OCCASIONAL PAPERS
THE MUSEUM
TEXAS TECH UNIVERSITY

NUMBER 137 18 FEBRUARY 1991

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

TRACY S. SCHAFER

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

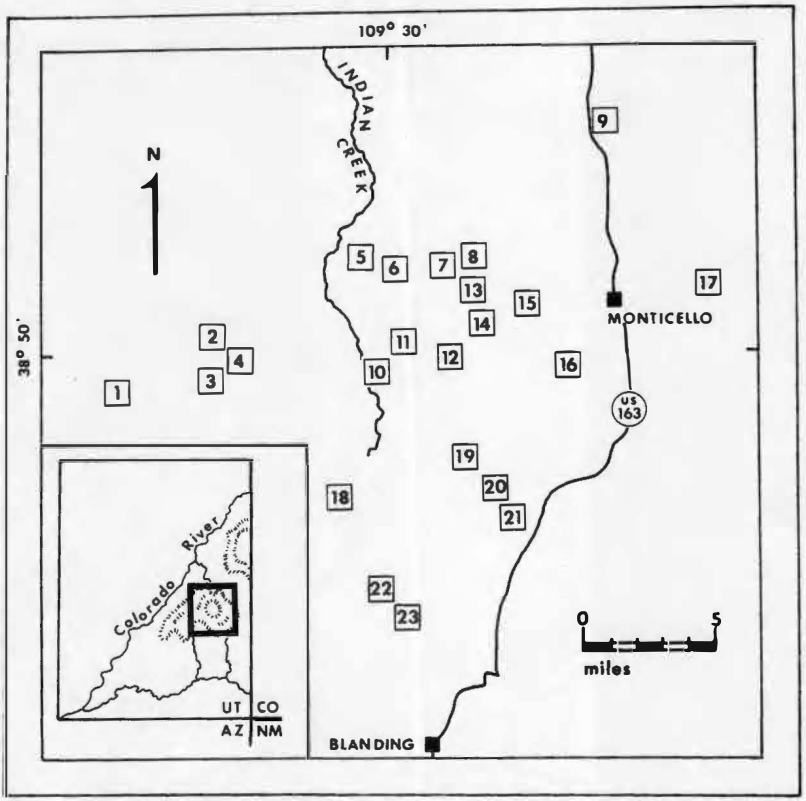

FIG. 1.—Collecting localities in the Abajo Mountains as listed in text. Inset shows location of the Abajo Mountains within San Juan County, Utah.

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.

ACKNOWLEDGMENTS

I am deeply indebted to W. W. Dalquest and F. B. Stangl, Jr., for their guidance throughout the course of this project and for critically reviewing the manuscript. Stangl prepared the figure and gave considerable time to improving the

manuscript. David M. Armstrong made many useful criticisms on an earlier draft. Appreciation is expressed to Stephen Kasper for his many suggestions and for assistance in the field. I thank Jane Lindsey for her technical assistance, N. V. Horner for reviewing an earlier draft of the manuscript, and the Utah Department of Natural Resources for issuing the collecting permits. I am grateful to Utah residents Joanne Harvey, Guy Wallace, and Carl Mahon for giving their time, helpful suggestions, and information pertinent to the study. This study was undertaken in partial fulfillment of the requirements for the degree of Master of Science at Midwestern State University.

LITERATURE CITED

ARMSTRONG, D. M. 1982. Mammals of the canyon country. Canyonlands Nat. Hist. Assoc., 263 pp.

BARBOUR, R. W., AND W. H. DAVIS. 1969. Bats of America. Univ. Press Kentucky, Lexington, 286 pp.

CAHALANE, V. H. 1947. Mammals of North America. The MacMillan Co., New York, x + 682 pp.

DALQUEST, W. W. 1943. Seasonal distribution of the hoary bat along the Pacific Coast. Murrelet, 24:21-24.

DURRANT, S. D. 1952. Mammals of Utah. Univ. Kansas Publ., Mus. Nat. Hist., 6:1-549.

DURRANT, S. D., AND M. R. LEE. 1955. Rare shrews from Utah and Wyoming. J. Mamm., 36:560-561.

FINDLEY, J. S., AND C. JONES. 1964. Seasonal distribution of the hoary bat. J. Mamm., 45:461-470.

HALL, E. R. 1981. The mammals of North America. John Wiley and Sons, 1:xv + 1-600 + *90* and 2:vi + 601-1181 + *90*.

JONES, J. K., JR., D. C. CARTER, H. H. GENOWAYS, R. S. HOFFMANN, D. W. RICE, AND C. JONES. 1986. Revised checklist of North American mammals north of Mexico, 1986. Occas. Papers Mus., Texas Tech Univ., 107:1-22.

JUNGE, J. A., AND R. S. HOFFMANN. 1981. An annotated key to the long-tailed shrews (genus *Sorex*) of the United States and Canada, with notes on a Middle American *Sorex*. Occas. Papers Mus. Nat. Hist., Univ. Kansas, 94:1-48.

KELSON, K. R. 1951. Speciation in rodents of the Colorado River Drainage. Univ. Utah Biol. Ser., 11:vii + 1-125.

LEE, M. R. 1960. Montane mammals of southeastern Utah, with emphasis on the effects of past climates upon occurrence and differentiation. Unpublished Ph.D dissertation, Univ. Utah, iv + 199 pp.

YOUNG, S. P., AND E. A. GOLDMAN. 1944. The wolves of North America. Amer. Wildlife Inst., Washington, D. C., xx + 636 pp.

Address of author: *Department of Biology, Midwestern State University, Wichita Falls, Texas 76308.* *Received 9 July 1990, accepted 10 August 1990.*

PUBLICATIONS OF THE MUSEUM
TEXAS TECH UNIVERSITY

Three serials of The Museum of Texas Tech University are published by Texas Tech University Press. Short research studies are published as Occasional Papers, whereas longer contributions appear as Special Publications. Papers of practical application to collection management and museum operations are issued in the Museology series. All are numbered separately and published on an irregular basis.

The preferred abbreviation for citing The Museum's Occasional Papers is Occas. Papers Mus., Texas Tech Univ.

Institutional subscriptions ($19/yr., typically 10 numbers issued per year) are available through Texas Tech University Press, Sales Office, Texas Tech University, Lubbock, Texas 79409-1037. Individuals can purchase separate numbers of the Occasional Papers for $2.00 each from Texas Tech University Press. Remittance in U.S. currency check, money order, or bank draft must be enclosed with request (add $1.00 per title or 200 pages of publications requested for foreign postage; residents of the state of Texas must pay sales tax on the total purchase price). Copies of the "Revised checklist of North American mammals north of Mexico, 1986" (Jones *et al.*, 1986, Occas. Papers Mus., Texas Tech Univ., 107:1-22) are available at $1.25 each in orders of 10 or more.

ISSN 0149-175X

Texas Tech University Press
Lubbock, Texas 79409-1037