

Chapter 3

Dichotomous Keys to the Mammals of the South by Order

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Order Didelphimorphia

The opossum belongs to one of the seven orders of mammals commonly known as “marsupials,” referring to the abdominal pouch or marsupium where the young are carried. However, only about half of all marsupials actually possess a permanent pouch. Considered to be a primitive marsupial order, Didelphimorphia is restricted to the New World (Gardner 1993). The sole family in the order, Family Didelphidae, is represented by 15 genera and 66 species that are distributed throughout South, Central, and North America (Nowak 1999). Baker et al. (2003) report one species in North America, the Virginia opossum (*Didelphis virginiana*).

Family Didelphidae

Didelphids are small to medium-sized, ranging in total length from approximately 150–1050 mm. The foot posture is plantigrade with fore and hind feet each bearing five clawed digits with exception of the opposable pollex (thumb). The pelage is variable but is typically short, fine, and woolly. The sparsely haired tail is long, scaly, and prehensile. Didelphids are primarily nocturnal, solitary, and semi-arboreal.

Didelphis virginiana is distinguished easily from other mammals of the region. The skull is characterized by an elongate rostrum, a narrow braincase with a well developed sagittal crest, a heavy zygomatic arch with the jugal participating in the formation of the mandibular fossa, two pairs of well developed palatal vacuities, and a medially inflected angular process on the dentary. Adult opossums have 50 teeth, which is more than any other North American mammal.

Order Insectivora

Insectivores are among the most primitive eutherian mammals. Seven families with 68 genera and over 440 species occur worldwide (Nowak 1999). Two families occur in North America: Soricidae (shrews) and Talpidae (moles). There are four genera of shrews with 38 species and five genera of moles with seven species (Baker et al. 2003). No single feature distinguishes insectivores from other mammalian orders.

Generally, insectivores are small with elongate, fleshy rostrums. The eyes and pinnae are reduced and almost rudimentary, especially in moles. The pelage is dense, medium to dark-colored, and of uniform length. Many species have musk glands on their flanks. The feet exhibit the primitive condition of 5-clawed digits. Teeth are simple, usually with small differentiation between the incisors, canines, and premolars. The molars usually retain a primitive W-shaped pattern of cusps.

Many insectivores in the South are semi-fossorial or fossorial. In addition to insects, shrews and moles will prey on small vertebrates and occasionally eat plant material. Due to small body size and concomitant rapid heat loss, shrews have high metabolic rates that require them to forage almost continuously.

Key to the Families of Insectivora

1. (a) Front feet less than twice as broad as hind feet; eyes and pinnae reduced, but clearly visible; zygomatic arches and auditory bullae lacking; length of front pair of upper teeth (incisors) at least three times their width; incisors with small posterior cups; all teeth tipped in red or black **Soricidae (Shrews)**
- (b) Front feet twice as broad as hind feet; eyes and pinnae not visible; zygomatic arches and auditory bullae present; longitudinal and lateral dimensions of incisors moderately roughly equal; incisors lacking posterior cusp; teeth not tipped in red or black **Talpidae (Moles)**

Family Soricidae

Four genera and 11 species of shrews occur in the South. The southern Appalachian region contains among the highest species richness in North America (Berman 2007). Shrews are the smallest of the insectivores. Their eyes and pinnae are reduced but not as much as in moles. Shrews are difficult to identify from skins; it is often necessary to examine skulls and teeth. The paired, medial lower incisors are laterally compressed, elongate, and bear many cusps. The medial upper incisors bear two cusps and project anteriorly. Behind the upper medial incisors are a series of smaller unicuspid teeth. The number, size, and shape of the unicuspid teeth are crucial for soricid identification. Behind the unicuspid teeth on each side are a series (usually four) of larger teeth. The first is a premolar and the remaining W-shaped (dilambdodont) teeth are molars.

Correct identification of the three species of *Blarina* is extremely difficult. The northern short-tailed shrew (*Blarina brevicauda*) and the southern short-tailed shrew (*B. carolinensis*) exhibit a clinal decrease in size from north to south. Members of the genus also exhibit a wide range of pelage coloration, external measurements, and cranial measurements that often overlap. Keys based on pelage color or measurements have limited utility, and in some cases will lead to incorrect identification. However, the regional range of *B. brevicauda* and *B. carolinensis* largely are separate with a broad zone of parapatry (i. e., *B. brevicauda* to the north and *B. carolinensis* to the south, with limited areas of sympatry). *Blarina hylophaga* (Elliot's short-tailed shrew) has a restricted distribution in the South. The three species of *Blarina* are distinguished based on karyological, protein, or multivariate cranial morphological differences. Reference to regional discriminant studies or examination by a specialist may be required for proper identification. The several species of *Sorex* also are difficult to distinguish. The ranges of external measurements of most species overlap significantly; examination of skull and dental

characteristics is necessary. Only in the case of the long-tailed or rock shrew (*S. dispar*) and the American water shrew (*S. palustris*) can identification be based solely upon size and external features.

Shrews are among the most poorly studied mammals in the South. Two of the species (*B. carolinensis* and *B. hylophaga*) were recognized only recently as distinct species.

Key to the Species of Soricidae

1. (a) Tail short, less than 40 percent of head and body length; three, four, or five unicuspid in each upper jaw, if five unicuspid are present, the first two are noticeably larger (second unicuspid is the largest) than the third and fourth 2
- (b) Tail long, greater than 40 percent of head and body length; five unicuspid in each upper jaw and the first two, similar in size, not much larger than the third and fourth 6
2. (a) Upper pelage grayish above; three upper unicuspid; species restricted to western Arkansas and southeastern Oklahoma *Notiosorex crawfordi* (Crawford's desert shrew)
- (b) Upper pelage variable, from brownish to gray to slate black; four or five upper unicuspid. 3
3. (a) Pelage brown to gray above, noticeably lighter below; four upper unicuspid, the first two large and approximately equal in size, the third small, the fourth tiny and seldom visible in lateral view. *Cryptotis parva* (Least shrew)
- (b) Pelage variable, grayish brown to black above, only slightly paler below; five upper unicuspid, the first two larger than the third and fourth; all four visible in lateral view, but the fifth unicuspid is small and seldom visible in lateral view 4
4. (a) Occurring only in northwestern Arkansas, eastern Oklahoma (except southeastern portion), and extreme northwestern Louisiana. *Blarina hylophaga* (Elliot's short-tailed shrew)
- (b) Occurring in the extreme southeastern corner of Oklahoma and south and east of north-western Arkansas 5
5. (a) Condylbasal length greater than 17.4 mm, cranial breadth greater than 11.0 mm; maxillary tooth row length greater than 7.8 mm. *Blarina brevicauda* (Northern short-tailed shrew)
- (b) Condylbasal length less than 17.4 mm, cranial breadth less than 11.0 mm; maxillary tooth row less greater than 7.8 mm *Blarina carolinensis* (Southern short-tailed shrew)
6. (a) Total length usually greater than 130 mm; hind feet greater than 18 mm and fringed with stiff hairs; condylbasal length greater than 19 mm. *Sorex palustris* (American water shrew)
- (b) Total length usually less than 130 mm; hind feet less than 18 mm and not fringed with stiff hairs; condylbasal length less than 19 mm. 7
7. (a) Tail length greater than 75 percent of head and body length; tail not distinctly bicolored; anterior border of zygomatic plate posterior to the plane separating first and second molars *Sorex dispar* (Long-tailed shrew)
- (b) Tail length less than 75 percent the length of head and body length; tail faintly bicolored; anterior border of zygomatic plate even with or anterior to the plane separating first and second molar 8

8. (a) Hind foot length 10 mm or less; only three upper unicuspid easily visible in lateral view, the third unicuspid disc-like and longitudinally compressed, the fifth unicuspid minute and barely visible *Sorex hoyi* (Pygmy shrew)
- (b) Hind foot length 10 mm or longer; five upper unicuspid visible in lateral view, the third unicuspid not compressed 9
9. (a) Condylobasal length greater than 17.8 mm; maxillary breadth greater than 4.6 mm; first two unicuspid generally broader than long *Sorex fumeus* (Smoky shrew)
- (b) Condylobasal length less than 17.8 mm; maxillary breadth less than 4.6 mm; first two unicuspid generally square or longer than broad 10
10. (a) Tail length usually greater than 35 mm; rostrum elongate and narrow; palate long, flat, and not strongly arched; third unicuspid usually larger than fourth; third and fourth unicuspid about equal in size to first and second. *Sorex cinereus* (Masked shrew)
- (b) Tail length usually less than 35 mm; rostrum short and broad; palate short and strongly arched; third unicuspid smaller than fourth; third and fourth unicuspid slightly smaller than first and second *Sorex longirostris* (Southeastern shrew)

Family Talpidae

All of the North American moles are fossorial. The body is torpedo-shaped, the limbs are short and thick, the eyes, ears, and tail are reduced. The pelage is short, thick, and silky. The forefeet are paddle-shaped, which is an adaptation for digging. Most moles have a distinctive musky odor. External features distinguish the three monotypic species that occur in the South.

Key to the Species of Talpidae

1. (a) Tail naked and short (less than 1/6 body length); 36 teeth, 10 above and 8 below on each side of the jaw *Scalopus aquaticus* (Eastern mole)
- (b) Tail well-haired and long (greater than 1/6 body length); 44 teeth, 11 on each side of upper and lower jaw. 2
2. (a) Snout with 22 fleshy lobes; tail long (1/3 to 1/2 of body length) with short, stiff hairs; premaxillae extend beyond narial aperture; first upper incisor large, curved inward; canines and premolars separated from each other and adjacent teeth by spaces; posterior border of palate anterior to third molar *Condylura cristata* (Star-nosed mole)
- (b) Snout lacking fleshy lobes; tail short (less than 1/4 of body length), constricted at base and densely haired; premaxillae end at narial aperture; first upper incisor large, but not curved inward; canines and premolars not separated from each other and adjacent teeth by spaces; posterior border of palate even with or posterior to third molar. *Parascalops breweri* (Hairy-tailed mole)

Order Chiroptera

Order Chiroptera is one of the largest and widely distributed order of mammals. There are 18 families, 192 genera, and 977 species worldwide (Nowak 1999). Baker et al. (2003) report four families and 46 species of bats in North America. Two families (Molossidae and Vespertilionidae) and 18 species that occur in the South are described in this book.

Bats are unique because they are capable of true flight. The wings are composed of skin membranes (patagia) stretched between the elongated bones of the fingers and arms. The patagium is anchored at the shoulder and extends along the upper arm and forearm to a point of attachment at the thumb. The propatagium is the portion of the patagium that constitutes the leading edge of the wing and contains a muscle that alters the aerodynamic curvature of the wing. The chiropatagium is the portion of the patagium that forms a flexible webbing between the elongated finger bones that comprise the largest surface area of the wing. The patagium that extends from the last finger to the sides of the body and the foot is called the plagiopatagium. The surface area of the wing may be augmented by another flight membrane (uropatagium) which stretches between the hind legs and the tail. The uropatagium is further supported by a long, cartilaginous rod (calcar) that extends outward from the heel. The form of the calcar, the extent of hair covering on the uropatagium, and the length of the tail in relation to the uropatagium varies among bat species.

Bats have small eyes and are capable of sight; however, most species locate flying prey using echolocation. A foraging bat produces high frequency, ultrasonic sounds in the larynx. Most species can determine the shape, size, and flight speed of their prey from distances up to 15 meters. Not all insectivorous bats prey entirely on flying arthropods. Some species hover around foliage and glean prey from leaves; others alight on the ground to capture prey.

It is often difficult to identify bats. The keys below can be augmented by details presented in Sealander and Heidt (1990) and Menzel et al. (2002).

Key to the Families of Chiroptera

1. (a) Tail extending well beyond the posterior edge of the tail membrane; tragus present, but small and rounded; bony palate complete at incisors, or if not complete, incisors 1/2 **Molossidae (Free-tailed bats)**
- (b) Tail enclosed in uropatagium for all or most of its length; tragus well-developed; bony palate incomplete at incisors, incisors separated by a gap wider than the width of the largest tooth; incisors 2/3 or 1/3 **Vespertilionidae (Vesper bats)**

Family Molossidae

There are 16 genera and 86 species of molossid bats worldwide (Nowak 1999). Eight species occur from Argentina through Mexico and the Caribbean to the southern United States. Members of this family are characterized by having a tail that extends well beyond the margin of the uropatagial membrane. Molossids produce a strong, musty odor. Colonial in habit, these bats commonly roost in dense groups in caves, buildings, and under bridges.

Key to the Species of Molossidae

1. (a) Forearm length greater than 55 mm; ears united basally at midline of the head. ***Eumops glaucinus* (Wagner's bonneted bat)**
- (b) Forearm less than 55 mm in length; ears not united basally at the midline of the head ***Tadarida brasiliensis* (Brazilian free-tailed bat)**

Family Vespertilionidae

There are 43 genera and 342 species of vespertilionid bats worldwide (Nowak 1999). Vespertilionids select a wide variety of roosting locations including caves, rock crevices, tree cavities, or under loose bark. Several species commonly feed around street lamps and live in association with humans.

With few exceptions, most members of this family are relatively small with minute eyes. The tail is well developed and is an integral part of the uropatagial membrane. The ears are separated at the base; each has a well-developed tragus. Vespertilionids do not have the leaf-like nasal appendages or other facial adornments that characterize species in other chiropteran families.

Keys to the Species of Vespertilionidae

1. (a) Ear length greater than 25 mm; obvious raised glands (pararhinal glands) present on both sides of nose; dorsal profile (from lateral view) of skull rounded 2
 (b) Ear length less than 25 mm; pararhinal glands absent; dorsal profile of skull flat 3
2. (a) Abdominal hairs blackish at the base, and grayish or whitish at the tip; first upper incisor with two cusps *Corynorhinus rafinesquii* (Rafinesque's big-eared bat)
 (b) Abdominal hairs uniformly brownish, lacking distinct color change from root to tip; first upper incisor with a single cusp . . . *Corynorhinus townsendii* (Townsend's big-eared bat)
3. (a) Dorsal surface of uropatagium at least partially furred 4
 (b) Dorsal surface of uropatagium not furred. 8
4. (a) Pelage black, tips of hairs frosted with white 5
 (b) Pelage red, mahogany or yellow 6
5. (a) Total length less than 115 mm; forearm length less than 45 mm; posterior 1/3 of uropatagium bare, ear solid black. *Lasionycteris noctivagans* (Silver-haired bat)
 (b) Total length over 120 mm, skull length usually more than 15.5 mm, uropatagium heavily furred throughout; forearm more than 45 mm; ears yellow rimmed in black; dorsal pelage dark brown frosted with white *Lasiurus cinereus* (Hoary bat)
6. (a) Pelage solid yellow; white shoulder patch absent; frosting absent. *Lasiurus intermedius* (Northern yellow bat)
 (b) White shoulder patch present, red or mahogany coloration, frosting usually present (except male *Lasiurus borealis*) 7
7. (a) Pelage brick-red, tips of hair frosted white (except males), face light red/yellow *Lasiurus borealis* (Eastern red bat)
 (b) Pelage dark mahogany, tips of hair frosted white, face mahogany/red . *Lasiurus seminolus* (Seminole bat)
8. (a) Total length greater than 100 mm; forearm length greater than 45 mm; total number of teeth 32 *Eptesicus fuscus* (Big brown bat)
 (b) Total length less than 100 mm; forearm length less than 45 mm; total number of teeth 30, 34, or 38 9

9. (a) Tragus (projection within the ear) short, blunt and curved; total number of teeth 30 or 34 10
- (b) Tragus long, pointed at tip and straight; total number of teeth 38 11
10. (a) Dorsal fur dark brown, forearm dark and more than 32 mm; total teeth 30 *Nycticeius humeralis* (Evening bat)
- (b) Dorsal fur tricolored when parted (black at base, yellowish-brown in the middle and dark brown at tips); forearm pink and less than 32 mm; total teeth 34 *Pipistrellus subflavus* (Eastern pipistrelle)
11. (a) Forearm 40 mm or greater; skull with prominent sagittal crest; plagiopatagium attached to tarsus *Myotis grisescens* (Gray myotis)
- (b) Forearm 38 mm or less; plagiopatagium attached to side of foot at the base of toes; sagittal crest absent or weakly developed. 12
12. (a) Ear more than 16 mm long, extends more than 2 mm beyond the tip of nose when laid forward *Myotis septentrionalis* (Northern long-eared myotis)
- (b) Ears 15 mm or less, not extending beyond nose when laid forward 13
13. (a) Calcar keeled 14
- (b) Calcar not keeled 15
14. (a) Black mask across face; greatest length of skull less than 14.5 mm; foot usually less than 7 mm, forearm usually less than 35 mm, pelage long and glossy *Myotis leibii* (Eastern small-footed myotis)
- (b) Face lacking black mask; greatest length of skull more than 14.5 mm; foot usually more than 7 mm, forearm usually more than 35 mm, pelage short and wooly *Myotis sodalis* (Indiana myotis)
15. (a) Tips of hairs not reddish, pelage short and wooly. *Myotis austroriparius* (Southeastern myotis)
- (b) Tips of hairs reddish, pelage long and glossy. *Myotis lucifugus* (Little brown myotis)

Order Xenarthra

Order Xenarthra contains the armadillos, anteaters, and sloths. The order (formerly referred to as Edentata) includes 13 genera and 29 species in four families (Nowak 1999). All xenarthrans lack incisors and canines. The forefoot has 2–3 large digits, each bearing a long claw. The ordinal name is derived from the presence of accessory articulating facets, called xenarthrales, on many of the vertebrae. Although xenarthrans were widely distributed in North America during the Pleistocene, most species now are restricted to the New World tropics. One family occurs in the South (Baker et al. 2003).

Family Dasypodidae

Family Dasypodidae is represented by 20 species in eight genera; one occurs in the region (Nowak 1999). The nine-banded armadillo (*Dasypus novemcinctus*) expanded its range into the South through both natural colonization and human-augmented introductions. The species is unlikely to be confused with any other mammal. Armadillos have short legs, and the body is covered by a series of bony plates. Bands of overlapping and moveable plates surround the mid-body; the shoulder and pelvic regions are protected by solid, armor-like coats. The teeth are peg like, lack enamel, and are single rooted. Armadillos possess two pairs of mammary glands; one pair is inguinal and the other pair is pectoral.

Order Lagomorpha

Widely distributed and conspicuous, lagomorphs are a familiar group of mammals. Order Lagomorpha includes two modern families, Leporidae (rabbits and hares) and Ochotonidae (pikas). The order contains 13 genera and 81 species worldwide (Nowak 1999). Baker et al. (2003) reports both families in North America: Ochotonidae (1 genus and 2 species) and Leporidae (4 genera and 19 species). Six species of leporids occur in the South.

Lagomorphs superficially resemble the rodents: both have pairs of large incisors in the upper and lower jaws. Lagomorphs are easily distinguished from rodents because lagomorphs have an additional pair of small, peg-like upper incisors located directly behind the first pair. Between the incisors and cheek teeth is a diastema, an elongate space lacking teeth. The maxillary tooth rows are widely separated from the mandibular tooth rows, permitting occlusion on one side at a time. Lagomorphs also are characterized by small or indistinct tails, and foot soles that are largely or completely covered with fur.

Family Leporidae

Leporids have large ears and eyes; a short, recurved tail; hind limbs that are longer than the forelimbs; elongate hind feet; and dense pelage. Their skulls are easily recognized by highly fenestrated (i.e., perforated with numerous, small openings in a lattice arrangement) lateral surfaces of the rostrum. The size, shape, and degree to which the anterior and posterior portions of the supraorbital processes are fused to the frontal bones are important in distinguishing the species that occur in the region.

The two species of hares that occur in the region are readily differentiated. However, considerable difficulty may be encountered in distinguishing the rabbits in the field or using specimens consisting only of skins. Although the ranges of the swamp rabbit (*S. aquaticus*) and the marsh rabbit (*S. palustris*) are largely parapatric, the range of the eastern cottontail (*S. floridanus*) is sympatric with both and overlaps that of the Appalachian cottontail (*S. obscurus*) in the Appalachian Highlands. The ranges of size in external and cranial features of most species often overlap. Particular difficulty is encountered in attempting to distinguish between *S. floridanus* and *S. obscurus*.

Key to the Species of Leporidae

- 1. (a) Hind foot usually greater than 110 mm; interparietal bone usually indistinct, fused to parietals; supraorbital process wide and wing-like 2
- (b) Hind foot usually less than 110 mm; interparietal bone usually distinct, not fused to parietals; supraorbital process narrow, strap-like, often fused or absent 3
- 2. (a) Ear length less than 90 mm; tail length less than 60 mm; basilar length of skull less than 67 mm; supraorbital process small, anterior portion fused to frontal *Lepus americanus* (Snowshoe hare)
- (b) Ear length greater than 90 mm; tail length greater than 60 mm; basilar length of skull greater than 67 mm; supraorbital process large, anterior portion free . . *Lepus californicus* (Black-tailed jackrabbit)
- 3. (a) Total length greater than 450 mm; hind foot rarely less than 100 mm; basilar length of skull greater than 63 mm. *Sylvilagus aquaticus* (Swamp rabbit)
- (b) Total length usually less than 450 mm; hind foot rarely greater than 95 mm; basilar length of skull less than 63 mm 4

4. (a) No white on ears or feet; venter and underside of tail gray; posterior portion of supraorbital process fused to skull, usually for its entire length *Sylvilagus palustris* (Marsh rabbit)
- (b) White on ears and feet; venter and underside of tail white; posterior portion of supraorbital process free from skull, usually for its entire length 5
5. (a) Pelage buffy, lacking pinkish cast and heavy black wash; black spot absent between ears; ears lacking distinct dark edging; posterior portion of supraorbital process broad and in contact with braincase at terminus; sutures between frontals and nasals smooth in outline *Sylvilagus floridanus* (Eastern cottontail)
- (b) Pelage buffy, often with pinkish cast overlain by black wash; black spot usually present between ears; ears with distinct dark edging; posterior portion of supraorbital process thin, tapering to a point, and only slightly or not at all touching braincase; sutures between frontals and nasals jagged and irregular in outline *Sylvilagus obscurus* (Appalachian cottontail)

Order Rodentia

The rodents comprise the largest order of mammals in the South. Two suborders are represented worldwide (Nowak 1999); this includes 29 families, 468 genera, and 2,052 species. Baker et al. (2003) report totals for nine families in North America: Castoridae (1 genera and 1 species); Geomyidae (3 genera and 18 species); Heteromyidae (5 genera and 38 species); Muridae (21 genera and 86 species); Myocastoridae (1 genera and 1 species); Sciuridae (8 genera and 68 species); Zapodidae (2 genera and 4 species); Aplodontidae (1 genera and 1 species); and Erethizontidae (1 genera and 1 species). This book describes 26 genera and 41 species that occur in the South.

Rodents are easily distinguished from other mammals by the single pair of incisors in the upper and lower jaws. Each incisor has enamel only on the front surface. The soft dentine of the remainder of the tooth wears away more rapidly resulting in the characteristic sharp front edge with a distinctive chisel shape in lateral view. The incisors grow throughout life and the long, open roots extend posteriorly into the bones of the upper and lower jaws. Rodents have a well-developed diastema between the incisors and molariform teeth. The cheek teeth are never more than 2/1, 3/3. Rodents are extremely diverse, with a variety of locomotor and feeding specializations.

Key to the Families of Rodentia

1. (a) Body large, total length of adults usually over 0.8 m; width of lower incisor greater than 6.0 mm . . . 2
- (b) Body small to moderate size, total length of adults usually less than 0.8 m; width of lower incisor less than 5.5 mm 3
2. (a) Tail broad and flat; infraorbital canal smaller than foramen magnum. *Castoridae* (Beavers)
- (b) Tail cylindrical; infraorbital canal larger than foramen magnum; paraoccipital processes elongate *Myocastoridae* (Nutria)
3. (a) External cheek pouches; infraorbital canal opening laterally on and perforating rostrum 4
- (b) No external cheek pouches; infraorbital canal opening anteriorly, not perforating rostrum 5

- 4. (a) Body form robust, tail short; forefeet larger than hind feet; infraorbital canal small, not perforating entire rostrum; distinct pits between last molars ***Geomyidae* (Pocket gophers)**
- (b) Body form elongate, tail long; hind feet larger than forefeet; infraorbital canal perforating entire rostrum; no distinct pits between last molars. ***Heteromyidae* (Pocket mice)**
- 5. (a) Tail bushy, much wider than fleshy portion, hairs bicolored; infraorbital canal small to minute; frontals with prominent, pointed postorbital processes ***Sciuridae* (Squirrels)**
- (b) Tail not bushy, hairs not bicolored; infraorbital canal vertically elongate and oval or V-shaped 6
- 6. (a) Tail equal in length to or shorter than head and body; hind feet not particularly elongate; infraorbital canal V-shaped ***Muridae* (Mice, Rats, and Voles)**
- (b) Tail much longer than head and body; hind feet elongate; infraorbital canal oval ***Zapodidae* (Jumping mice)**

Family Castoridae

The beavers consist of a single genus and two recent species, *Castor canadensis* of North America and *C. fiber* of Eurasia (although some authorities consider them conspecific). Once extirpated throughout much of the South, the beaver is now common. It is easily distinguished because of its large size, aquatic specialization, and large flat tail.

Family Geomyidae

Six genera and 40 species of gophers occur in North America (Nowak 1999). Geomyids are fossorial, and rarely emerge from their underground burrows. Gophers are readily distinguished from other rodents by a short, nearly naked tail and external, fur-lined cheek pouch. Two species occur in the South. *Geomys breviceps* is restricted to areas west of the Mississippi River in Arkansas, Louisiana, Texas, and Oklahoma. *G. pinetis* is restricted to portions of Alabama, Florida, and Georgia.

Key to the Species of Geomyidae

- 1. (a) Occurs only west of the Mississippi River ***Geomys breviceps* (Baird’s pocket gopher)**
- (b) Restricted to Alabama, Florida, and Georgia ***Geomys pinetis* (Southeastern pocket gophers)**

Family Heteromyidae

Heteromyids include the kangaroo rats, pocket mice, and allies. Six genera and 60 recent species occur from northern South America throughout western and central United States (Nowak 1999). Similar to pocket gophers, heteromyids have external fur-lined cheek pouches; however, their bodies and tails are much more elongate. Although heteromyids inhabit underground burrows, they are active on the surface. Several species exhibit extreme adaptation for saltatorial locomotion. One species occurs in the South. *Chaetodipus hispidus* is restricted to western Louisiana, eastern Texas, and eastern Oklahoma.

Family Muridae

There are 1,336 species of murid rodents included in 301 genera, making it the most diverse family of mammals worldwide. Twenty-one genera including 89 species occur in North America (Baker et al. 2003); of these, 27 species occur in the South. Rodents possess a generalized mammalian body; variable body morphology among species reflects species richness and feeding specializations. Murids in the region are represented by three subfamilies and are most easily distinguished by discussing them from a subfamilial perspective.

Key to the Subfamilies of Muridae

1. (a) Long sparsely haired tail with annulations of scales readily observable; upper molars with cusps in three longitudinal rows, lophs form three transverse rows. **Murinae (Old World Rats and Mice)**
- (b) Tail of variable length, well haired (except in *Neofiber* and *Ondatra*), scale annulations concealed; upper molars with cusps in two longitudinal rows, lophs forming two transverse rows, or a prismatic pattern. **2**
2. (a) Length of tail greater than 45% of total body length; rostrum not abruptly constricted in front of braincase; molars rooted, crown bearing cusps without sharp angles (except *Neotoma*) **Sigmodontinae (New World Rats and Mice)**
- (b) Total length of body and tail variable; rostrum abruptly constricted in front of braincase; molars rootless, crown with prismatic pattern, exhibiting sharply acute angles **Arvicolinae (Voles, Lemmings, and Muskrats)**

Key to the Species of Murinae

Murids include the introduced Old World rats and mice. These species have become widely established throughout the South, frequently living in close association with humans.

1. (a) Total length less than 200 mm; greatest length of skull less than 25 mm; supraorbital and temporal ridges absent; upper incisors notched in side view ***Mus musculus* (House mouse)**
- (b) Total length greater than 200 mm; greatest length of skull longer than 25 mm; supraorbital and temporal ridges present; upper incisors not notched in side view **2**
2. (a) Tail length does not exceed head and body length; temporal ridges approximately parallel, length of parietal equal to or greater than distance between temporal ridges ***Rattus norvegicus* (Norway rat)**
- (b) Tail length exceeds head and body length; temporal ridges bow outward, length of parietal less than the distance between temporal ridges ***Rattus rattus* (Black rat)**

Key to the Species of Sigmodontinae

The Sigmodontinae includes species formerly regarded as members of the Subfamily Cricetinae, Family Cricetidae. Sigmodontines are among the most common and widely distributed native mammals. There are problems involved in the identification of several species. For example, it is often very difficult to distinguish *Peromyscus maniculatus* from *P. leucopus* in areas where they occur in sympatry. Similarly, *P. gossypinus* and *P. leucopus* are difficult to distinguish when sympatric over a geographic region. It is often necessary to include statistical procedures or genetic techniques to discriminate between species. Difficulty may also be encountered in discrimination

of *Neotoma floridana* and *N. magister*; the presence of the maxillo-vomerine notch may be useful as a distinguishing character. Similarly, careful examination of the teeth may be required to correctly identify species of *Reithrodontomys* (see Spencer and Cameron 1982 for an extensive key) when identification based on range is not possible.

1. (a) Total length greater than 220 mm; upper molars flat crowned in lateral view, separate cusps typically not apparent at any stage of wear, but elongated into transverse lophs 2
- (b) Total length less than 220 mm (except *Oryzomys*); upper molars not flat crowned, cusps apparent in lateral view and distinct in occlusal view 4
2. (a) Pelage above grizzled (hispid), yellowish to brownish gray, venter pale gray; tail much shorter than head and body, not bicolored; feet not white; cusps on molars elongated into transverse lophs forming a sigmoid (S) pattern; third molar not smaller than first; supraorbital ridges prominent *Sigmodon hispidus* (Hispid cotton rat)
- (b) Pelage soft, not grizzled; upper parts brownish gray with black wash, venter whitish; tail equal to head and body length, noticeably bicolored, dark above, white below; feet whitish; cusps on molars elongated into transverse lophs forming letter E, supraorbital ridges not prominent 3
3. (a) Maxillo-vomerine notch absent; bifurcated anterior palatal spine. . . *Neotoma floridana* (Eastern woodrat)
- (b) Maxillo-vomerine notch present; anterior palatal spine not bifurcated. *Neotoma magister* (Allegheny woodrat)
4. (a) Face of upper incisors with prominent groove 5
- (b) Face of upper incisors lacking prominent groove 8
5. (a) Tail 10–50% longer than head and body length; first primary fold of third upper molar as long as second fold, both extending more than halfway across crown of tooth; worn surface of third lower molar S-shaped *Reithrodontomys fulvescens* (Fulvous harvest mouse)
- (b) Tail length equal to or less than head and body length; first primary fold of third upper molar shorter than second fold, extending less than halfway across crown; worn surface of third lower molar C-shaped 6
6. (a) Tail not distinctly bicolored; labial ridges present on first and second lower molars *Reithrodontomys humulis* (Eastern harvest mouse)
- (b) Tail somewhat to markedly bicolored; labial ridges absent on first and second lower molars 7
7. (a) Tail length about equal to head and body length, tail somewhat bicolored; breadth of braincase greater than 9.5 mm. *Reithrodontomys megalotis* (Western harvest mouse)
- (b) Tail length less than head and body length; tail distinctly bicolored; breadth of braincase less than 9.6 mm *Reithrodontomys montanus* (Plains harvest mouse)
8. (a) Total length greater than 220 mm; supraorbital ridges present; inner and outer rows of cusps on upper molars opposite and appear symmetrical *Oryzomys palustris* (Marsh rice rat)
- (b) Total length less than 220 mm; supraorbital ridges absent; inner and outer rows of cusps on upper molars more or less alternate and appear asymmetrical. 9

9. (a) Total length usually less than 120 mm; hind foot length less than 15 mm *Baiomys taylori* (Northern pygmy mouse)
- (b) Total length more than 120 mm; hind foot length greater than 15 mm. 10
10. (a) Color of ears same as head; pelage above rich uniform orangish brown; posterior palatine foramina closer to the posterior palatal border than anterior palatine foramina. *Ochrotomys nuttalli* (Golden mouse)
- (b) Color of ears not same as head, typically more gray and rimmed in white; pelage above variable, orangish brown to grayish brown above usually with a darker midline; posterior palatine foramina equidistant between posterior palatal border and anterior palatine foramina. . . . 11
11. (a) Five plantar tubercles on soles of hind feet; restricted to the northern two-thirds of Florida *Podomys floridanus* (Florida mouse)
- (b) Usually six plantar tubercles on soles of hind feet; not endemic to Florida 12
12. (a) Total length relatively small, usually less than 150 mm; tail length relatively short, less than 60 mm, sharply bicolored; hind foot less than 20 mm 13
- (b) Total length relatively large, usually more than 150 mm; tail relatively long, greater than 60 mm, coloration of tail variable 14
13. (a) Light pelage coloration; distribution restricted to Florida, Georgia, South Carolina, and Alabama. *Peromyscus polionotus* (Oldfield mouse)
- (b) Regional distribution restricted to northern Virginia, western Kentucky and Tennessee, northern Arkansas and northeastern Oklahoma *Peromyscus maniculatus bairdii* and *P. maniculatus ozarkiarum* (Prairie and Ozark deer mice)
14. (a) Tail approximately as long as head and body, distinctly bicolored. 15
- (b) Tail less than head and body, not distinctly bicolored 16
15. (a) Restricted regionally to the Ouachita and Ozark Highlands of eastern Oklahoma and northwestern Arkansas. *Peromyscus attwateri* (Texas mouse)
- (b) Restricted regionally to Appalachian Highlands. *Peromyscus maniculatus nubiterrae* (Cloudland deer mouse)
16. (a) Hind foot length usually greater than 22 mm *Peromyscus gossypinus* (Cotton mouse)
- (b) Hind foot length usually less than 22 mm *Peromyscus leucopus* (White-footed mouse)

Key to the Species of Arvicolinae

The subfamily Arvicolinae includes former members of the Subfamily Microtinae, Family Cricetidae. Coarse pelage, rootless molars with prismatic crown pattern, and short tails (except in *Ondatra* and *Neofiber*) readily distinguish arvicolines from rats and mice in the Subfamily Sigmodontinae. Members of the genus *Microtus* can be difficult to distinguish; it is often necessary to examine details of their teeth.

1. (a) Size large, total length greater than 285 mm; hind foot greater than 35 mm; tail round or laterally compressed, long, greater than 50% head and body length, and sparsely haired; underfur dense and woolly; postorbital process forming nearly a right angle projecting into orbit as thin edged shelf. 2
- (b) Size small, total length less than 200 mm; hind foot less than 35 mm; tail round and short, less than 35% head and body length, well haired; underfur not dense and woolly; postorbital process not forming a right angle projecting into orbit as thin edged shelf. 3
2. (a) Total length greater than 400 mm; tail laterally flattened; length of skull greater than 50 mm; length of maxillary tooth row greater than 14 mm; posterior border of palate without palatal bridge *Ondatra zibethicus* (Common muskrat)
- (b) Total length less than 400 mm; tail not laterally flattened; length of skull less than 50 mm; length of maxillary tooth row less than 14 mm; posterior border of palate with palatal bridge *Neofiber alleni* (Round-tailed muskrat)
3. (a) Tail relatively short, approximately same length as hind foot; face of upper incisor grooved; reentrant angles deep on labial side of upper molars and lingual side of lower molars, in first and second upper molars reentrant angles reach across to lingual border of tooth; third upper molar formed of four transverse loops. *Synaptomys cooperi* (Southern bog lemming)
- (b) Tail comparatively long, greater than length of hind foot (only slightly so in *Microtus pinetorum*); face of upper incisor not grooved; reentrant angles of upper and lower molars not deeper on labial or lingual side; third upper molar not formed of four transverse loops 4
4. (a) Mid-dorsal surface having broad rusty or reddish band extending from forehead to rump; posterior border of palate a transverse shelf; cheek-teeth rooted in adults *Clethrionomys gapperi* (Southern red-backed vole)
- (b) Mid-dorsal surface lacking broad rusty or reddish band; posterior border of palate rounded or with sloping median spine; cheek-teeth not rooted in adults 5
5. (a) Dorsal pelage smooth, reddish brown, tail relatively short, less than 25 mm; two entrant angles on each side of third upper molar and two closed triangles; first lower molar with three closed triangles. *Microtus pinetorum* (Woodland vole)
- (b) Dorsal pelage coarse and grizzled, brown to grayish; tail comparatively longer, more than 25 mm; two or more entrant angles on both sides of upper molar and two, three, or five closed triangles; first lower molar with two, three, or five closed triangles. 6
6. (a) Rostrum (nose to eyes) yellow to orangish; third upper molar with five closed triangles *Microtus chrotorrhinus* (Rock vole)
- (b) Rostrum same color as remainder of head, no yellow or orange; third upper molar with two or three entrant angles on each side 7
7. (a) Dorsal pelage chestnut to dull brown, venter silvery gray; third upper molar with three entrant angles on each side, three closed triangles *Microtus pennsylvanicus* (Meadow vole)
- (b) Upper parts grizzled grayish brown, venter buffy gray washed with cinnamon; third upper molar with two entrant angles on each side, two closed triangles. . *Microtus ochrogaster* (Prairie vole)

Family Myocastoridae

The nutria or coypu (*Myocastor coypus*) is a large semi-aquatic rodent native to South America. The single genus and species in this family (Nowak 1999), it was introduced into several areas of the United States at the turn of the 20th century. Populations are now established in a number of southern states. It is much larger than the common muskrat (*Ondatra zibethicus*) and the round-tailed muskrat (*Neofiber alleni*), and distinguished from the American beaver (*Castor canadensis*) which has a large, flattened tail.

Family Sciuridae

There are 51 genera and 272 recent species of squirrels worldwide (Nowak 1999). Nine genera and 68 species occur in North America. Seven species that occur in the South are described here. Squirrels are extremely diverse and exhibit a range of specializations for locomotion and habitat use. A number of these adaptations are exhibited by forms that occur in the region, including flying squirrels (*Glaucomys volans* and *G. sabrinus*), tree squirrels (*Sciurus carolinensis*, *S. niger*, *Tamiasciurus hudsonicus*), and ground squirrels (*Tamias striatus*, *Marmota monax*).

Key to the Species of Sciuridae

1. (a) Tail bushy, dorsoventrally flattened; gliding membrane between forelimb and hind limb; infraorbital region relatively narrow, indented on each side by a distinct V-shaped notch. 2
- (b) Tail bushy, but not particularly dorsoventrally flattened; no gliding membrane present; infraorbital region relatively wide, and not distinctly notched. 3
2. (a) Body length greater than 255 mm, hind foot greater than 34 mm; base of venter hairs gray; length of skull greater than 36 mm *Glaucomys sabrinus* (Northern flying squirrel)
- (b) Body length less than 255 mm, hind foot less than 34 mm; base of venter hairs white; length of skull less than 36 mm *Glaucomys volans* (Southern flying squirrel)
3. (a) Body large, hind foot greater than 70 mm; tail short, 30–40% of head and body length; skull greater than 70 mm total length; postorbital processes broad, projecting at nearly right angles to long axis of skull; skull flat or concave between postorbital processes. *Marmota monax* (Woodchuck)
- (b) Body smaller, hind foot less than 70 mm; tail moderate to long, more than 50% of head and body length; skull less than 70 mm total length; postorbital processes projecting downward and backward; skull convex between postorbital processes. 4
4. (a) Total body length less than 300 mm, dorsal pelage striped; infraorbital opening a foramen piercing the zygomatic plate *Tamias striatus* (Eastern chipmunk)
- (b) Total body length more than 300 mm, dorsal pelage not striped; infraorbital opening piercing rostrum anterior to the zygomatic plate. 5
5. (a) Total body length less than 360 mm, tail length less than 140 mm; in ventral view, anterior border of orbit opposite last premolar *Tamiasciurus hudsonius* (Red squirrel)
- (b) Total body length greater than 360 mm, tail length greater than 140 mm; in ventral view, anterior border of orbit opposite first molar 6

- 6. (a) Dorsal pelage grayish overall, venter whitish, tips of hairs on tail white throughout; five upper cheek teeth, anterior premolar minute. *Sciurus carolinensis* (Eastern gray squirrel)
- (b) Pelage highly variable, varying from gray to rusty to black with a blackish head, tips of hairs on tail not white throughout; four upper cheek teeth. *Sciurus niger* (Eastern fox squirrel)

Family Zapodidae

The family includes 17 genera and 51 species (Nowak 1999). There are two North American representatives of this family, *Napaeozapus insignis* and *Zapus hudsonius*. Both forms occurring in the South exhibit adaptations for saltatorial locomotion including elongate hind limbs and tail.

Key to the Species of Zapodidae

- 1. (a) Hairs at tip of tail usually white; cheek teeth 3/3, upper premolar absent *Napaeozapus insignis* (Woodland jumping mouse)
- (b) Hairs at tip of tail not white; cheek teeth 4/3, small upper premolar present. *Zapus hudsonius* (Meadow jumping mouse)

Order Carnivora

Carnivores are predatory mammals that feed primarily on the flesh of other animals. Nonetheless, there is considerable diversity in dietary habits of this order such that some species actually are omnivorous; some consume more vegetable than animal matter. Nowak (1999) recognized eight families, 97 genera, and 246 species of carnivores worldwide. Baker et al. (2003) reported that nine families exist in North America, with a total of 36 genera and 57 species. This book describes six families and 17 species that occur in the South. Two additional species, the feral dog (*Canis familiaris*) and feral cat (*Felis catus*), occur in the region but are not included in the species accounts.

The distinguishing feature of carnivores is the presence of elongated canine teeth and carnassial molariform teeth. The term “carnassial” refers to the specialization of the fourth upper premolar (P4) and the first lower molar (M1) to serve a shearing or cutting function. Although carnassials are well developed in cat-like and dog-like carnivores, they are less functional in the omnivorous species. To facilitate the capture and holding of prey, carnivores have a deep, C-shaped mandibular fossa, the hinge joint where the lower jaw articulates with the skull.

Most carnivores have well developed claws on all of their digits. In most felids, the claws are retractile. This adaptation allows the claws to remain sharp because they have little contact with the ground.

All but a few carnivores have distinctive anal scent glands. Located on either side of the anus, they produce secretions that function in intraspecific communication and/or defense. Anal glands are especially well developed in the mustelids; skunks are capable of ejecting the strong-smelling contents of the anal glands for defense. Most carnivore species have an *os baculum* or penis bone. This bone may serve to prolong copulation in species with induced ovulation. In most cases, the size and shape of the *os baculum* may be used for species identification.

Key to the Families of Carnivora

1. (a) Six upper and 7 lower molariform (premolars plus molars) teeth 2
 (b) Molariform teeth other than 6/7 3
2. (a) Rostrum long and narrow; upper tooth rows not parallel; total length of skull less than 300 mm; tail long and bushy; hind foot with 4 toes **Family Canidae (Foxes and Wolves)**
 (b) Rostrum short and broad; upper tooth rows parallel; total length of skull greater than 310 mm; tail vestigial; hind foot with 5 toes **Family Ursidae (Bears)**
3. (a) Molariform teeth 6/6; large bushy tail strongly marked with black rings. **Family Procyonidae (Raccoons and Ringtails)**
 (b) Molariform teeth other than 6/6; tail lacking dark rings 4
4. (a) Molar-like teeth either 3/3 or 4/3; total teeth 30 or fewer; rostrum shortened; top of skull rounded when viewed from side; retractile claws **Family Felidae (Cats)**
 (b) Molar-like teeth 4/5, 5/5, or 5/6; total teeth 32 or more; rostrum not shortened; top of skull more or less flat when viewed from side; claws not retractile 5
5. (a) Dorsal pelage black with conspicuous white stripes or spots; palate relatively even with posterior edge of last molars **Family Mephitidae (Skunks)**
 (b) Dorsal pelage lacking conspicuous white markings; palate extends well beyond posterior edge of last molars **Family Mustelidae (Weasels, Otters, and Badgers)**

Family Canidae

All canids have dense fur, a bushy tail, and relatively long limbs. Canids are efficient predators that locate prey using acute senses of smell, sight and hearing. The nasal passages are housed in a long muzzle, which encloses a complex set of turbinal bones. These bones support membranes that increase the sensory areas for chemical reception in the nose. The carnassial teeth are well developed and the molariform teeth possess crushing surfaces.

Family Canidae is represented worldwide by 16 genera and approximately 36 species (Nowak 1999). Three genera and four species that occur in the South are described in this book.

Key to the Species of Canidae

1. (a) Postorbital processes thickened and convex dorsally; tail lacking both a black mid-dorsal stripe of stiff hairs and a white tip 2
 (b) Postorbital processes thin and concave dorsally; tail with either a black mid-dorsal stripe of stiff hairs or a white tip 3
2. (a) Anteroposterior diameter of canine less than 11 mm; diameter of rhinarium (nose pad) less than 25 mm; heel pad less than 32 mm in diameter **Canis latrans (Coyote)**
 (b) Anteroposterior diameter of canine greater than 11 mm; diameter of rhinarium greater than 25 mm; heel pad diameter greater than 32 mm. **Canis rufus (Red wolf)**

- 3. (a) Prominent temporal ridges meet at back of skull forming a U-shaped pattern on top of skull; tail with a black mid-dorsal stripe *Urocyon cinereoargenteus* (Common gray fox)
- (b) Prominent temporal ridges meet at back of skull forming a V-shaped pattern; tail with a distinct white tip *Vulpes vulpes* (Red fox)

Family Felidae

Family Felidae contains extremely efficient predators commonly referred to as “cats.” The physical characteristics of felids are relatively uniform, but cats exhibit considerable variation in size and color pattern. The long, sharp canines and carnassial molariform teeth and the enlarged temporal and master muscles enable felids to inflict a powerful bite. The claws are retractile and extremely sharp, allowing cats to hook and manipulate prey. Most cats prey exclusively on terrestrial vertebrates, but they occasionally include fruit, fish, insects, or mollusks in their diet.

Nowak (1999) lists four genera and 38 species of felids worldwide. This book describes two genera, each with a single species that occur in the South.

Key to the Species of Felidae

- 1. (a) Tail more than 30% of head and body length; 4 upper molar-like teeth; total teeth 30 *Puma concolor* (Mountain lion)
- (b) Tail less than 30% of head and body length; 3 upper molar-like teeth; total teeth 28 *Lynx rufus* (Bobcat)

Family Mephitidae

Until recently, the skunks (Family Mephitidae) were considered to be a subfamily within Family Mustelidae. However, Dragoo and Honeycutt (1997), using morphological and mitochondrial-DNA sequence data, supported the contention of Wayne et al. (1989) that Mephitidae should be raised to the familial level.

Skunks are efficient predators, and possess sharp canines. Although they prey on small vertebrates, skunks are opportunistic and hence omnivorous in their food habits with invertebrates, carrion, fruit, nuts, and fungi included in their diet. Skunks have well-developed anal glands and the ability to spray the odiferous secretions of these glands for defense. Skunks are easily recognized by their distinctive color patterns. The bold black-and-white pattern on the pelage serves as aposematic, or “warning,” colors.

Nowak (1999) described three genera and 10 species worldwide. This book describes two genera, each represented by a single species that occurs in the South.

Key to the Species of Mephitidae

- 1. (a) Dorsum usually with 2 continuous white stripes that may join near the back of the head; no white spot on forehead; total length greater than 500 mm; top of skull convex in profile *Mephitis mephitis* (Striped skunk)
- (b) Dorsum with white spots, or 4 or more lines of broken white stripes; white spot on forehead; total length less than 500 mm; top of skull flat in profile . . . *Spilogale putorius* (Eastern spotted skunk)

Family Mustelidae

The mustelids are small and aggressive predators. The dentition consists of elongate canines and sharp cheek teeth. The face is short and blunt; the back of the skull is broad and flat. The braincase provides an enlarged surface area for the attachment of relatively massive temporal muscles. These muscles allow mustelids to inflict a powerful bite. The mandibular condyle is surrounded by a large flange, which prevents the lower jaw from becoming disarticulated during a struggle.

The anal glands are well developed; members of this family produce strong, musky odors. Most mustelids are solitary. There are 25 genera and approximately 67 species recognized worldwide (Nowak 1999). Four genera and six species that occur in the South are described in this book.

Key to the Species of Mustelidae

1. (a) Feet broad and webbed; total teeth 36 *Lontra canadensis* (Northern river otter)
- (b) Feet small and lacking webs; total teeth 34 or 38 2
2. (a) Total teeth 38; dorsal pelage dark brown to black, but hairs with white tips presenting a frosted appearance. *Martes pennanti* (Fisher)
- (b) Total teeth 34; dorsal pelage lacking frosted appearance 3
3. (a) Skull more than 90 mm long; braincase triangular; last upper molar triangular; with a white stripe on top of head *Taxidea taxus* (American badger)
- (b) Skull less than 90 mm long; braincase elongate; last upper molar dumbbell-shaped; lacking white stripe on top of head 4
4. (a) Total length usually less than 300 mm; length of skull less than 40 mm . *Mustela nivalis* (Least weasel)
- (b) Total length usually greater than 300 mm; length of skull more than 40 mm. 5
5. (a) Tail length usually greater than 45% of total length; black tip on tail; venter yellowish-white *Mustela frenata* (Long-tailed weasel)
- (b) Tail long, but less than 45% of total length; no black tip on tail; venter brown, sometimes with scattered light spots *Mustela vison* (American mink)

Family Procyonidae

Most species in Family Procyonidae occur in the New World. With few exceptions, members of this family are omnivores. Although the cheek teeth bear sharp cusps, the carnassial is weakly developed. All species are excellent climbers. The most obvious feature of procyonids is the color pattern of the tail. All procyonids have a banded tail with alternating light and dark rings.

Family Procyonidae contains seven genera and 19 species worldwide (Nowak 1999). Two genera, each with a single species, occur in the South.

Key to the Species of Procyonidae

1. (a) Face lacking black mask; tail length greater than 35 mm; posterior border of palate opposite last molar *Bassariscus astutus* (Ringtail)
- (b) Black facial mask over eyes; tail 30 mm or less in length; posterior border of palate posterior to last molar *Procyon lotor* (Northern raccoon)

Family Ursidae

Bears are large, stout carnivores with a stubby tail and short, massive limbs. Although they are carnivorous, bears consume a variety of plant and animal material, including carrion. The canines of bears are large and the cheek-teeth are adapted for crushing and grinding.

There are three genera and eight species of bears worldwide (Nowak 1999). One genus and three species are represented in North America (Baker et al. 2003). One species, the American black bear (*Ursus americanus*), occurs in the South.

Order Artiodactyla

The diverse order of large mammals, Artiodactyla, is subdivided into two suborders, 10 families, 86 genera, and 221 species (Nowak 1999). Representatives of this order occur worldwide and are represented on the plains and savannas of the African continent. Humans have introduced several species outside of their natural ranges, especially in Europe, North America, Australia and New Zealand. Baker et al. (2003) reports five families of artiodactyls in North America, represented by 19 genera with 26 species. Two families and three species occur in the South.

Artiodactyls are distinguished from other mammals primarily by the structure of the foot. The foot is paraxonic (i.e., the plane of symmetry passes between digits three and four that terminate in hooves). The first digit is absent in all living species and two digits (two and five) are reduced. The limbs of most artiodactyls are long and slender. The skulls are elongated in front of the eyes and possess a postorbital bar or process. Horns or antlers are produced on the frontal bones of many species, but may be absent seasonally or confined to males. The two families occurring in the region are easily distinguished.

Key to the Families of Artiodactyla

1. (a) Canines reduced or absent; molars selenodont (occlusal surface with many crescent-shaped ridges); postorbital bar complete; nasal pad is never flattened terminally . . . *Cervidae* (Deer and Elk)
- (b) Canines present and directed outward; molars bunodont (rounded cusps on occlusal surface); postorbital bar incomplete; nasal pad flat terminally *Suidae* (Pigs)

Family Cervidae

There are 17 genera and 41 species of deer and deer-like mammals in Family Cervidae worldwide (Nowak 1999). Six genera with nine species occur in North America (Baker et al. 2003). Only two species, the white-tailed deer (*Odocoileus virginianus*) and the elk (*Cervus elaphus*), are native in the region. Although elk were extirpated from the South in the 1800s, elk from the western United States have been reintroduced into several locations in recent years.

Key to the Species of Cervidae

1. (a) Adult weight greater than 225 kg; antler points originate from 1 beam; canines present in upper jaw *Cervus elaphus* (Elk)
- (b) Adult weight less than 225 kg; antler points originate from main beam; canines absent in upper jaw *Odocoileus virginianus* (White-tailed deer)

Family Suidae

Family Suidae contains five genera and 14 species of swine that occur natively in Europe, Asia, and Africa (Nowak 1999); many populations have been introduced worldwide. Only one species, the feral pig (*Sus scrofa*), occurs in North America (Baker et al. 2003). Current populations represent descendents of the European wild boar and feral domestic pigs, both of which were introduced into North America during European settlement. The feral ancestry of the species has produced considerable variation in size and color.

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