels, chipmunks, and marmots. Sciurids can be arboreal, terrestrial, or semifossorial, and several species hibernate. Ground squirrels and chipmunks have internal cheek pouches, used for transporting food. Sciurid skulls are distinguished from those of other rodents by the presence of pointed postorbital processes. All sciurids except flying squirrels are diurnal. Consequently, they are the most visible and familiar rodents.







## **FAMILY GEOMYIDAE**

### **Pocket Gophers**

The common name of these rodents refers to external, fur-lined cheek pouches used for carrying food. Pocket gophers occur only in North and Central America. They inhabit open country and spend most of their time underground in extensive burrow systems. Adaptations for fossorial life include short fur, small eyes and external ears, long claws on the forefeet, and lips that can be closed behind the incisors while digging. Two species, the plains pocket gopher, and the yellow-faced pocket gopher occur in Kansas.



## **FAMILY CASTORIDAE**

### **Beavers**

There are only two beaver species — one in northern Eurasia, the other in North America. Beavers are very large rodents and highly specialized for semiaquatic life. Adaptations include dense fur, webbed hindfeet, nostrils and ears that can be closed, a transparent membrane (third eyelid) that covers the eyes, and lips that close behind the incisors. The great value of beaver pelts was a primary impetus for the fur trade which, in turn, played a major role in the exploration and settlement of western North America by European-Americans. Beavers also are noted for their ability to significantly alter their habitat by felling trees and building dams.

## **FAMILY CRICETIDAE**

### **Mice, Rats, Voles**

Cricetidae is the one of the largest families of mammals, containing nearly 700 species. Cricetids occupy a variety of terrestrial habitats and some are arboreal, semiaquatic, or fossorial. These rodents have high reproductive rates and short lifespans. Many feed primarily on green vegetation or seeds. Kansas cricetids range in size from the diminutive western harvest mouse to the muskrat. Fifteen Cricetidae live in Kansas.

## **FAMILY MURIDAE**

### **Old World Mice and Rats**

Muridae is the largest single family of mammals, with more than 700 species. Some of these rats and mice cause substantial economic losses and are of public health concern. Murids are native to the Old World, but three species have followed humans to the New World. The two murids that occur regularly in Kansas are the brown (Norway) rat and house mouse. The black rat (*Rattus rattus*) occasionally may appear in urban areas, but the larger, more aggressive brown rat prevents it from becoming established.





## **FAMILY DIPODIDAE**

### **Jumping Mice**

This family consists mostly of jerboas that inhabit the deserts of Eurasia and North Africa, but it also includes the birch mice of central Eurasia, the Chinese jumping mouse, and four species of North American jumping mice. These rodents are adapted for *saltatorial locomotion*, i.e. jumping; they have large hind feet and long tails (longer than their head and body). The meadow jumping mouse in Kansas hibernates.

## **ORDER CARNIVORA**

### **Carnivores**

This order includes wolves, cats, seals, sea lions, mongooses, hyenas, bears, raccoons, and weasels. The name of the order refers to the carnivorous habits of its members, most of whom are predators. However, some Carnivora, especially in the bear and raccoon families, are omnivores. The eleven wild species in Kansas represent five families: Canidae (dogs), Procyonidae (raccoons), Mustelidae (weasels), Mephitidae (skunks), and Felidae (cats). Their teeth are designed for eating meat. Long, pointed canines are used for grabbing and killing prey. The cheek teeth are relatively narrow with pointed cusps. The last upper premolar and first lower molar (carnassial teeth) come together like blades of a scissors for cutting flesh; this carnassial shear is best developed in the Felidae. Predators have sometimes been viewed as cruel killers of innocent creatures, or as otherwise-worthless economic threats to livestock and poultry. Indeed, wildlife management once was based on predator-control programs designed to exterminate wolves, coyotes, cougars, bobcats, and bears, as well as birds of prey. But predator removal resulted in sometimes disastrous population explosions of deer or rodents, demonstrating that predators are an integral component of natural communities.

## **FAMILY CANIDAE**

### **Dogs**

Members of this family, which includes the domestic dog, are readily recognized as canids. Wild canids have slender legs, bushy tails, erect ears, and long muzzles. The claws are blunt and not retractile. Most canids have 42 teeth, including long canines and well-developed carnassial teeth. Canids walk and run on their toes, an adaptation for speed, and their senses of smell, sight, and hearing are keen. Small canids hunt alone or in pairs, larger canids in packs.

Since the extirpation of the wolf (*Canis lupus*) four wild canids occur in Kansas: the coyote, the swift fox, the gray fox, and the red fox.



## **FAMILY MUSTELIDAE**

### **Weasels, Otters, Badgers**

Members of the weasel family are seemingly fearless predators. The family includes terrestrial, arboreal, and aquatic species, many of which have long, slender bodies and short legs. The reproductive cycle of mustelids typically involves delayed implantation of





embryos. Five members of this family are represented in Kansas plus the Black-footed Ferret which is currently being reintroduced in some areas.

### **FAMILY MEPHITIDAE**

#### **Skunks**

Members of this family, ten New World skunks and two Asian stink badgers, were formerly included in the family Mustelidae. They are characterized by black and white pelages (an example of warning coloration) and a pair of anal glands from which they can spray a foul-smelling musk. Two species of skunks, the striped skunk and the Spotted Skunk (T), live in Kansas. Skunks feed largely on invertebrates.



### **FAMILY PROCYONIDAE**

#### **Raccoons**

Most members of this family, which is restricted to the New World, have long, ringed tails and distinctive facial markings. Two procyonids are found in Kansas, the Northern Raccoon and the Ringtail. In the eastern United States is the raccoon. It is a habitat generalist and omnivore.





## **FAMILY FELIDAE**

### **Cats**

Members of this family vary greatly in size, but have a uniform body shape and are instantly recognizable as cats. Felids are the most carnivorous of the Carnivora. They have short muzzles that deliver a powerful bite; long, curved canines for grabbing and killing prey; and the most specialized carnassial teeth for cutting flesh. Long, curved retractile claws are drawn up into the paws much of the time (except in cheetahs). Excellent olfaction, hearing, and vision in low light make them formidable predators. Since the extirpation of cougars, the only native felid in Kansas is the bobcat. However, recent sightings suggest that cougars may once again be present in our state. Many thousands of feral house cats (*Felis catus*) also roam the state.



## **ORDER ARTIODACTYLA**

### **FAMILY CERVIDAE**

#### **Deer**

*Ungulates* are mammals with hooves covering their toes. Artiodactyls have two or four toes on each foot, but in most species only two are in contact with the ground. Most ungulates stand on the tips of their toes; this lengthens their legs and makes them swift runners. Artiodactyla is a large order that includes giraffes, hippopotamuses, antelopes, deer, camels, and wart hogs as well as domesticated cattle, sheep, goats, and pigs. Almost all deer (Cervidae) possess antlers that are often branched, restricted to males (except in caribou), and shed annually.



Deer are herbivores. There are three members of this family in Kansas, White-tailed deer, Elk, and Mule Deer.

### **FAMILY Antilocapridae**

#### **Antelope**

Only one species, the pronghorn (*Antilocapra americana*), is living today. Resembling an antelope, it bears small, forked horns. The horns resemble those of mammals in the family Bovidae (cattle, goats, sheep) in that they have a true horny sheath, but, unlike other bovids, they are shed outside the breeding season.





## R. CHECKLIST OF KANSAS MAMMALS

This checklist is revised and updated from "A Checklist of the Vertebrate Animals of Kansas" by George D. Potts, Joseph T. Collins and Kate Shaw, published by Kansas Biological Survey (1999). The common and scientific names used for each species are from the "Revised Checklist of North American Mammals North of Mexico", 2003 by Baker et al., published by the Museum of Texas Tech University, Occasional Papers Number 229 (2003).

E = Endangered T = Threatened

\* = Non-native X = Extirpated from the wild in Kansas

**88 Species**

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### **Order of Opossums [Didelphimorphia]**

#### **Family Didelphidae**

Virginia Opossum - *Didelphis virginiana*

### **Order of Shrews and Moles [Insectivora]**

#### **Family Soricidae**

Prairie Shrew - *Sorex haydeni*

Northern Short-tailed Shrew - *Blarina brevicauda*

Elliot's Short-tailed Shrew - *Blarina hylophaga*

Least Shrew - *Cryptotis parva*

#### **Family Talpidae**

Eastern Mole - *Scalopus aquaticus*

### **Order of Bats [Chiroptera]**

#### **Family Vespertilionidae**

Western Small-footed Myotis - *Myotis ciliolabrum*

Gray Myotis (E) - *Myotis grisescens*

Little Brown Myotis - *Myotis lucifugus*

Northern Long-eared Myotis - *Myotis septentrionalis*

Cave Myotis - *Myotis velifer*

Eastern Red Bat - *Lasiurus borealis*

Hoary Bat - *Lasiurus cinereus*





Silver-haired Bat - *Lasionycteris noctivagans*  
Eastern Pipistrelle - *Pipistrellus subflavus*  
Big Brown Bat - *Eptesicus fuscus*  
Evening Bat - *Nycticeius humeralis*  
Townsend's Big-eared Bat - *Corynorhinus townsendii*  
Pallid Bat - *Antrozous pallidus*

**Family Molossidae**

Brazilian Free-tailed Bat - *Tadarida brasiliensis*  
Big Free-tailed Bat - *Nyctinomops macrotis*

**Order of Toothless Mammals [Xenarthra]**

**Family Dasypodidae**

Nine-banded Armadillo - *Dasypus novemcinctus*

**Order of Rabbits and Hares [Lagomorpha]**

**Family Leporidae**

Swamp Rabbit - *Sylvilagus aquaticus*  
Desert Cottontail - *Sylvilagus audubonii*  
Eastern Cottontail - *Sylvilagus floridanus*  
Black-tailed Jackrabbit - *Lepus californicus*  
White-tailed Jackrabbit - *Lepus townsendii*

**Order of Rodents [Rodentia]**

**Family Sciuridae**

Eastern Chipmunk - *Tamias striatus*  
Woodchuck - *Marmota monax*  
Franklin's Ground Squirrel - *Spermophilus franklinii*  
Spotted Ground Squirrel - *Spermophilus spilosoma*  
Thirteen-lined Ground Squirrel - *Spermophilus tridecemlineatus*  
Black-tailed Prairie Dog - *Cynomys ludovicianus*  
Eastern Gray Squirrel - *Sciurus carolinensis*  
Eastern Fox Squirrel - *Sciurus niger*  
Southern Flying Squirrel - *Glaucomys volans*

**Family Geomyidae**

Plains Pocket Gopher - *Geomys bursarius*  
Yellow-faced Pocket Gopher - *Cratogeomys castanops*

**Family Heteromyidae**

Plains Pocket Mouse - *Perognathus flavescens*  
Silky Pocket Mouse - *Perognathus flavus*



Hispid Pocket Mouse - *Chaetodipus hispidus*  
Ord's Kangaroo Rat - *Dipodomys ordii*

**Family Castoridae**

American Beaver - *Castor canadensis*

**Family Cricetidae**

Fulvous Harvest Mouse - *Reithrodontomys fulvescens*  
Western Harvest Mouse - *Reithrodontomys megalotis*  
Plains Harvest Mouse - *Reithrodontomys montanus*  
Texas Mouse - *Peromyscus attwateri*  
White-footed Mouse - *Peromyscus leucopus*  
Deer Mouse - *Peromyscus maniculatus*  
Northern Grasshopper Mouse - *Onychomys leucogaster*  
Hispid Cotton Rat - *Sigmodon hispidus*  
Eastern Woodrat - *Neotoma floridana*  
Prairie Vole - *Microtus ochrogaster*  
Meadow Vole - *Microtus pennsylvanicus*  
Woodland Vole - *Microtus pinetorum*  
Common Muskrat - *Ondatra zibethicus*  
Southern Bog Lemming - *Synaptomys cooperi*  
Southern Plains Woodrat - *Neotoma micropus*

**Family Muridae**

\* Norway Rat - *Rattus norvegicus*  
\* Black Rat - *Rattus rattus*  
\* House Mouse - *Mus musculus*

**Family Zapodidae**

Meadow Jumping Mouse - *Zapus hudsonius*

**Family Erethizontidae**

North American Porcupine - *Erethizon dorsatum*

**Order of Carnivores [Carnivora]**

**Family Canidae**

Coyote - *Canis latrans*  
Gray Wolf (X) - *Canis lupus*  
Swift Fox - *Vulpes velox*  
Red Fox - *Vulpes vulpes*  
Common Gray Fox - *Urocyon cinereoargenteus*

**Family Ursidae**

American Black Bear (X) - *Ursus americanus*  
Grizzly Bear (X) - *Ursus arctos*





**Family Procyonidae**

Ringtail - *Bassiriscus astutus*

Northern Raccoon - *Procyon lotor*

**Family Mustelidae**

Long-tailed Weasel - *Mustela frenata*

Black-footed Ferret (E) (X) - *Mustela nigripes*

Least Weasel - *Mustela nivalis*

Mink - *Mustela vison*

Badger - *Taxidea taxus*

River Otter - *Lontra canadensis*

**Family Mephitidae**

Eastern Spotted Skunk (T) - *Spilogale putorius*

Striped Skunk - *Mephitis mephitis*

**Family Felidae**

Mountain Lion (Puma) (X) - *Puma concolor*

Bobcat - *Lynx rufus*

**Order of Even-toed Hoofed Mammals [Artiodactyla]**

**Family Cervidae**

Wapiti - *Cervus elaphas*

Mule Deer - *Odocoileus hemionus*

White-tailed Deer - *Odocoileus virginianus*

Moose (X) - *Alces alces*

**Family Antilocapridae**

Pronghorn - *Antilocapra americana*

**Family Bovidae**

Bison (X) - *Bos bison*





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## USEFUL WEBSITES

American Society of Mammalogists—<http://www.mammalsociety.org>

American Zoo and Aquarium Association—<http://www.aza.org>

Bat Conservation International—<http://www.batcon.org>

Kansas Department of Natural Resources—<http://www.dnr.state.il.us>

Kansas Natural History Survey—<http://www.inhs.uiuc.edu>

Kansas State Museum—<http://www.museum.state.il.us>



