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**ANNOTATED CHECKLIST OF RECENT MAMMALS
OF NORTHWESTERN TEXAS**

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As defined here, northwestern Texas encompasses all the Panhandle and those counties south thereof that lie west of the 100th meridian, south to and including (from west to east) Andrews, Martin, Howard, Mitchell, and Nolan counties (see Fig. 1). This region has received less attention from a biological viewpoint than most others in Texas. This annotated checklist is intended as a summary of current knowledge of the distribution of mammals in the northwestern part of the state. It includes 75 species native to the region, at least one (*Sciurus carolinensis*) introduced from elsewhere in North America, and four species introduced from the Old World. Additionally, a list of 19 species of possible present or past occurrence is appended.

As a departure point, we used the compilations of Davis (1974) and Hall (1981)—to which the reader is referred for keys, descriptions, and range maps—augmenting distributional data in those two treatises with recently published information (some of which is cited in text) and also specimens housed in The Museum, Texas Tech University. Our own field work over the past several years, particularly in the Panhandle, has added greatly to knowledge of the geographic and ecological distributions of a number of mammalian species. For financial support of our field efforts, we thank the Graduate School, College of Arts and Sciences, and Office of the Vice President for Academic Affairs and Research, all at Texas Tech University, and the U.S.

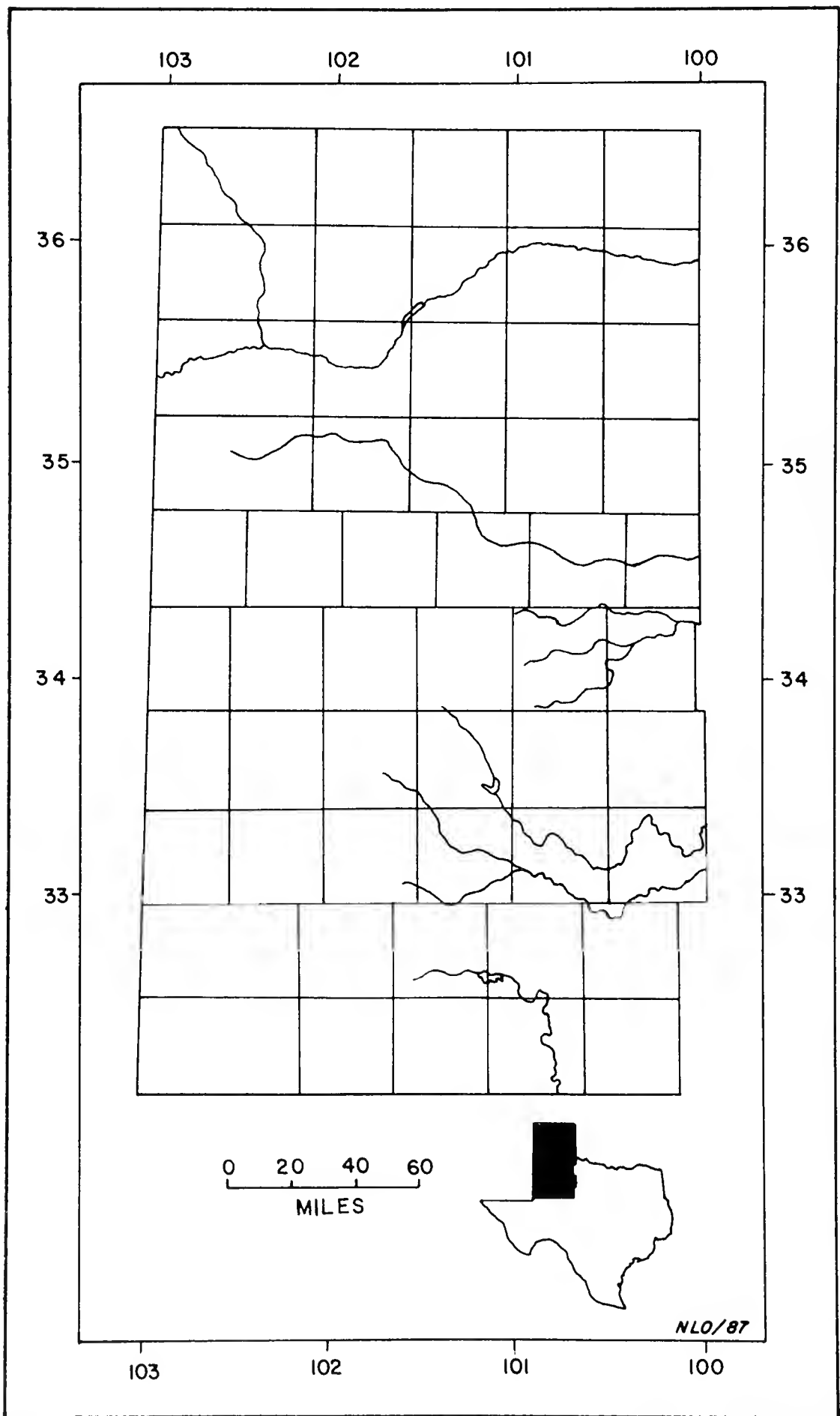


FIG. 1.—Map of northwestern Texas showing counties covered in this checklist and major drainages. Inset map indicates relationship of the region to the rest of the state.

Fish and Wildlife Service. Additionally, one of us (Manning) was awarded a summer research assistantship by the Graduate School in support of laboratory phases of the work.

Biological checklists are especially valuable to students, in this case those in courses such as mammalogy, field ecology, vertebrate natural history, and the like. They also are useful, however, to many others such as wildlife biologists, conservationists, environmentalists, and personnel at local, state, and federal nature preserves, parks, and game refuges. In comprising our list, we followed Jones *et al.* (1986b) in use of specific and vernacular names. Taxa are entered in traditional phylogenetic sequence (Hall, 1981) except for species in the same genus, which are treated alphabetically. Some users may not be aware that a recent handbook, *Guide to Mammals of the Plains States* (Jones *et al.*, 1986a), which, although not specifically covering Texas, includes summaries on natural history for all species listed herein save for a few restricted to the southern part of the region.

ORDER MARSUPIALIA—Marsupials

Family DIDELPHIDAE—Opossums

Didelphis virginiana (Virginia opossum).—Recorded from eastern and central parts of region, westward into New Mexico in Canadian River drainage. The subspecies is *D. v. virginiana* Kerr, 1792.

ORDER INSECTIVORA—Insectivores

Family SORICIDAE—Shrews

Cryptotis parva (least shrew).—Occurs in scattered, relatively mesic habitats in northern part of region, south at least to Lubbock County. Other counties of record are Bailey, Floyd, Hutchinson, Randall, Swisher, and Wheeler (Owen and Hamilton, 1986). The subspecies is *C. p. parva* (Say, 1823).

Notiosorex crawfordi (desert shrew).—Found on High Plains of western and central parts of northwestern Texas, eastward at least to Briscoe, Garza, Howard, Hutchinson, and Motley counties. The subspecies is *N. c. crawfordi* (Coues, 1877).

Family TALPIDAE—Moles

Scalopus aquaticus (eastern mole).—Known only from eastern part of region (Yates and Schmidly, 1977), west at least to Floyd, Garza, and Hutchinson counties; possibly west to New Mexico in

Canadian River drainage. The subspecies in northwestern Texas is *S. a. aereus* (Bangs, 1896).

ORDER CHIROPTERA—Bats

Family VESPERTILIONIDAE—Vespertilionid Bats

Myotis ciliolabrum (western small-footed myotis).—Known from northwestern Texas by a single specimen from Armstrong County (Hollander and Jones, 1987); to be looked for in rocky areas. The subspecies is *M. c. ciliolabrum* (Merriam, 1886).

Myotis thysanodes (fringed myotis).—Outside of Trans-Pecos Texas, recorded in state only from Crosby County (Jones *et al.*, 1987). The subspecies is *M. t. thysanodes* Miller, 1897.

Myotis velifer (cave myotis).—Occurs throughout northwestern Texas in suitable habitats. The subspecies is *M. v. magnamolaris* Choate and Hall, 1967.

Lasionycteris noctivagans (silver-haired bat).—Occurs in region only as spring and autumn migrant; recorded to date from Hale, Hockley, and Lubbock counties. *L. noctivagans* (Le Conte, 1831) is a monotypic species.

Pipistrellus hesperus (western pipistrelle).—Known from several counties in central part of region, from caves and other rocky areas near watercourses. The subspecies is *P. h. maximus* Hatfield, 1936.

Pipistrellus subflavus (eastern pipistrelle).—Occurs in east-central part of region in breaks along rim of Caprock and in similar habitats. The subspecies is *P. s. subflavus* (F. Cuvier, 1832).

Eptesicus fuscus (big brown bat).—Found throughout northwestern Texas. The subspecies is probably *E. f. pallidus* Young, 1908.

Lasiurus borealis (red bat).—Migrant in spring and late summer; a few resident in summer in wooded areas along streams, in cities, and the like. The subspecies is *L. b. borealis* (Müller, 1776).

Lasiurus cinereus (hoary bat).—Known from northwestern Texas only as seasonal migrant; presently recorded from Armstrong, Briscoe, Crosby, Gaines, Hansford, and Lubbock counties. The subspecies is *L. c. cinereus* (Palisot de Beauvois, 1796).

Plecotus townsendii (Townsend's big-eared bat).—Occurs anywhere in northwestern Texas where suitable caves and rocky crevices prevail. The subspecies is *P. t. pallescens* (Miller, 1897).

Antrozous pallidus (pallid bat).—Known from throughout region. The subspecies is *A. p. pallidus* (Le Conte, 1856).

Family MOLOSSIDAE—Molossid Bats

Tadarida brasiliensis (Brazilian free-tailed bat).—Occurs throughout region in warm months; migrates southward for winter. The subspecies is *T. b. mexicana* (Saussure, 1860).

Tadarida macrotis (big free-tailed bat).—Known from northwestern part of state only as seasonal migrant; presently recorded only from Hale and Lubbock counties. *T. macrotis* (Gray, 1839) is a monotypic species.

ORDER XENARTHRA—Xenarthrans

Family DASYPODIDAE—Armadillos

Dasypus novemcinctus (nine-banded armadillo).—Recorded only from northeastern part of region from Armstrong, Hemphill, and Lipscomb counties (Hollander *et al.*, 1987a); to be looked for elsewhere in northeast and to the east of the Llano Estacado. The subspecies is *D. n. mexicanus* Peters, 1864.

ORDER LAGOMORPHA—Lagomorphs

Family LEPORIDAE—Hares and Rabbits

Sylvilagus audubonii (desert cottontail).—Known from upland areas throughout region. The subspecies is *S. a. neomexicanus* Nelson, 1907.

Sylvilagus floridanus (eastern cottontail).—Occurs in relatively mesic habitats over most of northwestern Texas. The subspecies is *S. f. llanensis* Blair, 1938.

Lepus californicus (black-tailed jackrabbit).—Ranges throughout northwestern part of state. The subspecies are *L. c. melanotis* Mearns, 1890, in the northern two-thirds of the region and *L. c. texianus* Waterhouse, 1848, in the south.

ORDER RODENTIA—Rodents

Family SCIURIDAE—Squirrels

Spermophilus mexicanus (Mexican ground squirrel).—Known from southern half of region north at least to Cottle and Motley counties. The subspecies is *S. m. parvidens* Mearns, 1896.

Spermophilus spilosoma (spotted ground squirrel).—Found throughout entire region except extreme southeastern part. The subspecies is *S. s. marginatus* V. Bailey, 1902.

Spermophilus tridecemlineatus (thirteen-lined ground squirrel).—Occurs throughout Panhandle and in western half of southern part of region, south at least to Dawson and Gaines counties. The subspecies is *S. t. arenicola* (A. H. Howell, 1928); *S. t. texensis* Merriam, 1898, may be found in the extreme east-central part of the region.

Cynomys ludovicianus (black-tailed prairie dog).—Found throughout entire region. The subspecies is *C. l. ludovicianus* (Ord, 1815).

Sciurus carolinensis (gray squirrel).—Introduced and well established in Lubbock and possibly also in other urban areas. The subspecies probably is *S. c. carolinensis* Gmelin, 1788.

Sciurus niger (fox squirrel).—Occurs naturally in Canadian River drainage west to Oldham County (Hollander *et al.*, 1987a) and in Red River drainage west at least to Dickens County; introduced in some urban areas. The native subspecies is *S. n. rufiventer* É. Geoffroy St.-Hilaire, 1803.

Family GEOMYIDAE—Pocket Gophers

Geomys bursarius (plains pocket gopher).—Found throughout northwestern Texas. The subspecies are *G. b. jugossicularis* Hooper, 1940, in Dallam and Hartley counties in the extreme northwestern corner of the region (Hollander *et al.*, 1987a), *G. b. knoxjonesi* Baker and Genoways, 1975, in the southwest, and *G. b. major* Davis, 1940, in the remaining areas.

Cratogeomys castanops (yellow-faced pocket gopher).—Occurs throughout most of Panhandle and western half of region to the south. The subspecies are *C. c. perplanus* Nelson and Goldman, 1934, in the north and on the Llano Estacado and *C. c. simulans* (Russell, 1968) generally east of the Llano.

Family HETEROMYIDAE—Heteromyids

Perognathus flavescens (plains pocket mouse).—Found in suitable sandy habitats throughout region. The subspecies is *P. f. copei* Rhoads, 1894.

Perognathus flavus (silky pocket mouse).—Occurs across entire region. The subspecies are *P. f. bunkerii* Cockrum, 1951, in the extreme northeast, probably *P. f. flavus* Baird, 1855, in the northwest, and *P. f. gilvus* Osgood, 1900, in the south.

Chaetodipus hispidus (hispid pocket mouse).—Known from entire region. The subspecies is *C. h. paradoxus* (Merriam, 1889).

Dipodomys elator (Texas kangaroo rat).—Occurs only in east-central part of region (recorded from Cottle and Motley counties). *D. elator* Merriam, 1894, is a monotypic species.

Dipodomys merriami (Merriam's kangaroo rat).—Reported only from Gaines and Martin counties in southwestern part of region. The subspecies is *D. m. ambiguus* Merriam, 1890.

Dipodomys ordii (Ord's kangaroo rat).—Known from all but extreme southeastern part of region. The subspecies are *D. o. medius* Setzer, 1949, in the south and *D. o. richardsoni* (J. A. Allen, 1891) in the north.

Dipodomys spectabilis (banner-tailed kangaroo rat).—Recorded only from Andrews, Gaines, and Martin counties in southwestern part of region. The subspecies is *D. s. baileyi* Goldman, 1923.

Family CASTORIDAE—Beavers

Castor canadensis (beaver).—Probably once occurred throughout much of northwestern Texas in suitable aquatic habitats; recorded from Canadian River drainage as far west as Oldham County (Hollander *et al.*, 1987a) and Colorado River drainage as far north as Mitchell County. The subspecies may be *C. c. missouriensis* V. Bailey, 1919, in the extreme northern part of the region and *C. c. texensis* V. Bailey, 1905, in the south.

Family CRICETIDAE—Cricetids

Reithrodontomys fulvescens (fulvous harvest mouse).—Known only from Armstrong and Childress counties. The subspecies is *R. f. laceyi* J. A. Allen, 1896.

Reithrodontomys megalotis (western harvest mouse).—Found throughout northwestern Texas but relatively uncommon in many areas. Two subspecies thus far reported are *R. m. aztecus* J. A. Allen, 1895, and *R. m. megalotis* (Baird, 1858), in the northern and southern parts of the region, respectively.

Reithrodontomys montanus (plains harvest mouse).—Occurs throughout region, mainly in grassy upland habitats. The subspecies is *R. m. griseus* V. Bailey, 1905.

Peromyscus attwateri (Texas mouse).—Saxicolous species that occurs in southeastern part of region, north at least to Armstrong County (Fuller *et al.*, 1984). *P. attwateri* J. A. Allen, 1895, is a monotypic species.

Peromyscus boylii (brush mouse).—Occurs in rocky, brushy habitats, especially along edge of Llano Estacado and in adjacent

areas of northwestern part of state. The subspecies is *P. b. rowleyi* (J. A. Allen, 1893).

Peromyscus leucopus (white-footed mouse).—Occurs throughout region, mostly in relatively mesic, wooded habitats. Subspecies are *P. l. tornillo* Mearns, 1896, in the north and *P. l. texanus* (Woodhouse, 1853) in the south.

Peromyscus maniculatus (deer mouse).—Widely distributed in northwestern Texas. Four subspecies may be present: *P. m. nebracensis* (Coues, 1877) in the extreme northwest; *P. m. luteus* Osgood, 1905, over much of the region; *P. m. blandus* Osgood, 1904, along the Texas-New Mexico border, particularly in the southwest; and *P. m. pallescens* J. A. Allen, 1896, in the southeast.

Peromyscus truei (piñon mouse).—Known in Texas only from rocky, juniper-dominated habitats in Armstrong, Briscoe, Dickens, Garza, Lynn, and Randall counties. The subspecies is *P. t. comanche* Blair, 1943.

Baiomys taylori (northern pygmy mouse).—Recently recorded from east-central part of region, north to Collingsworth (Hollander *et al.*, 1987a) and Hall (Cleveland, 1986) counties, and southwest to Garza and Lubbock counties (Stangl *et al.*, 1983). The subspecies is *B. t. taylori* (Thomas, 1887).

Onychomys leucogaster (northern grasshopper mouse).—Found throughout region. The subspecies is *O. l. arcticeps* Rhoads, 1898.

Sigmodon hispidus (hispid cotton rat).—Common and widespread over most of region. The two subspecies are *S. h. texianus* (Audubon and Bachman, 1853) in the northeastern part of the Panhandle and *S. h. berlandieri* Baird, 1855, elsewhere.

Neotoma albigula (white-throated woodrat).—Occurs in rocky habitats in region; not reported from extreme northeast. Subspecies are *N. a. warreni* Merriam, 1908, north of the Canadian River, and *N. a. albigula* Hartley, 1894, to the south.

Neotoma micropus (southern plains woodrat).—Found throughout northwestern Texas. Subspecies are *N. m. canescens* J. A. Allen, 1891, which occurs over most of the area, and *N. m. micropus* Baird, 1855, along the extreme eastern edge.

Ondatra zibethicus (muskrat).—Known only from aquatic habitats in Hemphill, Hutchinson, and Lipscomb counties. The subspecies is *O. z. cinnamominus* (Hollister, 1910).

Family MURIDAE—Murids

Rattus norvegicus (Norway rat).—Introduced from Old World as a commensal of man; occurs over entire region, especially near human habitation. The subspecies probably is *R. n. norvegicus* (Berkenhout, 1769).

Rattus rattus (roof rat).—Introduced from the Old World as a commensal of man; found over the entire region, but most common in urban areas. The subspecies may be *R. r. rattus* Linnaeus, 1758.

Mus musculus (house mouse).—Introduced from Old World and is a commensal of man; found throughout region, especially near human habitation. In recent years, the question has been raised that *Mus domesticus* Rutly, 1772, may have been the species introduced into North America rather than *M. musculus* Linnaeus, 1758.

Family ERETHIZONTIDAE—Porcupines

Erethizon dorsatum (porcupine).—Occurs, rarely in some areas, over entire region. The systematics of *E. dorsatum* have not been studied in detail. As many as three subspecies may occur in northwestern Texas: *E. d. epizanthum* Brandt, 1835, along the Texas-New Mexico border; *E. d. bruneri* Swenk, 1916, in the north; and *E. d. couesi* Mearns, 1897, in the south.

ORDER CARNIVORA—Carnivores

Family CANIDAE—Canids

Canis latrans (coyote).—Common over all of northwestern Texas. Two subspecies are recognized, *C. l. latrans* Say, 1823, in the north and *C. l. texensis* V. Bailey, 1905, in the south.

Canis lupus (gray wolf).—Formerly occurred throughout region but now extirpated. The subspecies were *C. l. nubilus* Say, 1823, in the Panhandle and *C. l. monstrabilis* Goldman, 1937, southwardly.

Vulpes velox (swift fox).—Uncommon in short-grass habitats of Llano Estacado and some areas to the east. The subspecies is *V. v. velox* (Say, 1823).

Vulpes vulpes (red fox).—Found over much of northwestern Texas. The subspecies is thought to be *V. v. fulva* (Desmarest, 1820).

Urocyon cinereoargenteus (gray fox).—Presently recorded from Crosby, Dickens, Lubbock, Lynn, Oldham, Potter, and Scurry

counties; probably occurs over entire region. The subspecies is *U. c. scottii* Mearns, 1891.

Family URSIDAE—Bears

Ursus americanus (black bear).—Formerly occurred in suitable habitats throughout region, now extirpated from northwestern Texas. The subspecies were *U. a. americanus* Pallas, 1780, in the eastern two-thirds of the area and *U. a. amblyiceps* Baird, 1859, in the west.

Family PROCYONIDAE—Procyonids

Bassariscus astutus (ringtail).—Known from throughout the region, especially in broken country. The subspecies is *B. a. flavus* Rhoads, 1894.

Procyon lotor (raccoon).—Occurs throughout the region, especially in mesic areas and near human habitation. The subspecies are *P. l. hirtus* Nelson and Goldman, 1930, in the northern part of the Panhandle and *P. l. fuscipes* Mearns, 1914, in the south.

Family MUSTELIDAE—Mustelids

Mustela frenata (long-tailed weasel).—Probably ranges throughout northwestern Texas but records are scarce (Jones *et al.*, 1985). The subspecies is *M. f. neomexicana* (Barber and Cockerell, 1898).

Mustela nigripes (black-footed ferret).—Once ranged across entire region; now absent from Texas and most of the former geographic range. *M. nigripes* (Audubon and Bachman, 1851) is a monotypic species.

Taxidea taxus (badger).—Found throughout northwestern Texas. The subspecies is *T. t. berlandieri* Baird, 1858.

Spilogale gracilis (western spotted skunk).—Known in region only by a single record from Howard County (Hollander *et al.*, 1987b). The subspecies is *S. g. leucoparia* Merriam, 1890.

Spilogale putorius (eastern spotted skunk).—Apparently ranges throughout much of northern and central parts of region, but there are few records (Jones *et al.*, 1985). The subspecies is *S. p. interrupta* (Rafinesque, 1820).

Mephitis mephitis (striped skunk).—Probably the most common carnivore in region. The subspecies is *M. m. varians* Gray, 1837.

Conepatus mesoleucus (hog-nosed skunk).—Ranges into southern one-half of northwestern Texas (Manning *et al.*, 1986). The subspecies is *C. m. mearnsi* Merriam, 1902.

Lutra canadensis (river otter).—Seldom-seen inhabitant of rivers and streams; probably now absent from region. The subspecies is *L. c. lataxina* F. Cuvier, 1823.

Family FELIDAE—Cats

Felis concolor (mountain lion).—Once occurred throughout region, especially in canyons and rough country; possibly extirpated in northwestern part of state. The subspecies is *F. c. stanleyana* Goldman, 1938.

Felis pardalis (ocelot).—Formerly ranged into northwestern Texas (recorded from Donley County—Davis, 1951); now absent from this part of state. The subspecies is *F. p. albescens* Pucheran, 1855.

Felis rufus (bobcat).—Known from throughout region, especially near wooded and broken country. The subspecies are *F. r. baileyi* (Merriam, 1890) in the northern and western parts and *F. r. texensis* (J. A. Allen, 1895) in the southeast.

ORDER ARTIODACTYLA—Even-toed Ungulates

Family CERVIDAE—Cervids

Cervus elaphus (wapiti).—Once widely distributed over northwestern Texas; now extirpated in region. The subspecies probably was *C. e. merriami* Nelson, 1902.

Odocoileus hemionus (mule deer).—Once occurred throughout region; populations reached record low in 1940s but have rebounded through introductions from Trans-Pecos, Texas; species now found in suitable habitats, mostly in Panhandle and along edge of Caprock. The subspecies is *O. h. crooki* (Mearns, 1897), although the nominate race once may have occurred in the northernmost part of the region.

Odocoileus virginianus (white-tailed deer).—Ranges over most of northwestern Texas where suitable cover available. The subspecies is *O. v. texanus* (Mearns, 1898).

Family ANTILOCAPRIDAE—Pronghorn

Antilocapra americana (pronghorn).—Once common over region but nearly driven to extinction; spotty current distribution achieved mostly through reintroductions. Two native subspecies

may have been present, *A. a. americana* (Ord, 1815) in the north and *A. a. mexicana* Merriam, 1901, southwardly.

Family BOVIDAE—Bovids

Bison bison (bison).—Once occurred throughout northwestern Texas; now extinct except in captive herds. The subspecies is *B. b. bison* (Linnaeus, 1758).

Ammotragus lervia (Barbary sheep).—North African native initially introduced into Palo Duro Canyon; stable herd now exist along much of the eastern edge of the Caprock. The subspecies is not known.

SPECIES OF PAST OR PRESENT POSSIBLE OCCURRENCE

At least 19 mammalian species occur, or once occurred, near the borders of northwestern Texas, as here defined, and users of this checklist should be aware of their possible present or past occurrence in the region. These species are listed below:

Myotis lucifugus (little brown myotis).—Recorded from northeastern New Mexico.

Myotis volans (long-legged myotis).—Known from Trans-Pecos, Texas, and by a single extralimital record from Knox County, east of region.

Myotis yumanensis (Yuma myotis).—Recorded from northeastern New Mexico and Oklahoma Panhandle.

Ammospermophilus interpres (Texas antelope squirrel).—Unlikely resident of extreme southern part of northwestern Texas.

Spermophilus variegatus (rock squirrel).—Possibly will be found in rocky areas of southern part of region or those in extreme north.

Thomomys bottae (Botta's pocket gopher).—May occur in extreme northwestern part of region or along southern border.

Chaetodipus intermedius (rock pocket mouse).—To be looked for in extreme southwestern part of region.

Chaetodipus nelsoni (Nelson's pocket mouse).—Same as for *C. intermedius* above.

Chaetodipus penicillatus (desert pocket mouse).—Same as for *C. intermedius* above.

Peromyscus difficilis (rock mouse).—Known from northeastern New Mexico and Oklahoma Panhandle.

Peromyscus eremicus (cactus mouse).—Same as for *C. intermedius* above.

Peromyscus pectoralis (white-ankled mouse).—Possibly will be found in extreme southeastern part of region.

Onychomys arenicola (Mearns' grasshopper mouse).—Same as for *C. intermedius* above.

Neotoma mexicana (Mexican woodrat).—Recorded from northeastern New Mexico and Oklahoma Panhandle.

Microtus ochrogaster (prairie vole).—Possibly will be found along Canadian River in extreme northeast.

Ursus horribilis (grizzly bear).—Individuals of this species once may have roamed into region from the west, especially in canyons.

Vulpes macrotis (kit fox).—Possibly occurs in extreme southern part of region; may be conspecific with *V. velox*.

Mustela vison (mink).—Once may have occurred around permanent water in eastern part of northwestern Texas; probably absent now.

Tayassu tajacu (collared peccary).—Once ranged as far north as Red River; now absent from region except possibly in extreme southwest.

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**PHYLOGENETIC IMPLICATIONS OF COMPARATIVE
PELAGE MORPHOLOGY IN APLODONTIDAE AND
THE NEARCTIC SCIURIDAE, WITH OBSERVATIONS ON
SEASONAL PELAGE VARIATION**

FREDERICK B. STANGL, JR., AND JOHN V. GRIMES

The family Sciuridae presents a taxonomic array of species well suited for comparative studies. The group is cosmopolitan in distribution, consisting of at least 49 genera and 262 species (McLaughlin, 1984). The Nearctic taxa afford a suitable sampling of this diversity (Hall, 1981).

The Nearctic Sciuridae commonly are thought to consist of three phyletic lines that are generally coincidental to differing ecological niches—ground squirrels (*Marmota*, *Cynomys*, *Ammospermophilus*, and *Spermophilus*) and chipmunks (*Tamias*), tree squirrels (*Sciurus* and *Tamiasciurus*), and flying squirrels (*Glaucomys*). The primary purpose of this study was to produce a sciurid phylogeny based on pelage morphology that can be compared to other phylogenies derived from paleontological evidence (Black, 1963), skeletal and dental morphology (Bryant, 1945), immunology (Hight *et al.*, 1974), and electrophoretic analysis (Hafner, 1984).

Previous investigators of mammalian pelage characters have addressed the descriptive microanatomy of individual hair shafts (Hausman, 1920, 1924, 1930; Short, 1978; Williams, 1938). Medullar organization and cuticular scale patterns have received the most attention. Such features have proven useful in construction of identification keys of hairs (Keogh, 1983; Mathiak, 1938; Mayer, 1952; Moore *et al.*, 1974), although

