
MAMMALIAN ZOOGEOGRAPHY
OF A ROCKY MOUNTAIN-GREAT
PLAINS INTERFACE IN NEW MEXICO,
OKLAHOMA, AND TEXAS

Walter W. Dalquest, Frederick B. Stangl, Jr.,
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INTRODUCTION

The region encompassed by the present study comprises some of the least-known areas of New Mexico, Oklahoma, and Texas with respect to distribution of mammals. The senior author initiated collecting in Union County, New Mexico, and nearby Texas counties in 1965, mostly to determine the presence or absence in Texas of several mammalian species with ranges mapped by Hall and Kelson (1959) as closely approaching the state. For two years, he was assisted by Midwestern State University graduate students Edward L. Roth and Robert L. Westmoreland, but the study was abandoned before completion.

During the intervening years, Findley *et al.* (1975) produced a work on the mammals of New Mexico, but it contained little information on Union County not already reported from collections made in the early 1900s. Two exceptions are Best's (1971) additions of several species to the known fauna, and his (1973) study on the distribution of three species of pocket gophers in the county. Hall's (1981) revised edition of *The Mammals of North America* incorporated information from the publications cited above, and served as the primary point of departure for this study.

The Oklahoma Panhandle historically has been neglected by mammalogists, with the exception of Black Mesa. The authors of the long-awaited book on mammals from that state (Caire *et al.*, 1990) summarized known specimens and further illustrated the lack of material from much of the region.

In 1983, the senior and second authors initiated work toward completion of the original study, and expanded it to include the Oklahoma Panhandle and northern tier of counties in the Texas Panhandle (Fig. 1). Shortly thereafter, the third author and colleagues began work in the northern Texas Panhandle, and the results of their efforts, incorporating our earlier Texas material, subsequently were published (Jones *et al.*, 1988). In turn, we have included their published distributional records. However, with few exceptions, our New Mexico and Oklahoma specimens are reported in the literature for the first time. See also Jones and Manning (1990*b*).

Our principle concern has been the distribution of mammalian species in the study area. To this end, we herein report 19 new county records—eight from New Mexico, 10 from Oklahoma, and one from Texas. We have found, however, that the lack of information about mammals of the region has led to inconsistent treatment of subspecific distributions. For example, seven species of rodents occurring in the study area are represented, according to Hall (1981), by two or more subspecies. The boundary lines between races as mapped by him and others vary, however, and none closely approximates physiographic or environmental parameters in the area.

Another feature that became apparent in the course of this work was evidence of westward invasion of parts of the region by grasslands and prairie-adapted mammals, and concomitant retreat of species of mammals

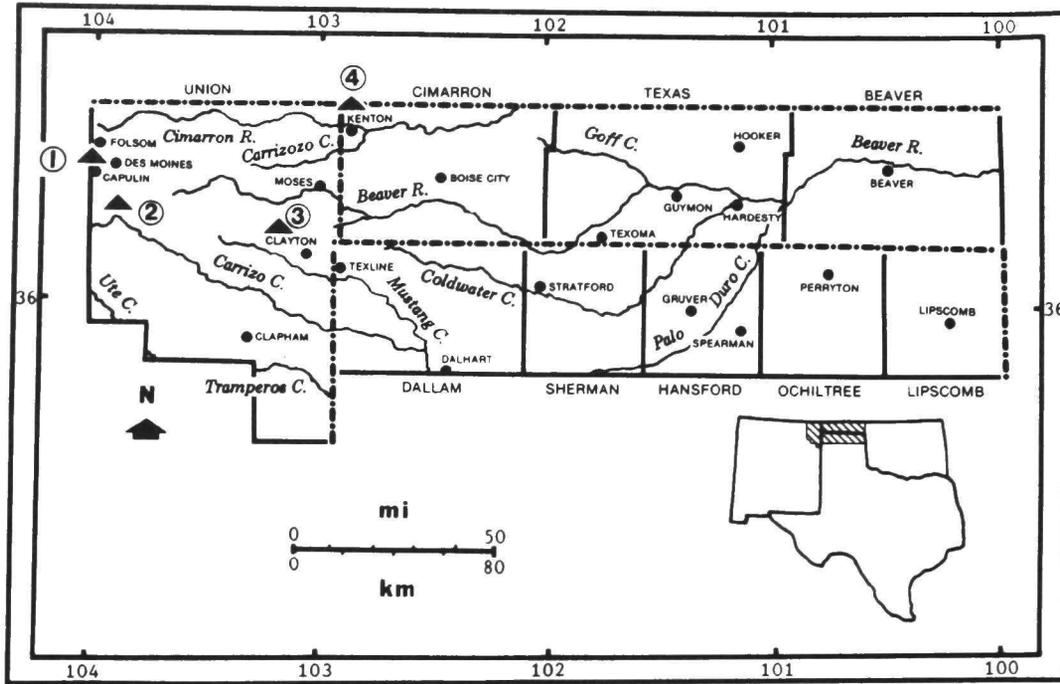


FIG. 1.—Map of tristate study region, comprised of Union County, New Mexico, Oklahoma Panhandle, and northern tier of Texas Panhandle counties. Figured are cities and towns (circles), major physical features (triangles), and waterways often referred to in text. Circled numbers refer to the following physical features: 1, Capulin Mountain; 2, Sierra Grande Mountain; 3, Rabbit Ears Mountain; 4, Black Mesa.

more adapted to coniferous woodlands and softer, moister soils. Mammals of our study area inhabit the boundary between the prairies of the Great Plains and the woodlands fringing the foothills of the southern Rocky Mountains. West of the panhandles, mammalian populations are dynamic, in a state of flux. Even in the two panhandles, there is some indication of change in the distribution of species other than that related to the obvious results of activities of man (the apparent recent increase of *Microtus ochrogaster*, for example). Supportive evidence is found in late Pleistocene (Dalquest and Stangl, 1989) and early Holocene (Dalquest *et al.*, 1990) faunas of the region. It is important, we think, to record the geographic ranges of mammals in the study area in some detail so that future changes may be identified.

METHODS AND ACKNOWLEDGMENTS

Collections were made during all seasons of the year using standard collecting techniques. Most small mammals were taken by Victor rat and Museum Special snap traps, and in Sherman live traps. Bats were collected by hand, or with mist nets, and shrews were taken mostly in pitfall traps. Specialized commercial traps were used to capture pocket gophers and in an attempt to capture moles. Larger animals (lagomorphs and carnivores, for example) were hunted with guns, collected from trappers, or salvaged from roadways. Most specimens were prepared as museum study skins accompanied by skulls; soft tissues (liver, heart, kidney, and muscle) were saved from selected specimens and are deposited in the Collection of Frozen Tissues

at The Museum of Texas Tech University. Most voucher specimens are deposited in the Collection of Recent Mammals, Midwestern State University, and in The Museum, Texas Tech University. In the accounts that follow, all measurements are in millimeters and weights are in grams.

We gratefully acknowledge the many landowners who permitted collecting on their property. For this and many other kindnesses, we especially thank the following individuals: Jack Wiggins and Bud Davis, of Cimarron County; Carlos Cornay, A. W. Layton, and A. W. Layton, Jr., of Union County; Jim Boussard, of Lipscomb County; and Layne Allen, formerly of Ochiltree County.

For field assistance during the course of this study, we thank the following workers: R. M. Carpenter, L. L. Choate, R. R. Hollander, C. S. Hood, C. Jones, S. Kasper, M. J. Kocurko, R. W. Manning, D. A. McCullough, R. J. Pesaturo, J. W. Rogers, E. L. Roth, T. S. Schafer, F. M. Stangl, K. W. Wells, and R. L. Westmoreland. We also wish to acknowledge the curators and collection managers of the following collections (identifying acronyms in parentheses) for allowing access to specimens in their care: Museum of Natural History, The University of Kansas (KU); Museum of Vertebrate Zoology, University of California, Berkeley (MVZ); New Mexico State University (NMSU); Oklahoma State University (OSU); Texas Cooperative Wildlife Collection, Texas A&M University (TCWC); National Museum of Natural History, Smithsonian Institution (USNM); Texas Memorial Museum, University of Texas (UT); The Museum, Texas Tech University (TTU); and West Texas State University (WTSU).

Finally, we thank the offices of the New Mexico Department of Game and Fish, Oklahoma Department of Wildlife Conservation, and Texas Parks and Wildlife Department, for providing collecting permits for their respective states.

ACCOUNTS OF SPECIES

Species are arranged in the following accounts in the order listed by Jones *et al.* (1986). Specimens examined that are deposited in the Midwestern State University Collection of Recent Mammals carry no institutional designation; others are identified by acronyms given in the section on methods and acknowledgments. Specimens are listed alphabetically by state and by county within each state. Within a single county, they generally are arranged from north to south or are grouped by place-name; at the same latitude, western localities usually precede those farther east.

Unless otherwise listed, sources of literature records are as follows: for New Mexico, Findley *et al.*, 1975; for Oklahoma, Caire *et al.*, 1990; and for Texas, Jones *et al.*, 1988. For the most part, natural history data in those three publications are not repeated here.

On distribution maps, localities from which specimens were examined are represented by solid symbols, whereas open symbols are used to indicate

records from the literature. Species with one or only a few known distributional records from the study area either are not mapped or are combined on a map with other taxa. To alleviate crowding of symbols, immediately adjacent localities for some species are not mapped or symbols are slightly offset.

Didelphis virginiana virginiana Kerr, 1792

Virginia Opossum

Records of the opossum from our study area are scarce. A. W. Layton reported that his dogs treed an opossum in cottonwoods along the Cimarron River in Union County, about 10 miles west of Kenton, Oklahoma, and that he had heard of another killed earlier in the same vicinity. The species probably occurs sparingly throughout the region where suitable riparian habitat exists along watercourses.

Literature records.—OKLAHOMA. Cimarron Co.: 10 mi. W Felt. TEXAS. Lipscomb Co.: Higgins.

Sorex merriami leucogenys Osgood, 1909

Merriam's Shrew

The only record of this species from the tristate region is that of George (1990), who obtained a single specimen in a pitfall trap in montane habitat on the peak of Sierra Grande (Fig. 2). The few other records of Merriam's shrew from New Mexico (Findley *et al.*, 1975) were taken in fir forests, at elevations of approximately 8000 feet, and more than 100 miles to the southwest. Elsewhere, *S. merriami* is known to occur in more arid situations than other *Sorex*, and at considerably lower elevations (Armstrong and Jones, 1971). Much of Union County and parts of Cimarron County probably provide suitable habitat for this species. Use of pitfall traps in sagebrush areas, for example, may extend the known range farther east than Sierra Grande. We employ the subspecific name *S. m. leucogenys* on geographic grounds.

Literature record.—NEW MEXICO. Union Co.: Sierra Grande, 3 mi. S, 3 mi. W Des Moines (George, 1990).

Sorex nanus Merriam, 1895

Dwarf Shrew

We took no specimens of the dwarf shrew, but George (1990) reported one taken in the same pitfall trapline at the top of Sierra Grande that produced an individual of *S. merriami* (Fig. 2). Little is known of the ecology and distribution of this monotypic species (Hoffmann and Owen, 1980). Although most records are from high montane habitats, this shrew is known to extend into the lower foothills of the Rockies (Armstrong, 1972). As in the case of *S. merriami*, more intensive collecting efforts in using pitfall traps may better define the ecology and distribution of this species in the region.

Literature record.—NEW MEXICO. Union Co.: Sierra Grande, 3 mi. S, and 3 mi. W Des Moines (George, 1990).

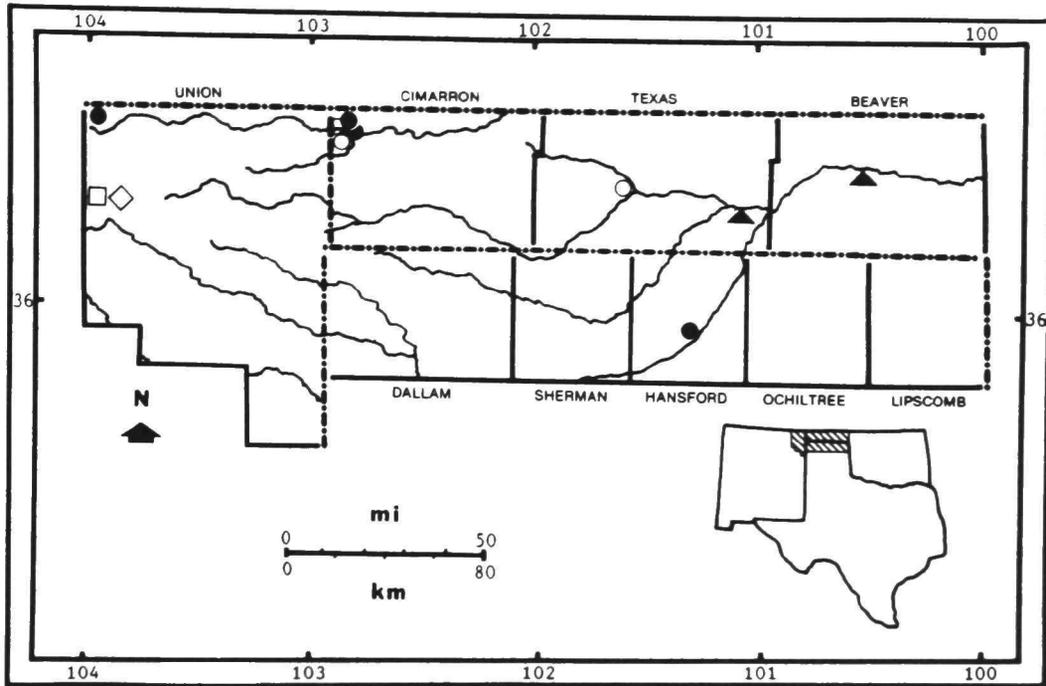


FIG. 2.—Distribution of *Sorex merriami* (diamond), *S. nanus* (square), *Cryptotis parva* (triangles), and *Notiosorex crawfordi* (circles) in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Cryptotis parva parva (Say, 1823)

Least Shrew

The least shrew is primarily an inhabitant of the eastern United States; on the southern Great Plains, it occurs in mesic grassland situations and riparian habitats. The species seems to be extending its range westward in the wake of agricultural land development (Armstrong, 1972; Owen and Hamilton, 1986), and it recently has been taken in extreme southeastern Colorado and southwestern Kansas (Choate and Reed, 1988), adjoining our study area to the north.

C. parva doubtless occurs in suitable habitats throughout the study area. Our two specimens document the presence of the species in the Oklahoma Panhandle (Fig. 2). A mummified specimen was recovered from a dry stocktank in sandy grassland in Beaver County along the Beaver River. The shrew from Texas County was taken at an abandoned homestead where a partially buried gallon bucket served as a pitfall. Fragments of a variety of insects, mostly beetles, indicated the shrew fed on similarly trapped animals while available; it probably had died the same morning it was discovered.

Specimens examined (2).—OKLAHOMA. Beaver Co.: 8 mi. W Beaver, 1. Texas Co.: 11.8 mi. E Hardesty, 1.

Notiosorex crawfordi crawfordi (Coues, 1877)

Desert Shrew

The desert shrew is not well represented in most collections, and once was considered rare; most workers now agree that its apparent scarcity is reflective of inadequacy of standard collecting techniques rather than actual rarity.

N. crawfordi is notably tolerant of a wide variety of habitats, including some that are quite arid. However, we found this shrew to be at least locally common in rocky situations in the piñon-juniper zone of Cimarron County (Fig. 2). At the Wiggins Ranch, just north of Kenton, a specimen was caught by hand as it traveled across a small clearing bounded by a low cliff and basalt talus on one side and scattered cedar shrubs and a fallen cottonwood trunk on the other. Fifteen pitfall traps were set just to the south of the site, five among large boulders and 10 along a low cliff among tall trees and dense low vegetation. Over the next six weeks, four desert shrews were taken among the boulders, but none was taken in the more mesic site along the cliff. At Tollgate Canyon, 15 pitfalls were set among boulders and at the base of a cliff on a steep hillside in an oak-pine woodland. In six weeks of trapping, a single specimen was taken.

Specimens examined (7).—NEW MEXICO. Union Co.: Tollgate Canyon, 10 mi. N Folsom, 1. OKLAHOMA. Cimarron Co.: 4 mi. N Kenton, 1; 3 mi. N Kenton, 1; 2 mi. N Kenton, 3. TEXAS. Hansford Co.: 10 mi. S, 3 mi. E Gruver, 1 (KU).

Literature records.—OKLAHOMA. Cimarron Co.: Tesequite Canyon. Texas Co.: 11.5 mi. N, 1 mi. E Goodwell.

Scalopus aquaticus aureus (Bangs, 1896)

Eastern Mole

A single specimen from Lipscomb County (Yates and Schmidly, 1977) documents the presence of the eastern mole in our study area, although there are numerous records to the south in Texas (Jones *et al.*, 1988), to the north in Kansas (Bee *et al.*, 1981), and in Colorado (Armstrong, 1972). Mole runs were noted in sandy areas along the Cimarron and Beaver rivers in the Oklahoma Panhandle, and T. L. Best (personal communication) reported mole sign north of Kenton, just a few miles from New Mexico. In many areas, mole runs were so common as to make walking difficult. However, our trapping efforts took place mostly during dry times of the year, and difficulty in distinguishing active burrow systems may account for our failure to collect specimens.

Numerous workers (Findley *et al.*, 1975; Jones *et al.*, 1988; T. A. Yates and T. L. Best, personal communications) have suggested that range of *S. aquaticus* probably extends into Union County, New Mexico. Although we did not note mole sign in that county, the species likely will be found there along river systems.

Literature records.—TEXAS. Lipscomb Co.: Lipscomb (Yates and Schmidly, 1977). Ochiltree Co.: Wolf Creek.

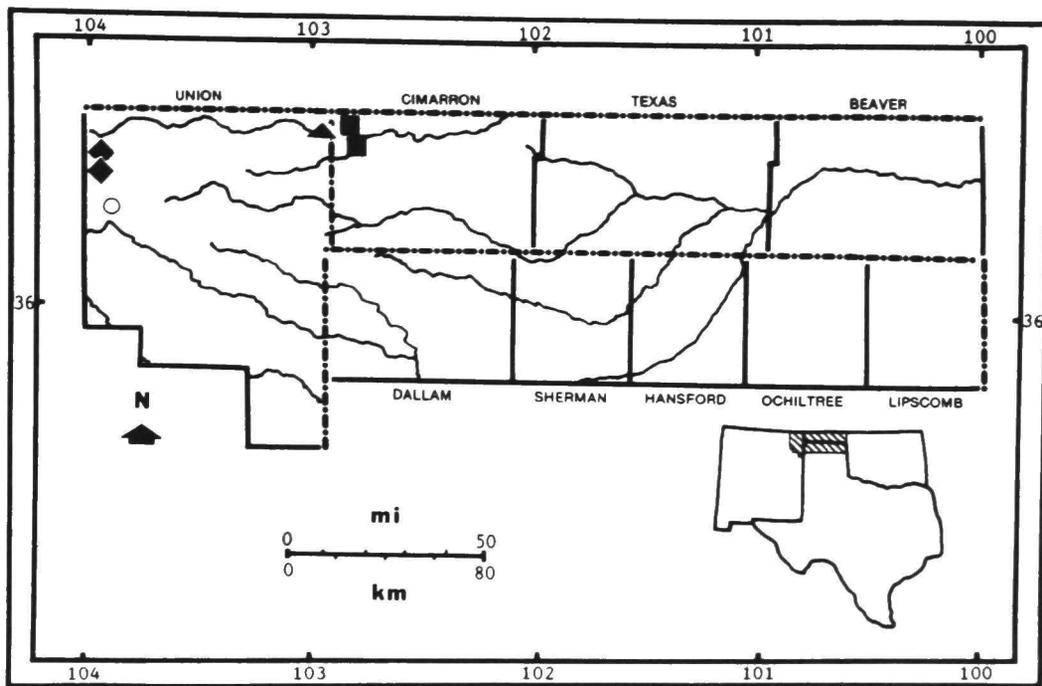


FIG. 3.—Distribution of *Myotis evotis* (diamonds), *M. ciliolabrum* (squares), *M. lucifugus* (circle), and *M. thysanodes* (triangle) in the trisstate study region. Solid symbols represent specimens examined; open symbol represents literature record.

Myotis evotis evotis (H. Allen, 1864)

Long-eared Myotis

The long-eared myotis has not been reported previously from the study area (Fig. 3), the nearest records being 12.5 mi. W Gardner, Colorado (Armstrong, 1972), and Vermejo River, New Mexico (Findley *et al.*, 1975).

On 27 July, a bat was seen emerging from a crevice in a waist-high block of basalt near the top of a large pressure ridge north of Capulin Mountain. Shattered basalt littered the surface of the ridge, and numerous piñons, junipers, and small oaks grew from crevices at the surface. The crevice from which the bat had emerged was hastily blocked, and, using long forceps, three other *M. evotis* were captured. One was an adult female. Two, one of each sex, were nearly grown young-of-the-year. The crevice from which the bats were taken was about 10 centimeters deep and one centimeter wide at the top; when pried apart, the bottom of the crevice was found covered with bat droppings. Deeper parts of the crevice were filled with black silt that was permeated with termite tunnels. The silt may have resulted from an accumulation of bat guano. A mist net set near the crevice took no bats the following night, although many were heard and seen flying over the lava plain at the base of the pressure ridge.

On 17 July, a long-eared myotis was taken in a mist net set over a stock tank on the Cornay Ranch, a mile north of where the three other specimens were collected. Tall piñons, junipers, and a few yellow pines grew nearby, and extensive grassy fields covered adjacent level areas. Barbour and Davis

(1969) noted a close association of *M. evotis* with yellow pine. Where these trees are scarce, tall junipers and piñons may, in part, serve as substitutes.

Specimens examined (4).—NEW MEXICO. Union Co.: 4 mi. N Capulin, 1; west base of Capulin Mountain, 3 mi. N Capulin, 3.

***Myotis ciliolabrum ciliolabrum* (Merriam, 1886)**

Western Small-footed Myotis

Glass (1949) and Glass and Ward (1959) reported several records of this small-footed myotis from Cimarron County, but Caire *et al.* (1990) referred many of these to *M. yumanensis*. We netted for bats on several occasions near where undoubted specimens of this uncommon species had been reported (Fig. 3), but took none.

Specimens examined (3).—OKLAHOMA. Cimarron Co.: North Carrizo Creek, below Black Mesa, 1 (OSU); mouth North Carrizo Creek, 1 (OSU); 3 mi. S, 1.5 mi. E Kenton, 1 (TTU).

***Myotis lucifugus carissima* Thomas, 1904**

Little Brown Myotis

The only record (Fig. 3) of this little brown bat from our study area is from Sierra Grande (Findley *et al.*, 1975). The main range of this species is the high country of New Mexico and Colorado, to the west and the north. *M. lucifugus* is known from south-central Kansas (Bee *et al.*, 1981) and may be found, therefore, to occur in eastern parts of the Texas and Oklahoma panhandles.

Literature record.—NEW MEXICO. Union Co.: Sierra Grande.

***Myotis thysanodes thysanodes* Miller, 1897**

Fringed Myotis

The fringed myotis has not been recorded previously in the tristate area (Fig. 3), the nearest stations of record (Hall, 1981) being Wooten, Colorado, and Montezuma, New Mexico.

On 16 August 1986, Jack Wiggins of Kenton took us to an old copper mine at the western base of Black Mesa, which had been abandoned at the turn of the century. The nearly straight shaft harbored approximately 300 *M. thysanodes*, 100 *M. yumanensis*, 200 *Plecotus townsendii*, and 50 *Tadarida brasiliensis*. Adult fringed myotis, all females, were found in association with young-of-the-year, which were nearly of adult size, but duller in color.

The mine tunnel was drilled into the base of the mesa. At the top of the mesa, perhaps 100 feet higher but only a few hundred feet to the east, is a rock cairn that we took to be the boundary marker between Oklahoma and New Mexico. The fringed myotis certainly occurs in Oklahoma, but netting over springs, stock tanks, and streams east of the mine produced only *M. yumanensis*.

Specimens examined (29).—NEW MEXICO. Union Co.: 5 mi. NNW Kenton, Oklahoma, 29.

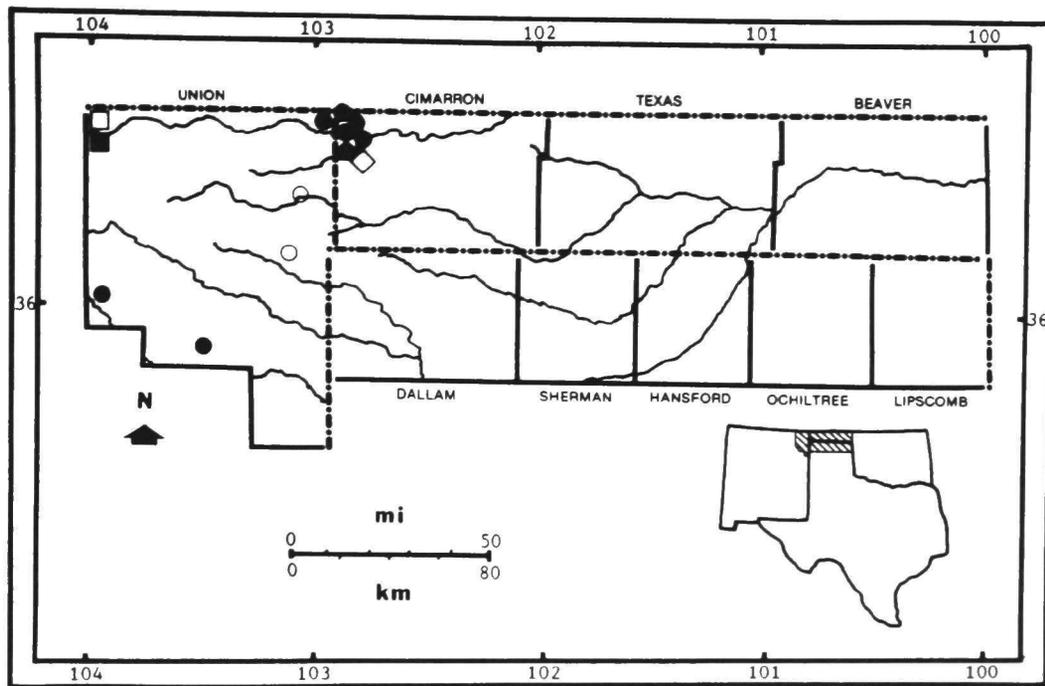


FIG. 4.—Distribution of *Myotis velifer* (diamond), *M. volans* (squares), and *M. yumanensis* (circles) in the trisate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Myotis velifer magnamolaris Choate and Hall, 1967

Cave Myotis

A single specimen of this species is known from the study area (Fig. 4), although it is known from caves and man-made structures in southern Kansas, and adjacent parts of Texas and Oklahoma, to the south and east. We follow Dalquest and Stangl (1984) in assigning bats of the Texas and Oklahoma panhandles to *M. v. magnamolaris*.

Literature record.—OKLAHOMA. Cimarron Co.: Black Mesa State Park, 8 mi. SE Kenton.

Myotis volans interior Miller, 1914

Long-legged Myotis

The only records of the long-legged myotis from our study area are from the westernmost border of Union County (Fig. 4). The specimen examined is from a site where there are numerous cliffs cloaked in piñon and juniper, with a few scattered yellow pines.

Specimen examined (1).—NEW MEXICO. Union Co.: 4 mi. N Capulin, 1.

Literature record.—NEW MEXICO. Union Co.: Raton Range, Oak Canyon.

Myotis yumanensis yumanensis (H. Allen, 1864)

Yuma Myotis

The Yuma myotis seems to be the common myotis of the piñon-juniper zone in Cimarron and Union counties (Fig. 4). Perhaps the lack of suitable daytime retreats explains the apparent absence of this species from prairies

to the east, although we did collect specimens on 27 July from the attic of an old garage near Gladstone, Union County—two lactating females and their young. The two young animals, still in gray juvenile pelage, each weighed 6.4, 0.1, and 0.2 grams more than their respective mothers.

M. yumanensis was the second most common bat in the copper mine where *M. thysanodes* was taken. Although the bats tended to segregate by species into clusters of 10 to 30 animals, an occasional yuma myotis was found within groups of the larger fringed myotis.

Specimens from our study area are quite uniform in color—dark brownish gray. They are darker than topotypes of *M. y. yumanensis*, the race Hall (1981) mapped as occurring in New Mexico, and darker than specimens in a comparative series from Trans-Pecos Texas. Pending a needed systematic review of the species, we only tentatively use the subspecific name *yumanensis*.

Specimens examined (142).—NEW MEXICO. Union Co.: 5 mi. NW Kenton, Oklahoma, 24; 4 km. N, 17 km. W Kenton, Oklahoma, 1; 2.7 mi. E Gladstone, 4; 15 mi. W Clapham, 1. OKLAHOMA. Cimarron Co.: Carrizo Creek, 6 mi. N Kenton, 3 (OSU); 5 mi. NNW Kenton, 3; 4 mi. N Kenton, 2; Kenton, 6 (OSU); 3 mi. N, 1 mi. E Kenton, 4 (TTU); 5 mi. S, 2 mi. E Kenton, 3 (TTU); 4.3-4.5 mi. S, 2.4 mi. E Kenton, 4 (TTU); 1.5 mi. S, 3 mi. E Kenton, 6 (TTU); 3 mi. S, 2 mi. E Kenton, 6 (TTU); 3 mi. SE Kenton, 3; Carrizo Creek, 1 (OSU); Cimarron River, 6 (OSU); Cimarron River, near mouth of North Carrizo Creek, 5 (OSU); Cimarron River, E mouth North Carrizo Creek, 3 (OSU); cave, Tesequite Canyon, 7 mi. SE Kenton, 21 (OSU); Pigeon Cave, 2 (OSU); cave, NW Tesequite Canyon, 13 (OSU); Tesequite Canyon Cave, 21 (OSU).

Literature records.—NEW MEXICO. Union Co.: 5.5 mi. NE Folsom; 6 mi. S, 3 mi. W Kenton, Oklahoma; 0.5 mi S, 0.5 mi. W Moses; Clayton, Apache Canyon.

Lasionycteris noctivigans (Le Conte, 1831)

Silver-haired Bat

The silver-haired bat, which is a monotypic species, has not been recorded previously from the study area. Our specimens are all from the vicinity of Black Mesa in Oklahoma. We are uncertain whether this bat is resident in the western part of the study area or occurs there only as a migrant, which seems more likely. Three were captured in nets set over a spring on the Wiggins Ranch just north of Kenton on 18 April, but nets over the same spring took no specimens on 21 June. All three specimens were females, and none exhibited gross reproductive activity. The other eight individuals were collected in September (two) and October, all presumably migrants moving southward (Jones and Manning, 1990b).

Specimens examined (11).—OKLAHOMA. Cimarron Co.: 4.5 mi. N Kenton, 3; 1.5 mi. S, 3 mi. E Kenton, 6 (TTU); 3 mi. S, 2 mi. E Kenton, 2 (TTU).

Pipistrellus hesperus maximus Hatfield, 1936

Western Pipistrelle

The western pipistrelle emerges quite early in the evening from rock crevices where it spends the day. It flies in a characteristic, fluttery fashion, and individuals are relatively easy to shoot by evening light. We would have expected the species to be relatively abundant throughout the piñon-juniper

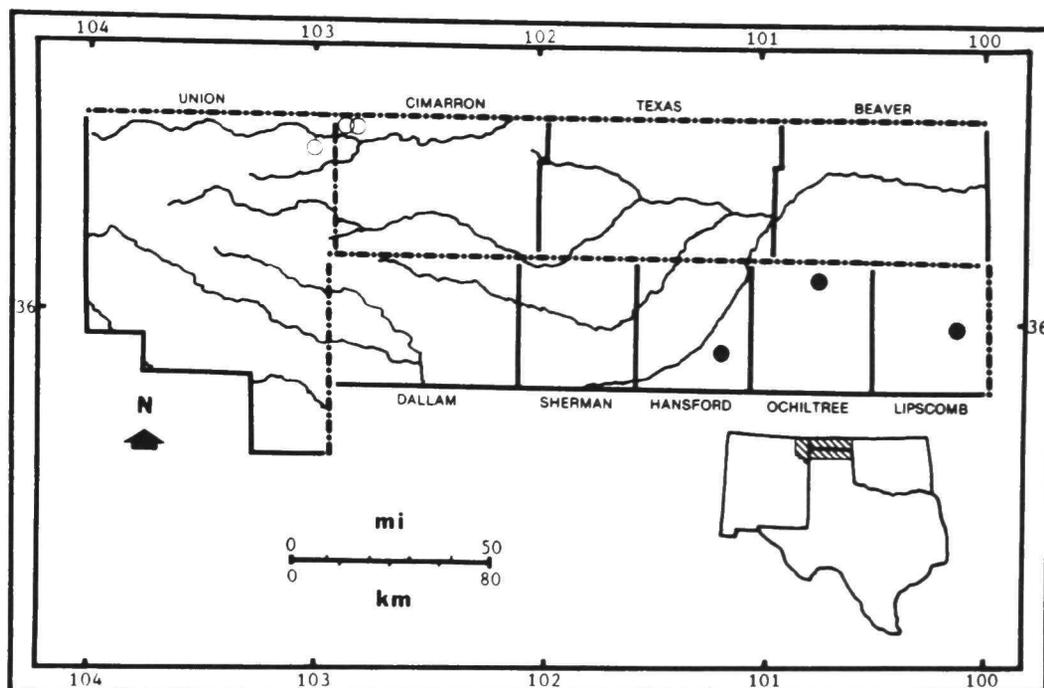


FIG. 5.—Distribution of *Eptesicus fuscus* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

zone, but we took none in that habitat. Nevertheless, it apparently is an uncommon resident, based on the single literature record.

Literature record.—NEW MEXICO. Union Co.: 3 mi. W Kenton, Oklahoma.

Eptesicus fuscus fuscus (Palisot de Beauvois, 1796)

Big Brown Bat

The big brown bat has a widespread distribution (Fig. 5), but Manning *et al.* (1989) have demonstrated that the species actually is quite localized in the Texas Panhandle. Records indicate that *E. fuscus* is present in the eastern and western parts of our study area; we believe that absence of records from elsewhere in the Texas and Oklahoma panhandles are not artifactual. The limiting factor may be the unavailability of suitable daytime retreats because there are no caves and few hollow trees on these prairies. However, big brown bats use man-made structures for roosts as well.

On 24 June 1987, Jim Brussard took us to an old barn, 3 mi. E Lipscomb, where bats had been permitted to live for many years. Approximately 100 *Eptesicus* were found residing in the barn; most were females with small, non-volant young attached to their teats. Representative adult and young animals were retained, although in the process, the colony was disturbed and we were unable to ascertain individual litter sizes.

Records from the Black Mesa regions of Oklahoma and New Mexico come from both the piñon-juniper zone, and from where level prairies interdigitate with wooded canyons leading to the Cimarron River.

Manning *et al.* (1989) tentatively referred specimens from northwestern Texas, including the Panhandle, to the subspecies *E. f. pallidus*, noting that

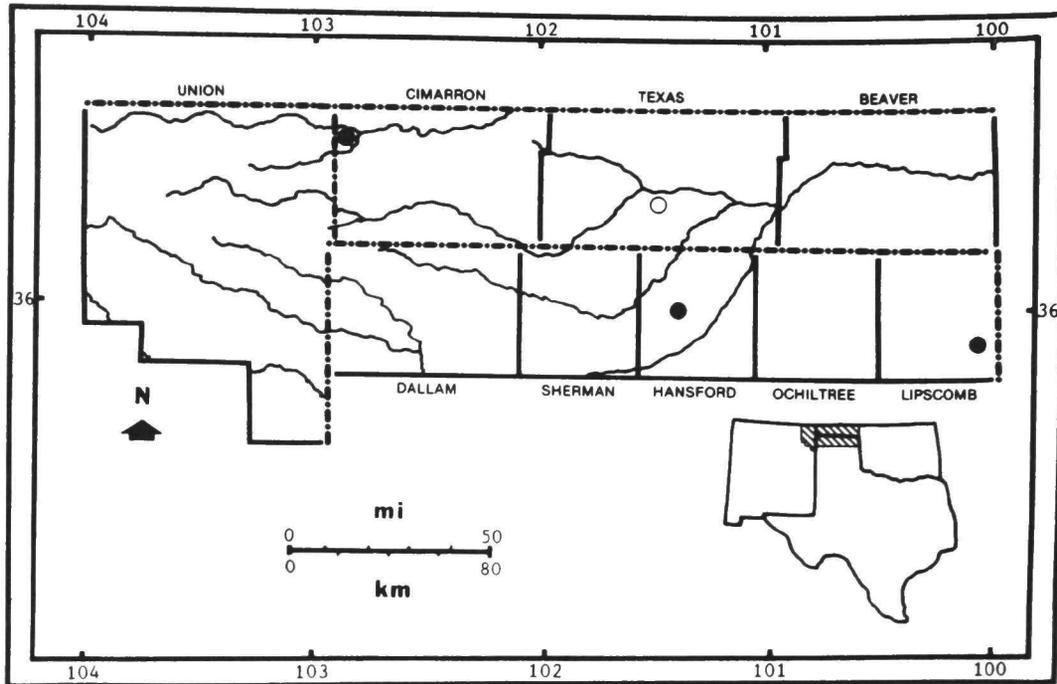


FIG. 6.—Distribution of *Lasiurus borealis* in the tristate study region. Solid symbols represent specimens examined; open symbol represents literature record.

they resembled the latter in color but *E. f. fuscus* of eastern Texas in size. These authors, however, had no data from northwestern Texas on litter size—female *pallidus* typically bear a single offspring whereas those of *fuscus* normally have twins. In the spring of 1989, Jones and Manning (1990a) took females in Garza County that carried twin fetuses, prompting them to opine that big brown bats from the Panhandle region, although intergrades, should be assigned to the race *fuscus* (see also Burnett, 1983).

Specimens examined (12).—TEXAS. Hansford Co.: Spearman, 1 (TTU). Lipscomb Co.: 3 mi. E Lipscomb, 7. Ochiltree Co.: Perryton, 4 (TTU).

Literature records.—NEW MEXICO. Union Co.: 3 mi. W Kenton, Oklahoma. OKLAHOMA. Cimarron Co.: N Carrizo Creek; Carrizo Creek, 6 mi. N Kenton; Dripping Springs, 6 mi. N, 4 mi. E Kenton.

Lasiurus borealis (Müller, 1776)

Eastern Red Bat

Records indicate that the red bat occurs sparingly along riparian habitat throughout the Texas and Oklahoma panhandles, where large trees afford suitable roosting situations (Fig. 6). We follow Baker *et al.* (1988) in listing *L. borealis* as a monotypic species.

Specimens examined (4).—OKLAHOMA. Cimarron Co.: 1.5 mi. S, 3 mi. E Kenton, 2 (TTU). TEXAS. Hansford Co.: Gruver, 1 (KU). Lipscomb Co.: 8 mi. NW Higgins, 1 (TTU).

Literature record.—OKLAHOMA. Texas Co.: Guymon.

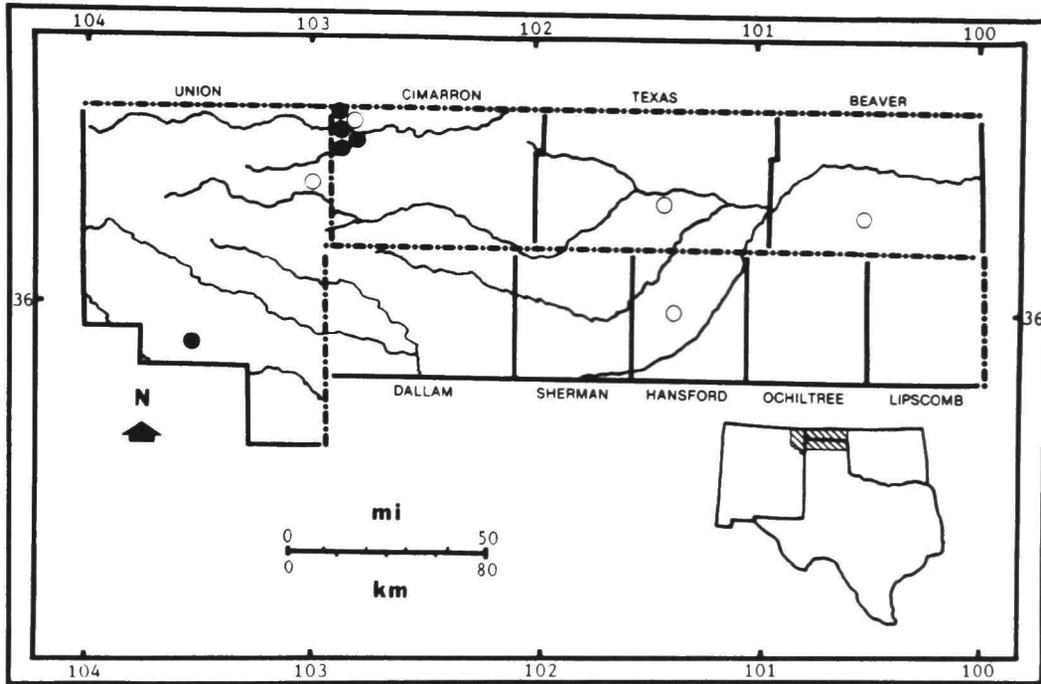


FIG. 7.—Distribution of *Lasiurus cinereus* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Lasiurus cinereus cinereus (Palisot de Beauvois, 1796)

Hoary Bat

The hoary bat is a tree-roosting migrant. Most of our records are from April and May from the piñon-juniper zone (Fig. 7), and of migrants from September and October. Migrating individuals might be expected to occur anywhere in the region where suitable habitat prevails.

Jones *et al.* (1988) speculated that *L. cinereus* spends the warmer months, and presumably also rears young, north of the Texas Panhandle, although a female obtained on 16 May from Roberts County, Texas (adjacent to Ochiltree County), to the south was pregnant with two fetuses (crown-rump length, 12). On 13 May, a pregnant female carrying two near-term fetuses of similar size was taken in southern Union County. It is possible that at least some females are residents of the region during warmer months of the year. One from 3 mi. SE Kenton, taken on 20 April, was not visibly pregnant. Most of our specimens were late summer or autumn migrants (Jones and Manning, 1990b).

Specimens examined (26).—NEW MEXICO. Union Co.: 15 mi. W Clapham, 2. OKLAHOMA. Cimarron Co.: 5 mi. NNW Kenton, 3; 3 mi. S, 2 mi. E Kenton, 12 (TTU); 4 mi. S, 2 mi. E Kenton, 2 (TTU); 4.3-4.5 mi. S, 2.4 mi. E Kenton, 4 (TTU); 1.5 mi. S, 3 mi. E Kenton, 2 (TTU); 3 mi. SE Kenton, 1.

Literature records.—NEW MEXICO. Union Co.: N of Moses. OKLAHOMA. Beaver Co.: 3 mi. S, 2 mi. W Elmwood. Cimarron Co.: 2.5 mi. SE Kenton; Carrizo Creek, 6 mi. N Kenton. TEXAS. Hansford Co.: Gruver (Cutter, 1959b).

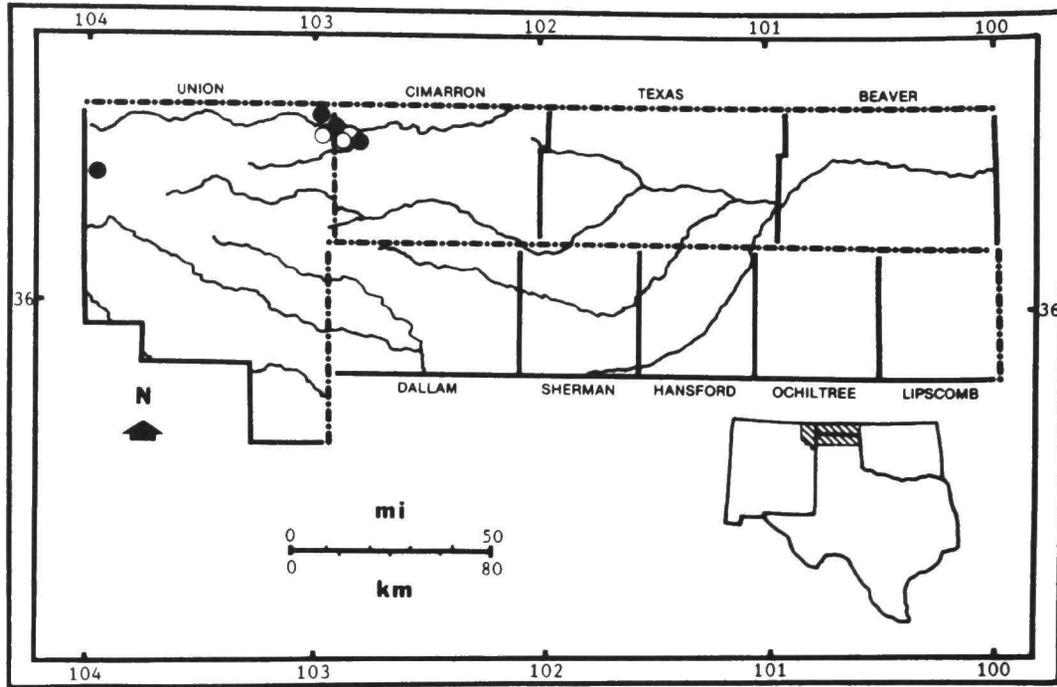


FIG. 8.—Distribution of *Plecotus townsendii* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Plecotus townsendii pallescens (G. S. Miller, 1897)

Townsend's Big-eared Bat

Availability of caves for daytime retreats is probably the factor limiting distribution of Townsend's big-eared bat. In northwestern Cimarron County and in northeastern Union County, the Cheyenne Sandstone is a cliff- and cave-forming stratum that supports colonies of this and other species of bats. Farther west, in the basalt lava flows in the Capulin Mountain volcanic region, lava caves support populations of *Plecotus*.

Because the big-eared bat also roosts in sheltered attics and barns, it may range occasionally into the prairie parts of the study region, but we know of none taken east of the Black Mesa-Kenton area (Fig. 8). This species is more abundant than our collections indicate, because many individuals were released from mist nets or examined but left unmolested in caves.

Specimens examined (9).—NEW MEXICO. Union Co.: 8 mi. S Capulin, 1; 5 mi. NW Kenton, Oklahoma, 4. OKLAHOMA. Cimarron Co.: 4 mi. SSE Kenton, 4.

Literature records.—NEW MEXICO. Union Co.: 3 mi. W Kenton, Oklahoma. OKLAHOMA. Cimarron Co.: Tesequite Canyon Cave.

Antrozous pallidus bunkerii Hibbard, 1934

Pallid Bat

The pallid bat is a colonial species, spending the day in small groups in rock crevices, spaces between support beams of bridges, or in gaps between boards of old buildings. Although a heavy-bodied bat, individuals can creep into surprisingly narrow spaces. Suitable daytime roosts are found throughout most of the tristate region. Habitat, and not available roosting

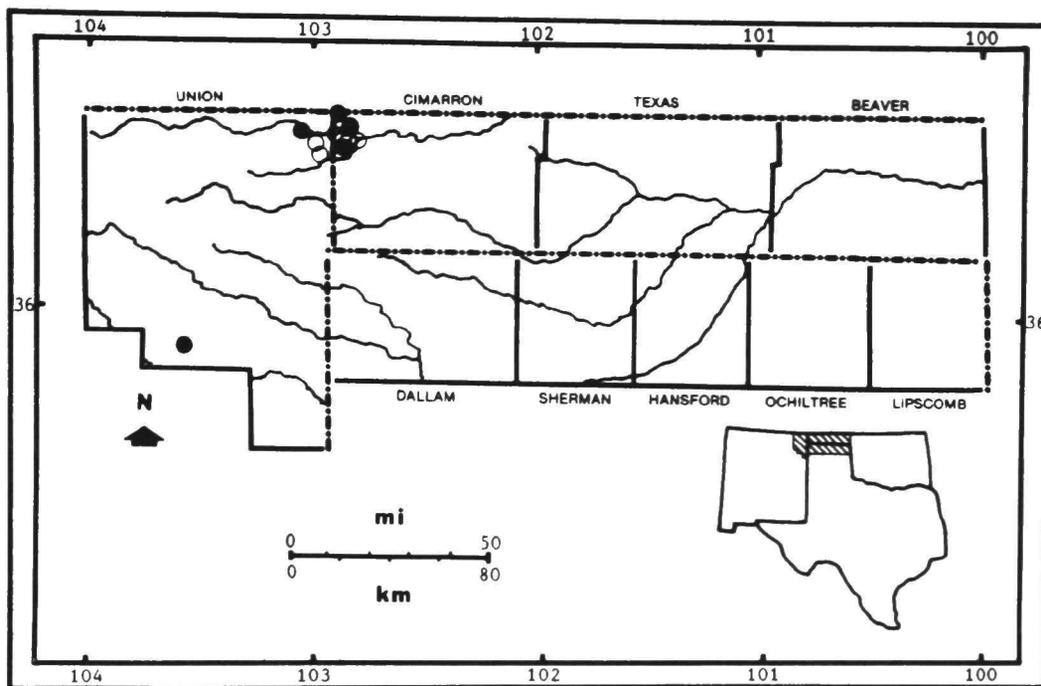


FIG. 9.—Distribution of *Antrozous pallidus* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

sites, seems to govern the range of this species. Manning *et al.* (1988) recently assigned pallid bats from the Texas and Oklahoma panhandles and adjacent parts of New Mexico to the subspecies *A. p. bunkerii*.

All known specimens from our study area are from New Mexico and the Black Mesa region of Oklahoma (Fig. 9). Most were caught in mist nets set over water. Surrounding land was usually arid, with cliffs and adjacent grasslands nearby. Many netted individuals were released after representative voucher material had been secured. Females taken from mid-July to early August were lactating, and accompanied by nearly adult-sized juveniles.

Specimens examined (19).—NEW MEXICO. Union Co.: 4 km. N, 17 km. W Kenton, Oklahoma, 2; 15 mi. W Clapham, 1. OKLAHOMA. Cimarron Co.: 5 mi. NNW Kenton, 2; 4.5 mi. N Kenton, 2; 4 mi. N Kenton, 1; 3 mi. S, 2 mi. E Kenton, 2 (TTU); 1.5 mi. S, 3 mi. E Kenton, 1 (TTU); 3 mi. S, 2.4 mi. E Kenton, 1 (TTU); 4.3 mi. S, 2.4 mi. E Kenton, 2 (TTU); 3 mi. SSE Kenton, 5.

Literature records.—NEW MEXICO. Union Co.: 6 mi. S, 3 mi. W Kenton, Oklahoma; 3 mi. W Kenton, Oklahoma. OKLAHOMA. Cimarron Co.: Carrizo Creek; Asa Jones barn, Kenton; Regnier Ranch, 2 mi. N, 1 mi. E Kenton; Regnier Ranch, 2 mi. S, 1 mi. E Kenton; north side Black Mesa, 6 mi. N Kenton; 3 mi. N Kenton; Pigeon Cave, 0.5 mi. N, 2 mi. E Kenton; 5 mi. S Kenton; bat cave, Tesequite Canyon; Tesequite Bat Cave; Tesequite Canyon Cave.

Tadarida brasiliensis mexicana (Saussure, 1860)

Brazilian Free-tailed Bat

This free-tailed bat is common throughout the southern United States. It is a colonial species, occupying attics of buildings and sometimes forming enormous colonies in caves. Absence of records from the eastern part of the study area (Fig. 10) probably reflects a paucity of suitable daytime retreats. Habitat preferences are variable inasmuch as this insectivorous species may

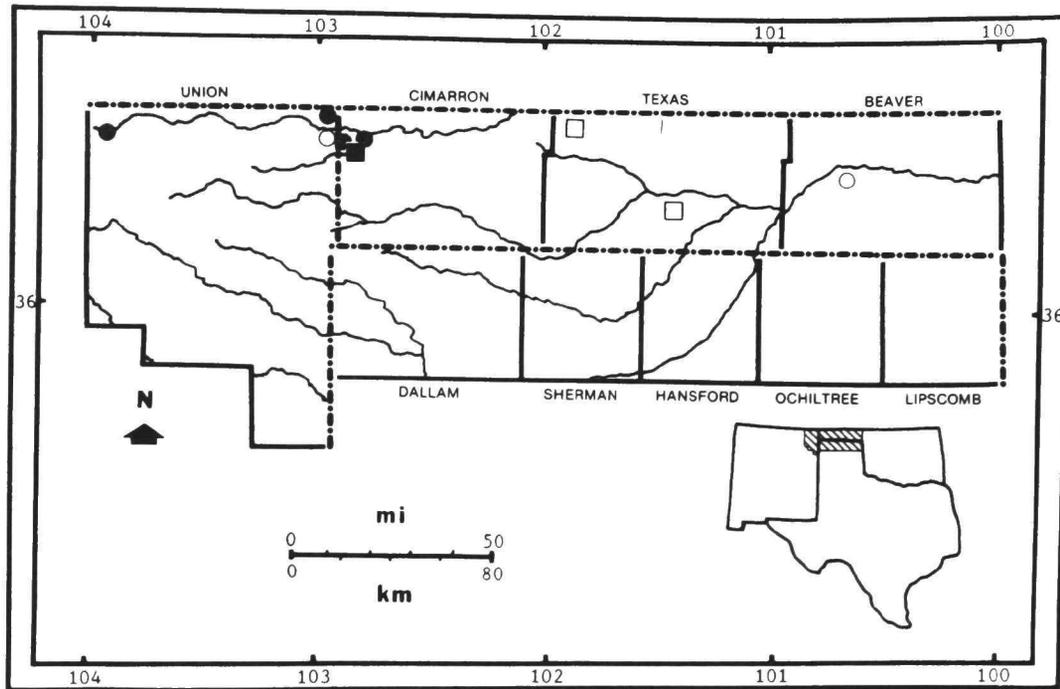


FIG. 10.—Distribution of *Tadarida brasiliensis* (circles) and *Nyctinomops macrotis* (squares) in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

feed at relatively great heights and at relatively great distances from roosting sites.

The piñon-juniper zone of the western part of the study area would seem to be ideal for *T. brasiliensis*, with abundant cliffs and mountains of sandstone and basalt. However, we found it to be only moderately common there. About 50 individuals were noted in a copper mine in northeastern Union County on 15-16 August. Seven were taken in a mist net set across a cave entrance in Tesequite Canyon on 20 April, and another was netted on 23 August over the plunge pool of Folsom Falls in western Union County. Many specimens, all female, were released after examination.

Specimens examined (14).—NEW MEXICO. Union Co.: 5 mi. NW Kenton, Oklahoma, 3; Folsom Falls, 4 mi. NE Folsom, 1. OKLAHOMA. Cimarron Co.: 4.4-4.5 mi. S, 2.4 mi. E Kenton, 2 (TTU); 3 mi. S, 2 mi. E Kenton, 5 (TTU); 4 mi. SSE Kenton, 3.

Literature records.—NEW MEXICO. Union Co.: 3 mi. W Kenton, Oklahoma. OKLAHOMA. Beaver Co.: T. 4 S, R. 13 E, sec. 7; Cimarron Co.: Pigeon Cave; Tesequite Canyon Cave.

Nyctinomops macrotis (Gray, 1839)

Big Free-tailed Bat

Less colonial than the smaller *Tadarida brasiliensis*, the big free-tailed bat is a strong, far-ranging flier. Records from extreme ends of the Oklahoma Panhandle (Fig. 10) indicate this species may be taken any place in the tristate region during seasonal migration. It is doubtful that this monotypic species is a summer resident there.

Specimen examined (1).—OKLAHOMA. Cimarron Co.: 2 mi. E, 3 mi. S Kenton (TTU).

Literature record.—OKLAHOMA. Texas Co.: 4 mi. S Elkhart; Guymon.

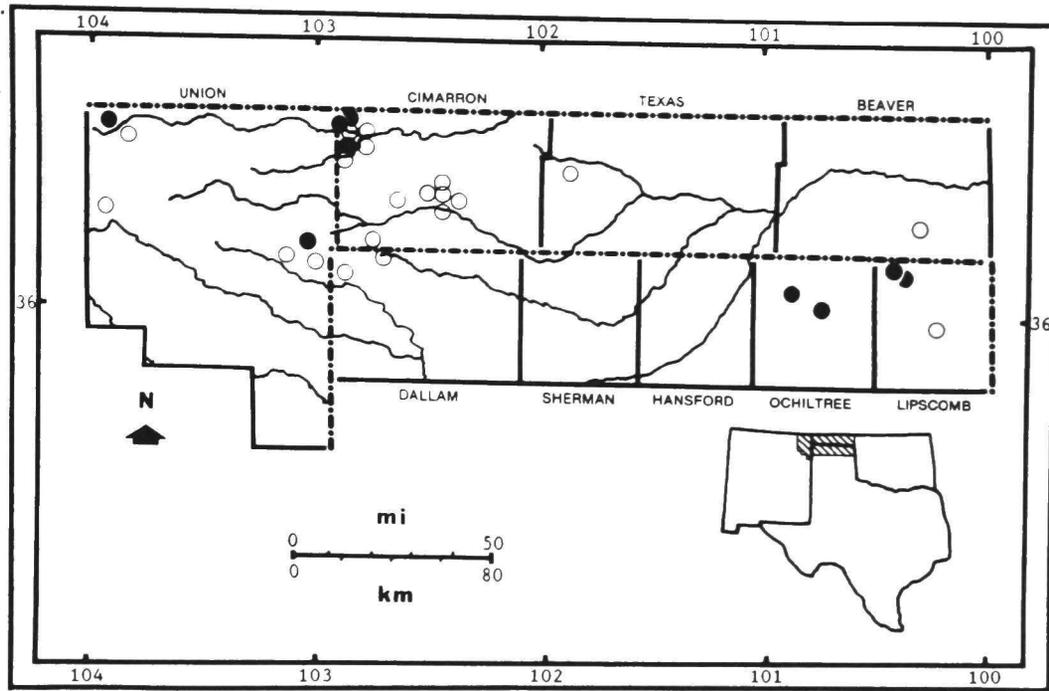


FIG. 11.—Distribution of *Sylvilagus audubonii* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Dasyus novemcinctus mexicanus Peters, 1864

Nine-banded Armadillo

We have no voucher specimens of the armadillo from the study area, although Hollander *et al.* (1987) noted a road-killed animal from Lipscomb County. Armstrong (1972) suspected that armadillos occur at least intermittently along the Cimarron River and its tributaries. Records from north-eastern Colorado (Choate and Pinkham, 1988) indicate an expanding range, and the species is probably at least an occasional member of the fauna.

Literature record.—TEXAS. Lipscomb Co.: 7 mi. NW Higgins (Hollander *et al.*, 1987).

Sylvilagus audubonii neomexicanus Nelson, 1907

Desert Cottontail

The desert cottontail is the most widely distributed of the three cottontails in the study area, especially to the west (Fig. 11), and also is the most abundant. It retreats by day to cover in thickets and rocks, or, if these are not available, the shade of an isolated mesquite or clump of grass. At night, it ranges over grassy areas and openings in piñon-juniper brushland. Roadside greenery evidently is tempting to these rabbits because many individuals are killed on roadways by motor vehicles.

In the western part of the tristate region, this rabbit may be distinguished from *S. nuttallii* by its paler color. Farther east, in the Texas and Oklahoma panhandles, it is sometimes difficult to separate *S. audubonii* from *S. floridanus* based solely on external characters, although the latter has shorter ears. Skulls can be separated readily by the large size of the bullae of the desert

cottontail, and it also can be distinguished from other cottontail species in the area by characters of the lower P4 (Dalquest *et al.*, 1989).

Half-grown or smaller individuals were taken near Kenton on 30 July and 15 August. Adult males obtained on 18 April and 30 July had scrotal testes (38 and 46 in length).

Specimens examined (14).—NEW MEXICO. Union Co.: 8 mi. NNE Folsom, 1; Rabbit Ears Mountain, 1. OKLAHOMA. Cimarron Co.: 5 mi. N Kenton, 2; 5 mi. NNW Kenton, 4; 4.5 mi. NNW Kenton, 1; 3.4 mi. S, 2.4 mi. E Kenton, 1 (TTU). TEXAS. Lipscomb Co.: 2.5 mi. E Booker, 1 (WTSU); 4 mi. E Booker, 1 (WTSU). Ochiltree Co.: 2 mi. S, 4 mi. E Perryton, 1 (TTU); 7 mi. S, 2 mi. E Perryton, 1 (TTU).

Literature records.—NEW MEXICO. Union Co.: Clayton, Apache Canyon; 7 mi. W Clayton; Perico Arroyo, W Mt. Clayton; Emory Peak; Sierra Grande. OKLAHOMA. Beaver Co.: 10.4 mi. E Elmwood. Cimarron Co.: Boise City; N Canadian River, S Boise City; 3 mi. W Boise City; 4 mi. N Boise City; 0.5 mi. S, 4.5 mi. E Boise City; 17 mi W Boise City. Cimarron Co.: 3 mi. WSW Felt; Kenton; 0.5 mi. SE Kenton; 2 mi. S, 4 mi. E Kenton; 2 mi. S, 5 mi. E Kenton; 0.8 mi. S, 2.1 mi. E Kenton; 2.5 mi. S Kenton; 2.5 mi. S, 4 mi. E Kenton; 3 mi. N Kenton; 3 mi. NE Kenton; 3 mi. S Kenton; 2.5 mi. S Kenton; 2.5 mi. SE Kenton; 4 mi. NE Kenton; 5 mi. N Kenton; 6 mi. N Kenton; 6 mi. S, 2 mi. E Kenton; 8 mi. S Kenton; Tesequite Canyon; Tesequite Canyon, 4.4 mi. from hwy. Texas Co.: 2 mi. E Eva. TEXAS. Dallam Co.: 16 mi. ENE Texline; Texline (Nelson, 1909); Buffalo Springs (Bailey, 1905). Lipscomb Co.: Lipscomb (Nelson, 1909).

Sylvilagus floridanus llanensis Blair, 1938

Eastern Cottontail

The eastern cottontail ranges across the panhandles of Texas and Oklahoma, but there are few actual records from the latter state (Fig. 12). Although occupying much the same general areas as the desert cottontail, the two species are generally found in different habitats. *S. floridanus* prefers agricultural lands, pastures, and the environs of towns and buildings. The desert cottontail generally avoids mesic habitats, preferring sheltered areas on open prairie and arid brushland. In the piñon-juniper zone of the Black Mesa area, we found *S. audubonii* only, but we suspect that *S. floridanus* occurs in eastern and southern Cimarron County.

Findley *et al.* (1975) did not record the eastern cottontail from Union County. However, we found it present in at least the extreme eastern part of the county. An adult female collected in Beaver County on 17 May was lactating.

Specimens from the Texas and Oklahoma panhandles clearly are referable to *S. f. llanensis*. Hall (1981) mapped a distributional hiatus in eastern New Mexico as separating populations from the panhandles from those of eastern New Mexico. The specimen from west of Clayton bridges this gap, and compares favorably with *S. f. llanensis* to the east.

Specimens examined (11).—NEW MEXICO. Union Co.: 1 mi. W Clayton, 1. OKLAHOMA. Beaver Co.: 2 mi. N Beaver, 1. TEXAS. Dallam Co.: 10 mi. E Texline, 2 (TTU); 16 mi. E Dalhart, 1 (TTU). Hansford Co.: 10 mi. S, 3 mi. W Gruver, 1 (KU). Lipscomb Co.: 4 mi. E Booker, 1 (WTSU). Ochiltree Co.: 2 mi. S, 4 mi. E Perryton, 1 (TTU); 12 mi. S, 9 mi. E Perryton, 1 (TTU); 9 mi. S, 11 mi. E Spearman, 2 (TTU).

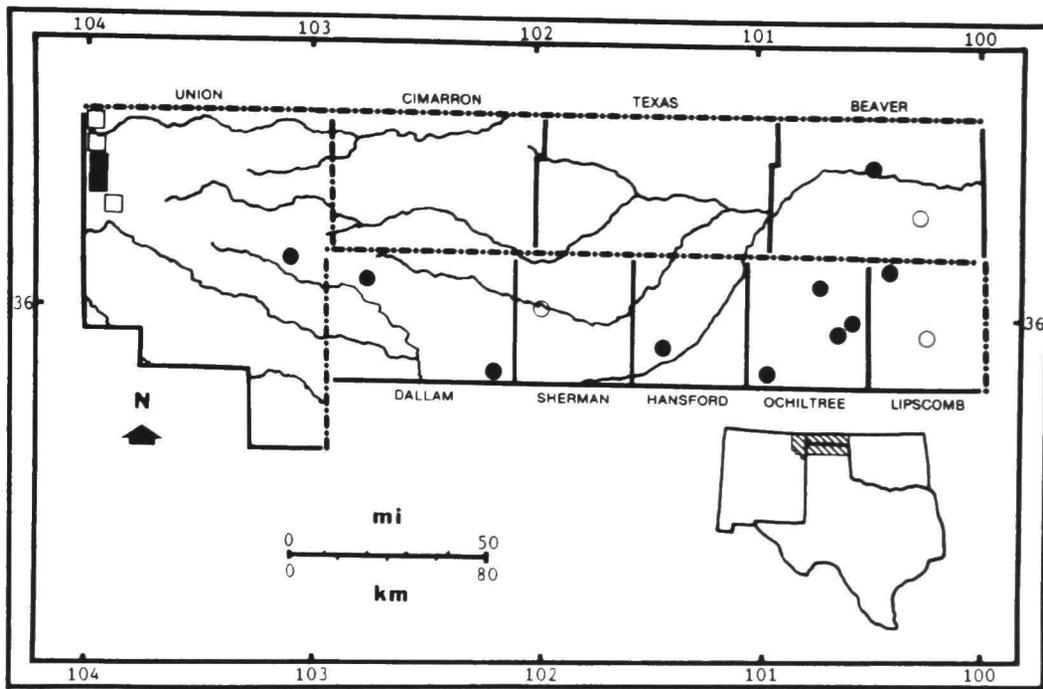


FIG. 12.—Distribution of *Sylvilagus floridanus* (circles) and *S. nuttallii* (squares) in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Literature records.—OKLAHOMA. Beaver Co.: 5 mi. E, 3 mi. N Elmwood; N Canadian River, 4 mi. S Floris. Cimarron Co.: 6.6 mi. W Boise City; 8 mi. E Felt. TEXAS. Dallam Co.: 6 mi. SW Stratford. Lipscomb Co.: Lipscomb (Nelson, 1909).

Sylvilagus nuttallii pinetus (J. A. Allen, 1894)

Nuttall's or Mountain Cottontail

The mountain cottontail has been recorded previously from Oak Canyon in extreme northwestern Union County (Fig. 12). A desert cottontail was taken in typical habitat for *S. nuttallii* in adjacent Tollgate Canyon. We suspect that, in this area at least, *S. audubonii* is invading areas formerly occupied by the mountain cottontail. However, in the Capulin Mountain area a short distance to the south, *S. nuttallii* still occurs, and at considerably lower elevations than in Tollgate Canyon.

A recently weaned young animal (112.5 in weight) was obtained north of Capulin on 19 July.

Specimens examined (3).—NEW MEXICO. Union Co.: 5 mi. N Capulin, 1; base of Capulin Mountain, 2.

Literature records.—NEW MEXICO. Union Co.: Raton Range, Oak Canyon, 5 mi. N Folsom; Sierra Grande.

Lepus californicus melanotis Mearns, 1890

Black-tailed Jackrabbit

In past years, the black-tailed jackrabbit had been an abundant animal throughout most of the study area. This was true when our collecting efforts first were begun in the 1960s. However, when our activities were resumed

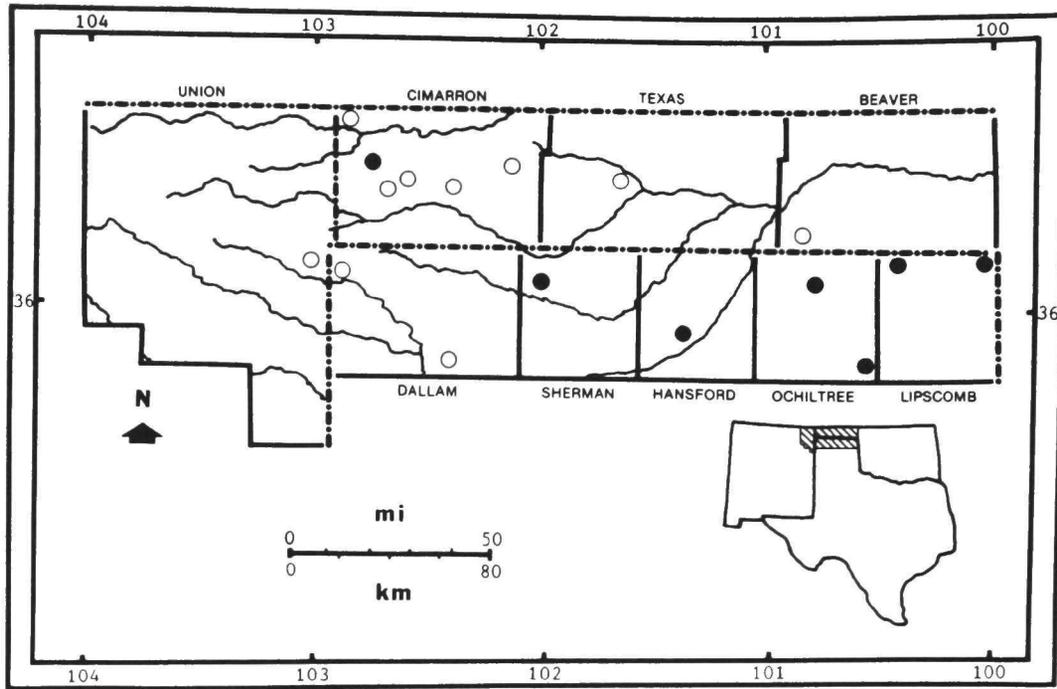


FIG. 13.—Distribution of *Lepus californicus* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

in 1983, we found jackrabbits to be uncommon. Whereas in past years road-killed corpses littered the highways, one can now travel for many miles without seeing one. Jackrabbits still are widely distributed throughout the study area (Fig. 13), and even occur in clearings in the piñon-juniper zone, but seem to be absent in higher clearings, at the margin of yellow pines.

Specimens examined (7).—OKLAHOMA. Cimarron Co.: 27 mi. WNW Boise City, 1. TEXAS. Hansford Co.: 1 mi. S, 2 mi. E Gruver, 1 (KU). Lipscomb Co.: 1.5 mi. N, 3 mi. W Catesby, Oklahoma, 1 (WTSU); 2 mi. E Booker, 1 (WTSU). Ochiltree Co.: 0.25 mi. S Perryton, 1 (TTU); 9 mi. S, 11 mi. E Spearman, 1 (TTU). Sherman Co.: 5 mi. N Stratford, 1 (TTU).

Literature records.—NEW MEXICO. Union Co.: Clayton. OKLAHOMA. Beaver Co.: 0.5 mi. S, 5 mi. W Gray; Cimarron Co.: 4.6 mi. W Boise City; 6 mi. W Boise City; 17 mi. E, 5 mi. N Boise City; 17 mi. W Boise City; 4.4 mi. N, 1 mi. W Kenton; 1 mi. N, 10 mi. E Wheelless; 1 mi. N, 15 mi. E Wheelless; T. 4 N, R. 3 E., sec. 36. Texas Co.: 6 mi. N, 14 mi. W Guymon. TEXAS. Dallam Co.: Texline (Nelson, 1909); 5 mi. N Dalhart. Lipscomb Co.: Lipscomb (Nelson, 1909).

Tamias quadrivittatus quadrivittatus (Say, 1823)

Colorado Chipmunk

The Colorado chipmunk is found throughout much of the higher parts of the piñon-juniper zone of Union County and on the Black Mesa of Oklahoma (Fig. 14). Despite its extensive range, we found it uncommon and collected few specimens. At Trampiros Creek in southern Union County, we noted remains of piñon cones, scattered on large boulders, that appeared to have been opened by chipmunks.

In the summer of 1968, Dalquest noted a chipmunk on the eastern peak of Rabbit Ears Mountain, in Union County, just a few miles from the Texas border. Subsequent attempts to secure chipmunks, or find evidence of their

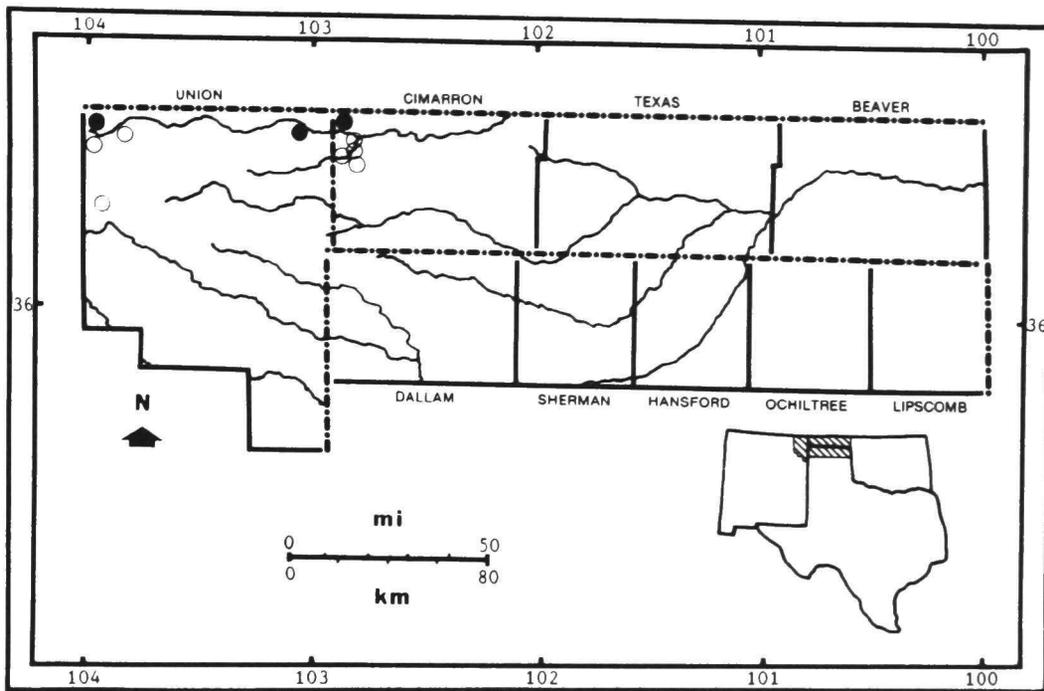


FIG. 14.—Distribution of *Tamias quadrivittatus* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

continued presence there, have failed. An adult male taken near Kenton on 18 April had scrotal testes measuring 17 in length.

Specimens examined (4).—NEW MEXICO. Union Co.: 10 mi. N Folsom, 1; 4 km. N, 17 km. W Kenton, 1. OKLAHOMA. Cimarron Co.: 5 mi. NNW Kenton, 1; 4.5 mi. NNW Kenton, 1.

Literature records.—NEW MEXICO. Union Co.: Emory Peak; Folsom; Sierra Grande. OKLAHOMA: Cimarron Co.: canyon, E of North Carrizo Creek; 0.5 mi. SE Kenton; T. 4 N, R. 1 E, sec. 5, 3.5 mi. S, 0.5 mi. W Kenton; 1 mi. S, 2 mi. E Kenton; 6 mi. S, 2 mi. E Kenton; 3 mi. S, 2.5 mi. E Kenton; 4 mi. SE Kenton; 4.2 mi. S, 0.5 mi. E Kenton; 4.2 mi. S, 0.8 mi. W Kenton; 4.5 mi. SE Kenton; rocks above Spring Canyon, Regnier Ranch, 5 mi. S Kenton; 1.5 mi. S, 5.5 mi. E Kenton.

Spermophilus spilosoma marginatus Bailey, 1902 Spotted Ground Squirrel

The spotted ground squirrel is found throughout the panhandles, exclusive of the piñon-juniper zone of Oklahoma (Fig. 15). Its range seems to be governed by presence of sandy soils, and consequently its distribution is correlated mostly with the sandy terraces of streams. Such sandy areas are of limited value for agriculture and, therefore, are left as uncultivated sandsage. Where roads pass through these areas, spotted ground squirrels may be seen standing upright, or scurrying for cover from oncoming vehicles. The species is rarely prominent, and is quite shy and secretive for a ground squirrel, accounting for relatively few records.

Specimens examined (8).—TEXAS. Dallam Co.: 10 mi. E Texline, 4 (TTU); 21 mi. N Dalhart, 1. Lipscomb Co.: Lipscomb, 1 (USNM); 2 mi. NW Lipscomb, 2.

Literature records.—OKLAHOMA. Beaver Co., 10 mi. N, 12 mi. E Beaver. Cimarron Co.: 13 mi. S Boise City; 14 mi. W Boise City; 15 mi. W Boise City. Texas Co.: 4.5 mi. N Guymon; 5.5 mi. N Guymon; 1 mi. S, 6 mi. E Hardesty; 1 mi. S, 7 mi. E Hardesty. TEXAS. Dallam Co.: Dalhart.

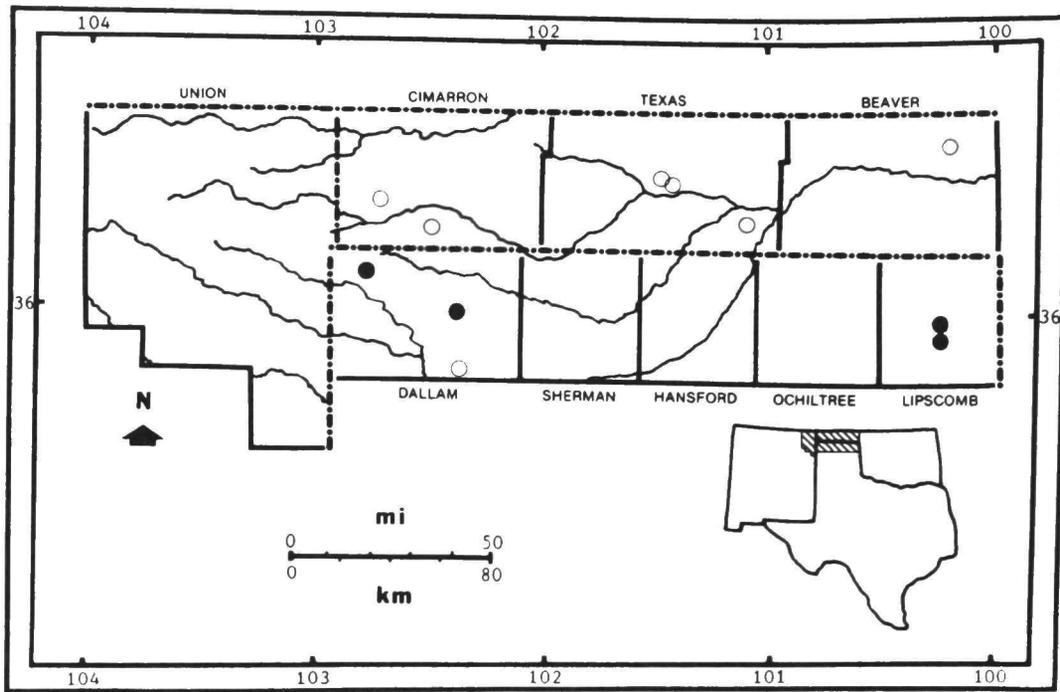


FIG. 15.—Distribution of *Spermophilus spilosoma* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Spermophilus tridecemlineatus (Mitchill, 1821)

Thirteen-lined Ground Squirrel

This ground squirrel occupies the same general distribution as the spotted ground squirrel (Fig. 16) but has a broader ecological tolerance, living on firm or even hard-packed soils. The two species may occur in the same local areas. In Lipscomb County, a thirteen-lined ground squirrel was flooded from its burrow along the margin of a shallow wash where, less than a half mile away, an individual of *S. spilosoma* similarly was taken.

These squirrels commonly live in or near towns, ranch houses, and prairie dog colonies. Short-grass areas are preferred; brushy areas are avoided. The mowed margins of roads also are favored habitat. Females taken in May and July were lactating.

Hall (1981) mapped the entire study site as within the range of *S. t. arenicola*. Our specimens from New Mexico, Texas, and the westernmost two Oklahoma counties are referable to this taxon. However, specimens from Beaver County are darker, and indistinguishable from individuals of *S. t. texensis* from southwestern Oklahoma and north-central Texas.

Spermophilus tridecemlineatus arenicola (A. H. Howell, 1928)

Specimens examined (29).—NEW MEXICO. Union Co.: 8 mi. S Capulin, 1; Clayton, 1. OKLAHOMA. Cimarron Co.: 2 mi. E Boise City, 1. Texas Co.: Guymon, 1; near Guymon, 1. TEXAS. Dallam Co.: 1 mi. N, 3 mi. W Dalhart, 1 (TTU). Hansford Co.: 8 mi. N Spearman, 1 (WTSU); Gruver, 2 (KU); 8 mi. S Spearman, 1 (TTU). Lipscomb Co.: 2 mi. E Booker, 1 (WTSU); Lipscomb, 3 (USNM); 13 mi. S, 13.5 mi. W Lipscomb, 1 (TTU); 2 mi. NW Lipscomb, 1. Ochiltree Co.: Perryton, 12 (TTU). Sherman Co.: 3 mi. SW Texhoma, 1 (TTU).

Literature records.—NEW MEXICO. Union Co.: Clayton; Folsom. OKLAHOMA. Cimarron Co.: Black Mesa; 1 mi. S, 3 mi. E Boise City; 2.5 mi. S, 4 mi. E Boise City; 14 mi. E Boise City. Texas

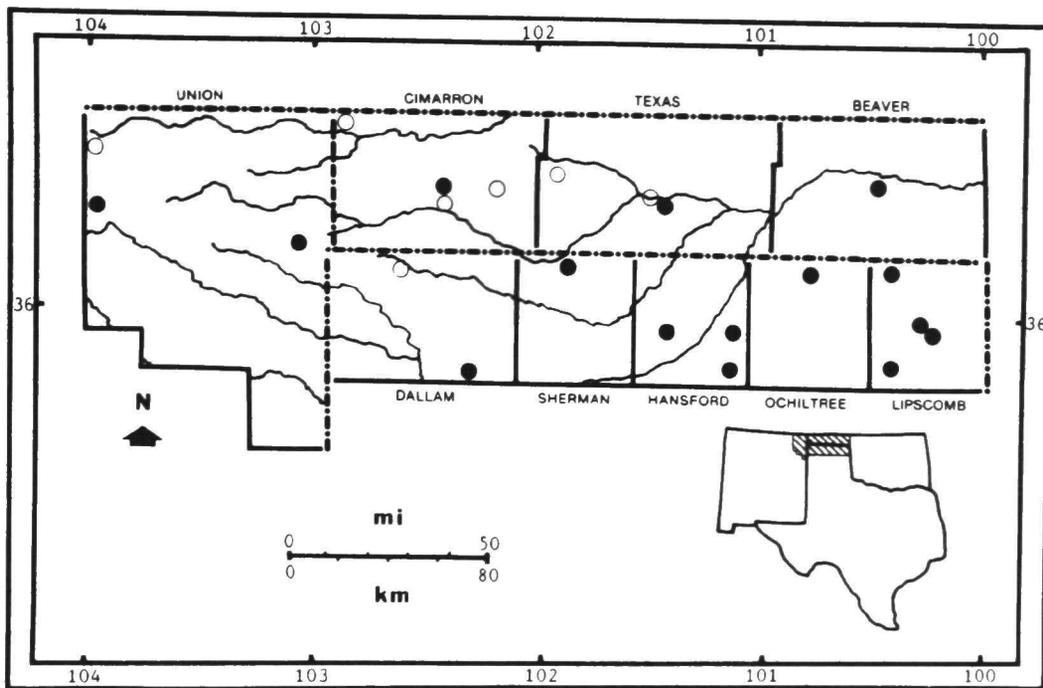


FIG. 16.—Distribution of *Spermophilus tridecemlineatus* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Co.: 2 mi. E Eva; Coldwater Creek, S Guymon; NE Guymon. TEXAS. Dallam Co.: 20 mi. E Texline (Howell, 1938).

Spermophilus tridecemlineatus texensis Merriam, 1898

Specimens examined (3).—OKLAHOMA. Beaver Co.: Beaver, 3.

Literature record.—OKLAHOMA. Beaver Co.: Lake Evans Chambers.

Spermophilus variegatus grammurus (Say, 1823)

Rock Squirrel

The rock squirrel probably is found throughout the rough and broken lands of Union and Cimarron counties (Fig. 17); Blair's (1939) record from Beaver County seems an anomaly.

We found this species to be rare and shy. Individuals were seen at a number of sites in Union County and in the Black Mesa area of Oklahoma, but the squirrels invariably took shelter quickly.

Specimen examined (1).—OKLAHOMA. Cimarron Co.: 4.5 mi. N Kenton, 1.

Literature records.—NEW MEXICO. Union Co.: Clayton, Apache Canyon; Folsom; Sierra Grande. OKLAHOMA. Beaver Co.: no specific locality (Blair, 1939). Cimarron Co.: Black Mesa; Clark Ranch, 15 mi. N, 5 mi. W Boise City; 1.7 mi. E Kenton; 3 mi. SE Kenton; 2.5 mi. SE Kenton; 4 mi. N Kenton; 4.2 mi. S Kenton; 4.2 mi. S, 0.5 mi. E Kenton; canyon, east side North Carrizo Creek, 6 mi. N Kenton.

Cynomys ludovicianus ludovicianus (Ord, 1815)

Black-tailed Prairie Dog

Prairie dog "towns" are found in every county of the study area (Fig. 18). These colonies often are destroyed by ranchers and farmers, but the animals remain moderately common, especially in Cimarron County.

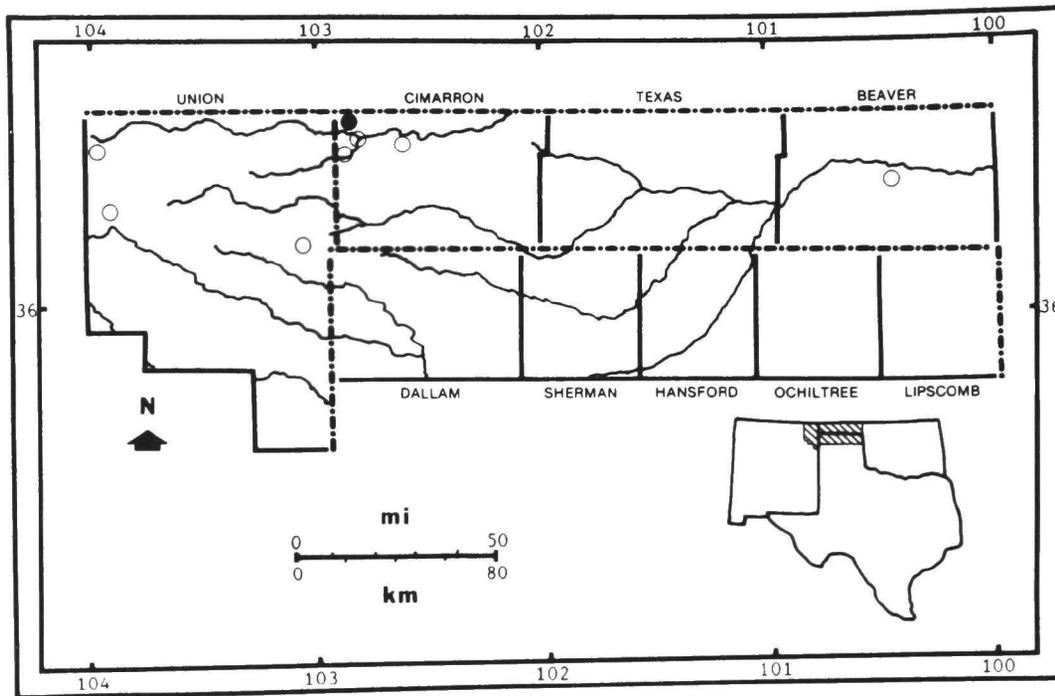


FIG. 17.—Distribution of *Spermophilus variegatus* in the tristate study region. Solid symbol represents specimen examined; open symbols represent literature records.

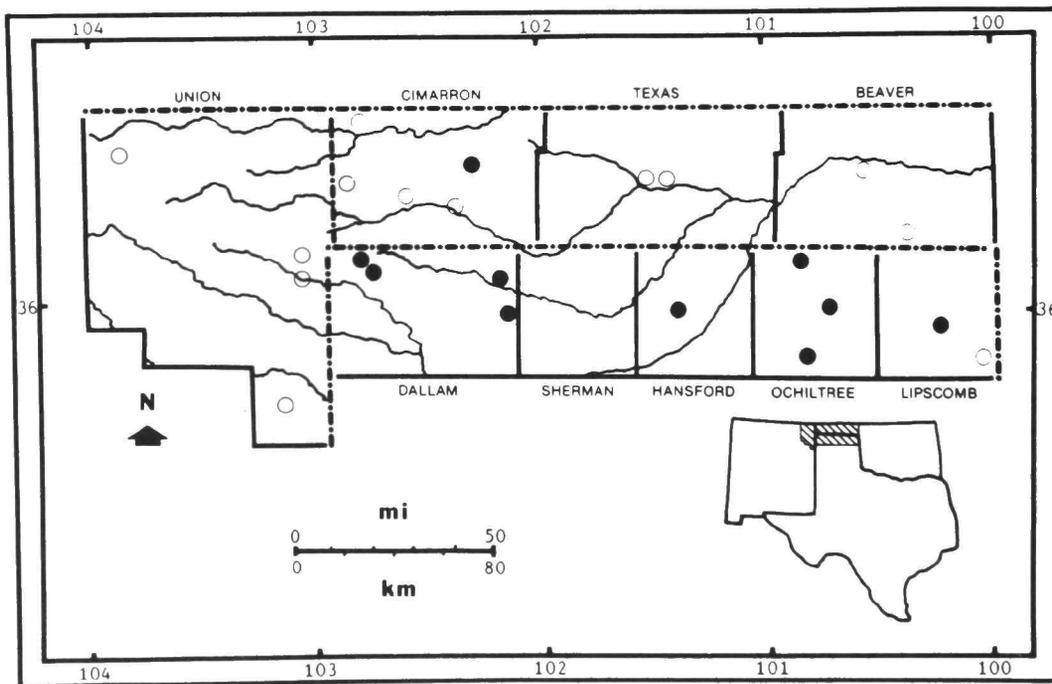


FIG. 18.—Distribution of *Cynomys ludovicianus* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Individual sightings of animals running across roads during spring and summer months, often miles from any known prairie dog town, probably represent dispersers.

Specimens examined (12).—OKLAHOMA. Cimarron Co.: 12 mi. ENE Boise City, 1. TEXAS. Dallam Co.: 20 mi. ENE Texline, 1 (USNM); 10 mi. E Texline, 2 (TTU); 6 mi. N Conlen, 2 (WTSU); 15 mi. W Stratford, 1 (WTSU). Hansford Co.: 2 mi. W Gruver, 1 (KU). Lipscomb Co.: Lipscomb, 1

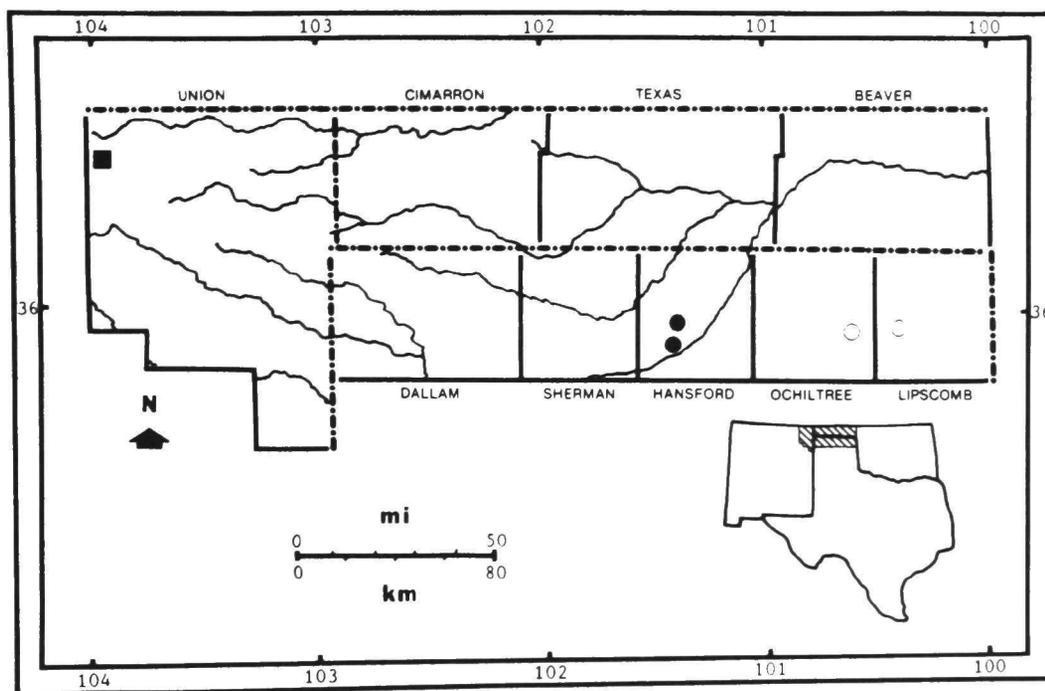


FIG. 19.—Distribution of *Sciurus aberti* (square) and *S. niger* (circles) in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

(USNM). Ochiltree Co.: 8 mi. N Perryton, 1 (KU); 7 mi. S, 6 mi. E Perryton, 1 (TTU); 23 mi. S Perryton, 1 (KU).

Literature records.—NEW MEXICO. Union Co.: near Clayton (Seton, 1929); 12.8 km. S Clayton (Chesser, 1983); 8.5 km. NE Des Moines (Chesser, 1983); 9.6 km. E Hayden (Chesser, 1983). OKLAHOMA. Beaver Co.: 11 mi. S, 4 mi. W Beaver City; 8 mi. S, 4.5 mi. E Elmwood. Cimarron Co.: 1 mi. S, 2 mi. W Boise City; 5.2 mi. S, 5.1 mi. E Boise City; 8 mi. E Kenton; 7 mi. N, 2 mi. E Kenton; 1 mi. S, 1 mi. W Wheelless; 0.5 mi. S, 1.3 mi. E Wheelless. Texas Co.: 4 mi. N Guymon; 4.5 mi. N, 5.5 mi. W Guymon; 3 mi. S, 4.5 mi. W Turpin. TEXAS. Lipscomb Co.: Higgins.

Sciurus aberti ferreus True, 1894

Abert's Squirrel

We were surprised to find this squirrel on the Cornay Ranch just north of Capulin Mountain (Fig. 19). Two were seen on the steep slopes just west of the ranch house, in thick woodlands of large junipers and oaks. Large ponderosa pines, reportedly (see, for example, Armstrong, 1972; Findley *et al.*, 1975; Keith, 1965) a major limiting resource for this species, also were present.

Recently published records of *S. aberti* (Davis and Bissell, 1989) have extended considerably the known range of the species in Colorado, the result of either active range expansion or simply the discovery of populations overlooked by earlier workers.

Our specimen is assigned on geographic grounds to *S. a. ferreus* following Hoffmeister and Diersing (1978), who considered *S. a. mimus* Merriam, 1904, to be a synonym of *ferreus*.

Specimen examined (1).—NEW MEXICO. Union Co.: 5 mi. N Capulin, 1.

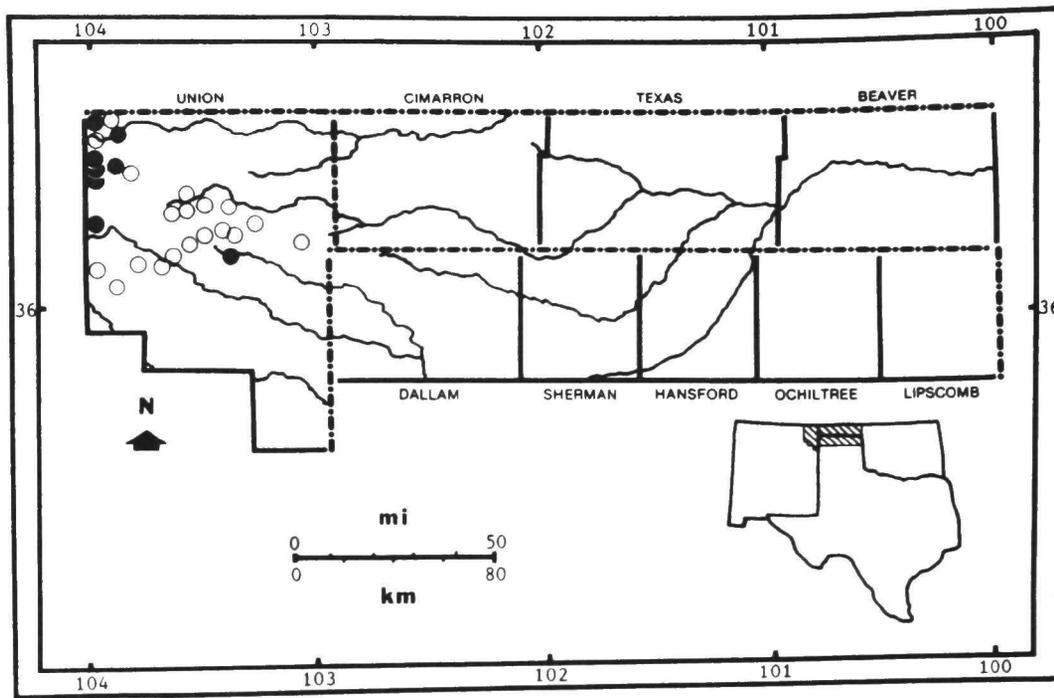


FIG. 20.—Distribution of *Thomomys bottae* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Sciurus niger rufiventer É. Geoffroy St.-Hilaire, 1803
Fox Squirrel

Fox squirrels occur in riparian habitat along watercourses of the Texas Panhandle, and just enter our study area to the south (Fig. 19). They were looked for without success along the Beaver and Cimarron rivers of the Oklahoma Panhandle.

Specimens examined (9).—TEXAS. Hansford Co.: 3 mi. S, 6 mi. W Gruver, 6 (3 KU, 3 TTU); 10 mi. S, 3 mi. W Gruver, 3 (TTU).

Literature records.—TEXAS. Lipscomb Co.: Wolf Creek. Ochiltree Co.: Wolf Creek.

Thomomys bottae cultellus Kelson, 1951
Botta's Pocket Gopher

T. bottae does not occur in the Texas and Oklahoma panhandles (Fig. 20), although Best (1973) recorded specimens from just north of Clayton, less than 20 miles west of Dallam County, Texas. These may represent a relict population. In western Union County, especially in clearings in coniferous woodlands and along roadsides in wooded areas, the species is common, and is the only pocket gopher present.

Sympatry or near sympatry of three genera of pocket gophers in Union County, northwestern Cimarron County, and adjacent parts of southeastern Colorado, has drawn the interest of other investigators. Best (1973) made an exhaustive study of gophers in Union County. Moulton *et al.* (1983) made a similar study in Colorado and parts of Union and Cimarron counties. With

such large collections on record, our efforts were limited mostly to study of comparative material.

Botta's pocket gopher reaches its eastern distributional limit in Union County. Here, the species does not occur together with either *Cratogeomys* or *Geomys* (Best, 1973), although elsewhere (Moulton *et al.*, 1983) *Thomomys* may occur in sympatry with the larger *Cratogeomys*.

Best (1973) thought that the three genera, in areas of sympatry or near-sympatry, were separated by complex and interwoven ecological factors, and that soil type was most important. *Thomomys* prefers relatively mesic conditions, and thrives in clay-loam soils with some consolidated particles. Our observations in Union County substantiate this. Moulton *et al.* (1983) considered soil type less important a factor, but found that *Thomomys* burrows were consistently shallower than those of sympatric *Cratogeomys*. This was considered by them as an intermediate stage in interspecific competition, and that *Cratogeomys* eventually would displace the smaller *Thomomys*. It seems probable that *T. bottae* in western Union County, where it is the only species of pocket gopher present, represents part of the original population, still unthreatened, whereas gophers occurring farther to the east are relict populations on the verge of extinction.

Dalquest *et al.* (1990) examined ancient beaver dam sediments of Holocene age from four sites on the Black Mesa and southeastern Union County. Remains of *Thomomys* were found south of Clayton (*ca.* 530 years BP), in extreme northeastern Union County (*ca.* 2630 years BP), and at the Black Mesa of Oklahoma (*ca.* 2700 years BP), but *Geomys* and *Cratogeomys* were absent. A Pleistocene site at Tesequite Canyon (*ca.* 31,000 years BP), reported on by Dalquest and Stangl (1989), also produced only *Thomomys*.

Some females collected in May and July were lactating. Three from northeastern Union County carried small fetuses (litter sizes four, four, and five) that were 5-6 in crown-rump length. Scrotal testes of males averaged larger (length 20 or greater) in May than in July. A half-grown animal was taken on 27 July.

Specimens examined (41).—NEW MEXICO: Union Co.: 5 mi. N Capulin, 10; Capulin Mountain, 5 mi. NNE Capulin, 6; N side Capulin Mountain, 3; Capulin Mountain, 3; 4 mi. N Capulin, 2; 3 mi. N Capulin, 1; 10 mi. N Folsom, 1; Folsom Falls, 4 mi. NE Folsom, 13; 8 mi. S Capulin, 1; Hwy. 453 and Carrizo Creek, 26 mi. W Clayton, 1.

Literature records.—NEW MEXICO. Union Co.: Folsom; Oak Canyon, Raton Range; Sierra Grande. All Union County records as follows are from Best (1973): 9 mi. N, 2 mi. E Folsom; 3.6 mi. N, 3.3 mi. E Folsom; 1.4 mi. N, 2.7 mi. W Folsom; 0.4 mi. S, 0.8 mi. W Folsom; 3.2 mi. N, 0.9 mi. E Capulin; 1.7 mi. E Des Moines; 1.4 mi. S, 3.5 mi. E Des Moines; 2.4 mi. S, 10.3 mi. E Des Moines; 8.8 mi. N, 2 mi. E Grenville; 4.5 mi. S, 8.7 mi. E Des Moines; 4.5 mi. S, 5.1 mi. E Des Moines; 5.6 mi. S, 2.3 mi. E Des Moines; 2.2 mi. N, 6.3 mi. W Grenville; 2 mi. S, 1.2 mi. E Grenville; 5.9 mi. N, 5.1 mi. W Clayton; Mt. Dora; 1.5 mi. S, 6 mi. E Mt. Dora; 1.7 mi. S, 5.8 mi. E Mt. Dora; 2.4 mi. N, 7.6 mi. W Clayton; 2.8 mi. N Sofia; 2 mi. N Sofia; 2.5 mi. S, 5.3 mi. W Mt. Dora; 1.7 mi. W Sofia; 1.8 mi. E Sofia; 10.2 mi. E Sofia; 5.5 mi. E Sofia; 4.3 mi. S Mt. Dora; 8.6 mi. N, 1 mi. E Gladstone; 6.1 mi. N Gladstone.

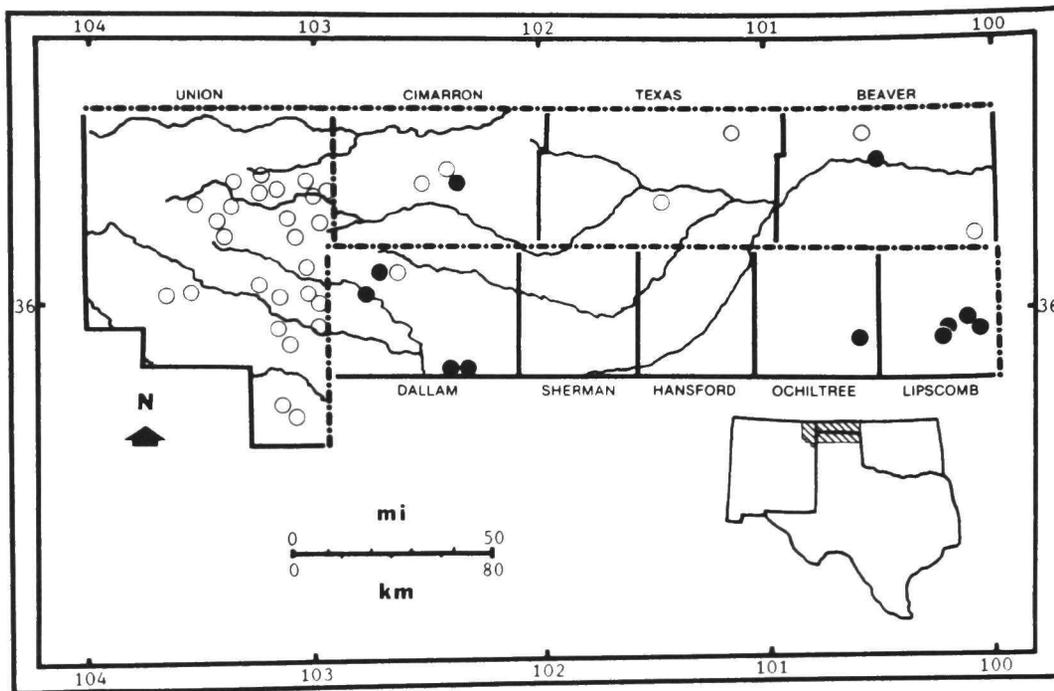


FIG. 21.—Distribution of *Geomys bursarius* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Geomys bursarius (Shaw, 1800)
Plains Pocket Gopher

The plains pocket gopher occurs in all counties of the study area (Fig. 21), but its distribution is not so general as records might suggest. It does not penetrate into western Union County, where only *Thomomys* occurs. Elsewhere in that county, *Geomys* appears to be a recent immigrant, as suggested by lack of remains from Pleistocene (Dalquest and Stangl, 1989) and Holocene sediments (Dalquest *et al.*, 1990) from as recent as 500 years BP. The natural range of the plains pocket gopher in the study area is dendritic, confined to terraces and meadows of stream valleys. Human disturbance of the land has created more extensive habitat, and the species now occupies farmlands, roadsides, and gardens. Gopher mounds found in artificially created habitats were invariably those of *G. bursarius*. *Geomys* seems not to come into contact with *Thomomys* in Union County, although ranges of the two genera approach closely. In Colorado to the north, this also appears true (Moulton *et al.*, 1983). Ranges of *Geomys* and *Cratogeomys castanops* exhibit considerable general sympatry, although the two are ecologically separated. In such areas, Moulton *et al.* (1983) found *Geomys* restricted to roadside ditches, whereas *Cratogeomys* occupied open rangeland.

Two females from Lipscomb County were pregnant. One taken on 31 March contained two fetuses measuring 22, and another collected on 1 April carried five, measuring 13.

Two nominal races of the plains pocket gopher occur in our study area. *G. b. jugossicularis* occupies Union County, New Mexico (Best, 1973), and adjoining Dallam County, Texas (Jones *et al.*, 1988). Our one specimen

from Cimarron County also appears referable to this taxon. Although we have seen no specimens from Texas County, our two gophers from Beaver County and those from elsewhere in the Texas part of our study area are referred to *G. b. major*.

Geomys bursarius jugossicularis Hooper, 1940

Specimens examined (12).—OKLAHOMA. Cimarron Co.: 1 mi. E Boise City, 1. TEXAS. Dallam Co.: 12 mi. E Texline, 4 (TTU); 5 mi. E Perico, 4 (WTSU); 1 mi. N, 3 mi. W Dalhart, 2 (TTU); 2.5 mi. E Dalhart, 1 (TCWC).

Literature records.—NEW MEXICO. Union Co.: 4 mi. S Clayton, Perico Creek. All Union County records as follows are from Best (1973): 13.3 mi. N, 14.8 mi. E Grenville; 2.6 mi. N, 3.8 mi. W Moses; 10.3 mi. N, 17.2 mi. E Grenville; 10.3 mi. N, 18.5 mi. E Grenville; 3.1 mi. E Moses; 0.7 mi. S, 0.5 mi. W Moses; 7.3 mi. N, 1 mi. W Grenville; 10.5 mi. N, 10 mi. E Mt. Dora; 4.7 mi. N, 2 mi. E Grenville; 2 mi. N, 3.4 mi. W Seneca; 0.7 mi. N Seneca; 1.3 mi. N, 1.5 mi. E Grenville; 5.9 mi. N, 10.2 mi. E Mt. Dora; 7.9 mi. N, 10.1 mi. E Clayton; 4 mi. S, 1.1 mi. W Seneca; 5.7 mi. N, 10 mi. E Clayton; 2 mi. S, 9.3 mi. W Clayton; 1.8 mi. S, 4.8 mi. W Clayton; 3.7 mi. W, 4.8 mi. S Clayton; 5.5 mi. S Clayton; 6.8 mi. S, 4.25 mi. E Clayton; 1.5 mi. N, 5.2 mi. E Pasamonte; 2.2 mi. N, 12.8 mi. E Pasamonte; 9.1 mi. S, 7.8 mi. E Clayton; 10.1 mi. S Clayton; 1 mi. N, 1 mi. E Thomas; 13.5 mi. S Clayton; 14.6 mi. S Clayton; 6 mi. N, 4.9 mi. E Sedan; 1.6 mi. N, 3 mi. W Sedan; 3.2 mi. N, 2.4 mi. W Amistad; 3.7 mi. S, 0.4 mi. W Amistad. OKLAHOMA. Cimarron Co.: N Boise City; 8 mi. W Boise City. TEXAS. Dallam Co.: 15 mi. E Texline (Hall and Kelson, 1952).

Geomys bursarius major Davis, 1940

Specimens examined (17).—OKLAHOMA. Beaver Co.: 2 mi. N Beaver, 2. TEXAS. Lipscomb Co.: 2 mi. NNW Lipscomb, 3; 3.2 km. NNW Lipscomb, 2; 2 mi. N, 8 mi. E Lipscomb, 2 (TTU); 1 mi. N, 1 mi. W Lipscomb, 1; Lipscomb, 4 (USNM); 9 mi. E Lipscomb, 1 (TTU); 8 mi. NW Higgins, 1 (TTU). Ochiltree Co.: 25 mi. SE Perryton, 1 (TCWC).

Literature records.—OKLAHOMA. Beaver Co.: 2 mi. W Forgan; 3 mi. S, 3 mi. E Slapout. Texas Co.: Guymon; RR at Hooker.

Cratogeomys castanops perplanus (Nelson and Goldman, 1934)

Yellow-faced Pocket Gopher

This pocket gopher ranges throughout much of the study area (Fig. 22), but its distribution is discontinuous and it may be rare or absent locally. These large gophers are powerful diggers, able to penetrate even the caliche layer often underlying the thin prairie soil. They also occupy disturbed, loamy soils of roadsides, and are found in sandy areas in the absence of *Geomys*. The species seems to be absent from much of the eastern parts of the two panhandles, where *Geomys* occupies habitat that otherwise could be inhabited by *Cratogeomys*. This distribution suggests that *C. castanops* is a recent immigrant from the south or west.

Half-grown animals were taken in April and June from near Kenton, and an adult female taken on 31 July was lactating. We follow Hollander's (1990) recent revision of this species in assigning all *Cratogeomys* from within our study area to *C. c. perplanus*.

Specimens examined (45).—NEW MEXICO. Union Co.: Rabbit Ears Mountain, 2; 3 mi. ENE Seneca, 1. OKLAHOMA. Cimarron Co.: 5 mi. N Kenton, 1; 4.5 mi. N Kenton, 2; 4 mi. N Kenton, 3; 3 mi. N Kenton, 1; 4.3 mi. S, 2.4 mi. E Kenton, 2 (TTU); 3 mi. S, 2 mi. E Kenton, 1 (TTU); 1.5 mi. S, 3 mi. E Kenton, 6 (TTU). TEXAS. Dallam Co.: 12 mi. E Texline, 1 (TTU); 1.7 mi. S, 0.3 mi. W Texline, 1 (NMSU); 2.4 mi. S, 0.3 mi. W Texline, 2 (NMSU). Hansford Co.: 5 mi. SW Gruver, 2; 6 mi. S, 3 mi. W Gruver, 1 (KU); 11 mi. SW Gruver, 1. Lipscomb Co.: 5 mi. S Booker,

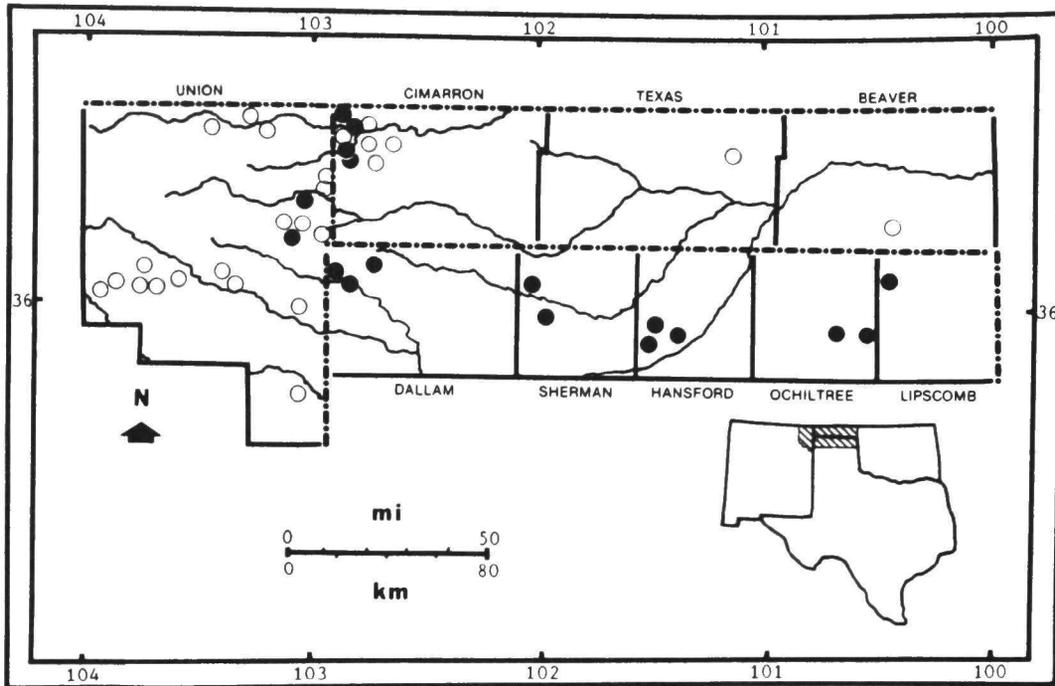


FIG. 22.—Distribution of *Cratogeomys castanops* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

4 (WTSU). Ochiltree Co.: 11 mi. S, 4 mi. E Perryton, 1 (TTU); 12 mi. S, 9 mi. E Perryton, 9 (TTU). Sherman Co.: Stratford, 3 (TTU); 8 mi. S, 2 mi. E Stratford, 1 (TTU).

Literature records.—NEW MEXICO. Union Co.: Clayton. All other Union County records as follows are from Best (1973): 9 mi. N, 34 mi. E Folsom; 29.5 mi. N, 0.9 mi. E Mt. Dora; 33 mi. N, 6.3 mi. W Clayton; 6 mi. N, 2.6 mi. E Moses; 3.3 mi. N, 2.2 mi. E Moses; 0.5 mi. E Clayton Lake; 6.5 mi. N, 3.5 mi. E Clayton; 9 mi. E, 4.1 mi. N Clayton; 2.9 mi. N, 1.7 mi. W Clayton; 1.1 mi. N, 2.3 mi. W Clayton; 0.25 mi. S Clayton; 0.5 mi. S Clayton; 6.6 mi. S, 3.5 mi. E Mt. Dora; 4.5 mi. N, 5.2 mi. E Pasamonte; 4.9 mi. S, 12.9 mi. W Clayton; 7.4 mi. S, 17.3 mi. W Clayton; 1.2 mi. N, 3.6 mi. E Pasamonte; 1.2 mi. N, 7.2 mi. E Pasamonte; 1.2 mi. E Gladstone; 2.2 mi. E Gladstone; 9.7 mi. S Clayton; 0.6 mi. N, 0.5 mi. W Amistad. OKLAHOMA. Beaver Co.: 4 mi. E Elmwood Post Office. Cimarron Co.: 25 mi. NW Boise City; Pigeon Cave, 0.5 mi. N, 2 mi. E Kenton; 3.75 mi. S, 9.25 mi. E Kenton; 2.5 mi. SE Kenton; 2.6 mi. NNE Kenton; 4.4 mi. N, 0.4 mi. W Kenton; 2 mi. S, 5 mi. E Kenton; 5 mi. SE Kenton; 6 mi. N Kenton; north side Black Mesa, 6 mi. N Kenton; Tesequite Canyon, 7 mi. SE Kenton; 9 mi. SE Kenton; 10 mi. NW Kenton; 0.25 mi. S Colorado line on North Carrizo Creek; Tesequite Canyon; Tesequite Canyon, 4 mi. from Highway 325; T. 4 N, R. 1 E, sec. 4. Texas Co.: W Hooker.

Perognathus flavescens copei Rhoads, 1894

Plains Pocket Mouse

The plains pocket mouse is known from north (Bee *et al.*, 1981; Reed and Choate, 1986a), south (Jones *et al.*, 1988) and east (Caire *et al.*, 1990) of the tristate region, where the species often has been reported as locally common in sand sage habitat. Records of this diminutive pocket mouse from our study area are few, however (Fig. 23), and trapping efforts in sand sage failed to produce specimens.

Reed and Choate (1986b) noted an apparent absence of intergradation between *P. f. copei* and *P. f. flavescens*, which occurs immediately to the north in Kansas and Colorado. Whether this observation results from a true

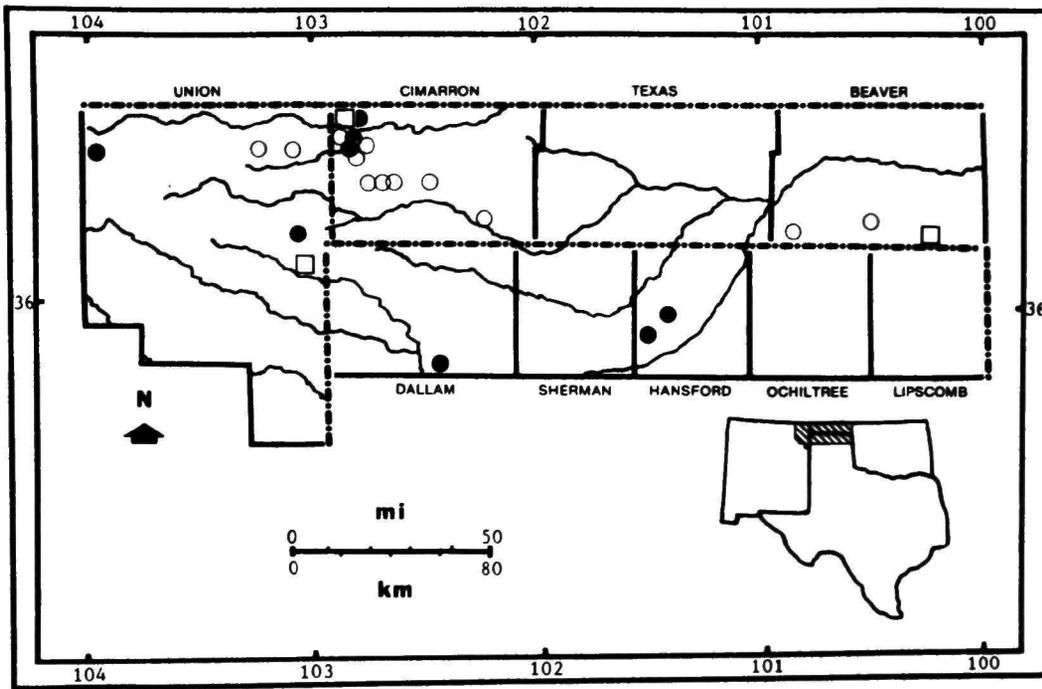


FIG. 23.—Distribution of *Perognathus flavescens* (squares) and *P. flavus* (circles) in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

allopatric distribution of the two races or from a lack of specimens from the Oklahoma Panhandle is uncertain, and confirmation must await the availability of additional material.

Literature records.—NEW MEXICO. Union Co.: 4 mi. S Clayton, Perico Creek. OKLAHOMA. Cimarron Co.: 3 mi. N Kenton (Blair, 1939).

Perognathus flavus flavus Baird, 1855

Silky Pocket Mouse

Silky pocket mice range through most of the study area (Fig. 23). In the Oklahoma and Texas panhandles, they are sometimes locally abundant along grassy-weedy fencerows bordering cultivated land, and especially in open prairie where the vegetation consists mostly of short grass and yucca. In contrast to other pocket mice, this species has a relatively broad tolerance to varied ecological conditions. On Rabbit Ears Mountain, we took a specimen on gently sloping, stony soil among scattered basalt cinders and bombs. Near Capulin, another was collected along the margin of a well-grazed meadow in the piñon-juniper zone.

Of five females taken from Hansford County on 20 May, one contained four small fetuses. Juveniles were taken in mid- to late August in northwestern Union County and near Kenton.

Hall (1981) mapped three subspecies as occurring in our study area. However, we follow the conservative treatment of Jones *et al.* (1988) for the reasons outlined therein.

Specimens examined (35).—NEW MEXICO. Union Co.: N side Capulin Mountain, 1; Rabbit Ears Mountain, 1. OKLAHOMA. Cimarron Co.: 5 mi. NNW Kenton, 3; 1.5 mi. S, 3 mi. E Kenton, 6

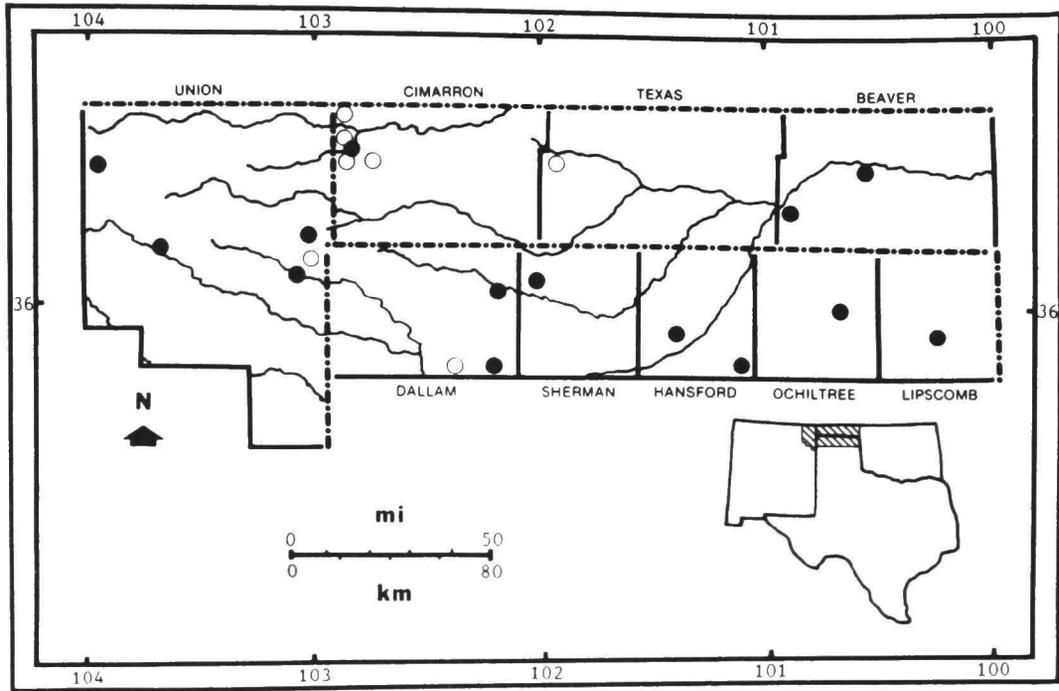


FIG. 24.—Distribution of *Chaetodipus hispidus* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

(TTU); 2.4 mi. E, 4.3 mi. S Kenton, 8 (TTU); 3 mi. S, 2 mi. E Kenton, 5 (TTU). TEXAS. Dallam Co.: 1 mi. N, 6 mi. W Dalhart, 1 (TTU). Hansford Co.: Gruver, 1 (KU); 11 mi. SSW Gruver, 9.

Literature records.—NEW MEXICO. Union Co.: 16 mi. N, 10 mi. W Moses, Cimarron River; 4 mi. S, 10 mi. W Kenton, Oklahoma. OKLAHOMA. Beaver Co.: 15 mi. S Beaver; T. 1 N, R. 21 E, sec. 13; T. 1 S, R. 20 E, sec. 21; T. 1 S, R. 21 E, sec. 30; T. 1 S, R. 20 E, sec. 33. Cimarron Co.: Black Mesa; Black Mesa State Park; W Boise City; 12 mi. W Boise City; 14 mi. W Boise City; 12.8 mi. W Boise City; 15.8 mi. W Boise City; 17 mi. W Boise City; 17.6 mi. W Boise City; 18 mi. W Boise City; 8 mi. W Griggs; 2 mi. S, 1 mi. E Kenton; 6 mi. S, 2 mi. E Kenton; 3 mi. N Kenton; 2.5 mi. SE Kenton; 3.1 mi. N Kenton; 4 mi. N Kenton; 4 mi. S, 0.5 mi. E Kenton; 2.8 mi. SE Kenton; 5 mi. N Kenton; north side Black Mesa, 6 mi. N Kenton; 8 mi. N Kenton; 8 mi. SE Kenton; 9 mi. SE Kenton; 9 mi. N Kenton; T. 4 N, R. 5 E, NW $\frac{1}{4}$ sec. 3; T. 4 N, R. 3 E, sec. 12.

Chaetodipus hispidus paradoxus (Merriam, 1889)

Hispid Pocket Mouse

We found the hispid pocket mouse to be uncommon but widely distributed in the tristate area (Fig. 24). In Union County, it was taken in areas of grass and weeds in clearings in the piñon-juniper zone. At Rabbit Ears Mountain, specimens were trapped in herbaceous vegetation near old lava flows. In the two panhandles, animals were taken along fencerows in agricultural lands.

The hispid pocket mouse has many vertebrate predators. We add the great blue heron to this list. A skull and skeletal remains of a hispid pocket mouse were recovered along with parts of crayfishes from the regurgitated pellets of this bird.

We noted an apparent preference of *C. hispidus* for slightly elevated mounds or ridges in level land. Characteristic burrows often were noted along fencerows elevated a few inches above the adjacent land, and also at the margins of ridges and terraces.

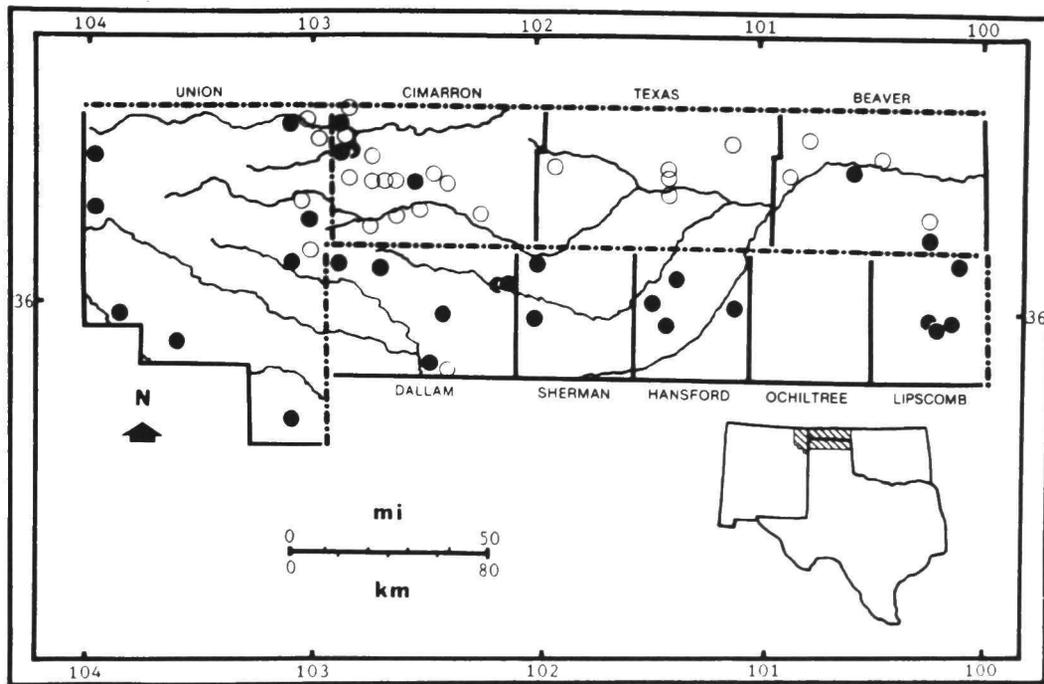


FIG. 25.—Distribution of *Dipodomys ordii* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

A female from near Clayton carried four fetuses (measuring 15 in crown-rump length) on 23 May, and half-grown animals were taken in July and August from Sherman, Union, and Beaver counties.

Specimens examined (26).—NEW MEXICO. Union Co.: NE side Capulin Mountain, 1; Rabbit Ears Mountain, 1; 6 mi. SW Clayton, 1; Hwy. 452 and Carrizo Creek, 26 mi. W Clayton, 1. OKLAHOMA. Beaver Co.: 8 mi. W Beaver, 1; 3.8 mi. W Bryan's Corner, 1. Cimarron Co.: 4.3 mi. S, 2.4 mi. E Kenton, 1 (TTU); 1.5 mi. S, 3 mi. E Kenton, 1 (TTU). TEXAS. Dallam Co.: 10.6 mi. W Stratford, 1 (TTU); 1 mi. N, 8 mi. W Dalhart, 4 (TTU); 1 mi. N, 6 mi. W Dalhart, 3 (TTU). Hansford Co.: 6 mi. S, 2 mi. W Gruver, 1 (KU); 8 mi. S Spearman, 4 (TTU). Lipscomb Co.: Lipscomb, 2 (USNM); Ochiltree Co.: 12 mi. S, 8 mi. E Perryton, 2 (TTU). Sherman Co.: 2 mi. N Stratford, 1.

Literature records.—NEW MEXICO. Union Co.: 4 mi. S Clayton, Perico Creek. OKLAHOMA. Cimarron Co.: Carrizo Creek on Colorado line; 6 mi. S, 2 mi. E Kenton; 2.5 mi. SE Kenton; 2.5 mi. NNE Kenton; 4 mi. SW Kenton; 4.6 mi. N, 0.2 mi. W Kenton; 3.1 mi. N Kenton; N side Black Mesa, 6 mi. N Kenton; 6 mi. N Kenton; 9 mi. SE Kenton. TEXAS. Dallam Co.: Dalhart.

Dipodomys ordii richardsoni (J. A. Allen, 1891)

Ord's Kangaroo Rat

Ord's kangaroo rat is an abundant resident in sand sage habitat throughout the tristate region (Fig. 25). It is less common in restricted areas of short-grass prairie. Although usually considered a species of sandy soils, it is surprisingly adaptable. In Union County, northwest of Des Moines, a highway passes through extensive areas of volcanic cinders. A specimen was taken a few hundred yards from a commercial cinder mine in an area with no visible soil development. On the northern side of Capulin

Mountain, a kangaroo rat was trapped on a steep hillside of volcanic cinders. Again, little exposed soil was present, although several burrows were noted.

In the original description of *D. o. richardsoni*, the type locality was identified as "one of the sources of the Beaver [= North Canadian] River" (Allen, 1891). Subsequently, Glass (1971) restricted the type locality to the confluence of Cienquilla and Currumpaw creeks, Cimarron County.

Specimens examined (127).—NEW MEXICO. Union Co.: 8 mi. S Capulin, 1; 1 mi. S Folsom, 1; 4 km. N, 17 km. W Kenton, 1; 6 mi. SW Clayton, 4; 7 mi. SW Clayton, 1; 15 mi. W Clapham, 4; 3 mi. ENE Seneca, 4; Ute Creek, Hwy. 120, 13 mi. SW Gladstone, 1; Monia Creek, 3 mi. S Amistad, 1. OKLAHOMA. Beaver Co.: 3 mi. N, 9 mi. W Beaver, 1; 2.9 mi. E Logan, 1. Cimarron Co.: 4 mi. N Kenton, 1; 3 mi. S, 2.4 mi. E Kenton, 5 (TTU); 1.5 mi. S, 3 mi. E Kenton, 2 (TTU); 4 mi. SSE Kenton, 2; 11 mi. W Boise City, 3. TEXAS. Dallam Co.: 2 mi. N, 13 mi. E Texline, 1 (TTU); Texline, 5 (USNM); 12 mi. E Texline, 11 (TTU); 15 mi. E Texline, 3 (USNM); 21 mi. N Dalhart, 1; 15 mi. W Stratford, 1 (WTSU); 10.6 mi. W Stratford, 1 (TTU); 1 mi. N, 6 mi. W Dalhart, 1 (TTU). Hansford Co.: 13 mi. N Gruver, 1 (TTU); 10 mi. N Spearman, 3 (WTSU); 2 mi. N, 11 mi. W Gruver, 25 (KU); 6 mi. S, 2 mi. W Gruver, 4 (KU). Lipscomb Co.: 1 mi. N, 5 mi. E Follett, 5 (WTSU); 2 mi. N, 8 mi. E Lipscomb, 2 (TTU); 2 mi. NNW Lipscomb, 22; 2 mi. NW Lipscomb, 1; 1 mi. N, 1 mi. W Lipscomb, 1; Lipscomb, 3 (USNM). Sherman Co.: 10 mi. N Stratford, 2 (TTU); 10 mi. S Stratford, 2 (KU).

Literature records.—NEW MEXICO. Union Co.: Clayton; 4 mi. S Clayton, Perico Creek; 3 mi. W Kenton, Oklahoma; 4 mi. N, 10 mi. W Kenton, Oklahoma; 0.5 mi. S, 0.5 mi. W Moses. OKLAHOMA. Beaver Co.: 1.5 mi. N Beaver; North Canadian River, 4 mi. S Floris; 3 mi. NW Slapout; North Canadian River, 7 mi. S Turpin. Cimarron Co.: 3 mi. NE Boise City; 4 mi. N Boise City; 9.5 mi. S, 6.7 mi. W Boise City; 9 mi. W Boise City; 10.4 mi. W Boise City; 12.5 mi. W Boise City; 13 mi. S Boise City; 14 mi. W Boise City; 15 mi. W Boise City; 15.8 mi. W Boise City; 25.4 mi. W Boise City; 8.3 mi. N, 0.5 mi. E Felt; 8 mi. W Griggs; Kenton; 6 mi. S, 2 mi. E Kenton; 2 mi. S, 6 mi. E Kenton; 2.5 mi. S Kenton; 2.5 mi. SE Kenton; 3.3 mi. S, 1 mi. E Kenton; 2.5 mi. SE Kenton; 4 mi. N Kenton; 4.4 mi. N, 0.4 mi. W Kenton; 3 mi. SE Kenton; 5 mi. N Kenton; 6 mi. N Kenton; 7 mi. SE Kenton; near Colorado line, 7 mi. N Kenton; 12 mi. SE Kenton; Tesequite Canyon; 3 mi. S Wheelless; T. 5 N, R. 3 E, sec. 36. Texas Co.: Eva; Beaver River, Guymon; Beaver River, 2 mi. N Guymon; 2.2 mi. W Guymon; 3 mi. N Guymon; 3 mi. NW Guymon; 4.8 mi. N Guymon; 5 mi. N Guymon; 5.5 mi. N Guymon; 1 mi. W Hooker. TEXAS. Dallam Co.: Dalhart.

Castor canadensis missouriensis Bailey, 1919

Beaver

Beavers are moderately common in several of the waterways in the tristate region (Fig. 26). We doubt, however, that these are descendents of the original population. The species was nearly extirpated from almost all of New Mexico by the early 1900s, but was restocked in the 1930s by the New Mexico Game and Fish Department (Findley *et al.*, 1975). Beavers in the panhandles would have been relatively easy prey for the early trappers, and the area was subject to intensive trapping pressure. Specimens examined are all from Texas, although we have seen beavers, their dams, and cuttings in New Mexico and Oklahoma.

Specimens examined (4).—TEXAS. Hansford Co.: Palo Duro Creek, NE part of county, 1 (TTU). Ochiltree Co.: Palo Duro Creek, NW part of county, 3 (TTU).

Literature records.—NEW MEXICO. Union Co.: 34.4 mi. N, 2.5 mi. E Clayton (Best, 1971). OKLAHOMA. Beaver Co.: Beaver. Texas Co.: no specific locality. TEXAS. Hansford Co.: 3 mi. S, 6 mi. W Gruver.

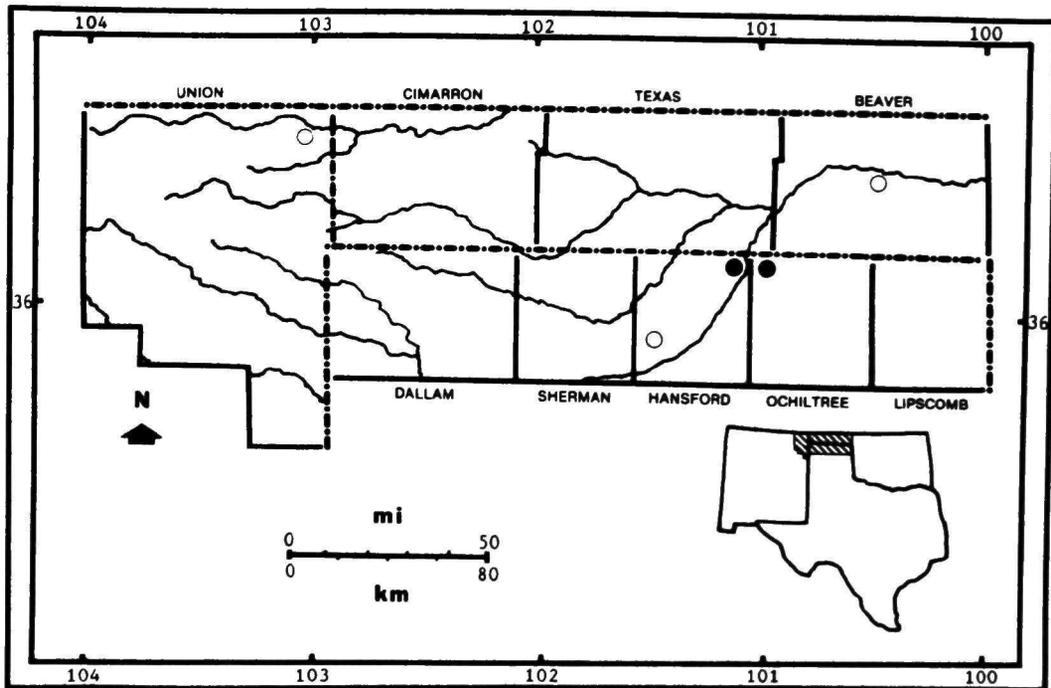


FIG. 26.—Distribution of *Castor canadensis* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

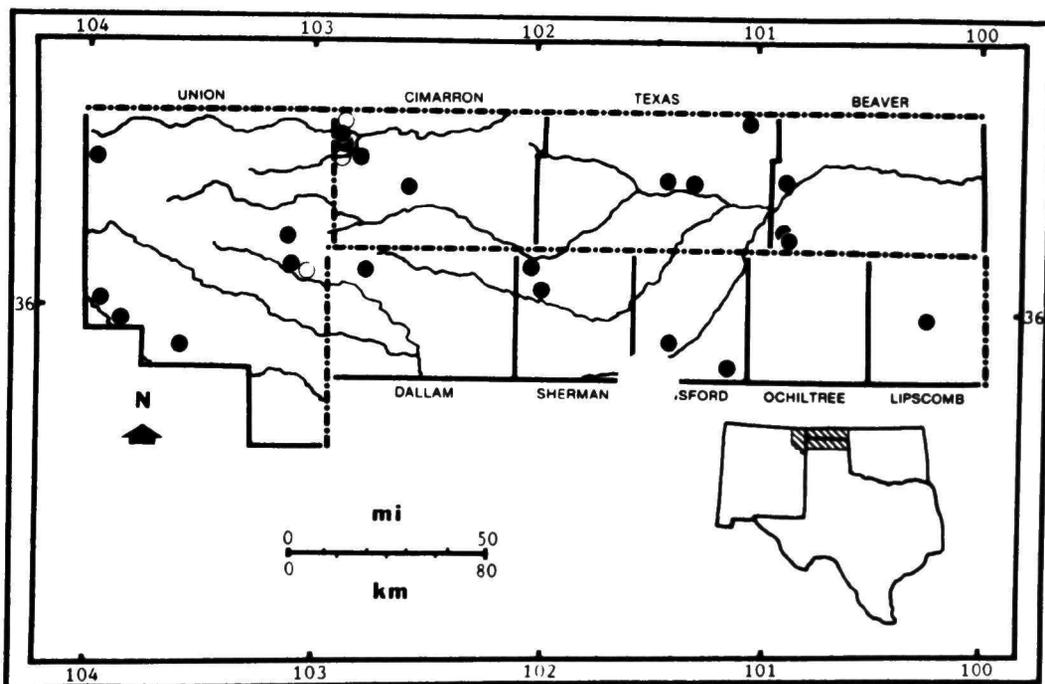


FIG. 27.—Distribution of *Reithrodontomys megalotis* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Reithrodontomys megalotis aztecus J. A. Allen, 1893
Western Harvest Mouse

The western harvest mouse is distributed throughout the tristate region (Fig. 27), although it is only locally common, especially in western parts of the study area. Tall grasses and weeds evidently are preferred habitat, but the species often is taken in sand sage and rocky areas as well. *R. megalotis*

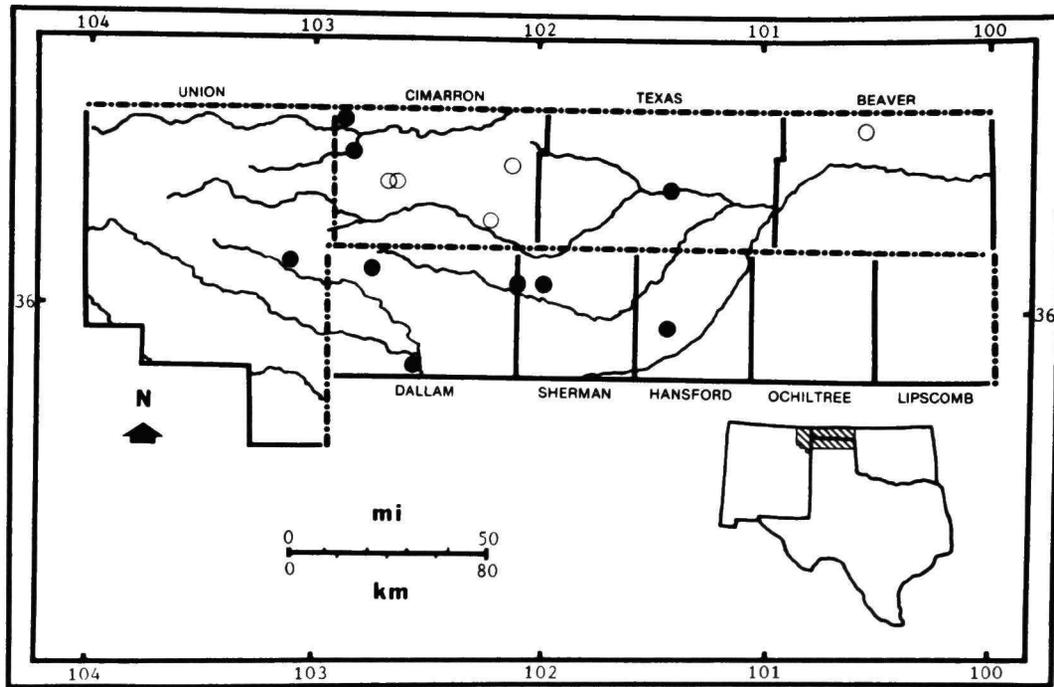


FIG. 28.—Distribution of *Reithrodontomys montanus* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

is sympatric with *R. montanus* throughout the study area, but the latter is less common and infrequently collected in heavy grasses and weeds.

Lactating females were taken in May, July, and August. A female taken on 16 June carried three fetuses measuring 7 in crown-rump length. Four of six females collected on 9 July were pregnant, with litter sizes of three, four, four, and five.

Specimens examined (98).—NEW MEXICO. Union Co.: Capulin Mountain, 7; Rabbit Ears Mountain, 1; 6 mi. SW Clayton, 5; 15 mi. W Clapham, 1; 7 mi. SW Clayton, 1; Ute Creek, Hwy. 120, 13 mi. SW Gladstone, 1; Ute Creek, Hwy. 56, 2.5 mi. E Gladstone, 9. OKLAHOMA. Beaver Co.: 7 mi. S Turpin, 1 (KU); 3.8 mi. W Bryan's Corner, 1; 8.3 mi. N Balko Post Office on Hwy. 83, 2. Cimarron Co.: Kenton, 2; 2 mi. N Kenton, 1; 4 mi. SSE Kenton, 1; 11 mi. W Boise City, 1. Texas Co.: 5.2 mi. NE Guymon, 1; 3.5 mi. SW Optima, 8 (KU); 4 mi. NE Tyrone, 7. TEXAS. Dallam Co.: 12 mi. E Texline, 2 (TTU). Hansford Co.: 10 mi. S, 1 mi. W Gruver, 2 (KU); 8 mi. S Spearman, 22 (TTU). Lipscomb Co.: 2 mi. NW Lipscomb, 1. Sherman Co.: 10 mi. N Stratford, 3 (TTU); 8 mi. S, 2 mi. E Stratford, 18 (TTU).

Literature records.—NEW MEXICO. Union Co.: 4 mi. S Clayton, Perico Creek. OKLAHOMA. Cimarron Co.: 3 mi. N Kenton; 3.5 mi. N, 1.2 mi. W Kenton; 4 mi. N Kenton; 4.1 mi. S, 0.5 mi. E Kenton; 4.6 mi. N, 0.2 mi. W Kenton.

Reithrodontomys montanus griseus Bailey, 1905

Plains Harvest Mouse

The plains harvest mouse is widely distributed but uncommon in our study area (Fig. 28). Ranges of this species and the western harvest mouse overlap broadly, and in places the two species can be taken in the same trapline. However, *R. montanus* appears more restricted to open grasslands.

Specimens examined (16).—NEW MEXICO. Union Co.: 6 mi. SW Clayton, 1. OKLAHOMA. Cimarron Co.: 4 mi. N Kenton, 1; 4.3 mi. S, 2.4 mi. E Kenton, 1 (TTU). Texas Co.: 5.2 mi. NE

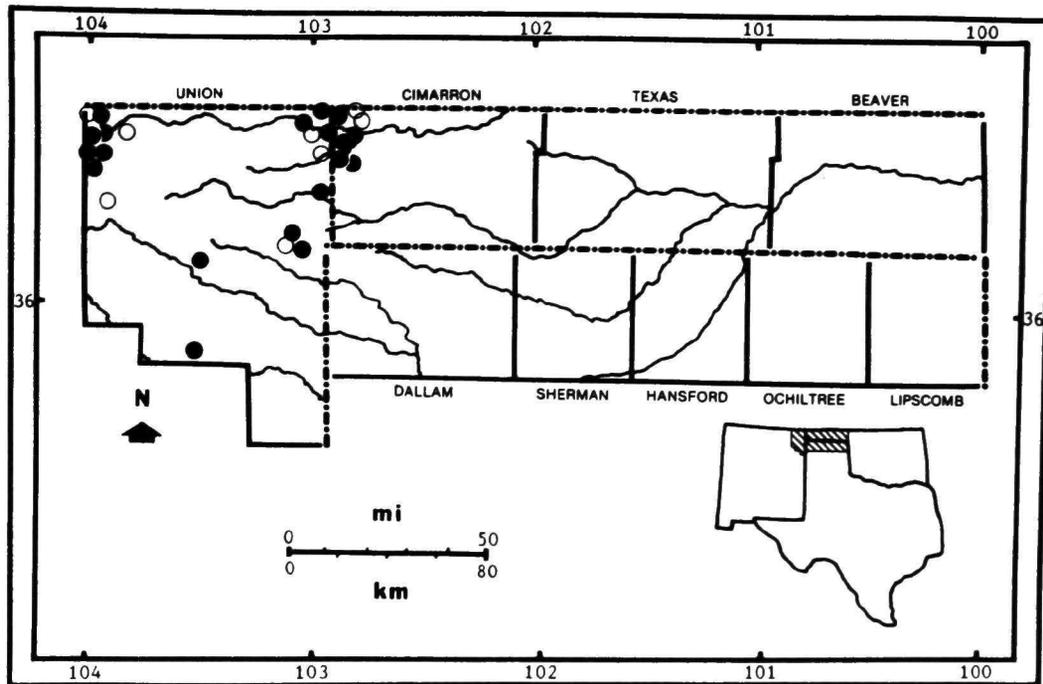


FIG. 29.—Distribution of *Peromyscus boylii* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Guymon, 1. TEXAS. Dallam Co.: 12 mi. E Texline, 2 (TTU); 1 mi. N, 8 mi. W Dalhart, 3 (TTU). Hansford Co.: 3 mi. S, 6 mi. W Gruver, 2 (KU). Sherman Co.: 10 mi. N Stratford, 3 (TTU); 8 mi. S, 2 mi. E Stratford, 2 (TTU).

Literature records.—OKLAHOMA. Beaver Co.: 2 mi. W Forgan. Cimarron Co.: 13 mi. S Boise City; 13.5 mi. W Boise City; 14 mi. W Boise City; 8 mi. W Griggs; 4 mi. N Kenton; 8 mi. E Keyes.

Peromyscus boylii rowleyi (J. A. Allen, 1893)

Brush Mouse

This relatively large and often locally abundant mouse occupies a variety of habitats, but seems to prefer wooded, rocky areas from the Black Mesa region of Oklahoma westward (Fig. 29). However, unlike other long-tailed *Peromyscus*, it may occupy brushland where rocks are absent.

The brush mouse can be separated from the piñon mouse, *P. truei*, by its relatively long tail, which is longer than the head and body, and relatively small ears (usually 17-19). It is brown dorsally as an adult, old individuals becoming richer in color. The two species often can be distinguished more easily when freshly taken than when compared as dried museum study skins. The rock mouse, *P. nasutus*, is distinctly larger than the brush mouse, with less brown and more gray in the dorsal pelage.

Animals taken from early May through late August evidenced reproductive activity. Of 11 pregnant females, four carried four fetuses, five carried three, and two carried one.

Specimens examined (209).—NEW MEXICO. Union Co.: Tollgate Canyon, 10 mi. N Folsom, 6; Tollgate Canyon, 6.5 mi. N, 2.5 mi. E Folsom, 14; Capulin Mountain, 10; NE side Capulin Mountain, 7; N side Capulin Mountain, 7; W base Capulin Mountain, Cornay Ranch, 5 mi. N Capulin, 29; 4 mi. N Capulin, 34; 1 km. N Capulin, 9; 8 mi. NNE Folsom, 9; Folsom Falls, 4 mi. NE Folsom, 13; 1 mi. NE Moses, 6; 4 km. N, 17 km. W Kenton, Oklahoma, 7; 8 mi. NNW

Kenton, Oklahoma, 4; Rabbit Ears Mountain, 4; eastern peak, Rabbit Ears Mountain, 2; Apache Canyon, 3 mi. NNW Clayton, 2; Hwy. 453 and Carrizo Creek, 26 mi. W Clayton, 1; 13 mi. WSW Clapham, 7. OKLAHOMA. Cimarron Co.: 5 mi. NNW Kenton, 4; 4.5 mi. NNW Kenton, 5; 4 mi. NNW Kenton, 1; 5 mi. N Kenton, 1; 4 mi. N Kenton, 1; 3.5 mi. N Kenton, 9; 4.3-4.5 mi. S, 2.4 mi. E Kenton, 5 (TTU); 2.5 mi. SE Kenton, 2; 1.5 mi. S, 3 mi. E Kenton, 4 (TTU); 3 mi. SE Kenton, 5; 4 mi. SE Kenton, 1.

Literature records.—NEW MEXICO. Union Co.: Apache Canyon; Emory Peak; base Emory Peak; Folsom; 6 mi. S, 3 mi. W Kenton, Oklahoma; 13 mi. W Kenton, Oklahoma; Oak Canyon, Raton Range; Sierra Grande. OKLAHOMA. Cimarron Co.: Black Mesa; 0.25 mi. E Kenton; Kenton; 0.25 mi. N, 0.75 mi. E Kenton; 2.75 mi. N, 1 mi. E Kenton; 1.25 mi. N Kenton; 2 mi. E Kenton; 2 mi. N, 1 mi. W Kenton; 6 mi. S, 2 mi. E Kenton; 2.5 mi. SE Kenton; 1.25 mi. N Kenton; 2 mi. E Kenton; 2 mi. N, 1 mi. W Kenton; 6 mi. S, 2 mi. E Kenton; 2.25 mi. N Kenton; 2 mi. S, 1 mi. E Kenton; 2.6 mi. S, 1.5 mi. E Kenton; 3 mi. N Kenton; 3 mi. N, 0.7 mi. W Kenton; 3.4 mi. S, 1.2 mi. E Kenton; 3.5 mi. N, 1 mi. E Kenton; 3.5 mi. N, 1.2 mi. W Kenton; 1.2 mi. W Kenton; 3.6 mi. S, 0.9 mi. E Kenton; 4 mi. SE Kenton; 4 mi. N Kenton; 2.6 mi. NNE Kenton; 4.2 mi. N, 0.1 mi. W Kenton; 4.2 mi. S Kenton; 4.2 mi. S, 0.5 mi. E Kenton; 4.2 mi. S, 0.8 mi. W Kenton; 4.4 mi. N, 0.4 mi. W Kenton; 4.5 mi. SE Kenton; 3.1 mi. N Kenton; 5.3 mi. S, 0.5 mi. E Kenton.

Peromyscus leucopus tornillo Mearns, 1896

White-footed Mouse

The race of white-footed mouse in the study area is relatively large, equal or nearly equal in size to the piñon mouse, and larger than the deer mouse. It is almost ubiquitous (Fig. 30), occurring on sand dunes and in sand sage, prairie, brushland, and rocky areas. In our experience, the only extensive habitats not occupied are evergreen-oak forests. Even there, it lives along forest margins. This species seems always to live in association with other species of *Peromyscus*.

Wilson (1968) reported that *P. maniculatus* was the dominant member of the genus in mixed conifer woodlands, whereas *P. leucopus* inhabited open country and grassy valleys. However, the reverse is true in the tristate area. Respective fetus counts for four females taken in late July and August were four, four, three and three.

Hall (1981) mapped Beaver County specimens as *P. l. leucopus* (Rafinesque, 1818), but our specimens from across the study area are large, relatively pale animals, and are referable to *P. l. tornillo*.

Specimens examined (209).—NEW MEXICO. Union Co.: Tollgate Canyon, 10 mi. N Folsom, 3; 5 mi. N Capulin, 3; 3 mi. N Capulin, 1; N side Capulin Mountain, 2; NE base Capulin Mountain, 7; W base Capulin Mountain, 2; Folsom Falls, 4 mi. NE Folsom, 3; 8 mi. NNW Kenton, Oklahoma, 1; 4 km. N, 17 km. W Kenton, Oklahoma, 2; 1 mi. NNE Moses, 2; Rabbit Ears Mountain, 3; Apache Canyon, 3 mi. NNW Clayton, 10; 6 mi. SSW Clayton, 2; 7 mi. SSW Clayton, 2; Ute Creek and Hwy. 120, 13 mi. SW Gladstone, 3; Hwy. 453 and Carrizo Creek, 26 mi. W Clayton, 1; 13 mi. WSW Clapham, 2. OKLAHOMA. Beaver Co.: 3 mi. N, 9 mi. W Beaver, 1; 8 mi. W Beaver, 5; near Beaver State Park, 2 mi. N Beaver, 14; 2.9 mi. E Logan, 4; 22.1 mi. E Elmwood, 4. Cimarron Co.: 5 mi. NNW Kenton, 14; 5 mi. N Kenton, 5; 4.5 mi. N Kenton, 3; 4 mi. N Kenton, 15; 2 mi. N Kenton, 4; 3 mi. SSE Kenton, 4; 11 mi. W Boise City, 2. TEXAS. Dallam Co.: 5.2 mi. NE Guymon, 2; 11.8 mi. E Hardesty, 1. TEXAS. Dallam Co.: 2 mi. N, 13 mi. E Texline, 3 (TTU); 12 mi. E Texline, 6 (3 TTU); 1 mi. N, 6 mi. W Dalhart, 1 (TTU). Hansford Co.: 2 mi. N, 11 mi. W Gruver, 4 (KU); 2 mi. S, 6 mi. W Gruver, 10 (KU); 7.5 mi. SE Gruver, 2 (KU). Lipscomb Co.: 1 mi. N, 5-5.5 mi. E Follett, 3 (WTSU); 2 mi. NNW Lipscomb, 4; 2 mi. N, 8 mi. E Lipscomb, 9 (TTU); Lipscomb, 11 (USNM); 9 mi. E Lipscomb, 4 (TTU); 2 mi. NW Lipscomb, 3. Ochiltree Co.: 12 mi. S, 8 mi.

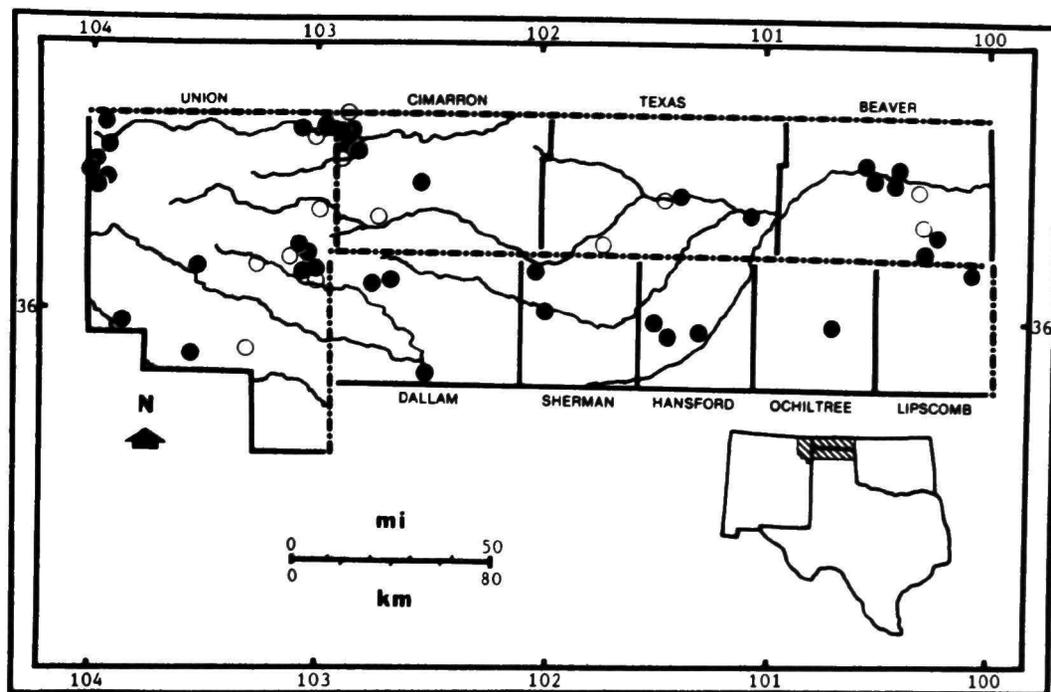


FIG. 30.—Distribution of *Peromyscus leucopus* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

E Perryton, 6 (TTU); 12 mi. S, 9 mi. E Perryton, 2 (TTU); 23 mi. S Perryton, 1 (WTSU); Sherman Co.: 10 mi. N Stratford, 10 (TTU); 8 mi. S, 2 mi. E Stratford, 3 (TTU).

Literature records.—NEW MEXICO. Union Co.: Apache Canyon, Clayton; 4 mi. S Clayton, Perico Creek; 18 mi. W Clayton; 5.5 mi. NE Folsom; 0.5 mi. N, 3 mi. E Kenton, Oklahoma; 4 mi. N, 10 mi. W Kenton, Oklahoma; 5 mi. S Moses; Clapham (Bailey, 1932). OKLAHOMA. Beaver Co.: Lake Evans Chambers; 3 mi. NW Slapout; Cimarron Co.: Black Mesa State Park; 8.3 mi. N, 0.5 mi. E Felt; 2.75 mi. N, 1 mi. E Kenton; 1.25 mi. N Kenton; 2 mi. N, 1 mi. W Kenton; 6 mi. S, 2 mi. E Kenton; 2.5 mi. SE Kenton; 2.25 mi. N Kenton; 2.2 mi. W Kenton; 3 mi. NE Kenton; 3.3 mi. S, 1 mi. E Kenton; 3.4 mi. S, 1.2 mi. E Kenton; 3.5 mi. N, 1 mi. E Kenton; 3.6 mi. N, 1.1 mi. W Kenton; 3.7 mi. N, 1.1 mi. W Kenton; 3.9 mi. N, 0.5 mi. W Kenton; 4 mi. S, 0.7 mi. E Kenton; 2.6 mi. NNE Kenton; 2.6 mi. NE Kenton; 4.2 mi. N, 0.1 mi. W Kenton; 4.2 mi. S Kenton; 4.2 mi. S, 0.8 mi. W Kenton; 4.4 mi. N, 0.4 mi. W Kenton; 4.5 mi. SE Kenton; 4.6 mi. N, 0.2 mi. W Kenton; 3.1 mi. N Kenton; 5 mi. N Kenton; 5.3 mi. S, 0.5 mi. E Kenton; 6 mi. N Kenton; T. 5 N, R. 2 E, sec. 8; T. 5 N, sec. 11. TEXAS Co.: 2 mi. N Guymon; 5.5 mi. N Guymon; Texhoma, Beaver River.

Peromyscus maniculatus (Wagner, 1845)

Deer Mouse

West of our study area, from the Sangre de Cristo Mountains westward, the deer mouse is almost ubiquitous (Fig. 31), occupying most habitats that other kinds of mice occupy; frequently it is the only species of *Peromyscus* present. In western Union County, *P. maniculatus* is locally common but avoids the forested habitats favored farther to the west. From western Union County eastward, numbers of deer mice decrease as numbers of other species increase and habitat becomes restricted.

At the Cornay Ranch north of Capulin, hillsides and cliffs are clothed with dense woodlands of piñon, juniper, oak, and some yellow pine. Densely strewn basalt talus and brush are found at the bases of the hillsides. The latter

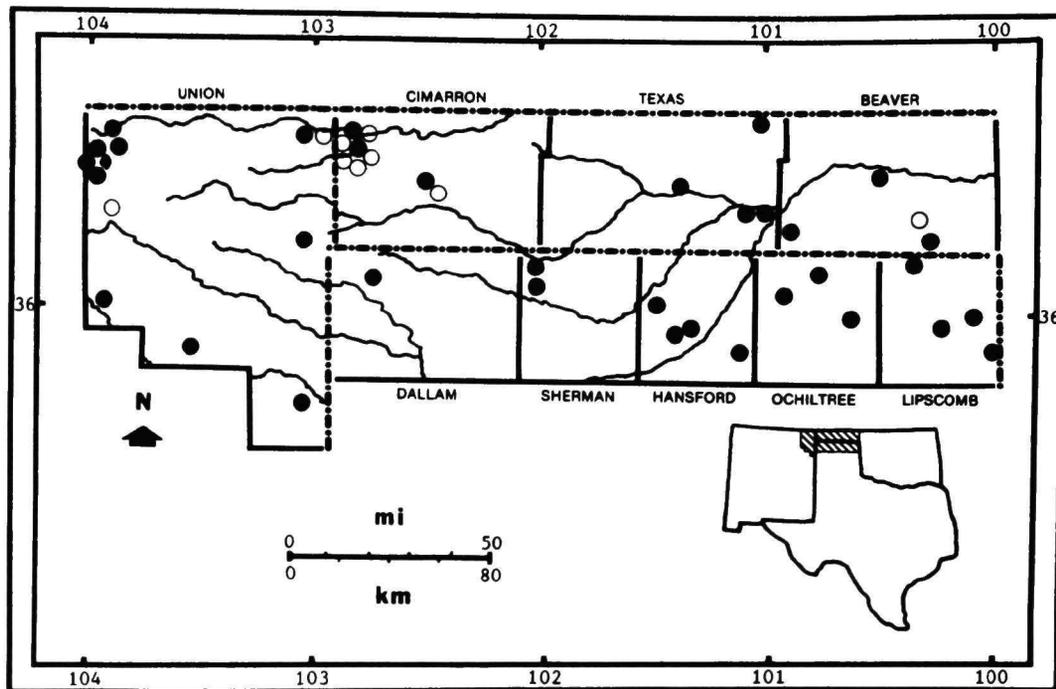


FIG. 31.—Distribution of *Peromyscus maniculatus* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

end abruptly at the edge of grassy meadows. Traps set in the forest took only long-tailed *Peromyscus* (*P. truei*, *P. nasutus*, and *P. boylii*), except in brush that had overgrown an abandoned ranch road, where a single *P. leucopus* was found. However, the brush and rocky band between forest and meadow was occupied by *P. maniculatus* along with smaller numbers of *P. leucopus* and *P. boylii*. Elsewhere in the higher parts of western Union County, the deer mouse was almost restricted to the margins of clearings and basalt lava flows, associated there with *P. leucopus* and *P. boylii*.

Farther east (Rabbit Ears Mountain and Trampiros Creek), a few specimens were taken in meadows grazed by cattle. Higher, in the Black Mesa area, we trapped few specimens. There seems to be almost a hiatus in the range of *P. maniculatus* along the eastern margin of Union County. Of 410 *Peromyscus* trapped in that vicinity by Geluso (1971), only two were reported as deer mice.

In the two panhandles, the deer mouse occurs in short-grass prairies and along grassy fencerows, where it usually was uncommon (one stretch of grassy roadside in Hansford County was an exception); frequently it was taken in association with kangaroo rats, harvest mice, and silky pocket mice. Areas of sand sage where we would have expected this species usually were occupied instead by *P. leucopus*. In the 1960s, traps set in sand sage south of Clayton took several deer mice, as well as other species. In 1987, intensive trapping at the same and nearby sites produced only *P. leucopus*.

Almost every person since Blair (1939) who has worked with deer mice from our study area has reached a different conclusion as to the number and names of subspecies present. Our specimens from western Union County are slightly smaller and somewhat less richly colored than typical examples of *P.*

m. rufinus (Merriam, 1890), but clearly are referable to that subspecies. Panhandle mice seem best assigned to *P. m. luteus* Osgood, 1905. The few specimens available to us from eastern and southern Union County are intergrades, and are herein tentatively assigned to *P. m. rufinus*.

Blair (1939) referred deer mice from Black Mesa to *P. m. nebrascensis*. He regarded these specimens as distinct from those of the flatlands of the Oklahoma Panhandle, which he referred to *P. m. luteus*. He did not consider *P. m. rufinus* in his comparisons, mentioning only that "the race *osgoodi* [= *nebrascensis*] probably intergrades with the race *nebrascensis* [= *luteus*] in the Short Grass Plains biotic district." Hall (1981) and Findley *et al.* (1975) mapped almost all of Union County within the range of *P. m. rufinus*.

Peromyscus maniculatus luteus Osgood, 1905

Specimens examined (170).—OKLAHOMA. Beaver Co.: 2 mi. N Beaver, 5; 3.8 mi. W Bryan's Corner, 2; 2.9 mi. E Logan, 2. Cimarron Co.: 3 mi. W Boise City, 1 (TTU); 1.5 mi. S, 3 mi. E Kenton, 1 (TTU); 4 mi. N Kenton, 2. Texas Co.: 10 mi. E Hardesty, 1 (TTU); 4 mi. NE Tyrone, 4; 5 mi. NE Guymon, 3; 11.8 mi. E Hardesty, 3. TEXAS. Dallam Co.: 12 mi. E Texline, 14. Hansford Co.: 2 mi. N, 11 mi. W Gruver, 5 (KU); 6 mi. S, 2 mi. W Gruver, 4 (KU); 11 mi. SSW Gruver, 4; 8 mi. S Spearman, 67 (TTU). Lipscomb Co.: 3.5 mi. NW Darrouzett, 1 (WTSU); 2 mi. NNW Lipscomb, 1; 2 mi. N, 8 mi. E Lipscomb, 2 (TTU); 12 km. NW Higgins, 1; 4 km. SSE Higgins, 1. Ochiltree Co.: 7 mi. N Perryton, 6 (TTU); 1 mi. N Farnsworth, 4 (WTSU); 12 mi. S, 9 mi. E Perryton, 2 (TTU). Sherman Co.: 10 mi. N Stratford, 16 (TTU); 2 mi. N Stratford, 2; 8 mi. S, 2 mi. E Stratford, 16 (TTU).

Literature records.—OKLAHOMA. Beaver Co.: 10.4 mi. E Elmwood. Cimarron Co.: Black Mesa; Black Mesa State Park; Boise City; W Boise City; 3 mi. W Boise City; 2 mi. S, 1 mi. E Kenton; 6 mi. S, 2 mi. E Kenton; 2 mi. S, 6 mi. E Kenton; 2.5 mi. S Kenton; 2.5 mi. SE Kenton; 3 mi. N, 0.7 mi. W Kenton; 4 mi. S Kenton; 4.2 mi. N, 0.1 mi. W Kenton; 6 mi. SE Kenton; 7 mi. N Kenton; 8 mi. SE Kenton; 8.5 mi. SE Kenton; 9 mi. SE Kenton. Texas Co.: 3 mi. NW Guymon; near Palo Duro Creek, 10 mi. E Hardesty.

Peromyscus maniculatus rufinus (Merriam, 1890)

Specimens examined (71).—NEW MEXICO. Union Co.: 8 mi. NNE Folsom, 2; Tollgate Canyon, 6.5 mi. N, 2.5 mi. E Folsom, 1; N side Capulin Mountain, 5 mi. NNE Capulin, 16; NE base Capulin Mountain, 2; Capulin Mountain, 20; 5 mi. N Capulin, 5; 4 mi. N Capulin, 10; 3 mi. N Capulin, 5; 13 mi. W Kenton, Oklahoma, 1; Rabbit Ears Mountain, 4; Ute Creek and Hwy. 56, 2.5 mi. E Gladstone, 2; 15 mi. W Clapham, 3.

Literature records.—NEW MEXICO. Union Co.: 3 mi. W Kenton, Oklahoma; 12 mi. W Kenton, Oklahoma; Sierra Grande.

Peromyscus nasutus nasutus (J. A. Allen, 1891)

Northern Rock Mouse

The rock mouse is the largest *Peromyscus* found in the study area. It is usually grayish above with a narrow line of dull ochraceous separating the upperparts from the white venter. The ears are large, but not relatively as large as those of *P. truei*. The tail is almost always more than 100 long in adult mice and often in subadults as well. Even though the characters are distinctive, specimens of the rock mouse sometimes escape notice in a mixed catch with *P. truei* and *P. boylii*. Dried museum study skins are more difficult to separate than are specimens in the flesh. We follow Carleton (1989) in use of the specific name *nasutus* for this species.

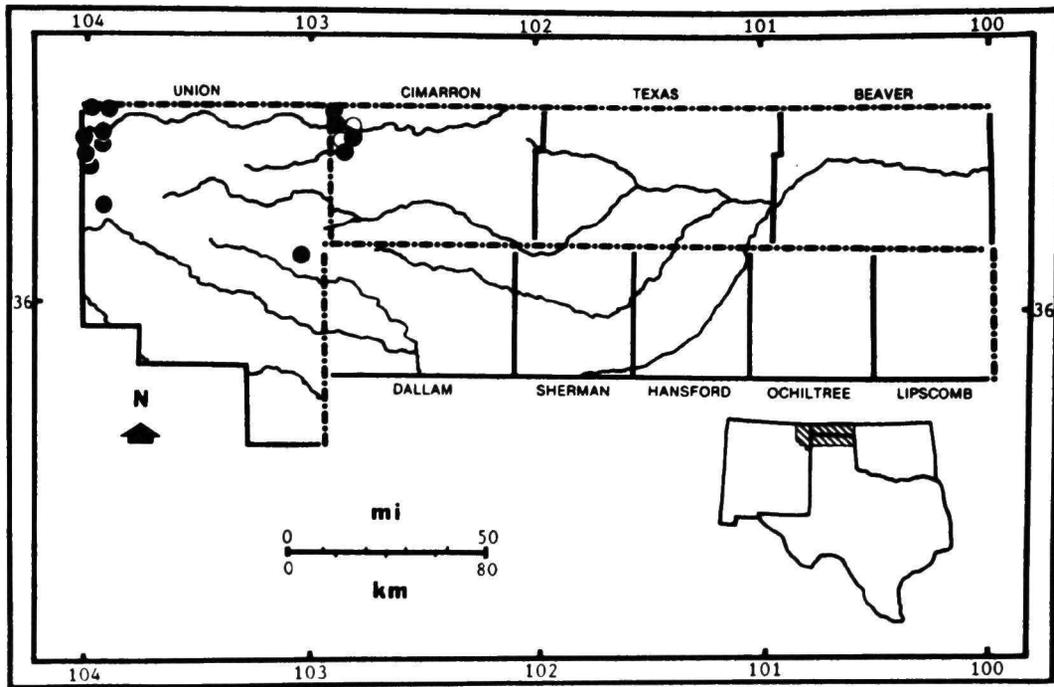


FIG. 32.—Distribution of *Peromyscus nasutus* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Rock mice occur throughout the higher parts of the piñon-juniper zone (Fig. 32) from Black Mesa westward in suitable habitat, except in parts of southern Union County. There, we trapped in seemingly suitable habitat at Trampiros Creek, but took no specimens.

Elsewhere in New Mexico, Wilson (1968) studied the ecological distribution of the same five species of *Peromyscus* that occur in the tristate region. Whereas species other than *P. truei* tend to be habitat generalists, *P. nasutus* was found only in rocky places.

We found much that has been written about the ecology of *P. nasutus* confusing and contradictory. Blair (1939) found the species at Black Mesa in "a rocky ravine." Glass (1949), however, did not list the species in his report of mammals from that area. Geluso (1971) reported finding *P. nasutus* at Black Mesa "associated with large rock masses," and "common in higher elevations of cliffs often devoid of vegetation." We trapped on numerous occasions in the masses of talus, lava, and sandstone ledges, including those high up on the slopes of Black Mesa, but took only an occasional *P. leucopus* or *P. boylii*. This was also true at Tesequite Canyon. Wilson (1968) and Findley *et al.* (1975) reported rock mice "in accumulations of large rocks or boulders, usually in pinyon-juniper and oak woodlands." We took two rock mice in the Black Mesa area from such conditions. The ground was covered with a layer of black humus, and the bases of cliffs were moss-covered. *P. boylii* was abundant there, and *P. truei* was moderately so.

At the Cornay Ranch near Capulin Mountain, we took specimens in boulders and cliffs along a small stream, in woodland of piñon, juniper, and oak. Only at Tollgate Canyon was the rock mouse abundant, occurring

mostly in stands of oak among large sandstone boulders and cliffs, where the ground was well shaded and littered with leaves and humus.

Two of our specimens appear brighter and more ochraceous than the others, tending toward the color of *P. truei*. Most are, as noted by Osgood (1909), grayish in color, with a narrow area of dull ochraceous along the shoulder region.

The exact ecological requirements of *P. nasutus* have not been adequately described. However, it is clear that in our study area it is limited to a narrow habitat, large rocks and oaks seemingly being the common denominators.

Dalquest and Stangl (1983) attempted to identify species of *Peromyscus* on the basis of lower jaws and teeth in assessing fossil and subfossil remains from a Trans-Pecos Texas cave deposit. *P. nasutus* was characterized as having no incisor base capsule on the mandible, an alveolar length of m1-m3 of more than 4.1, anteroconid of m1 broadly divided, and stylids or lophids usually present on m1. *P. truei* could not be well characterized because too few specimens were available to them at that time. We have assessed specimens of *P. nasutus*, *P. truei*, and *P. boylii* from the present study area in the same fashion. The broad division of the anteroconid of m1 does not hold true in the larger series of specimens, and *P. nasutus* is best identified by the large teeth and longer lower toothrow. Respective fetus counts for females taken on 22 May, 22 July, and 23 August, were three, four, and six.

Specimens examined (57).—NEW MEXICO. Union Co.: Raton Range, 1 (USNM); Raton Range, Oak Canyon, 6 (USNM); Tollgate Canyon, 6.5 mi. N, 3.5 mi. E Folsom, 11; Cornay Ranch, 5 mi. N Capulin, 4; Capulin Mountain, 4; NE side Capulin Mountain, 1; 1 km. N Capulin, 1; 5 km. SW Folsom, 1; Folsom Falls, 4 mi. NE Folsom, 1; Emory Peak, summit, 2 (USNM); Tollgate Canyon, 1 mi. N Folsom, 3; Folsom, 4 (USNM); Sierra Grande, 13 (USNM); Apache Canyon, Clayton, 1 (USNM). OKLAHOMA. Cimarron Co.: 1.5 mi. S, 3 mi. E Kenton, 1 (TTU); 4 mi. NNW Kenton, 1; 3 mi. SE Kenton, 1; 2 mi. N Kenton, 1.

Literature records.—OKLAHOMA. Cimarron Co.: Black Mesa; 2.6 mi. S, 1.5 mi. E Kenton; 3 mi. N, 0.7 mi. W Kenton; 3 mi. N Kenton; 3.5 mi. N, 1 mi. E Kenton; 3.5 mi. N, 1.2 mi. W Kenton; 2.5 mi. SE Kenton; 4 mi. N Kenton; 4.2 mi. N, 0.5 mi. W Kenton; 4.2 mi. S, 0.1 mi. W Kenton; 4.2 mi. S, 0.8 mi. W Kenton; 3.1 mi. N Kenton.

Peromyscus truei truei (Schufeldt, 1885)

Piñon Mouse

Restriction of the piñon mouse to piñon-juniper habitat (Fig. 33) is marked, as observed by other workers. At Black Mesa, we noted that this species often was trapped under or near piñon pines, even if the trees were isolated by up to 50 yards from other trees. In such habitat, *P. truei* usually is more common than either *P. leucopus* or *P. boylii*. A local exception was noted 11 mi. NNE Moses, in Union County, where the piñon mouse was especially abundant among boulders more than 100 yards from a piñon-juniper hillside. Possibly the population there had exceeded the carrying capacity of its normal habitat. Findley *et al.* (1975) noted that *P. truei* may be the most common mouse in some places in New Mexico. We were able to gather little reproductive data on the piñon mouse. Two females taken on 20 May and 20

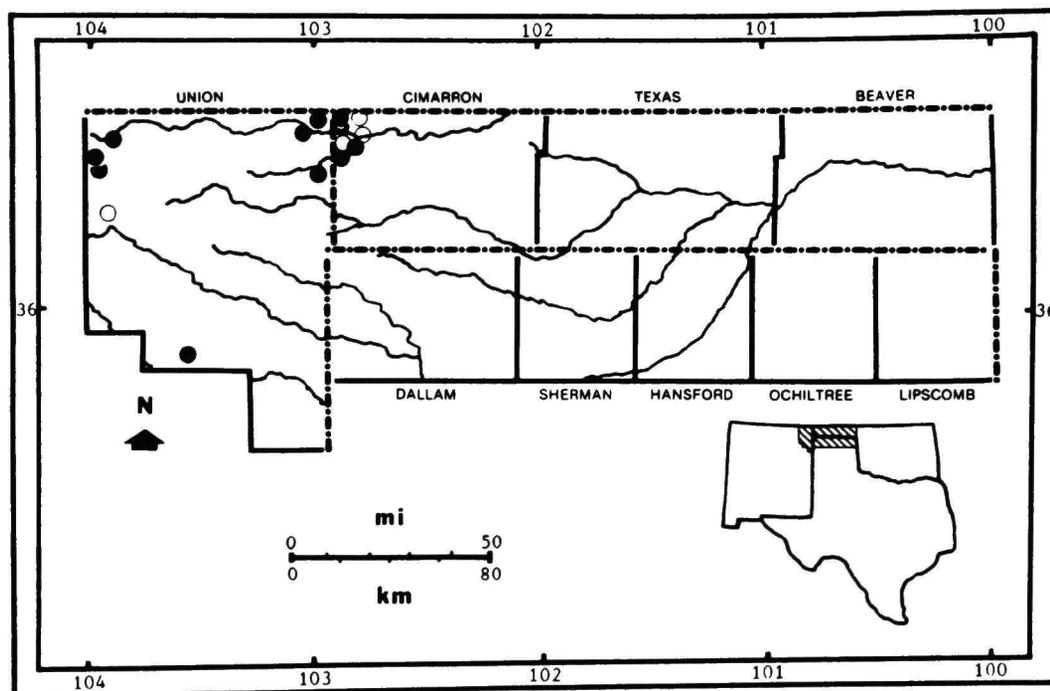


FIG. 33.—Distribution of *Peromyscus truei* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

July carried three and four fetuses, respectively, measuring 7 in crown-rump length.

Specimens examined (71).—NEW MEXICO. Union Co.: 4 mi. N Capulin, 2; Capulin Mountain, 1; 8 mi. NNW Folsom, 6; 6.5 mi. N, 2.5 mi. E Folsom, 1; 11 mi. NNE Moses, 12; 8 mi. NNW Kenton, Oklahoma, 6; 5 mi. NNW Kenton, Oklahoma, 3; 4 km. N, 17 km. W Kenton, Oklahoma, 7; 13 mi. WSW Clapham, 1. OKLAHOMA. Cimarron Co.: 4.5 mi. NNW Kenton, 12; 4 mi. NNW Kenton, 1; 4 mi. N Kenton, 11; 2 mi. N Kenton, 2; 1.5 mi. S, 3 mi. E Kenton, 4 (TTU); 3 mi. SSE Kenton, 2.

Literature records.—NEW MEXICO. Union Co.: base Sierra Grande. OKLAHOMA. Cimarron Co.: Kenton; E Kenton; 0.25 mi. NE Kenton; 0.25 mi. N, 0.75 mi. E Kenton; 0.25 mi. E Kenton; 0.5 mi. E Kenton; 4.5 mi. S, 0.5 mi. W Kenton; 1.25 mi. N Kenton; 2 mi. E Kenton; 6 mi. S, 2 mi. E Kenton; 2.25 mi. N Kenton; 2.5 mi. SE Kenton; 2.6 mi. S, 1.5 mi. E Kenton; 2.75 mi. N Kenton; 3 mi. N Kenton; 3 mi. N, 0.7 mi. W Kenton; 3 mi. NE Kenton; 3.4 mi. S, 1.2 mi. E Kenton; 3.5 mi. N, 1 mi. E Kenton; 3.5 mi. N, 1.2 mi. E Kenton; 3.6 mi. N, 0.9 mi. E Kenton; 3.9 mi. N, 0.5 mi. W Kenton; 2.5 mi. S Kenton; 2.5 mi. SE Kenton; 4 mi. S, 0.7 mi. E Kenton; 4 mi. N Kenton; 2.6 mi. NNE Kenton; 4.1 mi. S, 1.9 mi. E Kenton; 4.2 mi. N, 0.1 mi. W Kenton; 4.2 mi. S, 0.5 mi. W Kenton; 4.2 mi. S, 0.8 mi. W Kenton; 4.4 mi. N, 0.4 mi. W Kenton; 3.1 mi. N Kenton; Carrizo Creek, 6 mi. N Kenton; 7 mi. N Kenton; 8 mi. S Kenton.

Onychomys leucogaster articeps Rhoads, 1898

Northern Grasshopper Mouse

This short-tailed grasshopper mouse is widely distributed throughout the study area (Fig. 34). It often is common in sandy or short-grass prairie associations to the west, but in the northern parts of Union County and on Black Mesa, *O. leucogaster* is scarce and mostly restricted to grasslands in level valleys and to sandy soils adjacent to watercourses.

Fetus counts from four pregnant females taken from early May through early August were three, five, five, and six. Juvenile animals were obtained

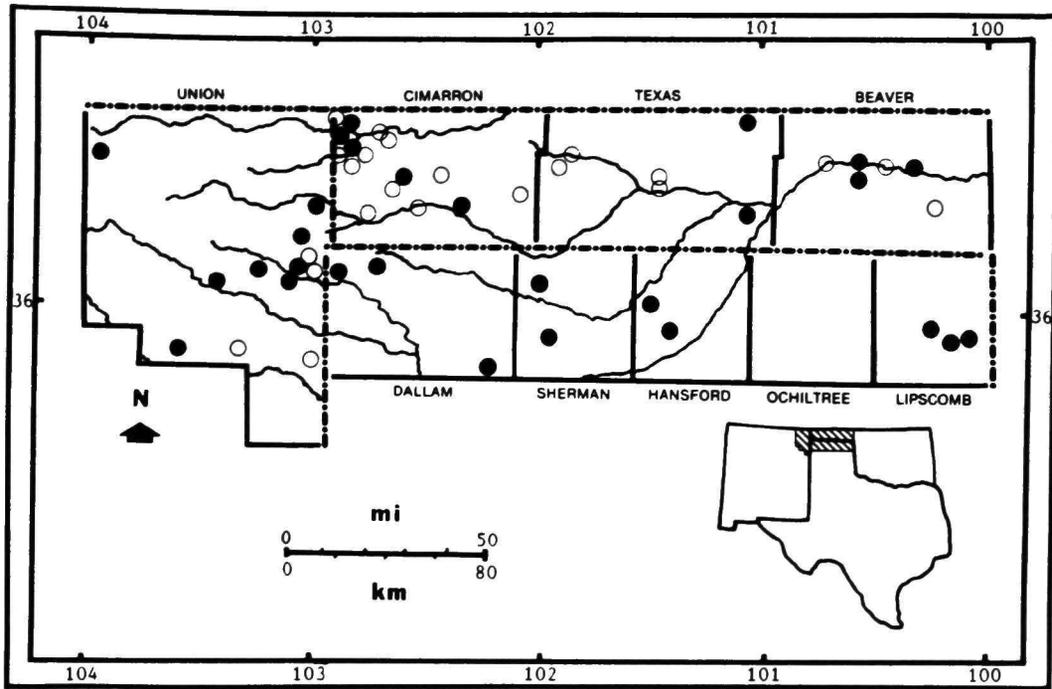


FIG. 34.—Distribution of *Onychomys leucogaster* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

from early May to late August, and may remain in the company of the mother until nearly fully grown. On one occasion a lactating female with six fetuses was taken in the same Sherman live trap as a two-thirds grown female. Two other comparable-sized young, all probably from an earlier litter of the female, were caught in adjacent traps.

Specimens examined (118).—NEW MEXICO. Union Co.: NE side Capulin Mountain, 1; Rabbit Ears Mountain, 2; 6 mi. SW Clayton, 4; 7 mi. SW Clayton, 6; 17.2 mi. WSW Clayton, 2; 3 mi. ESE Seneca, 1; 15 mi. W Clapham, 2. OKLAHOMA. Beaver Co.: 9 mi. W Beaver, 2; 8 mi. W Beaver, 1; 3 mi. N, 9 mi. W Beaver, 3; 2 mi. N Beaver, 1. Cimarron Co.: 1.5 mi. S, 3 mi. E Kenton, 1 (TTU); 5 mi. N Kenton, 4; 11 mi. W Boise City, 4; 12 mi. SSE Boise City, 1. Texas Co.: 4 mi. E Tyrone, 1; 11.8 mi. E Hardesty, 1. TEXAS. Dallam Co.: 2 mi. N, 13 mi. E Texline, 1 (TTU); Texline, 11 (USNM); 12 mi. E Texline, 3 (TTU); 1 mi. N, 8 mi. W Dalhart, 14 (TTU). Hansford Co.: 2 mi. N, 11 mi. W Gruver, 15 (KU); 6 mi. S, 2 mi. W Gruver, 3 (KU); 11 mi. SSW Gruver, 1. Lipscomb Co.: 12 km. NW Lipscomb, 6; 2 mi. NNW Lipscomb, 8; 2 mi. N, 8 mi. E Lipscomb, 1 (TTU); 2 mi. NW Lipscomb, 2; Lipscomb, 12 (USNM). Sherman Co.: 2 mi. N Stratford, 3; 8 mi. S, 2 mi. E Stratford, 1 (TTU).

Literature records.—NEW MEXICO. Union Co.: Clayton; 2 mi. N Sedan; 4 mi. S Clayton, Perico Creek; Clapham (Bailey, 1932); Clayton (Hollister, 1914). OKLAHOMA. Beaver Co.: 1.5 mi. N Beaver; 4 mi. S Floris; Lake Evans Chambers. Cimarron Co.: Black Mesa; 5.6 mi. N Boise City; 9.5 mi. S, 6.7 mi. W Boise City; 13 mi. S Boise City; 14 mi. W Boise City; 15.8 mi. W Boise City; 8.3 mi. N, 0.5 mi. E Felt; 9 mi. W Griggs; 2 mi. E, 6 mi. S Kenton; 2.5 mi. S Kenton; 2.5 mi. SE Kenton; 4.1 mi. S, 0.5 mi. E Kenton; 5 mi. N Kenton; 8 mi. SE Kenton; 1 mi. N, 9 mi. E Kenton; 10 mi. NW Kenton; 13.5 mi. E Kenton; Lake Etling. Texas Co.: 2 mi. E Eva; Sand Hills, 4.5 mi. NE Eva; 4.8 mi. N Guymon; 5.5 mi. N Guymon. TEXAS. Dallam Co.: Dalhart.

Sigmodon hispidus texianus (Audubon and Bachman, 1853)

Hispid Cotton Rat

Cotton rats frequently are common in areas where lush vegetation affords the necessary food and cover for their characteristic runway systems. In

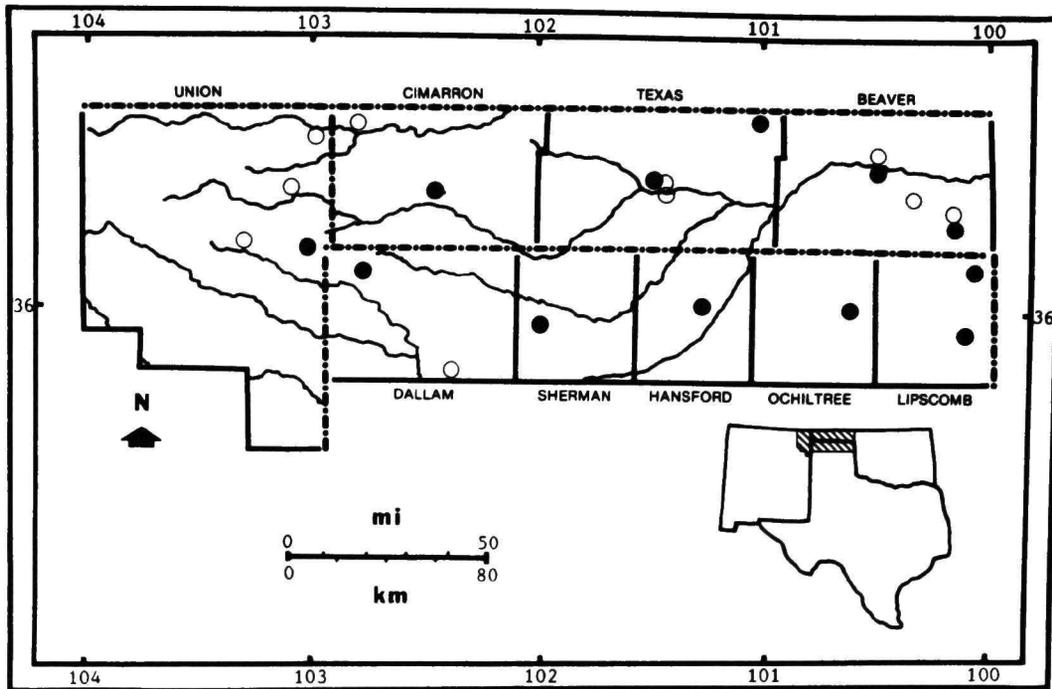


FIG. 35.—Distribution of *Sigmodon hispidus* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

much of Union County and western parts of the Oklahoma Panhandle, such sites are few and isolated (Fig. 35), and the species is mostly restricted to railroad and highway rights-of-way, and the margins of man-made bodies of water. One such site is a small marsh 3.8 mi. NE Clayton, where runways were initially mistaken for those of voles. Instead, we took five *Sigmodon*. Of four adult females, one carried five near-term fetuses measuring 41 in crown-rump length.

Hall (1981) mapped the eastern part of our study area as within the range of *S. h. texianus*, and the western region as within the range of *S. h. berlandieri* Baird, 1855. Jones *et al.* (1988) more recently assigned all cotton rats from the Texas Panhandle to *S. h. texianus*. We compared series from Beaver and Union counties, and found no appreciable differences.

Specimens examined (44).—NEW MEXICO. Union Co.: 3.8 mi. NE Clayton, 5. OKLAHOMA. Beaver Co.: 2 mi. N Beaver, 3; 22.1 mi. E Elmwood, 1. Cimarron Co.: Boise City, 1. Texas Co.: 4 mi. NE Tyrone, 1; 5.2 mi. NE Guymon, 1. TEXAS. Dallam Co.: 12 mi. E Texline, 1 (TTU). Hansford Co.: 6 mi. S, 2 mi. E Gruver, 2 (KU); 8 mi. S Spearman, 19 (TTU). Lipscomb Co.: 1 mi. N, 5 mi. E Follett, 5 (WTSU); 9 mi. E Lipscomb, 1 (TTU). Ochiltree Co.: 12 mi. S, 8 mi. E Perryton, 1 (TTU). Sherman Co.: 8 mi. S, 2 mi. E Stratford, 3 (TTU).

Literature records.—NEW MEXICO. Union Co.: 3 mi. W Kenton, Oklahoma; 5 mi. W Moses; Mount Dora. OKLAHOMA. Beaver Co.: 1.5 mi. N Beaver; Lake Evans Chambers; 3 mi. N Slapout. Cimarron Co.: 4 mi. N, 4 mi. E Kenton. Texas Co.: Beaver River, N Guymon; 2 mi. N Guymon; 4.25 mi. N Guymon; 5.5 mi. N Guymon. TEXAS. Dallam Co.: Dalhart.

Neotoma albigula warreni Merriam, 1908

White-throated Woodrat

The white-throated woodrat inhabits cliffs, rocky ledges, and talus throughout the piñon-juniper zone of the tristate region (Fig. 36). It is common

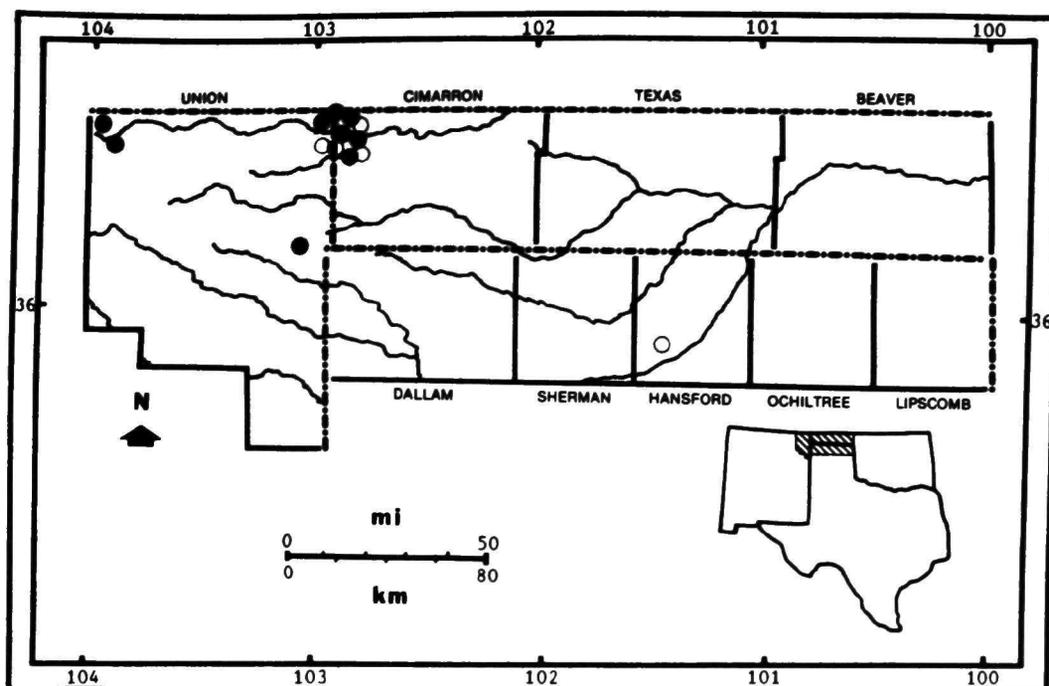


FIG. 36.—Distribution of *Neotoma albigula* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

in basalt flows and talus, as well as sandstone ledges and boulders of Black Mesa. We failed to find this species east of Black Mesa, although there is a record from Hansford County (Cutter, 1959c). Perhaps careful search along tributaries of the Beaver and Cimarron rivers will yield additional records from the eastern part of the region. The species is known from the Canadian River drainage to the south in Texas (Jones *et al.*, 1988).

At Black Mesa and in Union County, three species of *Neotoma* occur together, although segregated by habitat. *N. micropus* occupies the level flats of cactus and yucca, whereas *N. mexicana* lives among the talus and large boulders higher on rocky hillsides. *N. albigula* ranges from the margin of lowlands upwards through and including areas preferred by *N. mexicana*. At the Wiggins Ranch north of Kenton, we have taken *N. micropus* and *N. albigula* a few yards apart, although the white-throated woodrat occurs more broadly with *N. mexicana*.

One female obtained on 20 May carried two small fetuses, and another taken on 18 April had four. Many females taken from late July through late October were lactating.

Specimens examined (27).—NEW MEXICO. Union Co.: 4 mi. NE Folsom, 1; 10 mi. N Folsom, 2; 8 mi. NNW Kenton, Oklahoma, 1; Rabbit Ears Mountain, 2. OKLAHOMA. Cimarron Co.: 5 mi. N Kenton, 4; 5 mi. NNW Kenton, 1; 4.5 mi. NNW Kenton, 2; 4 mi. N Kenton, 2; 2.4 mi. E Kenton, 1 (TTU); 4.3 mi. S, 2.4 mi. E Kenton, 5 (TTU); 1.5 mi. S, 3 mi. E Kenton, 6 (TTU).

Literature records.—NEW MEXICO. Union Co.: Clayton; 6 mi. S, 3 mi. W Kenton, Oklahoma. OKLAHOMA. Cimarron Co.: Black Mesa; Black Mesa State Park; 0.5 mi. E Kenton; 1.5 mi. S, 2.75 mi. E Kenton; T. 5 N, R. 2 E, sec. 34; 2.75 mi. S, 1.5 mi. E Kenton; 2 mi. N, 1 mi. W Kenton; 2.25 mi. N Kenton; 2.5 mi. SE Kenton; 2.6 mi. S, 1.5 mi. E Kenton; 3 mi. N Kenton; 3.4 mi. S, 1.2 mi. E Kenton; 3.5 mi. N, 1 mi. E Kenton; 3.6 mi. N, 1.1 mi. W Kenton; 3.6 mi. N, 0.9 mi. E Kenton; 2.5 mi. SE Kenton; 4 mi. E Kenton; 4 mi. N Kenton; 4.2 mi. S Kenton; 4.2 mi. S, 0.5 mi. E

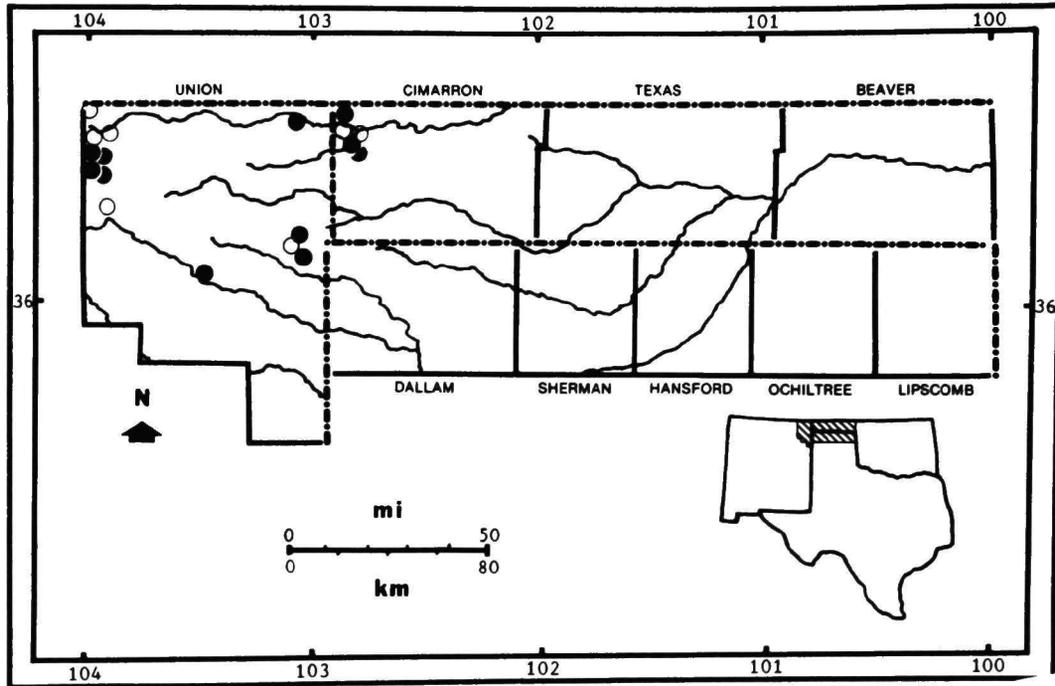


FIG. 37.—Distribution of *Neotoma mexicana* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Kenton; 4.2 mi. S, 0.8 mi. W Kenton; 4.5 mi. S Kenton; 5 mi. N Kenton; 5.3 mi. S, 0.5 mi. E Kenton; 6 mi. N Kenton; Black Mesa, Easter Pageant Bluff; Tesequite Canyon. TEXAS. Hansford Co.: 10 mi. S, 3 mi. W Gruver (Cutter, 1959c).

Neotoma mexicana scopulorum Finley, 1953

Mexican Woodrat

The Mexican woodrat occurs from Black Mesa westward (Fig. 37) in mountainous areas and lava flows. In many places where we took this species, we also found *N. albigula*. However, as a rule, *N. mexicana* dominates igneous formations, whereas the white-throated woodrat is most common among sandstone strata. Among igneous rocks at Folsom Falls, *N. mexicana* was the common woodrat, although a single *N. albigula* was taken in the same trapline. Along a high ledge on the eastern peak of Rabbit Ears Mountain, *N. albigula* was common, although a single *N. mexicana* was trapped there as well.

Mexican woodrats typically nest deep in rock crevices, without the obvious stick nests of other woodrats. In such cases, their presence usually is indicated by conspicuous toilets. However, along Carrizo Creek, 26 mi. W Clayton, we were surprised to take only *N. mexicana* from sandstone ledges where stick nests protruded in a fashion usually attributed to *N. albigula*.

Occasional specimens tend to be quite dark dorsally, sometimes nearly black. One such individual from near Folsom had a gray venter, and another from Carrizo Creek had ochraceous underparts.

A female taken on 16 May from near Capulin carried three fetuses measuring 10 in crown-rump length. Lactating females and juveniles were

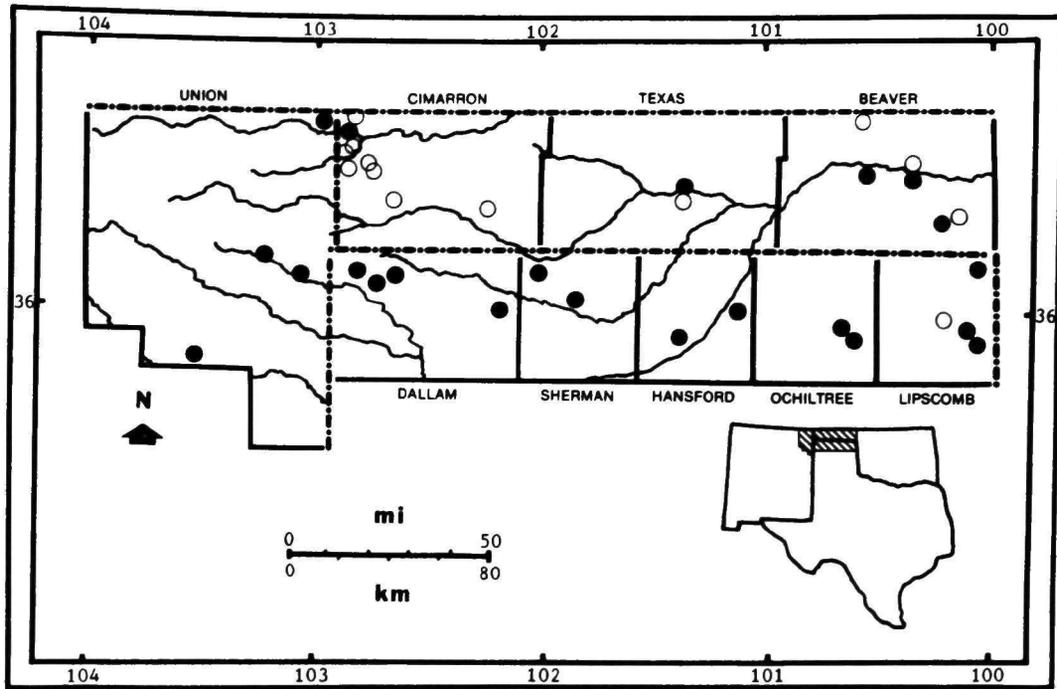


FIG. 38.—Distribution of *Neotoma micropus* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

collected as early as 19 June to as late as 24 August, indicating that the breeding season may be delayed relative to other woodrats considered herein.

Specimens examined (32).—NEW MEXICO. Union Co.: Tollgate Canyon, 10 mi. N Folsom, 1; 8 mi. NNE Folsom, 1; Folsom Falls, 4 mi. NE Folsom, 7; 5 mi. N Capulin, 1; 3 mi. N Capulin, 1; 1 km. N Capulin Mountain, 1; NE side Capulin Mountain, 1; Capulin Mountain, 1; 4 km. N, 17 km. W Kenton, Oklahoma, 1; Rabbit Ears Mountain, 1; Apache Canyon, 3 mi. NNW Clayton, 5; Hwy. 45 and Carrizo Creek, 26 mi. W Clayton, 2. OKLAHOMA. Cimarron Co.: 5 mi. NNW Kenton, 2; 3 mi. S, 2 mi. E Kenton, 1 (TTU); 4.5 mi. S, 2.4 mi. E Kenton, 2 (TTU); 4.3 mi. S, 2.4 mi. E Kenton, 1 (TTU); 1.5 mi. S, 3 mi. E Kenton, 3 (TTU).

Literature records.—NEW MEXICO. Union Co.: Apache Canyon, Clayton; Folsom; 5.5 mi. NE Folsom; Raton Range, Oak Canyon; Sierra Grande. OKLAHOMA. 2.5 mi. S, 1.5 mi. E Kenton; 5 mi. N Kenton; 6 mi. N Kenton; Tesequite Canyon.

Neotoma micropus canescens J. A. Allen, 1891
Southern Plains Woodrat

This woodrat is an exceedingly versatile species. It prefers the shelter of rocks, brush and small trees, abandoned buildings, or other solid structures against which to construct its characteristic stick nest. Where no prominent backdrop exists, nests may be built around such low-lying vegetation as sand sage or yucca, and can be difficult to detect. This is the only woodrat that is present over most of the study area (Fig. 38) and actually may displace *N. albigula* where the ranges of the two species overlap. The type locality of *N. m. canescens* is "on the North Beaver [= North Canadian] River, near the boundary line between the Indian Territory and New Mexico," in Cimarron County (Allen, 1891).

Juveniles were taken in June through August. Although no pregnant females were collected during the course of our study, lactating adult females were obtained from late May through early August.

Specimens examined (49).—NEW MEXICO. Union Co.: 8 mi. NNW Kenton, Oklahoma, 1; 6 mi. SW Clayton, 1; 17.2 mi. WSW Clayton, 1; 13 mi. WSW Clapham, 1. OKLAHOMA. Beaver Co.: 2 mi. N Beaver, 5; 9 mi. W Beaver, 1; 22.1 mi. E Elmwood, 1. Cimarron Co.: 4.5 mi. N Kenton, 2; 4 mi. N Kenton, 2. Texas Co.: 5.2 mi. NE Guymon, 1. TEXAS. Dallam Co.: 2 mi. N, 13 mi. E Texline, 2 (TTU); 12 mi. E Texline, 1; 10.6 mi. W Stratford, 1 (TTU); 1.5 mi. N Conlen, 5 (WTSU); 1 mi. N, 6 mi. W Dalhart, 1 (TTU). Hansford Co.: 10 mi. N Spearman, 8 (WTSU); 5 mi. N jct. Hwy. 15 and FM 2387, 1 (WTSU); 6 mi. S, 3 mi. W Gruver, 1 (KU); 6 mi. S, 2 mi. W Gruver, 1 (KU). Lipscomb Co.: 1 mi. N, 5 mi. E Follett, 1 (WTSU); 2 mi. N, 8 mi. E Lipscomb, 1 (TTU); 9 mi. E Lipscomb, 1 (TTU). Ochiltree Co.: 12 mi. S, 8 mi. E Perryton, 5 (TTU); 12 mi. S, 9 mi. E Perryton, 1 (TTU). Sherman Co.: 10 mi. N Stratford, 3 (TTU).

Literature records.—OKLAHOMA. Beaver Co.: 1.5 mi. N Beaver; 21 mi. S Meade, Kansas; 3 mi. NW Slapout. Cimarron Co.: 7.5 mi. S, 10 mi. W Boise City; 9 mi. W Griggs; 1 mi. S, 2 mi. E Kenton; 4 mi. N Kenton; 4.1 mi. S, 0.5 mi. E Kenton; 5 mi. N Kenton; 6 mi. N Kenton; 9 mi. SE Kenton; 11 mi. SE Kenton; Lake Etling, Black Mesa State Park; Tesequite Canyon. Texas Co.: 2 mi. N Guymon; 4.5 mi. N Guymon; 5.5 mi. N Guymon. TEXAS. Lipscomb Co.: Lipscomb (Goldman, 1910).

Microtus mexicanus mogollonensis (Mearns, 1890)

Mexican Vole

Dalquest (1975) first reported the Mexican vole from Union County, mistakenly identifying it as *M. montanus*. Finley *et al.* (1986) corrected the misidentification, and listed additional specimens from Sierra Grande. Another infelicity in Dalquest's (1975) note should be mentioned. A printer's error caused the last two lines in the first paragraph to be repeated at the end of the second paragraph, resulting in "Trapping yielded no additional specimens and *M. longicaudus*." Finley *et al.* (1986) took this as recording *M. longicaudus* at Capulin Mountain, although there are no specimens known from Union County.

Near Capulin, *M. mexicanus* appears to constitute a remnant population (Fig. 39) that inhabits conditions seemingly unsuitable for most voles. Soils are thin and stony, and the land is arid. Grasses are sparse on the lava plain due to heavy grazing by cattle. Characteristic runways often are obscure and difficult to recognize without close inspection. Runways usually extend for short distances into grasses of the lava plains from the cover of rocky shelters in pressure ridges. In one instance, voles had runways and burrows below piles of juniper branches which had been cut in production of fenceposts. Here, as elsewhere, more deserted runway systems than active trails were discovered. In only one instance did we find evidence of voles on a rocky, wooded hillside.

On one afternoon, an area of churned soil, a result of intensive burrowing activity, was discovered at the base of a small pressure ridge. Several burrow entrances of about three centimeters in diameter were located. No runways were present, and only fresh droppings around the entrances indicated that the site was not the result of pocket gopher activity. While we set traps near

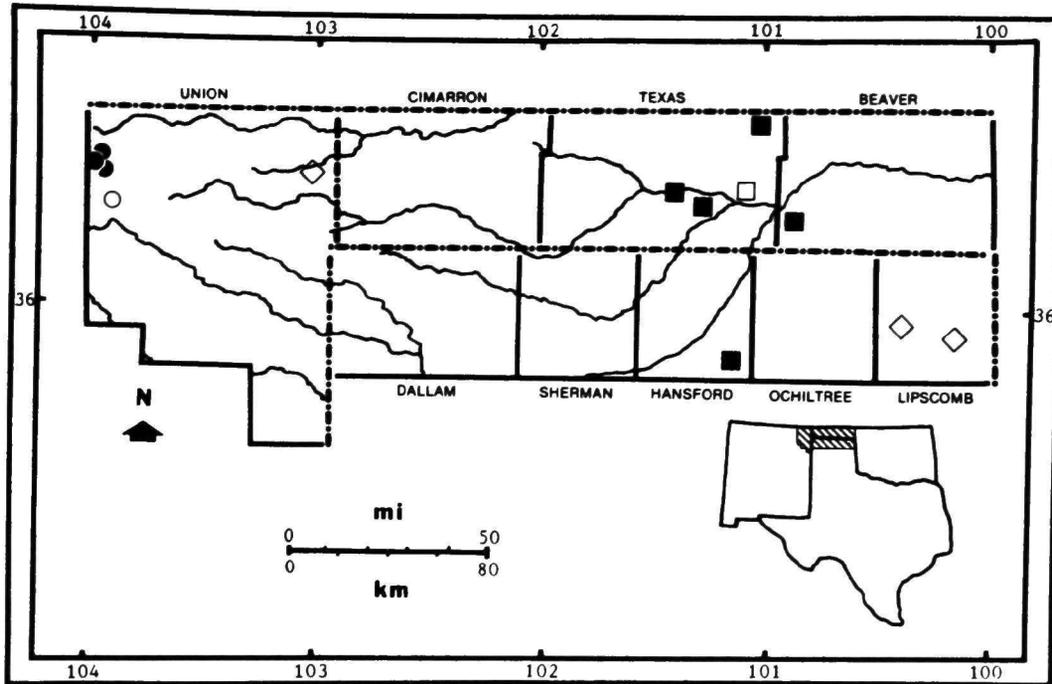


FIG. 39.—Distribution of *Microtus mexicanus* (circles), *M. ochrogaster* (squares), and *Ondatra zibethicus* (diamonds) in the trisate study region. Solid symbols represent specimens examined; open symbols represent literature records.

the burrows, a vole partially emerged from one, only to withdraw after about 20 seconds. An hour later and still well before sundown, one live trap set at this place contained an adult female Mexican vole.

Five adult females taken on 16 May displayed no signs of reproductive activity, indicating a late breeding season. One half-grown animal and a lactating female were collected on 19 July; of two females trapped on 28 July, one contained three small fetuses and the other had two that were nearly full-term (26 in crown-rump length).

The taxonomic status of voles in northeastern New Mexico is problematic (see Wilhelm, 1982). Of the two subspecies occurring in the state, the range of *M. m. guadalupensis* Bailey, 1902, most closely approaches our study area. However, populations of *guadalupensis* are separated by unsuitable terrain from the one in Union County, and they are unlikely to be continuous.

Specimens examined (10).—NEW MEXICO. Union Co.: 5 mi. N Capulin, 7; 3 mi. N Capulin, 2; W base Capulin Mountain, 1.

Literature record.—NEW MEXICO. Union Co.: Sierra Grande (Finley *et al.*, 1986).

Microtus ochrogaster taylori Hibbard and Rinker, 1943

Prairie Vole

The prairie vole has been recorded only recently from the Oklahoma (Reed and Choate, 1988) and Texas (Manning and Jones, 1988) panhandles. Our efforts have resulted in extending the known range of the species over most of the eastern half of the Oklahoma Panhandle (Fig. 39).

The prairie vole shares habitat in the study area with the hispid cotton rat, although neither seems to be particularly common. Where one of the two

species occurs, the other usually is either scarce or absent. Although Jones *et al.* (1988) collected specimens along a grassy fencerow in Hansford County where no runways were observed, our specimens from Oklahoma were taken where characteristic signs were noted. Burrows were situated in well-drained, friable soils under the cover of dense tall grasses or yucca. Runways radiated for short distances from the burrows before gradually disappearing into the surrounding sparsely vegetated area, leaving the impression that the animals must forage, at least to some degree, beyond the protective cover of dense plant growth.

Runway complexes usually were quite restricted, covering no more than perhaps 100 square meters, each occupied by only a few voles. Since first discovering prairie voles in the Oklahoma Panhandle, we have been unable to collect them at any site more than once. Runway systems visited from a month to a year later always were deserted. On one occasion, the burrows had been excavated, probably by skunks, and other times a prairie rattlesnake (*Crotalus viridus*) and a bullsnake (*Pituophis melanoleucus*) were discovered in the immediate vicinity of vole runway systems. Although the snakes were not collected for analysis of stomach contents, such predators easily could eliminate a small local vole population, and no voles were taken from the runway systems where the snakes were noted.

Of three adult females captured between 18-20 May, one was lactating. Another female collected on 5 January carried four tiny fetuses (3 in crown-rump length). Probably *Microtus ochrogaster* breeds in the tristate region at any time of the year when conditions are favorable (see also Jones *et al.*, 1988).

Hibbard and Rinker (1943) described *M. o. taylori* from a site in Meade County, Kansas, just across the border from Beaver County. Choate and Williams (1978) speculated that this subspecies was extirpated by drought and subsequently replaced by *M. o. haydenii* (Baird, 1858), or, alternatively, the population of *taylori* was so reduced that it was genetically swamped by the invading *haydenii*. Jones *et al.* (1988) assigned our Texas specimens to *M. o. haydenii*, following Choate and Williams (1978). However, when compared to the large series of presumably typical *M. o. haydenii* from central Oklahoma, our specimens are considerably paler dorsally and ventrally, and may represent, therefore, relict populations, as first postulated by Manning and Jones (1988). Because it is relatively uncommon, this species easily could have escaped previous notice by collectors in our study area.

Specimens examined (13).—OKLAHOMA. Beaver Co.: 3.8 mi. W Bryan's Corner, 2. Texas Co.: 11.1 mi. E Guymon, 1; 5.2 mi. NE Guymon, 1; 4 mi. NE Tyrone, 2. TEXAS. Hansford Co.: 8 mi. S Spearman, 7 (TTU).

Literature record.—OKLAHOMA. Texas Co.: 5.5 mi. N, 2 mi. E Hardesty (Reed and Choate, 1988).

Ondatra zibethicus cinnamominus (Hollister, 1910)

Muskrat

Muskrats probably occur in most permanent streams and tributaries of the tristate region where water is deep enough to support them. Trappers are an important source of voucher material for furbearing species, and the scarcity of muskrat records (Fig. 39) may be explained, at least in part, by lack of trapping efforts directed towards this species. The records from Lipscomb County are many years old (Bailey, 1905), and voucher specimens apparently were not preserved for a population of muskrats observed by Best (1971) in Union County.

Literature records.—NEW MEXICO. Union Co.: 34.4 mi. N, 2.5 mi. E Clayton (Best, 1971). TEXAS. Lipscomb Co.: 15 mi. W Lipscomb (Bailey, 1905); 5 mi. E Lipscomb (Bailey, 1905).

Rattus norvegicus (Berkenhout, 1769)

Norway Rat

The Norway rat is an introduced species that probably is restricted to man-made structures and their immediate environs in the study area, as is the case elsewhere. Scarcity of records probably is indicative of the lack of collecting efforts in towns, and around ranch buildings, dump sites, and feed yards where the species typically occurs.

Specimens examined (2).—TEXAS. Ochiltree Co.: 1 mi. S, 1 mi. E Perryton, 2 (TTU).

Literature records.—OKLAHOMA. Texas Co.: 2 mi. N Eva; S Guymon.

Mus musculus Linnaeus, 1758

House Mouse

Like *Rattus norvegicus*, the house mouse is an introduced mammal that is most commonly found in association with man. On occasion, the species may become established in feral populations, although seldom distant from human habitations.

Specimens examined (15).—TEXAS. Dallam Co.: 12 mi. E Texline, 1 (TTU); 1 mi. N, 8 mi. W Dalhart, 1 (TTU). Hansford Co.: 8 mi. S Spearman, 3 (TTU). Lipscomb Co.: 1 mi. N, 5 mi. E Follett, 5 (WTSU); 2 mi. N, 8 mi. E Lipscomb, 2 (TTU); 7 mi. E Lipscomb, 2 (TTU). Ochiltree Co.: 7 mi. N Perryton, 1 (TTU).

Literature records.—NEW MEXICO. Union Co.: 4 mi. S Clayton, Perico Creek. OKLAHOMA. Cimarron Co.: 6 mi. N Kenton; 8 mi. SE Kenton. Texas Co.: 2 mi. E Eva; Guymon; 2 mi. N Guymon; Beaver River, 3.5 mi. SW Optima.

Erethizon dorsatum bruneri Swenk, 1916

Porcupine

The porcupine is common in New Mexico, but is seemingly scarce across much of the Texas and Oklahoma panhandles (Fig. 40). Individuals wander

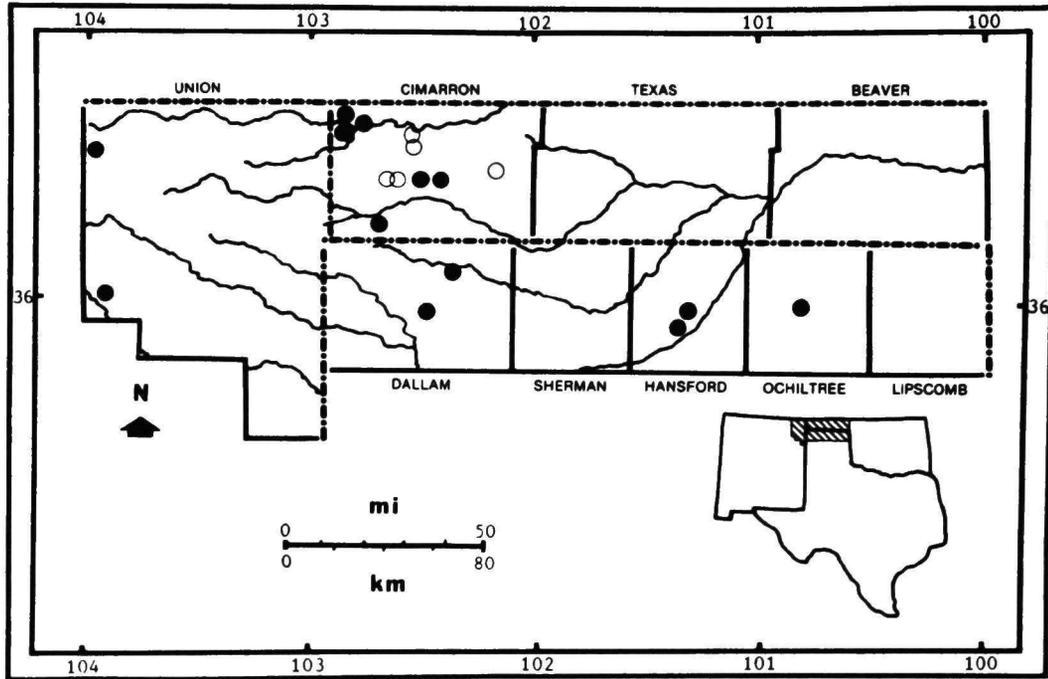


FIG. 40.—Distribution of *Erethizon dorsatum* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

far from the more rugged areas in which they frequently are common, rocky canyons being important dispersal routes. A Dallam County specimen was the skeleton of an animal that apparently had died in a cave along the bank of a dry wash located miles from any water or trees.

Game warden David Kirk of Beaver County informed us that the species has become relatively common there in recent years. It is surprising how so large and distinctive an animal can live in an area without being detected by humans. The first clues are often road-killed specimens, or dogs carrying quills as the result of an encounter with a porcupine.

Intraspecific variation in this species is poorly understood. Hall (1981) assigned Union County porcupines to *E. d. epixanthum* Brandt, 1835, and specimens from the panhandles to *E. d. bruneri* Swenk, 1916. We tentatively refer all our material to the latter.

Specimens examined (14).—NEW MEXICO. Union Co.: 5 mi. N Capulin, 1; Ute Creek and Hwy. 56, 2.5 mi. E Gladstone, 1. OKLAHOMA. Cimarron Co.: 4 mi. N Kenton, 1 (OSU); 1.1 mi. E Kenton, 1; near Robber's Roost, 6 mi. E Kenton, 1 (OSU); 10 mi. W Boise City, 1 (OSU); 4 mi. E Boise City, 1 (OSU); Felt, 1 (OSU). TEXAS. Dallam Co.: 15 mi. NW Conlen, 1 (WTSU); 21 mi. N Dalhart, 1. Hansford Co.: 6 mi. S, 2 mi. W Gruver, 2 (KU); 10 mi. S, 3 mi. W Gruver, 1 (KU). Ochiltree Co.: 11 mi. S, 5 mi. E Perryton, 1 (TTU).

Literature records.—OKLAHOMA. Cimarron Co.: Black Mesa; 12 mi. N, 1 mi. E Boise City; 13 mi. N Boise City; 15 mi. N Boise City; 2.5 mi. SE Kenton; 4 mi. S Keyes; T. 5 N, R. 2 E, sec. 10.

Canis latrans latrans Say, 1823

Coyote

The coyote is common to abundant throughout the region. Animals often were sighted during the day, and their characteristic howls were heard at nearly every site during evening hours, even in areas under intense cultivation.

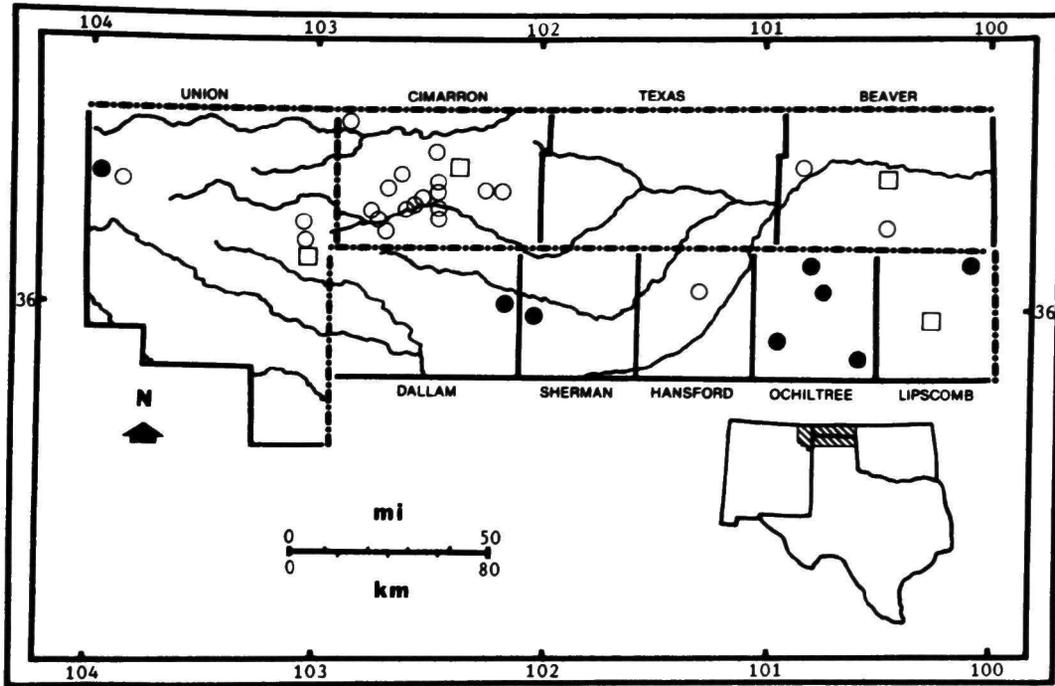


FIG. 41.—Distribution of *Canis latrans* (circles) and former distribution of *C. lupus* (squares) in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records:

Landowners with whom we talked view the coyote as neutral or beneficial in terms of its scavenging habits and value as a furbearer. Many records cited below (Fig. 41) are of animals taken by trappers.

Specimens examined (17).—NEW MEXICO. Union Co.: N side Capulin Mountain, 5 mi. NNE Capulin, 1. TEXAS. Dallam Co.: 8 mi. N Conlen, 1 (WTSU). Hansford Co.: 10 mi. S, 4 mi. W Gruver, 1 (KU). Lipscomb Co.: 1.5 mi. N, 3 mi. E Follett, 1 (WTSU). Ochiltree Co.: 1 mi. N, 1 mi. E Perryton, 1 (TTU); 9 mi. S, 4 mi. E Perryton, 1 (TTU); Wolf Creek drainage, SE part of county, 9 (TTU); 23 mi. S, 10 mi. W Perryton, 1 (TTU). Sherman Co.: 10 mi. S Stratford, 1 (WTSU).

Literature records.—NEW MEXICO. Union Co.: 6 mi. N Clayton; 15 mi. N Clayton; 6 mi. SE Des Moines; 7 mi. SE Des Moines. OKLAHOMA. Beaver Co.: 3 mi. E Elmwood; 7 mi. SE Turpin. Cimarron Co.: Boise City; 6 mi. SW Boise City; 8 mi. S Boise City; 8 mi. SW Boise City; 10 mi. SW Boise City; 12 mi. S Boise City; 14 mi. SW Boise City; 15 mi. NW Boise City; 16 mi. N Boise City; 3 mi. N, 16 mi. W Boise City; 17 mi. NW Boise City; 17 mi. W Boise City; 18 mi. SE Boise City; 24 mi. W Boise City; canyon, E North Carrizo Creek; 3 mi. W Felt; 5 mi. NW Felt; 6 mi. NW Felt; 8 mi. NW Felt; 10 mi. NW Felt; north side Black Mesa; 5 mi. N Kenton; 1 mi. E Watson Crossing. TEXAS. Dallam Co.: Texline (Bailey, 1905); Buffalo Springs (apparently not the former place by that name in Sherman County, as reported by Jones *et al.*, 1988, but rather "20 miles to the northeast of Texline," according to Bailey, 1905). Hansford Co.: 1 mi. N Bernstein (Cutter, 1959a).

Canis lupus nubilus Say, 1823

Gray Wolf

The gray wolf doubtless ranged throughout the tristate region (Fig. 41) until extirpated in the early 1900s. Bailey (1905) reported evidence of wolf predation on livestock in Lipscomb County as recently as 1903, and Union

County was included in the range of the last wolves of the area (Seton (1929, and subsequent popular works).

Literature records.—NEW MEXICO. Union Co.: Clayton (Seton, 1929). OKLAHOMA. Beaver Co.: Beaver Creek, Indian Territory. Cimarron Co.: Teepee Creek, Neutral Strip, Indian Territory. TEXAS. Lipscomb Co.: no specific locality (Bailey, 1905).

Vulpes velox velox (Say, 1823)

Swift Fox

The swift fox is a fairly common resident of the panhandle prairies (Fig. 42), where it seems to be the only native carnivore that residents of the area appreciate and protect. At one time, the species almost was extirpated by coyote poisoning programs, but today has recovered remarkably.

A female taken on 20 April by a Dallam County rancher was lactating. After a short search, a den was found that contained four blind pups, thought to be about a week old, which were removed and raised as pets. The burrow, about a foot in diameter and circular, descended gradually to a depth of nearly two feet, then continued in a generally linear fashion, terminating in a little-used escape exit 20 feet from the entrance. Two lateral burrows, extending at right angles from the main shaft, were plugged with grass. Two pups were found on bare earth of the main tunnel, and the others were each found in separate, short side tunnels (K. W. Wells, field notes).

Zumbaugh *et al.* (1985) summarized winter diets of swift foxes on the central High Plains, and found they fed mostly on rabbits, although rodents, birds, and carrion were important components. The excavated den discussed above contained a fresh, partially eaten cottontail. Diets of foxes from the Texas (Cutter, 1958) and Oklahoma (Kilgore, 1969) panhandles also were found to contain quantities of lower vertebrates and invertebrates.

Specimens examined (9).—TEXAS. Dallam Co.: 15 mi. W Stratford, 1 (WTSU); 21 mi. N Dalhart, 1. Hansford Co.: 3 mi. S Bernstein, 1 (KU); 10 mi. W Gruver, 1 (KU); 1 mi. N, 1 mi. E Morse, 2 (KU). Sherman Co.: 3 mi. E Stratford, 1 (KU); 4.5 mi. E Stratford, 1 (KU); no specific locality, 1 (TTU).

Literature records.—NEW MEXICO. Union Co.: near Clayton (Best, 1971). OKLAHOMA. Beaver Co.: 7 mi. SW Balko; 3 mi. E Elmwood; 0.5 mi. S, 3 mi. E Gray; Texas line at Hwy. 83; T. 1 N, R. 21 E, sec. 19; T. 1 N, R. 21 E, sec. 20. Texas Co.: 5 mi. NW Goodwell; near Guymon; 15 mi. E Hardesty. TEXAS (Cutter, 1959a). Hansford Co.: 1 mi. S, 4 mi. W Gruver; 10 mi. S, 4 mi. W Gruver. Lipscomb Co.: no specific locality. Ochiltree Co.: no specific locality.

Vulpes vulpes fulva (Desmarest, 1820)

Red Fox

The red fox is evidently a rare or occasional resident of the eastern part of the tristate region, where its numbers are perhaps controlled by the numerous coyotes. Jones *et al.* (1988) observed an individual run across U.S. Highway 83 in extreme southern Beaver County, and related a trapper's report of the presence of this fox in flatlands of northern Ochiltree County (Fig. 42).

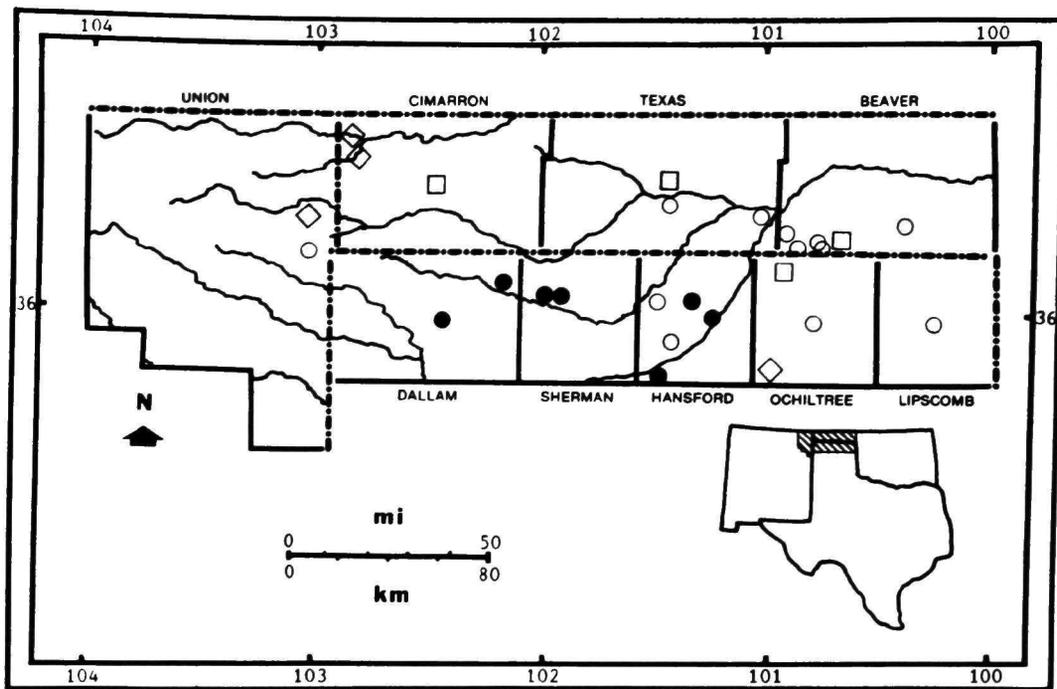


FIG. 42.—Distribution of *Vulpes velox* (circles), *V. vulpes* (squares), and *Urocyon cinereoargenteus* (diamonds) in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Zumbaugh and Choate (1985) provided a discussion of the historical biogeography of foxes in Kansas, immediately to the north of our study area. There, the red fox has become established either as the result of dispersal from the east along riparian corridors or by introduction, or both.

Literature records.—OKLAHOMA. Beaver Co.: U. S. Hwy. 83, about 8 mi. NW Perryton, Texas. Cimarron Co.: no specific locality. Texas Co.: no specific locality. TEXAS. Ochiltree Co.: northwest of Perryton.

Urocyon cinereoargenteus scottii Mearns, 1891

Gray Fox

The gray fox is known only from a few records in the more rugged western part of the study area, although broken lands to the east may support some individuals (Fig. 42). Jones *et al.* (1988) reported a specimen taken by a trapper in southwestern Ochiltree County, where it was the first of its kind seen by that individual in 12 years of trapping furbearers. Subspecific assignment is based solely on geographic grounds.

Literature records.—NEW MEXICO. Union Co.: Seneca, La Cienega. OKLAHOMA. Cimarron Co.: Kenton; Tesequite Canyon. TEXAS. Ochiltree Co.: southwestern corner.

Ursus americanus Pallas, 1780

Black Bear

The black bear once ranged along the rivers and tributaries of the Texas and Oklahoma panhandles (Brown, 1988), but native animals were extirpated by the early 1900s. Occasional individuals wander out of New Mexico

or southern Colorado, as reported in local newspapers. The species persists in northern Union County, as evidenced by droppings and tracks noted near Capulin Mountain and in Tollgate Canyon north of Folsom.

A series of black bear and mountain lion skulls was purchased by the first author more than 20 years ago from a retired hunting guide, who stated that at least some of each were from Union County, and the rest from nearby Colorado and Colfax County, New Mexico. The skulls are deposited in the Midwestern State University Collection of Recent Mammals.

Hall (1981) mapped the eastern part of our study area as within the range of *U. a. americanus* Pallas, 1780, and the western part in that of *U. a. amblyceps* Baird, 1859.

Literature record.—TEXAS. Dallam Co.: near Thompson Grove, 2 mi. N, 13 mi. E Texline.

Bassariscus astutus flavus Rhoads, 1894

Ringtail

The ringtail is a small, secretive carnivore of rugged and often rocky terrain. The tristate area is within the mapped range of the species, although no voucher specimens are available. Early one evening, we observed an animal moving swiftly through dense brush along the talus slopes at the base of Black Mesa, about 5 mi. N Kenton, which might have been a ringtail. Caire *et al.* (1990) reported a sighting of *B. astutus* in the same area, although landowners we queried were not familiar with the animal.

B. astutus often is taken by trappers in sets meant for more valuable furbearers. Because the species might be expected to occur in rough terrain throughout the study area, voucher specimens yet may be obtained.

Literature record.—OKLAHOMA. Cimarron Co.: no specific locality.

Procyon lotor hirtus Nelson and Goldman, 1930

Raccoon

Although records are few (Fig. 43), the raccoon may be one of the most common carnivores in our study area. Tracks were noted along most watercourses and around most permanent stock tanks. Road-killed animals, usually damaged beyond salvage, often were noted, especially where streams intersected highways. One farmer near Hardesty, Texas County, told us several raccoons inhabited the deserted homestead adjacent to his house. The buildings were surrounded by monoculture cropland, and miles from any waterway or cover of any consequence.

At Capulin Mountain, the species proved to be a pest, digging up and destroying our plastic pitfall traps set for shrews. On two occasions, aluminum Sherman live traps were found chewed on and damaged beyond use, leaving only remnants of the trapped small animals that attracted the predator.

Specimens examined (4).—TEXAS. Hansford Co.: 7 mi. S, 3 mi. W Gruver, 1 (KU). Ochiltree Co.: Wolf Creek, SE part of county, 2 (TTU). Sherman Co.: Beaver Bridge, U.S. Hwy. 54, 1 (WTSU).

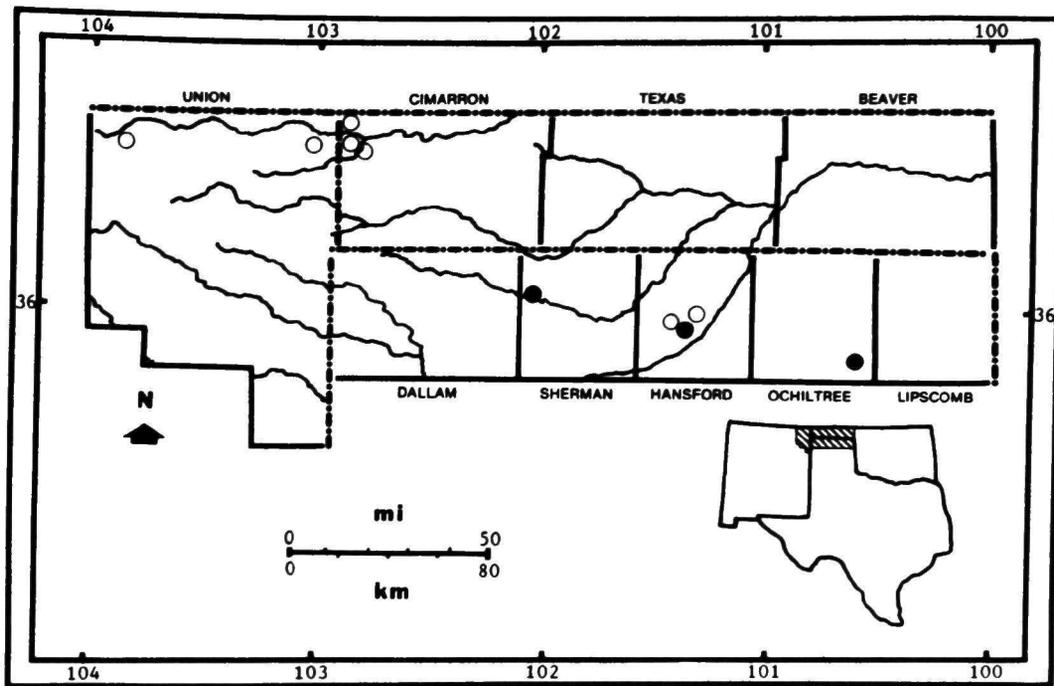


FIG. 43.—Distribution of *Procyon lotor* in the trisstate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Literature records.—NEW MEXICO. Union Co.: Carrizozo Bridge on NM 325; mouth Trinchera Pass, Raton Range. OKLAHOMA. Cimarron Co.: Kenton; 2.5 mi. SE Kenton; 6 mi. N Kenton. Texas Co.: Guymon. TEXAS. Hansford Co.: 4 mi. S, 2 mi. E Gruver (Cutter, 1959a); 7 mi. S, 3 mi. W Gruver (Cutter, 1959a).

Mustela frenata neomexicana (Barber and Cockerell, 1898)

Long-tailed Weasel

The long-tailed weasel probably occurs sparingly throughout the trisstate region, although only a single specimen documents its occurrence there (Fig. 44). Best (1971) recorded a weasel from 5 mi. W Capulin, just over the border from Union County, in Colfax County, and there are records from the Texas Panhandle to the south (Jones *et al.*, 1985) and to the north in Kansas (Bee *et al.*, 1981).

Literature record.—OKLAHOMA. Texas Co.: near Guymon.

Mustela nigripes (Audubon and Bachman, 1851)

Black-footed Ferret

Records indicate the black-footed ferret once was widely distributed throughout the study area (Fig. 44) where extensive prairie dog towns were found. Numerous small towns still exist, but prairie dogs have been reduced to the point where they probably no longer can support this ferret.

The last records in the region are from Lipscomb County in 1903 (Bailey, 1905) and Dallam County in 1953 (Cahalane, 1954). *M. nigripes* is a monotypic species.

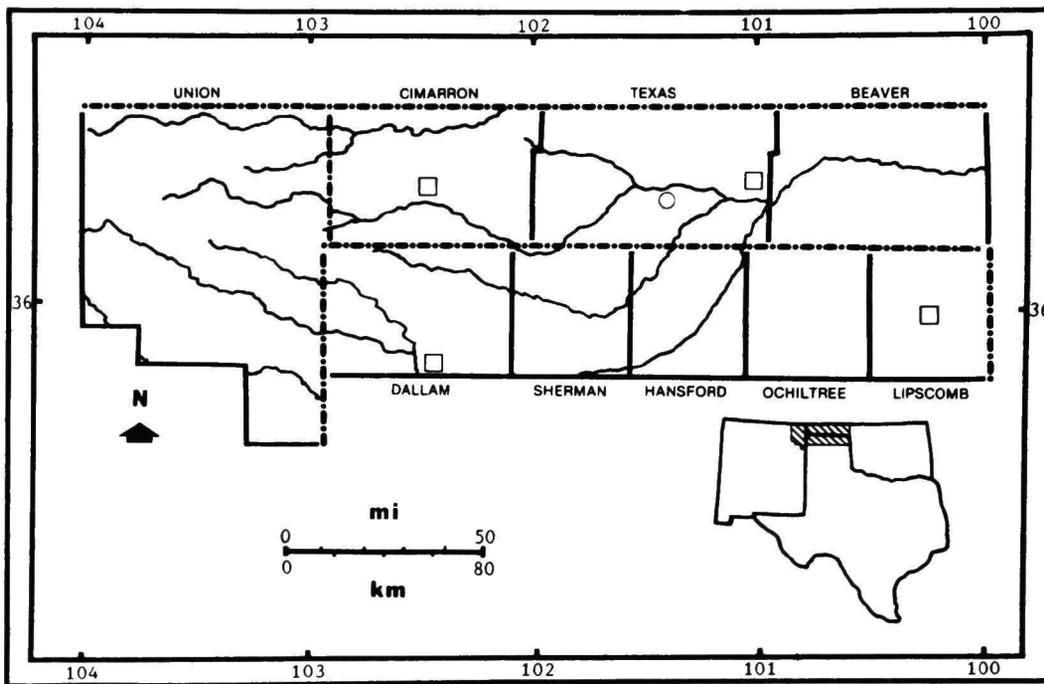


FIG. 44.—Distribution, based on literature records, of *Mustela frenata* (circle) and *M. nigripes* (squares) in the tristate study region.

Literature records.—OKLAHOMA. Cimarron Co.: T. 3 N, R. 5 E, near Boise City. Texas Co.: 8 mi. SE Adams. TEXAS. Dallam Co.: near Dalhart (Cahalane, 1954). Lipscomb Co.: Lipscomb (Bailey, 1905).

Taxidea taxus berlandieri Baird, 1858

Badger

The badger occurs throughout the study area (Fig. 45). Although the species seldom was seen, its characteristic diggings commonly were observed, and individuals sometimes were seen dead on roadways.

Hall (1981), following Long (1972), mapped two subspecies as occurring in the tristate region—*T. t. berlandieri* Baird, 1959, in New Mexico and Texas, and *T. t. taxus* (Schreber, 1778), from the Oklahoma Panhandle. We tentatively refer our material to the former taxon pending the collection of more material.

Specimens examined (4).—TEXAS. Hansford Co.: 1 mi. S, 4 mi. W Gruver, 1 (KU). Lipscomb Co.: 3 mi. N, 1 mi. E Follett, 1 (WTSU); 5 mi. E Booker, 1 (WTSU). Ochiltree Co.: 18 mi. S, 5 mi. W Perryton, 1 (TTU).

Literature records.—NEW MEXICO. Union Co.: 7 mi. S Des Moines. OKLAHOMA. Cimarron Co.: 14 mi. W Boise City; 3 mi. E Kenton. TEXAS Co.: 5 mi. W Eva on U.S. Hwy. 64; 3 mi. SW Guyman on Hwy. 54 (Long, 1972); 3 mi. N, 4 mi. E Goodwell.

Spilogale gracilis gracilis Merriam, 1890

Western Spotted Skunk

The western spotted skunk is a small, secretive animal. Its range encompasses Union and Cimarron counties of our region. The few records from this area (Fig. 46) indicate uncommon occurrence.

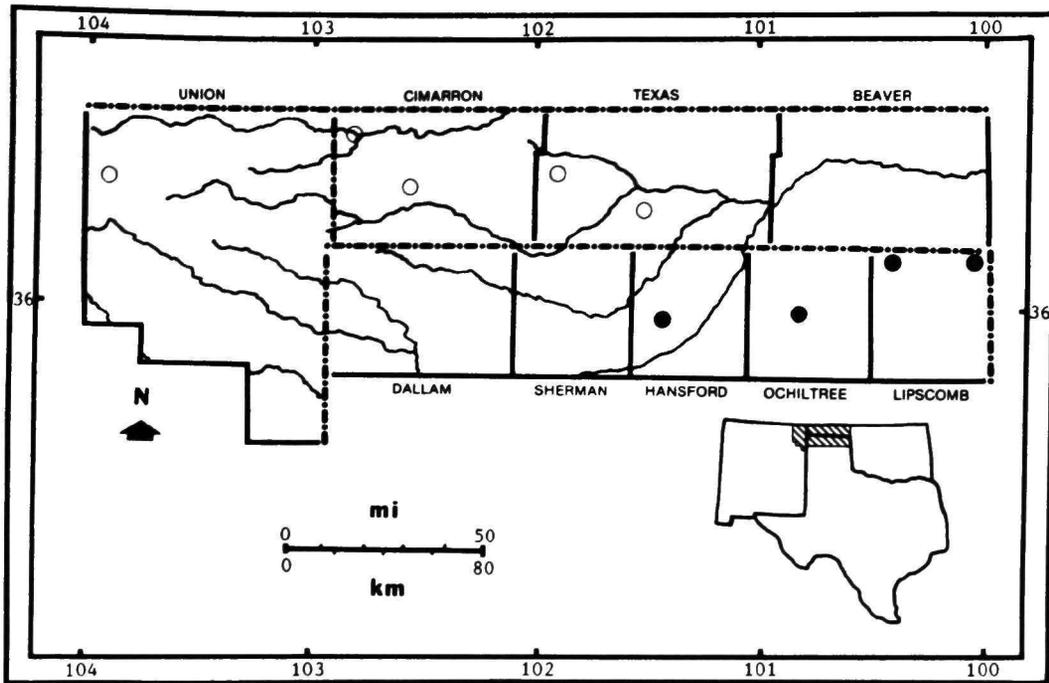


FIG. 45.—Distribution of *Taxidea taxus* in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

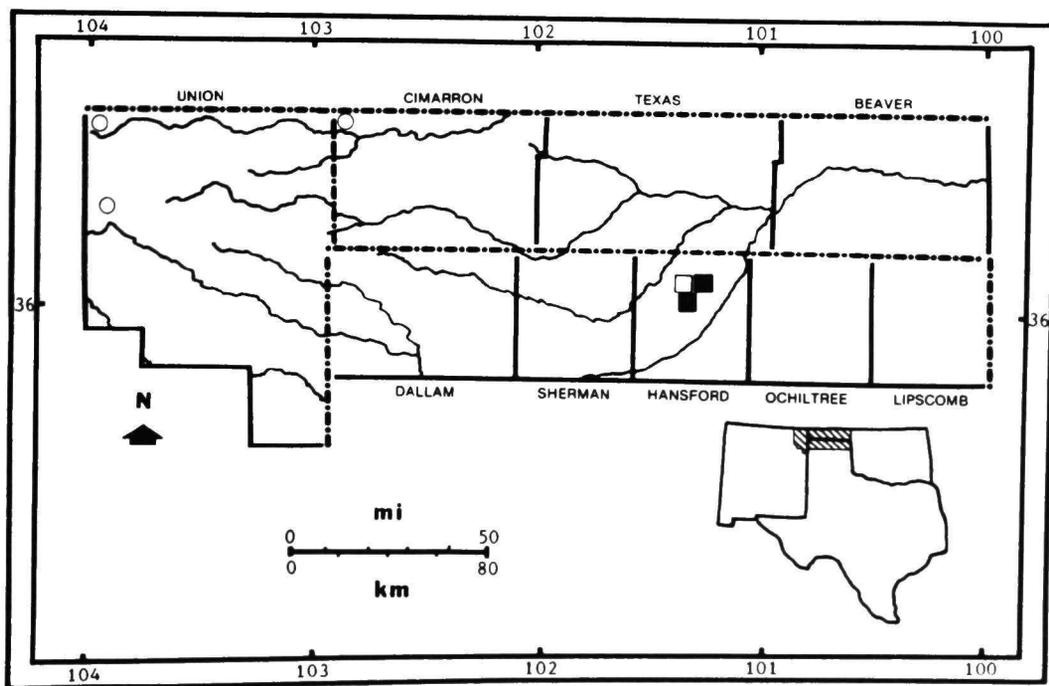


FIG. 46.—Distribution of *Spilogale gracilis* (circles) and *S. putorius* (squares) in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Literature records.—NEW MEXICO. Union Co.: Raton Range, Oak Canyon; Sierra Grande. OKLAHOMA. Cimarron Co.: 3.5 mi. N, 1.2 mi. W Kenton.

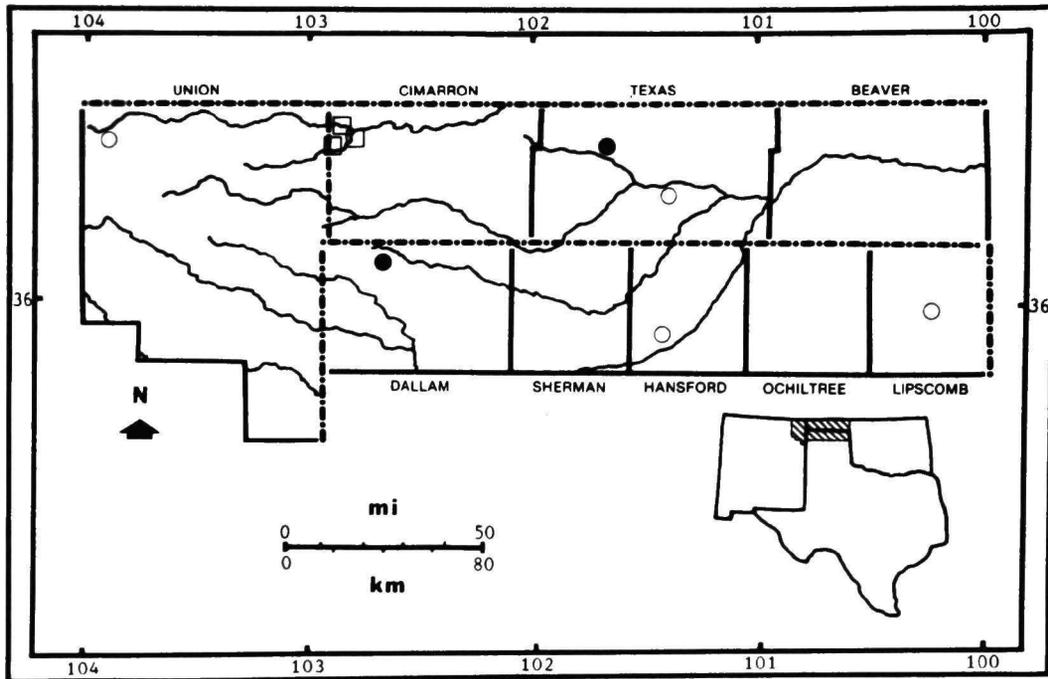


FIG. 47.—Distribution of *Mephitis mephitis* (circles) and *Conepatus mesoleucus* (squares) in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature records.

Spilogale putorius interrupta (Rafinesque, 1820)

Eastern Spotted Skunk

The eastern spotted skunk seems to occur throughout much of the eastern part of our study area, although landowners with whom we talked were not familiar with the animal. In general appearance and natural history, it is similar to *S. gracilis*. The two species are not known to occur in sympatry, but their ranges must at least closely approach each other near Black Mesa (Fig. 46).

Specimens examined (2).—TEXAS. Hansford Co.: 16 mi. N, 3 mi. E Gruver, 1 (KU); 1 mi. N Bernstein, 1 (KU).

Literature record.—TEXAS. Hansford Co.: Bernstein (Van Gelder, 1959).

Mephitis mephitis varians Gray, 1837

Striped Skunk

Despite the paucity of records (Fig. 47), the striped skunk is common and widely distributed throughout the study area, particularly in the two panhandles. The characteristic odor and funnel-like diggings made in quest of grubs often were noted. Animals were sometimes seen at night. Most of the many road-killed specimens we examined were badly damaged and could not be salvaged.

Specimens examined (3).—OKLAHOMA. Texas Co.: 21 mi. WNW Guymon, 1. TEXAS. Dallam Co.: 2 mi. N, 13 mi. E Texline, 2 (TTU).

Literature records.—NEW MEXICO. Union Co.: 7 mi. N Des Moines. OKLAHOMA. Cimarron Co.: Cold Springs, Garrett Township. Texas Co.: 1 mi. E Guymon. TEXAS. Hansford Co.: 10 mi. S, 4 mi. W Gruver (Cutter, 1959a). Lipscomb Co.: Lipscomb (Bailey, 1905); Higgins.

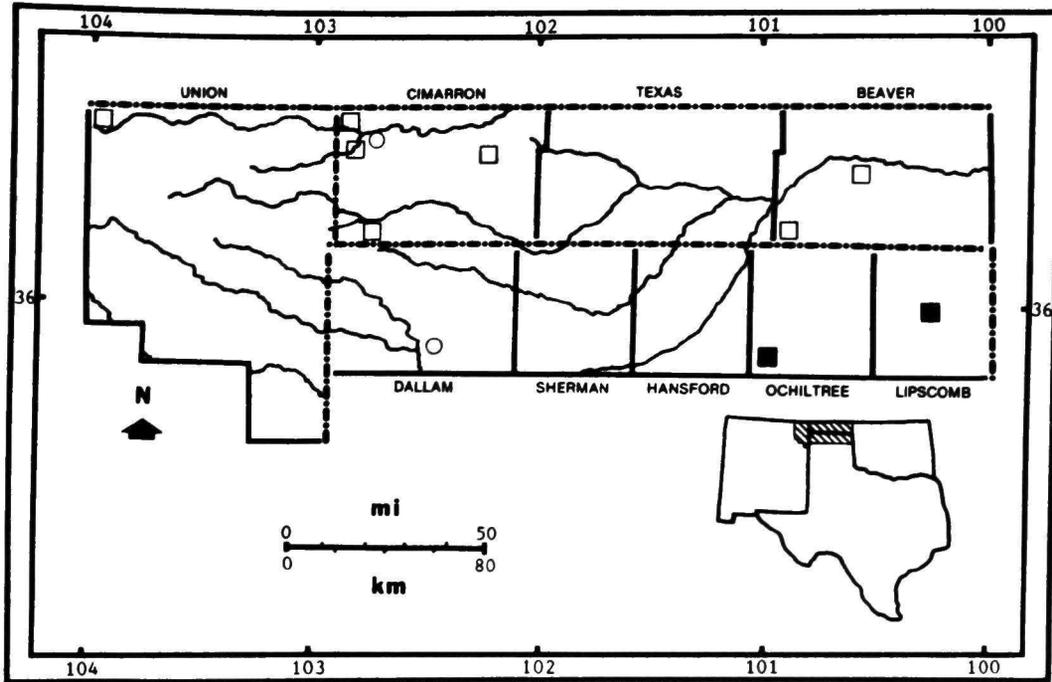


FIG. 48.—Distribution of *Felis concolor* (circles) and *F. rufus* (squares) in the tristate study region. Solid symbols represent specimens examined; open symbols represent literature record.

Conepatus mesoleucus figginsi F. W. Miller, 1925

Hog-nosed Skunk

The hog-nosed skunk occurs rarely in the extreme western part of the Oklahoma Panhandle and no doubt ranges into Union County, although we found no evidence of the species occurring there (Fig. 47). Most records of the subspecies *C. m. figginsi* are from extreme southeastern Colorado, just to the north of our study area (Armstrong, 1972).

Literature records.—OKLAHOMA. Cimarron Co.: Kenton; base SE end Black Mesa, 2 mi. NE Kenton.

Felis concolor Linnaeus, 1771

Mountain Lion

The mountain lion, or cougar, is a secretive animal, and is seldom seen in the wild. Once occurring across the tristate region (Fig. 48), the species still may be expected in broken country where deer are found. We have a series of skulls, without specific localities, some of which are said to be from Union County (see account of *Ursus americanus*).

Hall (1981) mapped northern Union County and the Oklahoma Panhandle as within the range of *F. c. hippolestes* Merriam, 1897, and the southern part of our study area as within the range of *F. c. stanleyana* Goldman, 1938.

Literature records.—OKLAHOMA. Cimarron Co.: near Dinosaur Quarry, 8 mi. E Kenton. TEXAS. Dallam Co.: 10 mi. N Dalhart.

Felis rufus texensis (J. A. Allen, 1895)

Bobcat

The bobcat is widespread, but scarce to only moderately common, judging from our observations and interviews with local residents. Most records are from rugged parts of our study area (Fig. 48). We follow Schmidly and Read (1986) in use of the subspecific name *texensis* for bobcats from the tristate region.

Specimens examined (3).—TEXAS. Lipscomb Co.: no specific locality, 1 (TCWC). Ochiltree Co.: 9 mi. S, 11 mi. E Spearman, 1 (TTU); no specific locality, 1 (TCWC).

Literature records.—NEW MEXICO. Union Co.: Oak Canyon, Raton Range (Bailey, 1932). OKLAHOMA. Beaver Co.: 6 mi. W Beaver; 4 mi. S, 10 mi. W Gray. Cimarron Co.: Black Mesa; 13 mi. NE Boise City; Squaw Canyon, Brookhart's sec. 1; house N of Currumpa Creek; Cienequilla Creek, 4 mi. W Felt; 2.5 mi. SE Kenton.

Cervus elaphus Linneaus, 1758

Wapiti or Elk

Elk are relatively common in northwestern Union County, but are progressively scarce eastwardly. The species no doubt occurred along stream valleys of the Oklahoma and Texas panhandles in the past. In 1987, the Texas Parks and Wildlife Department passed an emergency rule protecting elk in six Texas Panhandle counties, including Dallam County within our study area. Jones *et al.* (1988) attributed the few sightings of elk in the Texas Panhandle during recent years to wanderers from New Mexico.

Hall (1981) mapped our study area as within the range of *C. e. canadensis* Erxleben, 1777. This native race apparently was extirpated from the region, and reintroduction of *C. e. nelsoni* Bailey, 1935, from Colorado and Yellowstone Park, began in 1911. Current residents likely are descendents of the introduced stock.

Odocoileus hemionus (Rafinesque, 1817)

Mule Deer

Mule deer inhabit the more rugged and remote terrain of our study area. The species is particularly common in western Union County, where sign and animals were sighted regularly. In past years, Black Mesa ranchers told us, the mule deer became scarce as *O. virginianus* became more abundant. Eastward across the panhandles, the species becomes less common and more restricted in distribution. Nevertheless, we have been informed that mule deer comprise about one-fourth the annual take of Beaver County deer hunters.

Our study area falls within the historic range of *O. h. hemionus* (Rafinesque, 1817), although introductions of *O. h. crooki* (Mearns, 1898) from Trans-Pecos Texas into the Texas Panhandle took place about 20 years ago (Wallmo, 1981).

Specimen examined (1).—NEW MEXICO. Union Co.: 5 mi. N Capulin, 1.

Literature records.—OKLAHOMA. Cimarron Co.: 2.5 mi. SE Kenton; 7.5 mi. N Kenton; 8 mi. NE Kenton.

Odocoileus virginianus texanus (Mearns, 1898)

White-tailed Deer

The white-tailed deer occurs in riparian habitat throughout the tristate region, but is most common in the eastern part. Best (1971) recorded a specimen from western Union County as an uncommon occurrence. Local residents of Union County and the Black Mesa region of Oklahoma reported to us that *O. virginianus* has spread westward in the 1980s, and they fear the species will displace the more desirable mule deer.

Introductions of white-tailed deer (presumably of the native subspecies) during the 1940s and 1950s were made in parts of the Texas Panhandle as a supplement to local populations (Jones *et al.*, 1988).

Literature records.—NEW MEXICO. Union Co.: 5.5 mi. N, 33.6 mi. E Folsom (Best, 1971). TEXAS. Hansford Co.: 4 mi. N, 10 mi. E Gruver (Cutter, 1959a). Sherman Co.: "Beaver River where it crosses the Texas and Oklahoma line" (Bailey, 1905).

Antilocapra americana (Ord, 1815)

Pronghorn

The pronghorn is locally abundant in many areas where open, undisturbed plains still exist. Local ranchers consider it an important game animal. When hunting season is not in progress, herds of pronghorn often were seen grazing along highways, exhibiting little fear or awareness of passing automobiles.

Hall (1981) mapped our study area as within the historic range of *A. a. americana* (Ord, 1815). New Mexican animals are descendants of native stock, although populations in Texas were supplemented from 1942 through 1955 by introduction of individuals of the subspecies *A. a. mexicana* Merriam, 1901, from the southwestern United States.

Literature records.—OKLAHOMA. Indian Territory. TEXAS. Dallam Co.: "between Dalhart and Texline" (Bailey, 1905). Hansford Co.: 2 mi. N Bernstein (Cutter, 1959a).

Bison bison bison (Linnaeus, 1758)

Bison

The bison once ranged through the panhandles and eastern New Mexican plains by the millions but was extirpated by 1890. Bailey (1932) reported that the species once was common in northeastern New Mexico. Jones *et al.* (1988) summarized briefly the history of the species in the Texas Panhandle, where the last survivors remained in the northwestern corner until 1889.

Local ranchers sometimes keep token herds of bison on their ranches. We know of such occurrences at least in Union, Lipscomb, and Ochiltree counties.

Literature records.—OKLAHOMA. Several records from "Indian Territory" (= Oklahoma Panhandle), collected prior to subdivision of area into counties. Beaver Co.: no specific locality. TEXAS. Hansford Co.: no specific locality. Lipscomb Co.: no specific locality.

SPECIES OF POSSIBLE PRESENT OR PAST OCCURRENCE

The following several taxa include species for which no records exist from our study area, although evidence of past and present distributions infer that they once may have occurred there, or may be expected as occasional transients. Bats are excluded from this treatment because of their volant habits.

Tamias minimus (least chipmunk).—This sciurid prefers the margins of forest openings in the yellow pine zone or higher. Findley *et al.* (1975) recorded the species from the northeastern corner of Colfax County, New Mexico, immediately adjacent to our study area, and it may occur in the higher reaches of northwestern Union County.

Tamiasciurus hudsonicus (red squirrel).—This tree squirrel occurs in mixed conifers in the northeastern corner of adjacent Colfax County (Findley *et al.*, 1975). Like the least chipmunk, it is to be looked for in Tollgate Canyon in the northwestern corner of Union County.

Neotoma cinerea (bushy-tailed woodrat).—This woodrat is included in this section on the basis of a sight record by Sutton (1965) from Tesequite Canyon, Black Mesa, Cimarron County. The nearest certain records for *N. cinerea* to our study area are from spruce-fir situations about 100 miles to the west. Considering the extent of collecting in this region, it is possible a rock squirrel (*Spermophilus variegatus*) or Mexican woodrat provided the basis for Sutton's sighting.

Synaptomys cooperi (southern bog lemming).—The bog lemming is an animal of marshes and bogs. The southwesternmost population of this species, described by Hibbard and Rinker (1942) from extreme southern Kansas, apparently was extirpated shortly after its discovery as none has been taken since that time. Even though Hibbard and Rinker observed ideal conditions for the bog lemming in adjacent Beaver County, we unsuccessfully searched in northern parts of the county and in adjacent Kansas for the described habitat. Beaver County game warden David Kirk told us that isolated bogs and marshes as described by Hibbard and Rinker no longer exist in the area.

Ursus arctos (grizzly bear).—The tristate region is within the mapped historic range of the grizzly bear although no records exist for the species there.

Mustela erminea (ermine).—This short-tailed weasel is known from adjacent Colfax County, New Mexico (Findley *et al.*, 1975), and might be expected in western Union County.

Mustela vison (mink).—The mapped distribution of the mink includes our study area, although no specimens are known from the region. The species is a semiaquatic carnivore, and it may occasionally wander into Union County or the panhandles from the east or west along permanent waterways.

Lutra canadensis (river otter).—The otter once may have occurred along rivers and permanent streams in the tristate region, although its presence now is doubtful.

HISTORICAL PERSPECTIVE

An impressive feature of the present study has been the evidence for shifts in the distribution of mammalian species since the end of the Pleistocene. Some are inferred only, but others can be documented. We list some of the changes we have noted; some also are addressed in the foregoing accounts of species.

Didelphis virginiana.—Only within recent years have opossums been found in Union County, and along the Cimarron River west of Kenton, Oklahoma. These are distinctive animals that visit human habitations in search of food. Thus they often are treed or killed by dogs. Had opossums been resident in Union County in past years, they surely would have been noticed, but we have only one literature record from Cimarron County, and a rancher's report from just west of the Oklahoma boundary. There are no records from farther west. We suspect the species has invaded the western valley of the Cimarron only in the last few decades.

Sorex merriami and *Sorex nanus*.—These two shrews apparently reach the extreme eastern margin of their ranges in western Union County. Sierra Grande, where the specimens were taken, supports a relict population of yellow pine and spruce, and we suspect the shrews represent relict populations also.

Cryptotis parva.—Owen and Hamilton (1986) and Armstrong (1972) considered records of the least shrew from the Llano Estacado and Colorado, respectively, to be evidence of recent invasion resulting in land-use changes following introduction of agriculture. The same may apply to the species in our study area, although Choate and Reed (1988) suspected dispersal of this species into southwestern Kansas and adjacent Colorado occurred in "years of greater than average precipitation or stream flow."

Dasytus novemcinctus.—Choate and Pinkham (1988) concluded that the presence of the armadillo in northeastern Colorado has resulted from recent expansion of geographic range. *D. novemcinctus* has not been recorded from the western part of the tristate region, although Armstrong (1972) suspected that it occurs sparingly along the Cimarron River. Specimens from Union County would be evidence of recent invasion.

Sylvilagus floridanus.—This cottontail now occurs in extreme eastern Union County, where it had not been recorded previously, and where its presence probably results from a recent expansion of range. Specimens of *S. audubonii* were taken many years ago at several sites not far from Clayton (Nelson, 1909), and the eastern cottontail, had it been resident at Clayton, likely would have been detected as well.

Sylvilagus nuttallii.—This species was the cottontail of the higher parts of northwestern Union County when Hollister collected rabbits there almost a century ago (Nelson, 1909). We found only *S. audubonii* in “*S. nuttallii* habitat” in Tollgate Canyon in 1987. We suspect *S. audubonii* has replaced *S. nuttallii* at this site.

Tamias quadrivittatus.—Twenty years ago, chipmunks occurred on Rabbit Ears Mountain, Union County, only a few miles from the Texas boundary. The habitat suitable for chipmunks on the mountain is limited and the species seems now to have vanished. The nearest occurrence today is about 40 kilometers to the north.

Sciurus aberti.—The discovery of Abert’s squirrel in western Union County was surprising. We believe the population near Capulin is a relict, because the main range of the species lies to the west. We are uncertain whether the Union County population is continuous with those to the west and northwest or whether it now is isolated. We take the population to be relictual rather than invasive. Yellow pines, a requirement for *S. aberti*, are rare and scattered east of Capulin.

Thomomys bottae.—We have definite proof of a shift in the distribution of this pocket gopher in the Holocene. Sediments from ancient beaver ponds (Dalquest *et al.*, 1990) show that *Thomomys* was present in southern Union County *ca.* 500 YBP, and in Tesequite Canyon, Cimarron County, *ca.* 2630 YBP. None of the four sites dated from 500 to 2630 YBP contained remains of *Cratogeomys* or *Geomys*, the common gophers of the two panhandles and eastern Union County today. Presumably, the latter two genera have replaced *Thomomys* over all but the western part of the study area within the last five centuries, although there is one small, relictual population of *Thomomys* just west of Rabbit Ears Mountain (Best, 1973).

Sigmodon hispidus.—A cotton rat maxillary was recovered from sediments at the Leighton Ranch in northern Union County, dated at *ca.* 3770 YBP (Dalquest *et al.*, 1990). Goldman and Gardner (1947) suspected that a population of *Sigmodon hispidus* in the southeastern corner of Colorado was relictual, but Mohlenrich (1961) thought that the population had recently invaded the area. The early Holocene material is just southwest of where cotton rats occur today in Baca County, Colorado, supporting the former hypothesis.

Microtus mexicanus.—Finley *et al.* (1986) thought specimens of *M. mexicanus* from Union County represented an invasion from the west. Mexican voles live there in marginal habitat; they have been found at Capulin Mountain and Sierra Grande, but not farther east. In our opinion, these voles represent small, relictual populations, but there is no solid support for either alternative. However, if the species invaded the area from the west, the movement is contrary to the general situation involving other mammalian taxa, which is invasion from the south and east, and retreat to the west.

On the southern Great Plains, fossil or subfossil teeth of *M. ochrogaster* can be identified by the enamel pattern of m1; *M. pennsylvanicus* similarly can be distinguished by the M2. Thus, if teeth of either species are present in a Holocene site, they usually can be identified. However, the m1 of *M. mexicanus* cannot be distinguished from those of *M. montanus* or *M. pennsylvanicus*. We did find some lower m1s from Holocene deposits in eastern Union County and Cimarron County that did not seem to be from young animals and had an enamel pattern that closely resembled that of *M. pennsylvanicus*, but they were small enough to be *M. mexicanus*. However, until positively identified teeth of the Mexican vole are found in Cimarron or eastern Union counties, the status of *M. mexicanus* remains uncertain. We believe, however, that the population in our study area represents a relictual one.

Microtus pennsylvanicus.—The meadow vole was resident in the Black Mesa area ca. 31,360 YBP, and at the Leighton Ranch in northern Union County in the Holocene, ca. 3770 YBP, but it is not a part of the modern fauna of the study area. The species now lives to the north and west of the tristate region here considered.

Microtus ochrogaster.—The present distribution and distributional history of the prairie vole are peculiar. Previous to 1981, the species was thought to have an extensive but conventional and stable distribution from Alberta and Saskatchewan southward to central Oklahoma, and from central Montana and Wyoming eastward to Ohio, with an isolated subspecies, probably now extinct, in extreme southeastern Texas and adjacent Louisiana (Hall, 1981). There were no records from the Texas and Oklahoma panhandles, or from Union County, New Mexico. There are records of this vole from Colfax County, New Mexico, and Meade County, Kansas, near our study area, but the latter population has been considered extinct. The species also is known from central Colorado. These peripheral pockets appeared to be isolated from the main range of the species. Recently, small populations of prairie voles were discovered in the Texas (Manning and Jones, 1988) and Oklahoma (Reed and Choate, 1988) panhandles, and independently by us at four sites in the Oklahoma Panhandle. Later visits to the four sites where we captured voles produced no additional specimens, suggesting *M. ochrogaster* no longer occurred there.

We do not know whether *Microtus ochrogaster*, at the periphery of its range, is subject to sudden increases in numbers of small local populations, and then disappears, to increase in numbers elsewhere, or if the distributions noted in 1988 are atypical of the species. Perhaps the apparent absence of prairie voles to the south and west of the main range simply results from inadequate efforts by mammalogists to determine the status of this vole. Choate (1989) made a detailed study of an isolated, peripheral population of *M. ochrogaster* in southwestern Oklahoma, but nothing in his records suggested the unusual distributional pattern of the species discovered in our study area.

Odocoileus virginianus.—Numerous persons with whom we talked reported that white-tailed deer have only recently invaded Union County, or the species has greatly increased in numbers there at the expense of mule deer. This may be partly or principally the result of introduction of nonnative individuals over the years. Nevertheless, the pattern of the invasion is like that of others in the tristate region—from east to west.

There has been a steady westward movement of mammals from the Great Plains into the prairies and brushlands of Union County. No early or mid-Holocene faunas are available from the Texas and Oklahoma panhandles, and it thus is not possible to judge whether the immediate post-Pleistocene faunas from there were composed partly of montane species (*Thomomys bottae*, *Sorex palustris*, and *Zapus* sp.). In the Pleistocene, such montane mammals were important elements of these faunas (Schultz, 1969; Dalquest, 1965; Dalquest and Stangl, 1989). Associated with the montane mammals were prairie species, including taxa now found on the Great Plains, but far to the north of the study area (*Spermophilus franklinii*, *S. elegans*, *Sorex arcticus*, *Synaptomys cooperi*). The prairie dog, the typical index fossil of the Great Plains, is invariably present in late Pleistocene local faunas of the two panhandles.

Sierra Grande harbors relictual populations of mammalian species at the extreme border of their ranges. This mountain is one of the largest volcanos at the western margin of Union County. The list of mammals that have been found there includes most of the species known to occur in the highest parts of Union County. The mountain, at its peak, possesses woodland of yellow pine, rare east of Sierra Grande, and spruce, a relictual species found at higher elevations to the west. The lower slopes are deeply gullied by canyons and clothed with woodlands of piñon and juniper. Below the coniferous woodland, however, the mountain is surrounded by grassland. Species common on the mountain no doubt find the grassland an impassable barrier. Abundant taxa, such as *Peromyscus truei* and *P. boylii*, are isolated on the slopes of Sierra Grande from other populations of their species to the north and west.

Capulin Mountain, a smaller volcano northwest of Sierra Grande, shows a similar pattern. But there, though grasslands surround the mountain to the east and south, bands of coniferous trees, mostly growing along pressure ridges in lava, connect the wooded slopes of the mountain with woodlands to the north and west.

We judge that Sierra Grande, like similar volcanic mountains just to the west in Colfax County, was broadly connected to the woodlands of surrounding volcanic peaks and high areas until relatively recently. Grasslands, inhospitable to mammals adapted to woodland habitat, have expanded westward to surround and isolate Sierra Grande. Capulin Mountain is in the process of similar isolation. Peaks farther east, such as Rabbit Ear Mountain, are also completely isolated, but only a few species associated with woodlands, such as *Peromyscus boylii*, *Neotoma mexicana*, and doubtfully *Tamias quadrivittatus* still occur there.

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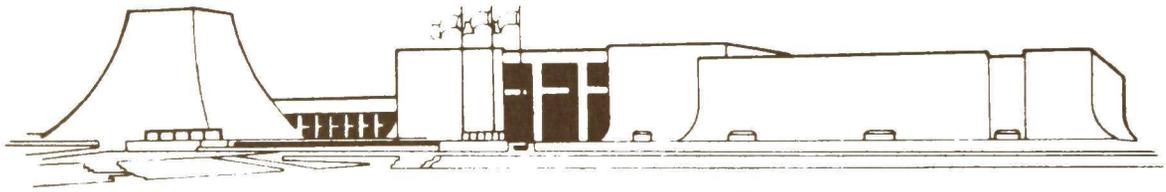
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