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MAMMALS OF THE ABAJO MOUNTAINS, AN ISOLATED MOUNTAIN RANGE IN SAN JUAN COUNTY, SOUTHEASTERN UTAH

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The Abajo Mountains are located in southeastern Utah. A large part of this range and the surrounding valley floor comprise much of the Manti-La Sal National Forest in San Juan County. The Abajo Mountains are completely separated from other mountain ranges, and there is no geological evidence that they ever have been connected to another range (for discussion, see Kelson, 1951, and Lee, 1960). The Abajos are bordered to the north by the desert floor of Canyonlands National Park, to the west by the deeply entrenching Colorado River, to the south by sagebrush flats, and to the east by sagebrush-covered lowlands that extend into western Colorado.

Spruce-fir forests with interspersed alpine meadows dominate higher elevations in the Abajos. Some of the high slopes are covered with talus and support little or no vegetation. Ponderosa pine, piñon pine, oak, and aspen dominate other communities, which are strongly influenced by soil type as well as elevation. Interspersed juniper occurs frequently throughout piñon pine and oak communities.

Kelson (1951) summarized the evidence for the Abajo Mountains having originated from laccolithic intrusions during the Eocene, which have since been severely eroded. Major differences between the east- and west-facing exposures are evident. Eastern exposures have a relatively heavy vegetational cover, whereas the western exposures are more arid; the latter

are predominantly sandstone, which affects permeability rates. Small reservoirs are scattered throughout the region, along with mountain springs and creeks. Indian Creek, the major permanent stream in the study site, is surrounded by a habitat that supports a lush vegetative cover of grasses and forbs.

Durrant (1952) is the most recent comprehensive treatment of mammals from the region. Kelson (1951) investigated rodent distribution of southeastern Utah, Armstrong (1982) treated the mammals of Canyonlands National Park, and Lee (1960) studied relictual mammalian faunas of isolated mountain ranges of the area. This study provides the first detailed investigation of one of the many isolated ranges. Findings indicate comparable studies of other such ranges are necessary to fully understand the complex island-like zoogeography of the southeastern corner of Utah. Documentation and natural history observations for 31 species of mammals from the Abajo Mountains are presented herein. Some of these are reported for the first time from the range, but equally noteworthy is the conspicuous absence of such taxa as *Ochotona, Marmota, Spermophilus lateralis, Clethrionomys, Neotoma, Zapus,* and *Procyon.*

Methods

In 1983 and 1986, Walter W. Dalquest made small collections of mammals in the Abajo Mountains, providing the impetus for a more detailed mammalian survey of them. The most intensive part of the study was accomplished during six continuous weeks in the field by the author in July and August of 1988. During this period, 2600 trap-nights took 574 small mammals, a trap success rate of 22 percent. Additionally, 78 bats were captured during 19 nights of mist netting. Most specimens were prepared as museum study skins accompanied by skulls.

The study area encompasses most of the Abajo Mountains (Fig. 1); elevations range from 6400 to 10,360 feet above sea level in the mountains and from selected sites on adjoining Elk Ridge and in the surrounding flats. Species determined to inhabit the Abajo Mountains, at least sporadically, are treated in accounts below. Durrant (1952) and Hall (1981) served as points of departure for the known distribution of mammals.

All specimens have been deposited in the Collections of Recent Mammals at Midwestern State University and The Museum of Texas Tech University. Tissues of selected individuals

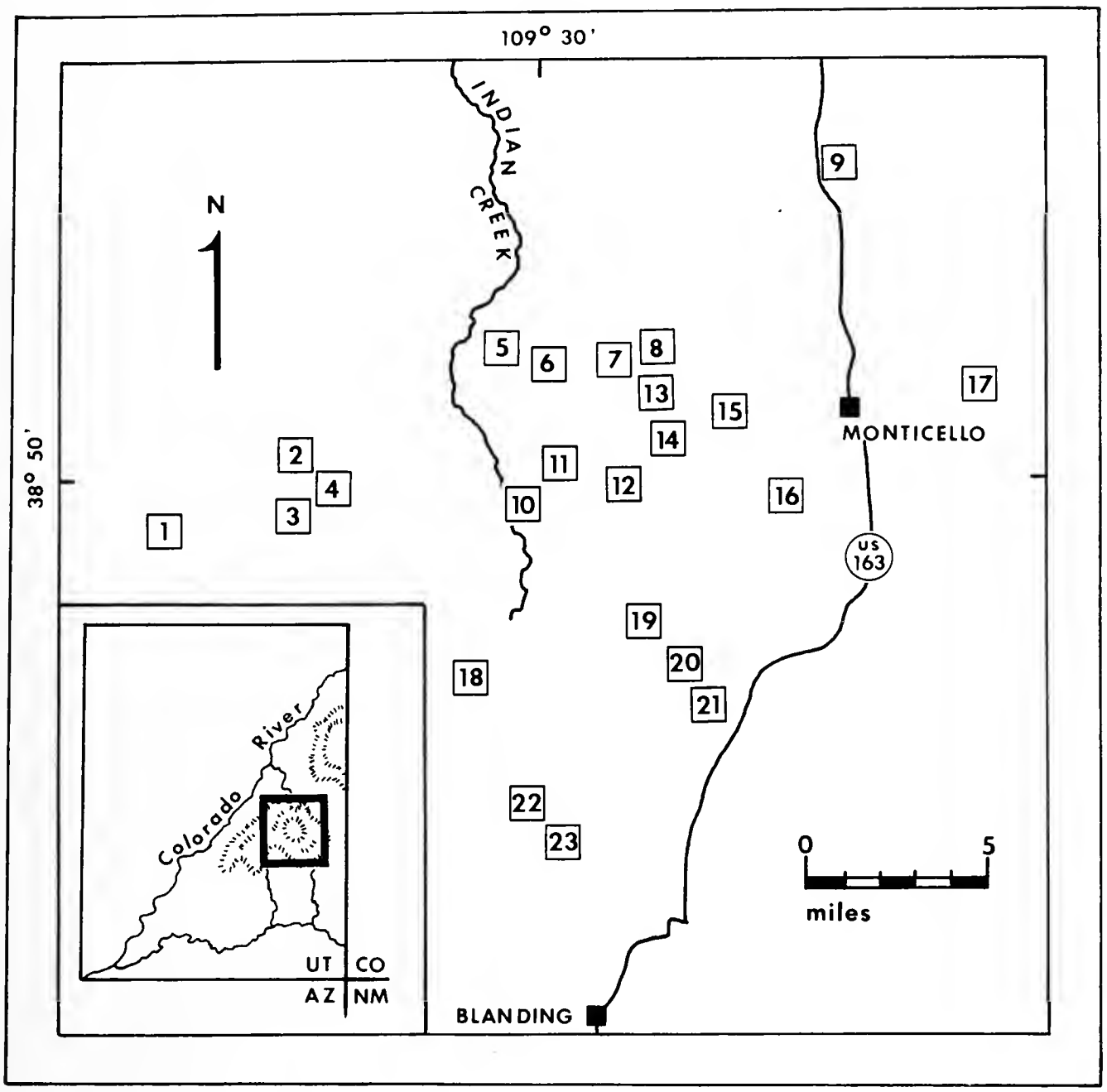

FIG. 1.—Collecting localities in the Abajo Mountains as listed in text. Inset shows location of the Abajo Mountains within San Juan County, Utah.

were placed in the collection of frozen tissues at Texas Tech University.

Following is a numerical listing, from north to south, and west to east, of major collecting localities (as mapped in Fig. 1) in San Juan County, Utah. Elevations (in feet) are given in parentheses following most localities: 9) 7 mi. N Monticello (9180); 5) Foy Lake, 10 mi. WNW Monticello (8690); 6) 9 mi. WNW Monticello (8690); 7) Monticello Lake, 7 mi. WNW Monticello (8700); 8) 5 mi. WNW Monticello (8200); 13) 6 mi. W Monticello; 15) 4 mi. W Monticello (8040); 17) Vega Creek, 4 mi. E Monticello (6400); 2) 14 mi. W Monticello (8101); 11) 9 mi. W Monticello (9500); 14) 6 mi. WSW Monticello; 4) Little Dry Mesa, 15 mi. W Monticello (7770); 10) Indian Creek, 10 mi. WSW Monticello (9180); 12) Abajo Peak, 7 mi. WSW Monticello (11360); 16) 3 mi. SW Monticello; 1) 19 mi. W Monticello

(7400); 3) 15 mi. W Monticello (8200); 19) 9 mi. SW Monticello (8200); 18) 13 mi. SW Monticello (7380); 20) 8 mi. SSW Monticello (7200); 21) 9 mi. SSW Monticello (7200); 22) 6 mi. N Blanding (6580); 23) 5 mi. N Blanding (6580).

Results and Discussion

Species Accounts

The following species accounts are of mammals for which information on occurrence in the Abajo Mountains was obtained. Systematic order of presentation and vernacular names follow Jones *et al.* (1986).

Sorex merriami Dobson

Merriam's Shrew

Merriam's shrew is one of the most xeric-adapted of North American *Sorex,* and commonly inhabits sagebrush desert and shrub steppe throughout its range (Junge and Hoffmann, 1981). One specimen was collected in 1983 by W. W. Dalquest, from a sagebrush community associated with lush grasses along a roadside east of the mountain.

Specimen examined (1).—5.5 mi. E Monticello.

Sorex monticolus Merriam

Montane Shrew

This is the most common shrew in the Abajo Mountains and the surrounding valley floor, where more mesic conditions occur. It was particularly abundant along Indian Creek in a spruce-fir community. This is probably the shrew Lee (1960) recorded from the area as *S. vagrans obscurus.*

Specimens examined (14).—Foy Lake, 10 mi. WNW Monticello, 1; 13 mi. W Monticello, 4; 11 mi. W Monticello, 1; 6 mi. WSW Monticello, 1; Indian Creek, 10 mi. WSW Monticello, 7.

Sorex nanus Merriam

Dwarf Shrew

No specimens of the dwarf shrew were taken; the only Utah record is that of Durrant and Lee (1955) from Elk Ridge.

Sorex palustris Richardson
Water Shrew

Three specimens of *Sorex palustris* were collected along Indian Creek, largest permanently flowing stream of the range. The specimens were taken along the bank at a site where the creek is about six inches deep and from two to four feet in width. Kelson (1951) declared the water shrew absent from the Abajo Mountains, and Lee (1960) failed to obtain specimens from the area. The only other locality of record was reported by Hall (1981) from North Creek, 7 mi. W Monticello, located three miles northeast of the site at Indian Creek.

Specimens examined (3).—Indian Creek, 10 mi. WSW Monticello.

Myotis evotis (H. Allen)
Long-eared Myotis

This long-eared bat inhabits coniferous forests of the western mountains, but apparently is never common (Barbour and Davis, 1969). Specimens of both sexes were collected in July and August, in ponderosa pine and spruce-fir associations.

Specimens examined (7).—Indian Creek, 10 mi. WSW Monticello, 3; 13 mi. SW Monticello, 4.

Myotis ciliolabrum (Audubon and Bachman)
Small-footed Myotis

One specimen was taken in a ponderosa pine community immediately after sunset. The single encounter with this bat suggests its scarcity in the area, although possibly its slow, fluttering flight enables it to detect and avoid nets.

Specimen examined (1).—Indian Creek, 10 mi. WSW Monticello.

Myotis volans (H. Allen)
Long-legged Bat

According to Barbour and Davis (1969), *Myotis volans* occupies a variety of habitats, particularly forested areas, but it seems to be absent from deserts of the Southwest. This bat is easily netted because of its direct flight. Specimens from the study area were captured only in spruce-fir communities.

Specimens examined (11).—19 mi. W Monticello, 2; Indian Creek, 10 mi. WSW Monticello, 9.

Lasionycteris noctivagans (Le Conte)
Silver-haired Bat

Forty-six silver-haired bats, all males, were collected in August; those taken at the end of that month were laden with subcutaneous fat. None was netted at the same locality in July. Males apparently occur in groups, residing in the area for a short time as they build fat reserves to sustain them through autumn migration.

Specimens examined (46).—Indian Creek, 10 mi. WSW Monticello.

Eptesicus fuscus (Beauvois)
Big Brown Bat

This species was seldom encountered and appears to be an uncommon resident of the Abajo Mountains. Individuals collected in late August lacked the fat reserves possessed by *Lasionycteris noctivagans.* A single female, taken on 21 July 1988, was lactating.

Specimens examined (3).—Indian Creek, 10 mi. WSW Monticello, 2; 13 mi. SW Monticello, 1.

Lasiurus cinereus (Palisot de Beauvois)
Hoary Bat

Barbour and Davis (1969) suggested that the sexes of the hoary bat are segregated throughout most of the summer range of the species, and that adult males typically are absent from the maternity ranges of females in the eastern and central United States. During this time, males evidently are limited to the western states (Dalquest, 1943; Findley and Jones, 1964).

Lasiurus cinereus is common in the Abajo Mountains; several specimens, all males, were netted over small bodies of water in ponderosa pine and spruce-fir communities. Most specimens were taken in July; one was taken in early August.

Specimens examined (7).—Indian Creek, 10 mi. WSW Monticello, 1; 13 mi. SW Monticello, 6.

Sylvilagus nuttallii (Bachman)
Nuttall's Cottontail

Nuttall's cottontail is uncommon throughout most of the Abajo Mountains. The species was observed only in oak woodlands and communities comprised mostly of antelope brush and rabbit brush at the lower elevations of the mountains and

on the valley floor. These habitats offer concealment and food resources lacking in alpine communities at higher elevations.

Specimens examined (2).—Monticello Lake, 7 mi. WNW Monticello, 1; Little Dry Mesa, 15 mi. W Monticello, 1.

Tamias minimus Bachman
Least Chipmunk

The least chipmunk is most abundant in oak woodlands, but is also common in ponderosa pine and other communities. It occurs sporadically in spruce-fir forests. As noted by Lee (1960), elevation does not appear to limit its distribution, as *Tamias minimus* was collected from the lowest to the highest elevations in the study site. Two females collected in mid-July were lactating.

Specimens examined (59).—7 mi. N Monticello, 3; Foy Lake, 10 mi. WNW Monticello, 8; Monticello Lake, 7 mi. WNW Monticello, 11; 14 mi. W Monticello, 6; 13 mi. W Monticello, 1; 9 mi. W Monticello, 2; 8 mi. W Monticello, 2; 4 mi. W Monticello, 2; 7 mi. E Monticello, 1; 8 mi. E Monticello, 4; 6 mi. WSW Monticello, 5; Abajo Peak, 7 mi. WSW Monticello, 1; Indian Creek, 10 mi. WSW Monticello, 1; 3 mi. SW Monticello, 3; 9 mi. SW Monticello, 1; 13 mi. SW Monticello, 3; 9 mi. SSW Monticello, 5.

Spermophilus variegatus (Erxleben)
Rock Squirrel

The rock squirrel seems most abundant among rocks, cliffs, and canyons in ponderosa pine and oak communities. Individuals were seen feeding on fungi, which seems to be a locally preferred food item and a possible source of moisture.

Specimens examined (3).—Little Dry Mesa, 15 mi. W Monticello, 1; 13 mi. WSW Monticello, 1; 9 mi. SW Monticello, 1.

Sciurus aberti Woodhouse
Abert's Squirrel

Clippings of needle clusters located beneath particular trees were noticed on several occasions, revealing that *Sciurus aberti* is a rather common resident in ponderosa pine communities. Because of the secretive nature of the species, only two squirrels were seen. Both were observed, on separate occasions, foraging on the ground in a ponderosa pine community. *Tamiasciurus hudsonicus* was not noted to inhabit this community type and the two species seem ecologically segregated in the Abajos. Because Abert's squirrel is a protected species in

Utah, none was collected. Lee (1960) listed several specimens from the Abajo Mountains.

Tamiasciurus hudsonicus Erxleben
Red Squirrel

Tamiasciurus hudsonicus is a common resident of the spruce-fir associations in the Abajo Mountains, but seems to be absent from ponderosa pine forests where *Sciurus aberti* was observed. Lee (1960) reported 16 specimens from the study area.

Specimens examined (3)—Abajo Peak, 7 mi. WSW Monticello, 1; Indian Creek, 10 mi. WSW Monticello, 2.

Thomomys bottae (Eydoux and Gervais)
Botta's Pocket Gopher

The genus *Thomomys* is represented by two species in the Abajo Mountains. *Thomomys bottae* is primarily southern in distribution. Where its range overlaps that of *T. talpoides*, Botta's pocket gopher typically is restricted to lower elevations, whereas *T. talpoides* inhabits the higher elevations.

Thomomys bottae probably is uncommon and is restricted to low elevations in the Abajos. One specimen was trapped in a small meadow among ponderosa pine at an elevation of 7400 feet, and may have come from a relict population distributed along the western exposure of the mountains. The habitat and elevation are otherwise typical of *T. talpoides*.

Specimen examined (1).—19 mi. W Monticello.

Thomomys talpoides (Richardson)
Northern Pocket Gopher

This pocket gopher is widely distributed in the Abajo range. It seems to be nowhere abundant, although Lee (1960) took 39 specimens. Populations appear localized in small areas, particularly along grassy roadsides. Mounds were common in small clearings throughout ponderosa pine communities, associated with the sandy-loam soils required by the trees. Primarily a gopher of northern distribution, the study site is near the southern extent of the range of the species.

Specimens examined (7).—5 mi. WNW Monticello, 1; 14 mi. W Monticello, 2; 8 mi. W Monticello, 2; 4 mi. W Monticello, 1; Indian Creek, 10 mi. WSW Monticello, 1.

Castor canadensis Kuhl
Beaver

Beavers were not seen within the study site, but abandoned beaver ponds were noted along Indian Creek. One of the ponds had large quantities of gnawed wood that obviously had been used to build a dam or lodge. Beaver ponds in the area are probably short-lived due to the heavy accumulations of sediment deposited by the spring runoff.

Peromyscus boylii (Baird)
Brush Mouse

Peromyscus boylii evidently is rare in the Abajo Mountains, but may be more common in brushland of the valley floor. Two specimens were collected along a canyon in a community dominated by ponderosa pine and sage. This site, where *Peromyscus maniculatus* was the most abundant mouse, was lower in elevation than most other collecting localities.

Specimens examined (2).—9 mi. SSW Monticello.

Peromyscus maniculatus (Wagner)
Deer Mouse

This mouse is the most abundant mammal in the study area, from the valley floor to the highest peak. Specimens commonly were taken from each trap line and in every habitat type. Occasional specimens even were collected in the afternoon in traps placed in *Microtus* runways under dense grassy cover. From mid-July to early August, seven gravid females were collected that carried from four to five embryos (mean 4.3).

Specimens examined (121).—19 mi. S Moab, 1; Foy Lake, 10 mi. WNW Monticello, 3; 9 mi. WNW Monticello, 8; Monticello Lake, 7 mi. WNW Monticello, 19; 5 mi. WNW Monticello, 5; 19 mi. W Monticello, 1; Little Dry Mesa, 15 mi. W Monticello, 2; 14 mi. W Monticello, 4; 13 mi. W Monticello, 4; 11 mi. W Monticello, 1; 10 mi. W Monticello, 1; Vega Creek, 4 mi. E Monticello, 2; 5.5 mi. E Monticello, 5; 7 mi. E Monticello, 4; 8 mi. E Monticello, 5; 11.5 mi. E Monticello, 1; 6 mi. WSW Monticello, 11; Abajo Peak, 7 mi. WSW Monticello, 9; Indian Creek, 10 mi. WSW Monticello, 9; 3 mi. SW Monticello, 6; 13 mi. SW Monticello, 6; 9 mi. SSW Monticello, 14.

Microtus longicaudus (Merriam)
Long-tailed Vole

Microtus longicaudus is abundant in suitable habitat of dense grasses along lake shores and streams. Lee (1960) collected

124 specimens, all from above 6200 feet in elevation. Many of my specimens were collected in oak communities with little grass understory. This is the most widespread of the two species of voles inhabiting the Abajo range, occuring in a wide variety of habitats. Between mid-July and early August, two lactating females and six gravid females were taken. The number of embryos ranged from four to six (mean 5.2).

Specimens examined (57).—7 mi. N Monticello, 1; Monticello Lake, 7 mi. NW Monticello, 3; Foy Lake, 10 mi. WNW Monticello, 4; 9 mi. WNW Monticello, 2; 11 mi. W Monticello, 5; 4 mi. W Monticello, 1; Vega Creek, 4 mi. E Monticello, 13; 6 mi. WSW Monticello, 3; Indian Creek, 10 mi. WSW Monticello, 17; 3 mi. SW Monticello, 3; 13 mi. SW Monticello, 2; 9 mi. SSW Monticello, 3.

Microtus montanus (Peale)

Montane Vole

The montane vole may be locally abundant where its preferred dense grass cover is present and *Microtus longicaudus* is absent. On 17 July 1988, a female gave birth to four young in a Sherman live trap. A lactating female and a gravid female containing six embryos were collected in mid-July.

Specimens examined (36).—Foy Lake, 10 mi. WNW Monticello, 2; Monticello Lake, 7 mi. WNW Monticello, 2; 13 mi. W Monticello, 13; 11 mi. W Monticello, 1; 7 mi. E Monticello, 3; 6 mi. E Monticello, 1; 5.5 mi. E Monticello, 1; 6 mi. WSW Monticello, 12; Indian Creek, 10 mi. WSW Monticello, 1.

Erethizon dorsatum (Linnaeus)

Porcupine

No porcupines were observed or collected, although trees gnawed on by this species commonly were observed.

Canis latrans Say

Coyote

One animal was observed at an elevation of approximately 8700 feet, and coyotes often were heard howling at elevations between 7000 and 9000 feet. The skulls of four individuals were salvaged from a fur trapper's carcass dump. The trapper told me they had been trapped on the sage flats north of Monticello.

Specimens examined (4).—7 mi. N Monticello.

Canis lupus Linnaeus
Gray Wolf

Young and Goldman (1944) reported two gray wolves taken in 1916 from Harts Draw, on the north slope of the Blue [=Abajo] Mountains, 20 mi. NW Monticello. No records from the area since then are known. One of the two specimens is the holotype of *Canis lupus youngi* Goldman.

Urocyon cinereoargenteus (Schreber)
Gray Fox

The skull of a gray fox was obtained from a trapper's dumpsite. The animal had been taken on the sage flats north of Monticello. No indications of gray foxes were seen on the mountain, and I believe they are uncommon there, although this species is not infrequently taken in traplines on the surrounding flats.

Specimen examined (1).—7 mi N Monticello.

Ursus americanus Pallas
Black Bear

From Abajo Peak, shortly after sunset, I observed a bear in the black color phase approximately one-half mile away in Gold Queen Gulch. It foraged in a small clearing in oak woodland for 10 minutes before disappearing into the surrounding forest.

A longtime resident and hunting guide, Carl Mahon, stated that during the 1940s few black bears existed in the area, after which time the population slowly began to increase. Today these bears are common and widely distributed throughout the mountain range. Mahon also noted that the black bear occupies higher elevations in summer and often wallows in water to escape the heat. According to him, the brown or cinnamon color phase is slightly more common locally than the black phase. Other color phases reported in the area are blonde and red.

Ursus arctos Linnaeus
Grizzly Bear

The grizzly no longer occurs in the Abajo Mountains, although Carl Mahon relates that sometime in the 1930s a

government trapper was brought to the mountains to eliminate a bear that had been killing cattle. Traps were set and a grizzly was taken the following day.

Mustela erminea Linnaeus
Ermine

The first evidence of presence of ermine was of trapped mice that had been consumed, and the traps then scattered. Two traps dragged to the entrance of a burrow in a creek bank marked where an ermine subsequently was taken in a live trap baited with mouse carcasses. This animal escaped, but a second was taken in a Sherman live trap, baited with rolled oats. Possibly the animal was lured by the residual scent of mice previously collected in the trap.

Specimen examined (1).—Foy Lake, 10 mi. WNW Monticello, 1.

Mustela frenata Lichtenstein
Long-tailed Weasel

On two separate occasions, long-tailed weasels were observed hunting chipmunks during midmorning hours, one along a dirt road near Foy Lake, and another among rocks of a talus slope. Chipmunks are undoubtedly an important component of the weasel's diet where the two co-occur. A single specimen, captured in a Sherman live trap baited with rolled oats, may have been attracted by the scent of mice on the trap.

Specimen examined (1).—Vega Creek, 4 mi. E Monticello.

Mephitis mephitis (Schreber)
Striped Skunk

The striped skunk is not common in the Abajo Mountains. No tracks were seen and only one individual was sighted during my study.

Felis concolor Linnaeus
Cougar

Carl Mahon reported that the cougar population on the mountain range is presently stable. This cat is sometimes hunted in the Abajo Mountains with dogs.

Felis rufus Schreber
Bobcat

Suitable habitat for the bobcat exists throughout the study site. Its presence has been noted by local residents.

Cervus elaphus Linnaeus
Elk

Lone elk occasionally were seen at various places in the Abajo Mountains. A herd of 20 was observed one morning near Abajo Peak, foraging in a clearing in a spruce-fir community. According to San Juan County game warden Guy Wallace, elk are native to the Abajos, the population is stable, and there is talk of opening a limited hunting season.

Odocoileus hemionus (Rafinesque)
Mule Deer

The population of mule deer on the Abajo Mountains has changed dramatically during the present century. According to Carl Mahon, mule deer were scarce during the early 1900s, probably due to overgrazing by livestock, and they did not begin to increase until the 1940s. Today the species is abundant and can be seen virtually anywhere on the range. The marked increase is probably a response to predator control and transition to a more brushy habitat as a result of overgrazing. The deer population in the Abajos is above carrying capacity, as evidenced by the high browse line often observed in woody communities.

The breeding season begins in winter and fawns usually are dropped in late June or early July (Cahalane, 1947), although a newborn fawn was seen on 7 August 1988.

Specimens examined (3).—Foy Lake, 10 mi. WNW Monticello, 1; 4 mi. W Monticello, 1; 3 mi. W Monticello, 1.

Ovis canadensis Shaw
Mountain Sheep

According to Carl Mahon, the bighorn sheep was a common resident of the Abajo Mountains during the 1930s. It was not unusual to see 30 or more individuals in a herd. Its abundance coincided with a time when mule deer were scarce. Increase of the mule deer population may have caused decline of the bighorn. In any event, the bighorn is restricted at present to

rocky terrain along the Colorado River adjacent to the study site.

Species of Hypothetical Occurrence

General distribution of the following species include the Abajo Mountains (Hall, 1981; Junge and Hoffmann, 1981), and further collecting efforts yet may document their presence. Because of the volant, and the sometimes migratory, nature of chiropterans, the following list is restricted to terrestrial species.

Sorex vagrans.—The wandering shrew is common throughout much of the western United States. It is possible that this species is a resident of the area, but has escaped notice. The shrews Lee (1960) reported as *Sorex vagrans* from the Abajo Mountains probably are referable to *S. monticolus.*

Sylvilagus audubonii.—The desert cottontail was not observed in the study area, although it probably occurs in the lower foothills and lowlands where suitable habitat is present.

Neotoma albigula.—The white-throated woodrat is reportedly a rare resident in the Needles District of Canyonlands National Park (Armstrong, 1982). It may occur in the lowlands of the Abajo Mountains, but characteristic sign of the genus was not noted during this study.

Neotoma mexicana.—This species has been reported from Devil Canyon, 14 mi. S Monticello (Kelson, 1951). This record is five miles south-southeast of the study site, and the canyon in which this specimen was obtained may be a route of possible dispersal into the Abajos. However, presence of the Mexican woodrat is doubtful, as no sign was observed.

Ondatra zibethicus.—Suitable habitat for the muskrat seems to be available in the Abajo Mountains, but no evidence of this animal was observed.

Bassariscus astutus.—An individual of this species possibly was sighted near the edge of a cliff within a sage community. Local residents claim ringtails occur on the flats north of Monticello.

Spilogale gracilis.—The Abajo Mountains are within the mapped range of this small, secretive skunk (Hall, 1981); it may inhabit the valley floor.

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RECORDS OF MAMMALS FROM THE LLANO ESTACADO AND ADJACENT AREAS OF TEXAS AND NEW MEXICO

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Recent field exploration on the Llano Estacado and in adjacent areas of western Texas and eastern New Mexico by field parties from The Museum of Texas Tech University has resulted in collection of several thousand specimens of mammals. Some of these provide noteworthy distributional data that establish the presence of, or better elucidate the status of, species inhabiting that region. We have summarized such information for 14 taxa in this paper.

Collecting efforts were supported by The Museum, the Department of Biological Sciences, and the Graduate School at Texas Tech University, and by the Rob and Bessie Welder Wildlife Foundation, which supported one of us (Choate) in the laboratory and in the field in 1989 and 1990 as a Welder Wildlife Foundation Fellow. This publication constitutes contribution no. 366 of that foundation.

In the following accounts, catalogue numbers refer to the collection of Recent mammals housed in The Museum at Texas Tech. Measurements are in millimeters.

Cryptotis parva parva (Say, 1823).—On 30 June 1990, a male (testes 3 × 1) least shrew (58316) was taken by J. R. Goetze in a museum special trap baited with rolled oats and set in a line along a grassy fencerow (mostly brome, white triden, and sweet clover) 12 mi. S and 1 mi. E Pampa, Gray Co., Texas. *Chaetodipus*

hispidus, Peromyscus maniculatus, Sigmodon hispidus, and *Mus musculus* were trapped at the same locality. This record adds to those published by Owen and Hamilton (1986) for the Llano Estacado, and further substantiates the general distribution of this species in the northern half of that region.

Several authors, including Owen and Hamilton (1986), have suggested that widespread irrigation on the High Plains has facilitated westward migration by *C. parva* in the past few decades. The latter authors also opined (p. 405) that this shrew "... will be found with increasing frequency ... in the vicinity of permanent playas, particularly those ... associated with substantial areas of uncultivated land supporting native vegetation." We would add that the Conservation Reserve Program, under which thousands of acres on the Llano Estacado that formerly were under cultivation have been returned to grassland, some planted to native grasses, also may result in increased populations of this shrew.

Myotis californicus californicus (Audubon and Bachman, 1842).—Two males of this small bat from nearby localities at the northwestern tip of the Llano Estacado in New Mexico, one (58707) taken 6 mi. N and 6 mi. E Newkirk, Guadalupe County, on 26 July 1990, and the other (58057) caught 3 mi. N Ima, Quay County, on 31 May 1990, provide the northeasternmost records of this species from the state and are the first to be reported from the Llano (see Findley *et al.*, 1975). Both individuals were netted over stock tanks located near the edge of the caprock in company with *M. ciliolabrum.* The tank in Quay County was surrounded by piñon and juniper, whereas the one in Guadalupe County was in a much more open area that supported mostly juniper.

Myotis ciliolabrum ciliolabrum (Merriam, 1886).—Three New Mexican specimens of this small-footed myotis, all females, two (58055–56) from 3 mi. N Ima and one (58708) from 6 mi. N and 6 mi. E Newkirk (see account above), establish new county records that help to clarify the distribution of this species in the northeastern part of that state. They also provide the second and third known localities of record for *M. ciliolabrum* on the Llano Estacado (the other being from Armstrong Co., Texas—Hollander and Jones, 1987). Two females netted on 31 May each carried a single fetus (4 in crown-rump length); one shot on 26 July evinced no reproductive activity.

Lasiurus borealis (Müller, 1776).—A few females of this migratory species rear young on the Staked Plains and in adjacent areas, but males evidently occur there only as young-of-the-year or as migrants. Specimens from four localities in western Texas better establish the red bat as seasonally widespread in the region: male (58059), 8 mi. S, 8 mi. E Claude, Armstrong County, 15 May 1990; female (56887), 10 mi. N, 35 mi. W Hereford, Deaf Smith County, 23 August 1989; male (58758), 3 mi. N, 8 mi. E South Plains, Floyd County, 29 August 1990; female (58319), 3 mi. N Jerico, Gray County, 30 June 1990. The circumstances under which the first three specimens were collected are described below. The female from Gray County, which was lactating, was netted along with two *Myotis velifer* over a water-filled overflow pit adjacent to a stock tank.

Lasiurus cinereus cinereus (Palisot de Beauvois, 1796).—The hoary bat evidently is not resident in western Texas and eastern New Mexico, but migrates through the area both to and from summer haunts farther northward. Texas records that help to document the seasonal occurrence of this species are as follows: female (58060, two fetuses 12 in crown-rump length), 8 mi. S, 8 mi. E Claude, Armstrong County, 15 May 1990; four specimens (56888–91) from 10 mi. N, 35 mi. W Hereford (=14 mi. S, 2 mi. E Glenrio), Deaf Smith County, a male (testes 7 × 3) on 16 August 1989, and two males (testes of both 5 × 2) and a female on 23 August 1989; male (58759, testes 6 × 3), 3 mi. N, 8 mi. E South Plains, Floyd County, 29 August 1990; male (57202, testes 7 × 4), Muleshoe National Wildlife Refuge, Bailey County, 10 September 1989.

The bat from Armstrong County was netted over Mulberry Creek under cottonwoods and other deciduous trees; those from Deaf Smith County were taken in a net stretched over a stock tank not too distant from the edge of the caprock, whereas one from Floyd County was netted over an impoundment fed by a natural spring at the base of the Llano escarpment (*Eptesicus fuscus, Lasiurus borealis, Antrozous pallidus*, and *Tadarida brasiliensis* were taken in the same net and *Pipistrellus hesperus* was shot over the spring). The male from Bailey County was one of two (the other escaped our net) trapped in a net over a small, water-filled, concrete tank near a residence.

Antrozous pallidus bunkeri Hibbard, 1934.—A male (52941, testes 11 × 6) pallid bat from 7 mi. W Justiceburg, Garza Co.,

Texas, captured on 10 September 1988, extends the known range of this subspecies almost 100 miles southward along the eastern edge of the Llano Estacado, a distributional pattern predicted by Manning *et al.* (1988). The large size of the specimen (forearm 55.4) clearly aligns it with *bunkeri.*

Spermophilus variegatus buckleyi Slack, 1861.—A male (6678) from 10 mi. E Eldorado, Schleicher Co., Texas, obtained by R. W. Wiley on 23 February 1968, represents a northern marginal record for this ground squirrel on the Edwards Plateau. We tentatively refer this specimen to the subspecies *buckleyi* because of the blackish coloration on the head, shoulders, and middorsum, which is typical of these squirrels in south-central Texas. However, color varies greatly in some populations of *S. variegatus* (Schmidly, 1977), and the species clearly is in need of systematic scrutiny with respect to intraspecific variation.

Spermophilus variegatus grammurus (Say, 1823).—A lactating female (58102) and adult male (58721, testes 28 × 13) taken 1 mi. N and 1 mi. W Ima, Quay Co., New Mexico, on 30 May and 24 July 1990, respectively, not only fill a distributional gap (see Findley *et al.*, 1975) in the northeastern part of the state, but are the first specimens of this species to be recorded from the Llano Estacado. The squirrels were shot on a west-facing, brushy slope strewn with large boulders. Scrub oak and skunkbush along with yucca and grasses comprised the dominate vegetation. Each squirrel was perched atop a boulder when shot, and the cheek pouches of both were filled with skunkbush seeds. The breaks along the extreme northwestern edge of the Llano Estacado well may be the only place where this species occurs in that region.

Perognathus flavescens copei Rhoads, 1894.—In their study of geographic variation in this pocket mouse on the Great Plains, Reed and Choate (1986) examined a number of specimens from eastern New Mexico and western Texas, but the distributional pattern revealed was decidedly spotty. Reed and Choate inferred that additional collecting efforts concentrated in areas of sandy soil would establish that the species, although probably not continuously distributed through the region, was more widespread than their records indicated. Over the past three years, we have collected *P. flavescens* on sandy or sandy loam soils at a number of places in western Texas where it previously was unknown. Some of these records were reported by Pesaturo *et al.* (1990); the others follow: *Andrews Co.*: 4 mi. N, 5

mi. E Andrews (56821); 3 mi. N, 6 mi. W Andrews (56822); 8.5 mi. S, 4 mi. E Andrews (56823–24); 9.5 mi. S, 5 mi. E Andrews (56825). *Gaines Co.*: 10 mi. S, 20 mi. W Seminole (58732). *Lynn Co.*: 4 mi. N, 3 mi. W New Home (58754). *Yoakum Co.*: 8 mi. N Bronco (58346); 13–14 mi. N Plains (56921–22, 58344–45).

Records of occurrence of *P. f. copei* on the Llano Estacado and in adjacent areas are mapped in Figure 1. The eastern margin of the range in Texas evidently is just east of the border of the map in Callahan (Davis, 1974) and Wilbarger (Dalquest and Horner, 1984) counties; the northernmost records are in adjacent Oklahoma. Otherwise, the known distribution of the subspecies is depicted in the figure.

Reithrodontomys fulvescens laceyi J. A. Allen, 1896.—Three adults of this harvest mouse from Wheeler County establish the northernmost localities of record in the Texas Panhandle. Davis (1974) previously mapped *R. fulvescens* as occurring in Armstrong County, to the southwest, but we do not know on what evidence that record was based. Two males (52218–19) were collected 2.5 mi. N and 9 mi. E Wheeler on 8 May 1990 in dense grass (mostly *Andropogon*) on the first terrace above Sweetwater Creek. On the following day, a nonpregnant female (58775) was trapped on sandy soil, in a low-lying, brushy habitat with rank bluestem, in the floodplain of the North Fork of the Red River at a place 2 mi. N Shamrock.

Peromyscus nasutus nasutus (J. A. Allen, 1891).—This rock mouse has been reported previously from the Llano Estacado in Quay County, New Mexico, by Tamsitt (1959) from 8.5 mi. S San Jon and by Aday and Gennaro (1973) from 3 mi. E and 2 mi. N Ragland. Three specimens from 9 mi. N and 3 mi. E Broadview, Curry County (56994–96), expand the known range a few miles farther eastward along the margin of the caprock from the former locality to within approximately 6.5 miles of the border with the Texas Panhandle (where *P. nasutus* has yet to be recorded). Unfortunately, we found no piñon extending along the edge of the Llano Estacado into Texas.

Our specimens, all adult females, were trapped on 16 August 1989 in rocky situations at the break of the Llano in piñon-juniper-scrub oak, and in the same general area as *P. boylii, P. leucopus*, and *P. truei*. One animal carried four fetuses (4 in crown-rump length), another was gravid with three (6 in length), whereas the third dropped two young in a live trap and

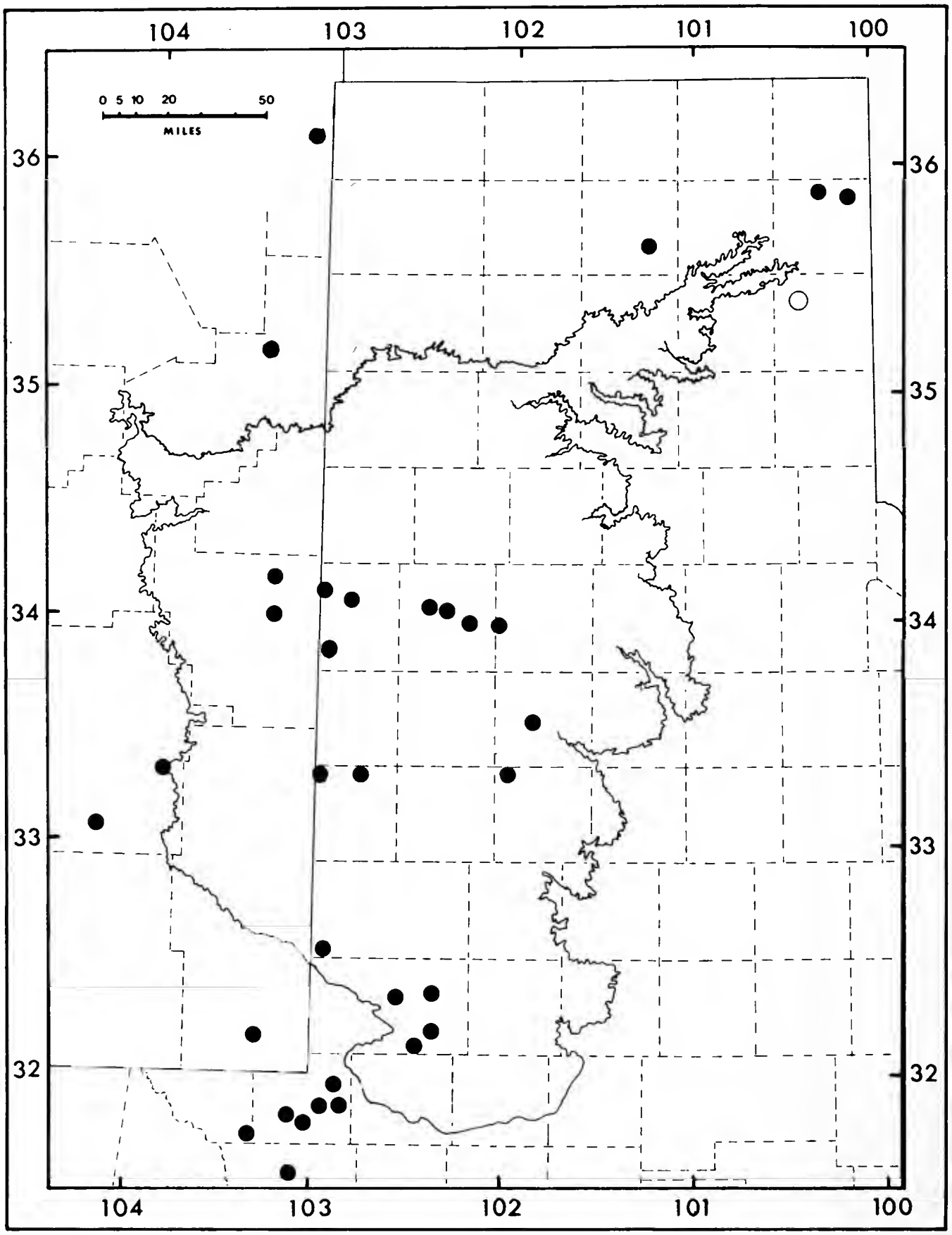

FIG. 1.—Known records of occurrence of *Perognathus flavescens copei* on the Llano Estacado and in adjacent areas of Texas and New Mexico after Findley *et al.* (1975), Jones *et al.* (1988), Pesaturo *et al.* (1990), and Reed and Choate (1986). Some records are not plotted because undue crowing of symbols would have resulted. The open symbol in Wheeler Co., Texas, is the type locality of the subspecies. The extent of the Llano Estacado is outlined on the map.

retained a fetus measuring 28. One was completely in worn pelage, but the other two were molting.

Respective external measurements are: total length, 191, 184, 191; length of tail, 94, 92, 92; length of hind foot, 23, 22, 22;

FIG. 2.—Juniper-clad break of Llano Estacado, 8 mi. S and 2 mi. E Glenrio, Deaf Smith Co., Texas. Two *Peromyscus truei truei* were trapped at the location in foreground.

length of ear, 21, 21, 21. From the sympatric and morphologically similar *P. t. truei*, the three *nasutus* differ in being somewhat darker dorsally, and in having ears that are shorter (rather than longer) than the hind feet and slightly smaller auditory bullae. They differ also in cusp morphology of the lower molars (see Hoffmeister, 1986). Cranial measurements are given in Table 1. We follow Carleton (1989) in regarding *P. nasutus* as a species distinct from *P. difficilis* (but see Janecek, 1990).

Peromyscus truei truei (Shufeldt, 1885).—Five piñon mice collected along the edge of the Llano to the south of Glenrio, Deaf Smith County, are the first of this subspecies to be reported from the Texas Panhandle. Previously, *P. t. truei* was known from the state only on the basis of four specimens from Guadalupe Mountains National Park, Culberson County (Cornely *et al.*, 1981), far to the southwest. All five specimens were trapped in association with *P. leucopus* on rock ledges beneath or near junipers (Fig. 2) as follows: two males (58043–44, testes 14 × 8 and 12 × 7), 8 mi. S, 2 mi. E Glenrio, 21 March 1990; male (58045, testes 12 × 7), 11 mi. S, 2 mi. E Glenrio, 22 March 1990; female (57015, lactating) and male (57016, testes 14 × 8), 10 mi. N, 35 mi. W Hereford (=14 mi. S, 2 mi. E Glenrio), 24 August and 14 August 1989, respectively.

We also obtained six specimens of this subspecies along the margin of the caprock in adjacent eastern New Mexico as follows: *Curry Co.*: three females (57013–14, 57471), 9 mi. N, 3 mi. E Broadview, two on 16 August (one with three fetuses measuring 10 in crown-rump length) and one (lactating) on 11 November 1989. *Quay Co.*: subadult female (56737), 5 mi. N Wheatland, 15 June 1989; female (58216, five fetuses 4 in length), 2 mi. N Ima, 31 May 1990; lactating female (58217), 4 mi. S, 3 mi. E Ima, 23 May 1990.

Average external measurements of nine adults (one individual with incomplete tail not included), four males and five females, from New Mexico and Texas (extremes in parentheses) are as follows: total length, 189.7 (180–205); length of tail, 90.2 (82–106); length of hind foot, 22.6 (22–24); length of ear, 23.8 (23–25). Length of ear was equal to that of hind foot in one specimen and greater in the other eight. See Table 1 for cranial measurements.

The specimens reported here of *P. t. truei* from Texas reduce the known diastema between the distribution of that subspecies and the isolated *P. t. comanche* to approximately 75 miles, albeit directly across inhospitable habitat. If the ranges of these two races meet, which we doubt, it will be along the circuitous northern margin of the Llano Estacado. However, significant rocky habitats and stands of juniper are lacking at some places in this area. As presently known, *comanche* is restricted to suitable outcroppings that support juniper along the eastern escarpment of the High Plains in Armstrong, Briscoe, and Randall counties. *P. t. comanche* differs from *P. t. truei* as described by Schmidly (1973), principally in having a longer tail on the average, measurably shorter ears that are about the same length as the hind feet, a flatter skull, and slightly smaller auditory bullae. See Table 1 for comparative cranial measurements of the two subspecies. In some features, *comanche* differs from *truei* in the same way as does *P. nasutus*, explaining why some previous authors aligned *comanche* with the latter. Our specimens of both subspecies of *truei* differ from *nasutus* in lacking well-developed accessory stylids and lophids on the first two lower molars. The two species also are known to differ chromosomally and electrophoretically.

External measurements taken by different collectors sometimes vary, causing difficulties in making critical comparisons among specimens. The larger ear of *P. t. truei* is aptly illustrated

TABLE 1.—*Cranial measurments of* Peromyscus nasutus *and* Peromyscus truei. *One standard deviation, extremes, and coefficient of variation are given for samples of* P. truei.

Specimen no. or number of specimens averaged, and sex	Greatest length of skull	Condylo-incisive length	Length of nasals	Rostral length	Rostral breadth	Interorbital constriction	Zygomatic breadth	Breadth of braincase	Mastoid breadth	Depth of skull	Length of incisive foramina	Length of bony palate	Length of max toothrow	Breadth across M1–M1	Length of man. toothrow
Peromyscus nasutus nasutus, Curry County, New Mexcio															
56994, ♀	27.47	24.74	10.32	10.49	4.30	4.36	13.29	13.00	12.73	10.21	5.44	3.95	4.42	5.01	4.39
56995, ♀	27.50	24.34	10.05	10.51	4.50	4.54	13.91	13.20	12.31	10.49	5.34	3.77	4.21	5.12	4.09
56996, ♀	28.22	25.05	10.61	10.77	4.78	4.38	13.59	12.98	12.57	10.55	5.46	3.98	4.30	5.25	4.05
Peromyscus truei truei, New Mexico and Texas															
Average 7 (4 ♂, 3 ♀)	28.3±0.4	25.2±0.6	10.8±0.3	11.1±0.2	4.9±0.2	4.5±0.1	13.9±0.3	13.0±0.3	12.4±0.3	10.5±0.1	5.5±0.1	4.1±0.2	4.3±0.1	5.3±0.2	4.1±0.2
Minimum	27.71	24.57	10.41	10.80	4.63	4.39	13.33	12.59	12.08	10.33	5.27	3.80	4.14	5.03	3.87
Maximum	29.01	25.99	11.02	11.37	5.19	4.63	14.30	13.25	12.72	10.68	5.65	4.39	4.39	5.49	4.34
C. V.	1.5	2.3	2.3	2.2	4.2	2.0	2.4	2.0	2.0	1.2	2.3	5.5	2.5	3.0	4.3
Peromyscus truei comanche, Briscoe County, Texas															
Average 7 (2 ♂, 5 ♀)	27.6±0.6	24.5±0.4	10.8±0.6	10.9±0.3	4.8±0.2	4.4±0.1	13.4±0.6	12.5±0.3	11.9±0.3	9.9±0.1	5.4±0.3	4.1±0.5	4.3±0.2	5.2±0.2	4.0±0.1
Minimum	27.18	23.95	10.32	10.61	4.52	4.30	12.59	12.24	11.44	9.64	4.91	3.73	4.07	4.87	3.89
Maximum	28.91	25.20	11.65	11.53	4.95	4.54	14.47	12.90	12.42	10.04	6.00	4.20	4.56	5.36	4.23
C. V.	2.1	1.8	5.1	3.0	3.4	2.0	4.6	2.1	2.8	1.5	6.4	12.1	4.3	3.5	2.5
Randall County, Texas															
Average 16 (10 ♂, 6 ♀)	27.5±0.7	24.4±0.6	10.5±0.4	10.7±0.3	4.8±0.7	4.4±0.2	13.6±0.4	12.7±0.3	11.9±0.2	9.9±0.2	5.5±0.3	3.9±0.3	4.2±0.1	5.3±0.2	4.1±0.1
Minimum	26.63	23.64	9.79	10.29	4.38	4.26	13.11	12.15	11.60	9.52	5.11	3.60	4.02	4.93	3.91
Maximum	28.87	25.80	11.28	11.27	5.13	4.92	14.54	13.32	12.32	10.47	6.04	4.54	4.38	5.55	4.25
C. V.	2.4	2.4	4.3	3.2	4.4	3.6	3.2	2.5	1.8	2.3	4.6	6.4	2.4	3.1	2.6

in comparison to that of *P. t. comanche* by dry measurements, however: 20.8 (19.1–21.8) in 10 adult specimens of the former listed above as opposed to 18.5 (17.3–20.4) in 22 specimens of *comanche* from Brisco Co., Texas.

Baiomys taylori taylori (Thomas, 1887).—Northward and westward dispersal of the northern pygmy mouse in northwestern Texas was documented by Choate *et al.* (1990), a paper in which habitats were described and mammalian associates listed. Specimens of *B. taylori* obtained in 1990 that extend the known range on the Llano Estacado beyond a line drawn through the northwesternmost localities of occurrence mapped by Choate *et al.* are as follows: *Armstrong Co.*: 1 mi. S, 7 mi. E Claude (58390–91). *Carson Co.*: 1 mi. S, 3 mi. W Groom (58119). *Lubbock Co.*: 5 mi. S, 3 mi. W Shallowater (58737). *Swisher Co.*: 1 mi. N, 2 mi. W Vigo Park (58393–94). *Terry Co.*: 3.5 mi. N, 10.5 mi. W Meadow (58392). *Yoakum Co.*: 5 mi. S, 13 mi. E Plains (58129). The last-listed locality is only approximately 20 miles east of the New Mexican border.

A female trapped in Swisher County on 18 June carried four fetuses (4 in crown-rump length). Of the two taken in early July, one from Armstrong County had three fetuses (3 in crown-rump length), whereas another from Terry County carried one that measured 17.

Spilogale gracilis leucoparia Merriam, 1890.—The posterior part of the cranium (58045) of a spotted skunk referable to this species was found at the base of a rocky slope near the bed of the Double Mountain Fork of the Brazos River, 5.5 mi. E Justiceburg, Garza Co., Texas, in April 1989. This record reduces the known hiatus to but a few miles between the range of *S. gracilis* and that of the eastern spotted skunk, *S. putorius*, just to the east of the Llano escarpment (the latter was reported from 1 mi. S Post, Garza County, by Jones *et al.*, 1985). Our specimen clearly is assignable to *gracilis* on the basis of its inflated mastoid region and enlarged auditory bullae. It is the northernmost record of the species in Texas (see Hollander *et al.*, 1987).

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ANNOTATED CHECKLIST OF LAND MAMMALS OF EL SALVADOR

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AND ROBERT J. BAKER

El Salvador, a country of approximately 21,000 square kilometers, is located in Central America between 13°09′ and 14°27′ N latitude and 87°41′ and 90°08′ W longitude. To the north and east it borders on Honduras, to the west on Guatemala, and to the south on the Pacific Ocean. El Salvador has more than 200 inhabitants per square kilometer, a population density more than 12 times the average of Latin American countries (Escamilla, 1986). It is the smallest of the Central American republics, and one of only two countries in the region (the other is Belize) that do not have a coast along both the Atlantic and Pacific oceans. Although small in area, the country has a varied climate and topography, and thus a diverse tropical biota.

Temperature changes relatively little during the year, with annual and daily variations rarely exceeding 10° C (Escamilla, 1986). In San Salvador, at 710 meters, the mean annual temperature is 22.8° C. The coldest month, December, has a mean of 21.8° C and the hottest month, April, has a mean of 24.5° C. Although the temperature at a given locality is relatively constant, temperature does vary considerably with altitude. For example, at Santa Cruz Porrillo (elevation 30 meters) the average annual temperature is 26.7° C. In contrast, at Montecristo (2230 meters) the mean annual temperature is only 12.8° C (Holdridge, 1975).

Climatic differences in El Salvador are due mainly to the quantity and distribution of annual precipitation. Rainfall is abundant from May through October but rare from November through April (Escamilla,

1986). The mean annual rainfall at San Salvador is 1789 mm., ranging from 355 mm in July to only 4 mm in February (Holdridge, 1975).

Elevations vary from sea level along the Pacific coast to 2730 meters in the mountains along the Honduran border. Habitat zonation ranges from dry tropical forest to wet montane forest. The country has been subdivided into 19 life zones, based on climate, according to the system devised by Holdridge (Tosi and Hartshorn, 1978).

According to Burt and Stirton (1961), the first mammalian specimen taken from El Salvador was a squirrel, probably obtained in Departamento de La Unión, to which Ogilby (1839) gave the name *Sciurus variegatoides*. Bats obtained near Volcán Izalco, Departamento de Sonsonate, and donated to the Academy of Natural Sciences of Philadelphia in 1860 also represent an early collection from the country. In 1866, H. Allen described *Vespertilio concinnus* (=*Myotis nigricans*) from "Salvador," presumably based on the material from Volcán Izalco (Burt and Stirton, 1961).

Systematic mammal collecting in El Salvador began in 1925 under the financial patronage of Donald R. Dickey. Collecting was done by the late Rubin A. Stirton from July 1925 to April 1926, and from late November 1926 through June 1927. Stirton returned to El Salvador from November 1941 to May 1942 as head of an expedition from the University of California. Milton Hildebrand served as mammalogist on that expedition (Burt and Stirton, 1961).

Dickey (1928*a*, 1928*b*, 1928*c*) described 11 new species and subspecies from Stirton's collections. Four other subspecies later were described from this material by Nelson and Goldman (1931), Nelson (1932), Goldman (1937), and Hooper (1949).

The only other general mammal collecting in El Salvador was by Heinz Felten from October 1952 to April 1954. Felten (1955, 1956*a*, 1956*b*, 1956*c*, 1957*a*, 1957*b*, 1958*a*, 1958*b*, 1958*c*) published nine papers on the mammals of the country in which he recorded 73 species and described two new subspecies.

The series of papers by Felten and the treatise on Salvadorian land mammals by Burt and Stirton (1961) are the only synoptic treatments of the mammalian fauna of the country. A total of 97 species was reported in these publications. Records published since then, together with several overlooked by Burt and Stirton, have increased the number of known species to 121 as here listed, almost half of which are bats. Probably at least an additional dozen taxa, possibly more, occur in El Salvador. For example, the genera *Caluromys, Diclidurus, Galictis,* and *Mazama* are unrepresented in our list; furthermore, only one species of *Micronycteris*, only four genera of glossophagines, and only

two kinds of xenarthrans have been reported from the country. In addition to new distributional records, systematic studies have resulted in changes in nomenclatorial status of several taxa in recent years. Some of the new distributional records and changes in nomenclature have been incorporated into second-hand summaries such as those of Hall (1981) and Jones *et al.* (1988).

Historic accounts of biological conditions in El Salvador (Daugherty, 1972, and Guzmán, 1883, for example), some of which address the drastic affect in recent centuries of humans on the environment, suggest the possible past occurrence of a few species of mammals not listed here. We have not included these taxa (howler monkeys, white-lipped peccaries, and brockets are examples) because the published records are of a general nature or speculative, and, in any event, are not substantiated by actual specimens or first-hand observations. Nonetheless, chronicles of conditions in colonial and early republican times are of considerable value in gauging the overall impact of land degradation and human population pressure on biodiversity in the country.

Following is a checklist of mammalian species known to occur in El Salvador or that occurred there until relatively recently. Taxa are arranged phylogenetically through genera, but species in each genus are listed alphabetically. Citations are given to publications that are primary (or principal) sources of distributional data on species and subspecies of Salvadorian mammals. In a few instances, notation is made of specimens reported in the literature under a name different than the one used here, or comments are entered concerning the taxonomic status of a taxon. We hope this checklist will prove a useful reference for both laboratory and field workers concerned with studies of mammalian biology in El Salvador. We are grateful to K. F. Koopman, T. J. McCarthy, and D. E. Wilson for comments on a draft version of the manuscript.

Order MARSUPIALIA

Family Didelphidae

Didelphis marsupialis caucae J. A. Allen, 1900. Felten (1958*c*: 217, as *D. m. californica* in part), Burt and Stirton (1961:18, as *D. m. tabascensis* in part), Gardner (1973:70).

Didelphis virginiana californica Bennett, 1833. Felten (1958*c*:217, as *D. marsupialis californica* in part), Burt and Stirton (1961:18, as *D. marsupialis tabascensis* in part), Gardner (1973:74).

Philander opossum pallidus (J. A. Allen, 1901). Felten (1958*c*: 215, as *P. o. fuscogriseus*), Burt and Stirton (1961:20).

Chironectes minimus argyrodytes Dickey, 1928. Dickey (1928*c*:15, as *C. argyrodytes*), Burt and Stirton (1961:20, as *C. argyrodytes*).

Marmosa mexicana mexicana Merriam, 1897. Felten (1958*c*: 215), Burt and Stirton (1961:19).

Order Insectivora

Family Soricidae

Cryptotis goodwini Jackson, 1933. Felten (1958*c*:218).

Cryptotis nigrescens merriami Choate, 1970. Burt and Stirton (1961:21), Choate (1970:279).

Cryptotis parva orophila (J. A. Allen, 1895). Choate (1970:264).

Order Chiroptera

Family Emballonuridae

Rhynchonycteris naso (Wied, 1820). Sanborn (1937:327, as *Rhynchiscus naso*), Felten (1955:276, as *Rhynchiscus naso*), Burt and Stirton (1961:22, as *Rhynchiscus naso*).

Saccopteryx bilineata (Temminck, 1838). Felten (1955:276), Burt and Stirton (1961:22). Regarded by some authorities as monotypic, but others recognize the subspecies *S. b. centralis* Thomas, 1904, as occurring in Central America.

Saccopteryx leptura (Schreber, 1774). Burt and Stirton (1961:23).

Peropteryx macrotis macrotis (Wagner, 1843). Felten (1955: 284), Burt and Stirton (1961:23).

Balantiopteryx plicata plicata Peters, 1867. Felten (1955:280), Burt and Stirton (1961:24).

Family Noctilionidae

Noctilio leporinus mastivus (Vahl, 1797). Hellebuyck *et al.* (1985: 784).

Family Mormoopidae

Pteronotus davyi fulvus (Thomas, 1892). Felten (1956*a*:78), Burt and Stirton (1961:27), Smith (1972:102), Hellebuyck *et al.* (1985: 785).

Pteronotus gymnonotus (Wagner, 1843). Felten 1956*a*:75, as *P. suapurensis*), Burt and Stirton (1961:26, as *P. suapurensis*), Smith (1972:106, as *P. suapurensis*).

Pteronotus parnellii mesoamericanus Smith, 1972. Felten (1956*a*: 69, as *Chilonycteris rubiginosa fusca*), Burt and Stirton (1961:25, as

P. rubiginosus fuscus), Smith (1972:74), Webb and Perrigo (1984:249), Hellebuyck *et al.* (1985:786).

Pteronotus personatus psilotis (Dobson, 1878). Felten (1956*a*:73, as *Chilonycteris personata*), Burt and Stirton (1961:26, as *P. psilotis*), Smith (1972:93).

Mormoops megalophylla megalophylla Peters, 1864. Felten (1956*a*: 80), Burt and Stirton (1961:27, as *M. m. senicula*), Davis and Carter (1962:67), Smith (1972:118).

Family Phyllostomidae

Micronycteris megalotis mexicana Miller, 1898. Felten (1956*b*:180), Burt and Stirton (1961:28).

Lonchorhina aurita aurita Tomes, 1863. Felten (1956*b*:181).

Macrophyllum macrophyllum (Schinz, 1821). Felten (1956*b*:183), Burt and Stirton (1961:28), Harrison and Pendleton (1975:869).

Phyllostomus discolor verrucosus Elliot, 1905. Felten 1956*b*:186), Burt and Stirton (1961:29).

Trachops cirrhosus coffini Goldman, 1925. Felten (1956*b*:189), Burt and Stirton (1961:30).

Chrotopterus auritus auritus (Peters, 1856). Burt and Stirton (1961:30).

Glossophaga commissarisi commissarisi Gardner, 1962. Hellebuyck *et al.* (1985:784-786).

Glossophaga leachii (Gray, 1844). Hall (1981:121, as *G. alticola*).

Glossophaga soricina handleyi Webster and Jones, 1980. Felten (1956*b*:192, as *G. s. leachii*), Burt and Stirton (1961:31, as *G. s. leachii*), Hellebuyck *et al.* (1985:784-786).

Anoura geoffroyi lasiopyga (Peters, 1868). Sanborn (1933:27), Felten (1956*b*:196), Hellebuyck *et al.* (1985:784-786).

Choeroniscus godmani (Thomas, 1903). Burt and Stirton (1961: 32), Owen *et al.* (1990:418).

Leptonycteris curasoae yerbabuenae Martínez and Villa, 1940. Jones and Bleier (1974:144), Arita and Humphrey (1988:55). We follow the latter authors in use of the name combination here employed.

Carollia perspicillata azteca Saussure, 1860. Felten (1956*b*:199), Burt and Stirton (1961:33), Pine (1972:70-71), Hellebuyck *et al.* (1985:784-786).

Carollia subrufa (Hahn, 1905). Felten (1956*b*:211, as *C. castanea subrufa*), Burt and Stirton (1961:33, as *C. castanea subrufa*), Pine (1972:28), Hellebuyck *et al.* (1985:785).

Sturnira lilium parvidens Goldman, 1917. Felten (1956*c*:341), Hellebuyck *et al.* (1985:784-785).

Sturnira ludovici ludovici Anthony, 1924. Hellebuyck *et al.* (1985: 784-786).

Uroderma bilobatum davisi Baker and McDaniel, 1972. Felten (1956*c*:343, as *U. b. bilobatum*), Burt and Stirton (1961: 34, as *U. b. bilobatum*), Davis (1968:695, as *U. b. bilobatum*), Baker and McDaniel (1972:4), Baker *et al.* (1972:428), Baker *et al.* (1975:141), Baker (1979:126), Baker *et al.* (1979:222), Baker (1981:297), Greenbaum (1981), Owen (1987:56).

Uroderma magnirostrum Davis, 1968. Davis (1968:680), Swanepoel and Genoways (1979:102).

Vampyrops helleri Peters, 1866. LaVal (1969:820), Hellebuyck *et al.* (1985:785-786).

Chiroderma salvini salvini Dobson, 1878. Hellebuyck *et al.* (1985: 785).

Chiroderma villosum jesupi J. A. Allen, 1900. Hellebuyck *et al.* (1985: 785), Owen (1987:55).

Artibeus aztecus major Davis, 1969. Hellebuyck *et al.* (1985:784-786). Owen (1987) removed this and other small species (including *phaeotis* and *toltecus*) from the genus *Artibeus* and placed them in the genus *Dermanura*.

Artibeus inopinatus Davis and Carter, 1964. Burt and Stirton (1961:35, as *A. hirsutus*), Davis and Carter (1964:121).

Artibeus intermedius J. A. Allen, 1897. Davis (1984:10), Owen (1987:54).

Artibeus jamaicensis paulus Davis, 1970. Felten (1956*c*:346, as *A. j. jamaicensis*), Burt and Stirton (1961:35, as *A. j. jamaicensis*), Davis (1970*b*:121), Hellebuyck *et al.* (1985:784-786).

Artibeus lituratus palmarum J. A. Allen and Chapman, 1897. Felten (1956*c*:350), Burt and Stirton (1961:34), Davis (1984:13), Hellebuyck *et al.* (1985:784-785).

Artibeus phaeotis palatinus Davis, 1970. Davis (1970*a*:401), Hellebuyck *et al.* (1985:784-786).

Artibeus toltecus hesperus Davis, 1969. Felten (1956*c*:351, as *A cinereus toltecus*), Burt and Stirton (1961:35, as *A. cinereus*), Davis (1969:26), Swanepoel and Genoways (1979:98), Hellebuyck *et al.* (1985:784-786).

Enchisthenes hartii (Thomas, 1892). Hellebuyck *et al.* (1985: 785). Owen (1987) reluctantly placed *hartii* in the genus *Dermanura*. Jones *et al.* (1988), however, opined that *Enchisthenes* probably merits generic status.

Centurio senex senex Gray, 1842. Felten (1956*c*:352), Burt and Stirton (1961:36), Davis *et al.* (1964:386), Paradiso (1967:601), Hellebuyck *et al.* (1985:784, 786), Owen (1987:55).

Desmodus rotundus murinus Wagner, 1840. Felten (1956*c*:354), Burt and Stirton (1961:36), Hellebuyck *et al.* (1985: 785).

Diaemus youngi Jentink, 1893. Greenbaum and Jones (1978:5), McBee *et al.* (1985:404), Owen *et al.* (1990:418).

Diphylla ecaudata Spix, 1823. Felten (1956*c*:364, as *D. e. centralis*), Burt and Stirton (1961:37). Currently regarded as a monotypic species (Jones *et al.*, 1988).

Family Natalidae

Natalus stramineus saturatus Dalquest and Hall, 1949. Felten (1957*a*:1, as *N. mexicanus*), Goodwin (1959:8), Burt and Stirton (1961:38, as *N. mexicanus*).

Family Vespertilionidae

Myotis keaysi pilosatibialis LaVal, 1973. Hellebuyck *et al.* (1985: 786).

Myotis nigricans nigricans (Schinz, 1821). H. Allen (1866:280), Felten (1957*a*:5), Miller and G. M. Allen (1928:181, 187), Burt and Stirton (1961:39), LaVal (1973*a*:10), Koopman (1976:5).

Myotis velifer velifer (J. A. Allen, 1890). Hellebuyck *et al.* (1985: 786).

Eptesicus fuscus miradorensis (H. Allen, 1866). Burt and Stirton (1961:39), Hellebuyck *et al.* (1985:785).

Lasiurus blossevillii frantzii (Peters, 1871). Burt and Stirton (1961:39, as *L. borealis*). We follow Baker *et al.* (1988) in use of the specific name *blossevillii*.

Lasiurus intermedius intermedius H. Allen, 1862. Hellebuyck *et al.* (1985:786).

Rhogeessa tumida H. Allen, 1866. Felten (1957*a*:6, as *R. parvula tumida*), Burt and Stirton (1961:40, as *R. parvula tumida*), LaVal (1973*b*:44), Bickham and Baker (1977:453), Baker (1984:179), Baker *et al.* (1985:235).

Family Molossidae

Nyctinomops laticaudatus yucatanicus (Miller, 1902). Felten (1957*a*:8, as *Tadarida yucatanica*).

Eumops auripendulus auripendulus (Shaw, 1800). Burt and Stirton (1961:40, as *E. abrasus*), Eger (1977:28).

Eumops underwoodi underwoodi Goodwin, 1940. Hellebuyck *et al.* (1985:787).

Molossus coibensis J. A. Allen, 1904. Felten (1957*a*:14, as *M. tropidorhynchus coibensis*), Burt and Stirton (1961:41), Dolan (1989:59).

Molossus molossus (Pallas, 1766). Felten (1957*a*:13, as *M. major aztecus*), Burt and Stirton (1961:41, as *M. major*), Warner *et al.* (1974:175, as *M. pygmaeus*), Dolan (1989:65).

Molossus rufus É. Geoffroy St.-Hilaire, 1805. Felten (1957*a*:9), Burt and Stirton (1961:41), Dolan (1989:46). Dolan (1989) regarded this large mastiff bat as monotypic, but indicated that further studies may show that recognition of subspecies is justified. In that case, the name *nigricans* would apply to Central American populations of the species.

Order Primates

Family Cebidae

Ateles geoffroyi vellerosus Gray, 1866. Kellogg and Goldman (1944:35), Felten (1958*c*:219), Burt and Stirton (1961:21).

Order Xenarthra

Family Myrmecophagidae

Tamandua mexicana mexicana (Saussure, 1860). Burt and Stirton (1961:42, as *T. tetradactyla mexicana*).

Family Dasypodidae

Dasypus novemcinctus fenestratus Peters, 1864. Felten (1958*c*: 220), Burt and Stirton (1961:42).

Order Lagomorpha

Family Leporidae

Sylvilagus floridanus hondurensis Goldman, 1932. Felten (1958*c*: 220), Burt and Stirton (1961:65).

Order Rodentia

Family Sciuridae

Sciurus deppei deppei Peters, 1863. Felten (1957*b*:149), Burt and Stirton (1961:52).

Sciurus variegatoides bangsi Dickey, 1928. Dickey (1928*b*:9), Harris (1937:11), Felten (1957*b*:150), Burt and Stirton (1961:52).

Sciurus variegatoides variegatoides Ogilby, 1839. Ogilby (1839: 117), Lesson (1842:112), J. A. Allen (1877:747), Nelson (1899:81), Dickey (1928*b*:8), Harris (1937:8), Felten (1957*b*:150), Burt and Stirton (1961:50).

Family Geomyidae

Orthogeomys grandis engelhardi Felten, 1957. Felten (1957*b*: 151), Burt and Stirton (1961:52).

Orthogeomys grandis pygacanthus Dickey, 1928. Dickey (1928*b*:9, as *O. pygacanthus*), Burt and Stirton (1961:52).

Family Heteromyidae

Liomys salvini salvini (Thomas, 1893). Felten (1957*b*:153, as *L. heterothrix*), Burt and Stirton (1961:54), Genoways (1973: 241).

Heteromys desmarestianus desmarestianus Gray, 1868. Dickey (1928*b*:10, as *H. d. psakastus*), Felten (1957*b*:152), Burt and Stirton (1961:53), Rogers and Schmidly (1982:385).

Family Muridae

Oryzomys alfaroi saturator Merriam, 1891. Felten (1958*a*:5), Burt and Stirton (1961:61, as *O. palustris couesi*).

Oryzomys couesi couesi (Alston, 1877). Felten (1958*a*:1), Burt and Stirton (1961:61).

Oryzomys fulvescens fulvescens (Saussure, 1860). Felten (1958*a*:6), Burt and Stirton (1961:62).

Oryzomys melanotis salvadorensis Felten, 1958. Felten (1958*a*:3, as *O. rostratus salvadorensis*), Burt and Stirton (1961:61).

Tylomys nudicaudus nudicaudus (Peters, 1866). Burt and Stirton (1961:59).

Ototylomys phyllotis phyllotis Merriam, 1901. Felten (1958*a*:7, as *O. p. guatemalae*), Hooper (1960:pl. 9), Burt and Stirton (1961:59), Lawlor (1969:40), Carleton (1980:25).

Nyctomys sumichrasti florencei Goldman, 1937. Goldman (1937: 422), Felten (1958*a*:7), Burt and Stirton (1961:59), Csuti (1980:43).

Reithrodontomys fulvescens chiapensis A. H. Howell, 1914. Hooper (1952:122), Burt and Stirton (1961:56).

Reithrodontomys gracilis anthonyi Goodwin, 1932. Hooper (1952:135), Anderson and Jones (1960:524), Burt and Stirton (1961:56).

Reithrodontomys gracilis pacificus Goodwin, 1932. Felten (1958*a*:9, as *R. g. anthonyi*), Anderson and Jones (1960:525).

Reithrodontomys mexicanus ocotepequensis Goodwin, 1937. Hooper (1952:150), Burt and Stirton (1961:56).

Reithrodontomys mexicanus orinus Hooper, 1949. Hooper (1949:169-170, 1952:149), Felten (1958*a*:10), Burt and Stirton (1961:55), Csuti (1980:44).

Reithrodontomys sumichrasti modestus Thomas, 1907. Hooper (1952:81), Felten (1958*a*:8), Burt and Stirton (1961:55).

Peromyscus aztecus cordillerae Dickey, 1928. Dickey (1928*a*:2, as *P. boylii cordillerae*), Ondrias (1960:218, as *P. boylii*), Burt and Stirton (1961:56, as *P. boylei cordillera*), Carleton (1979:294).

Peromyscus aztecus oaxacensis Merriam, 1898. Hooper (1957:12), Felten (1958*b*:133, as *P. oaxacensis*), Burt and Stirton (1961:57, as *P. oaxacensis*), Carleton (1979:295).

Peromyscus boylii sacarensis Dickey, 1928. Dickey (1928*a*:3), Burt and Stirton (1961:56), Carleton (1979:281).

Peromyscus gymnotis Thomas, 1894. Owen *et al.* (1990:417).

Peromyscus mexicanus saxatilis Merriam, 1898. Dickey (1928*a*:3, as *P. m. philombrius*, and 1928*a*:4, as *P. m. salvadorensis*), Hooper (1957:12), Felten (1958*b*:134), Ondrias (1960: 218), Burt and Stirton (1961:57), Huckaby (1980:16), Owen *et al.* (1990:417).

Peromyscus stirtoni Dickey, 1928. Dickey (1928*a*:5), Burt and Stirton (1961:58), Huckaby (1980:9).

Habromys lophurus (Osgood, 1904). Hooper (1958:pl. 13, as *Peromyscus lophurus*), Musser (1969:20, as *Peromyscus lophurus*), Robertson and Musser (1976:8, as *Peromyscus lophurus*). We follow Carleton (1980, 1989) in recognition of *Habromys* at the generic level.

Baiomys musculus nigrescens Osgood, 1904. Felten (1958*b*:136, as *B. m. grisescens*), Packard (1960:625), Burt and Stirton (1961:58).

Scotinomys teguina rufoniger Sanborn, 1935. Felten (1958*b*:137), Hooper (1960:pl. 11), Burt and Stirton (1961:58), Hooper (1972:19).

Sigmodon hispidus griseus J. A. Allen, 1908. Felten (1958*b*:138), Burt and Stirton (1961:62).

Rheomys thomasi stirtoni Dickey, 1928. Dickey (1928*b*:12), Stirton (1944:342), Burt and Stirton (1961:60).

Rheomys thomasi thomasi Dickey, 1928. Dickey (1928*b*:11), Stirton (1944:341-342), Burt and Stirton (1961:60), Hooper (1968:552).

Rattus rattus (Linnaeus. 1758). Felten (1958*b*:139. as *R. r. rattus*). Burt and Stirton (1961:63).

Mus musculus Linnaeus. 1758. Felten (1958*b*:140. as M. *m. domesticus*). Burt and Stirton (1961:63).

Family Erethizontidae

Coendou mexicanus mexicanus (Kerr. 1792). Felten (1957*b*:147). Burt and Stirton (1961:64).

Family Dasyproctidae

Agouti paca nelsoni Goldman. 1913. Felten (1957*b*:148. as *Cuniculus paca nelsoni*). Burt and Stirton (1961:64).

Dasyprocta punctata punctata Gray. 1842. Felten (1957*b*:149). Burt and Stirton (1961:65).

Order CARNIVORA

Family Canidae

Canis latrans dickeyi Nelson. 1932. Nelson (1932:224). Burt and Stirton (1961:48). Csuti (1980:57).

Urocyon cinereoargenteus guatemalae Miller. 1899. Felten (1958*c*:221. as *U. c. fraterculus*). Burt and Stirton (1961: 48).

Family Procyonidae

Bassariscus sumichrasti variabilis (Peters. 1874). Felten (1958*c*: 222). Burt and Stirton (1961:45. as *Jentinkia sumichrasti variabilis*).

Procyon lotor crassidens Hollister. 1914. Felten (1958*c*:222). Goldman (1950:70). Burt and Stirton (1961:43).

Procyon lotor dickeyi Nelson and Goldman. 1931. Nelson and Goldman (1931:20). Goldman (1950:69). Burt and Stirton (1961:43). Csuti (1980:59).

Nasua nasua narica (Linnaeus. 1766). Felten (1958*c*:222. as *N. narica narica*). Burt and Stirton (1961:44. as *N. narica narica*).

Potos flavus chiriquensis J. A. Allen. 1904. Felten (1958*c*:223. as *P. f. campechensis*). Burt and Stirton (1961:44). Kortlucke (1973:34).

Family Mustelidae

Mustela frenata goldmani (Merriam. 1896). Hall (1951:360). Felten (1958*c*:224). Burt and Stirton (1961:46).

Eira barbara inserta (J. A. Allen. 1908). Burt and Stirton (1961:46).

Spilogale putorius elata Howell, 1906. Van Gelder (1959:325), Burt and Stirton (1961:46).

Spilogale putorius tropicalis Howell, 1902. Van Gelder (1959: 319), Burt and Stirton (1961:46).

Mephitis macroura macroura Lichtenstein, 1832. Felten (1958*c*:225), Burt and Stirton (1961:47).

Conepatus mesoleucus nicaraguae J. A. Allen, 1910. Burt and Stirton (1961:47, as *C. leuconotus nicaraguae*).

Lutra longicaudis annectens Major, 1897. Burt and Stirton (1961:48, as *L. annectens*).

Family Felidae

Felis concolor mayensis Nelson and Goldman, 1929. Burt and Stirton (1961:49).

Felis onca centralis Mearns, 1901. Nelson and Goldman (1933: 235).

Felis pardalis pardalis Linneaus, 1758. Burt and Stirton (1961: 49).

Felis wiedii salvinia (Pocock, 1941). Felten (1958*c*:226), Burt and Stirton (1961:49).

Felis yagouaroundi fossata Mearns, 1901. Burt and Stirton (1961: 50).

Order Perissodactyla

Family Tapiridae

Tapiris bairdii (Gill, 1865). Hershkovitz (1954:496).

Order Artiodactyla

Family Tayassuidae

Dicotyles tajacu nigrescens (Goldman, 1926). Felten (1958*c*:226, as *Pecari tajacu nigrescens*), Burt and Stirton (1961:66, as *Tayassu tajacu nigrescens*). We follow Woodburne (1968) and more recently Wright (1989) in employing the generic name *Dicotyles*.

Family Cervidae

Odocoileus virginianus nelsoni Merriam, 1898. Felten (1958*c*:227), Hershkovitz (1958:543), Burt and Stirton (1961:66), Mendéz (1984:521).

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