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Mammals of the Guadalupe Mountains National Park, Texas

HUGH H. GENOWAYS, ROBERT J. BAKER and JOHN E. CORNELLY, Texas Tech University, Lubbock

The Guadalupe Mountains National Park was authorized by an act of Congress on 15 October 1966 and was formally established on 30 September 1972. The park covers 76,468.6 acres located in Culberson and Hudspeth counties of Trans-Pecos Texas. The park contains the Texas portion of the uplifted Capitan Reef of Permian age. The southern end of the escarpment is marked by the prominent El Capitan. The escarpment extending northwest from El Capitan contains other impressive peaks including Guadalupe Peak, which at 8759 ft is the highest point in Texas.

The low and intermediate elevations in the park contain floral and faunal elements from the Chihuahuan Desert. The high elevations are inhabited by montane elements with Rocky Mountain affinities. These montane elements represent an island surrounded by, and in dynamic equilibrium with, the desert flora and fauna. The mountains, all canyons, and desert areas contain many fragile floral and faunal microhabitats. To preserve the natural heritage of the park, baseline data are being gathered by the National Park Service for use in development of the park's master plan.

The first mammal survey of the Guadalupe Mountains was conducted by Vernon Bailey of the U.S. Biological Survey between 9 and 25 August 1901 (Bailey 1905). His field notes and specimens are deposited in the National Museum of Natural History. During his visit, Bailey worked in Upper Dog Canyon, McKittrick Canyon, and various portions of the high country. Bailey (1905) reported 17 species inhabiting the Guadalupe Mountains and listed two additional species that possibly occurred there. The next work in the area was conducted by William B. Davis and field parties from Texas A & M University during 1938, 1939, and 1940 (Davis 1940; Davis and Robertson 1944). They worked at seven stations including McKittrick Canyon, West Dog Canyon, The Bowl, Burned Cabin, Pine Springs and Bear Canyons, Frijole, and 7 miles N Pine Springs. A total of 35 species of mammals (Davis 1940; Davis and Robertson 1944) were recorded as occurring in the Guadalupe Mountains as a result of this survey. LaVal

(1973) studied the distribution and ecology of bats in McKittrick Canyon during 1968 and 1970. He presented data on 13 species.

Our survey began in late May 1973 and continued through August 1975. The objectives of our study, which was supported by the National Park Service, were to survey the mammals occurring in the Guadalupe Mountains National Park, Texas, and to correlate their distribution with major plant associations. This inventory of the natural resources of the park is preliminary to the development of any serious management program. Therefore, we present the following accounts to serve as baseline data for future mammalian work in the park and development of the master plan for the park.

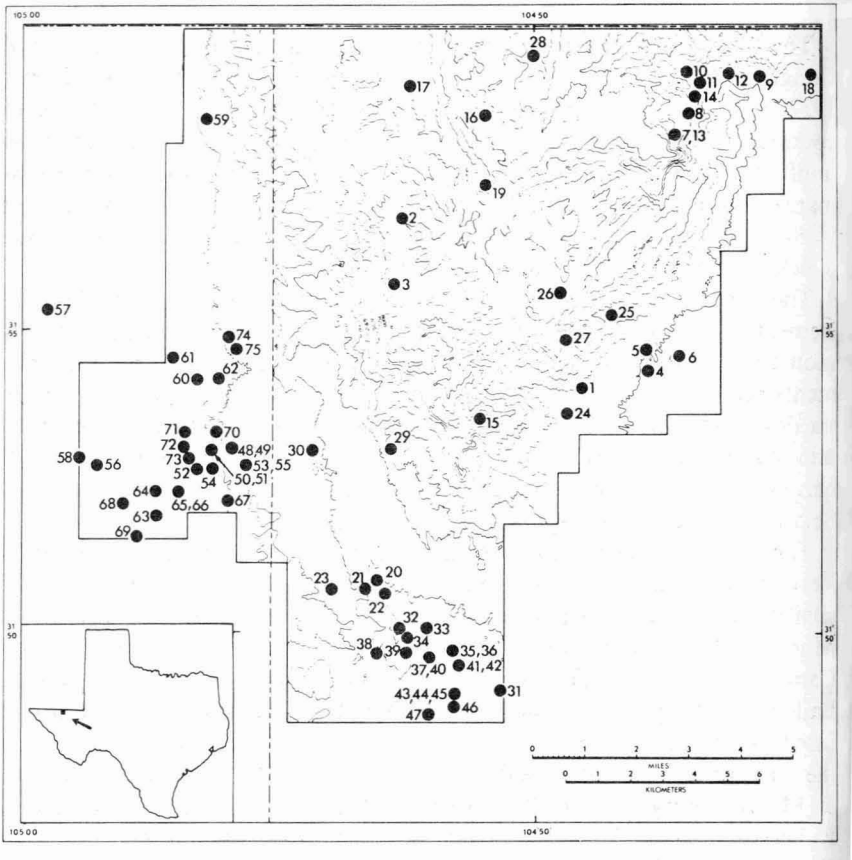


Fig. 1. Map showing collecting localities in the Guadalupe Mountains National Park, Texas. Numbers correspond to those given in text with the exact location of each place.



Fig. 2. (*Upper*) Photograph of eastern slope of Guadalupe escarpment showing Frijole and Manzanita Spring.

Fig. 3. (*Lower*) Photograph of a dry arroyo in McKittrick Canyon in the Guadalupe Mountains National Park, Texas.

METHODS AND MATERIALS

During our survey of mammals of the Guadalupe Mountains National Park in 1973–75, we visited selected sites throughout the park (see below) during all seasons of the year. Rodents were collected using various types of traps including museum specials, Sherman live-traps, Victor steel traps, and



Fig. 4. (*Upper*) Photograph of southwestern face of El Capitan (*right*) and Guadalupe Peak (*center*) showing creosote bush community typical of the western and southern lowlands in the Guadalupe Mountains National Park, Texas.

Fig. 5. (*Lower*) Photograph of the coniferous forest in The Bowl area in the Guadalupe Mountains National Park, Texas.

National live traps. Bats were obtained by mist-netting, by shooting individuals as they flew at dusk, and by inspecting daytime roosts. Carnivores were taken by shooting and trapping and rabbits were obtained by shooting. All individuals taken in our work were prepared as various types of standard museum specimens. These specimens and extensive field notes made during our work are deposited in The Museum of Texas Tech University (TTU).

In addition to our material, we have examined specimens (abbreviations used to identify specimens in text) deposited in the Texas Cooperative Wildlife Collection, Texas A & M University (TCWC) and National Museum of Natural History (USNM), Washington, D.C. All cranial measurements were taken by means of dial calipers; external measurements were those recorded by the field collector. All measurements are recorded in millimeters. Specimens were karyotyped using the methods of Baker (1970).

COLLECTING LOCALITIES

Listed below are the collecting localities visited during our survey of the mammals of the park. Locality numbers correspond to those given in Fig. 1.

Following each locality or groups of localities below is a brief description of the habitat being sampled. Four major habitats in which work was conducted are shown in Figs. 2-5. Cornely (1976) has presented a checklist of the mammals of the park with their major habitat preference.

Culberson County

1) **Bear Canyon-Pump House** (el. 1829 m).—The ruins of a pump house containing very large water pumps are situated on the Bear Canyon trail above upper Pine Spring. The vegetation is open canyon woodland including *Quercus grisea*, *Juniperus pinchotii*, *Arbutus xalapensis*, *Bouteloua gracilis*, and *Bouteloua curtipendula*.

2) **Blue Ridge Campground** (el. 2438 m).—Blue Ridge Campsite is situated at the north end of Blue Ridge which extends due north of Bush Mountain. The vegetation is open woodland including *Pinus ponderosa*, *Quercus gambelii*, *Pseudotsuga menziesii*, *Juniperus deppeana*, *Bouteloua gracilis*, *Muhlenbergia pauciflora*, and *M. dubia*.

3) **Bush Mountain** (el. 2530 m).—Bush Mountain forms part of the western ridge of the Guadalupe Mountains. Traps were set in pine-oak meadow immediately southeast of the summit. Plants included *Pinus ponderosa*, *Quercus gambelii*, *Pseudotsuga menziesii*, *Juniperus deppeana*, *Ceanothus greggii*, *Cercocarpus montanus*, *Bouteloua gracilis*, *Muhlenbergia pauciflora*, *M. dubia*, and *Hymenoxys richardsonii*.

4) **Frijole Ranger Station** (el. 1692 m); 5) **Manzanita Spring** (el. 1676 m); 6) **Nipple Hill** (el. 1646 m).—Frijole Ranger Station, Manzanita Spring, and Nipple Hill are on the bajada east of the Guadalupe Escarpment. The vegetation is open juniper woodland and grassland including *Juniperus pinchotii*, *Muhlenbergia setifolia*, *Bouteloua gracilis*, *B. warnockii*, and *Parthenium incanum*.

7) **Grisham-Hunter Lodge** (el. 1615 m); 8) $\frac{1}{2}$ mi. NNE **Grisham-Hunter Lodge** (el. 1615 m); 9) **Half-way between Pratt Lodge and McKittrick Canyon Parking Lot** (el. 1554 m); 10) **North McKittrick Canyon at Devil's Den Canyon** (el. 1585 m); 11) **Pratt Lodge** (el. 1585 m); 12) **0.3 mi. N, 0.5 mi. E Pratt Lodge** (el. 1570 m); 13) **Stone Cabin above Grisham-Hunter Lodge** (el. 1645 m); 14) **Thrush Hollow**, $\frac{1}{4}$ mi. S Pratt Lodge (el. 1590 m).—The vegetation of the canyon walls is succulent desert, whereas the canyon floor vegetation is canyon woodland. An intermittent stream in McKittrick Canyon is the only permanent stream in Guadalupe Mountains National Park. Plants in the canyon include *Acer grandidentatum*, *Quercus muhlenbergii*, *Arbutus*

xalapensis, *Pinus ponderosa*, *Stipa tenuissima*, *Muhlenbergia emersleyi*, *Quercus undulata*, *Juniperus deppeana*, and *Dasyliirion leiophyllum*.

15) **Guadalupe Peak Campsite** (el. 2439 m).—Guadalupe Peak Campsite is situated on top of the eastern escarpment due east of Guadalupe Peak. The vegetation is open coniferous woodland dominated by *Pinus ponderosa* and *Muhlenbergia pauciflora*.

16) **Lost Peak Mine** (el. 2164 m).—Lost Peak Mine is an old copper mine between Upper Dog Canyon Ranger Station and Lost Peak. The mine is on the west slope of the ridge which the trail from the ranger station to Lost Peak traverses. The vegetation is chaparral and succulent desert including *Ceanothus greggii*, *Cercocarpus montanus*, *Nolina micrantha*, *Dasyliirion leiophyllum*, and *Quercus undulata*.

17) **Marcus Cabin-West Dog Canyon**, 6½ mi. N, ¼ mi. W Guadalupe Peak (el. 1905 m).—West Dog Canyon is relatively large, with a steep wall forming the east side and a more gradual slope marking the west side. Deep soil of the canyon floor is cut by dry washes. The vegetation is mixed grassland with riparian vegetation along the washes. Plants include *Muhlenbergia repens*, *Bouteloua gracilis*, *B. warnockii*, *Aristida glauca*, *Berberis haematocarpa*, *Fallugia paradoxa*, *Opuntia imbricata*, *Xanthocephalum sarothrae*, *Xanthium spinosum*, *Verbesina encelioides*, and *Pinus edulis*.

18) **McKittrick Canyon Parking Lot** (el. 1524 m).—The parking lot is on the canyon floor at the mouth of the canyon. Canyon floor vegetation is open grassland with succulent desert on the slopes. Species include *Agave lecheguilla*, *Dasyliirion leiophyllum*, *Bouteloua eriopoda*, *B. gracilis*, *Muhlenbergia setifolia*, and *Juniperus pinchotii*.

19) **Mescalero Campground**, 4½ mi. N, ¼ mi. E Guadalupe Peak (el. 2286 m).—Mescalero is situated on top of a ridge separating West Dog Canyon drainage and South McKittrick Canyon drainage. The campsite is on the trail between Upper Dog Canyon Ranger Station and The Bowl. The vegetation is woodland including *Pinus edulis*, *P. ponderosa*, *Quercus undulata*, *Juniperus deppeana*, *Nolina micrantha*, *Ceanothus greggii*, *Rosa stellata*, and *Muhlenbergia dubia*.

20) **Patterson Hills Notch**, 3 1/16 mi. S, 1¾ mi. W Guadalupe Peak (el. 1356 m); 21) 3¼ mi. S, 1¼ mi. W Guadalupe Peak (el. 1341 m); 22) 3½ mi. S, 1½ mi. W Guadalupe Peak (el. 1356 m); 23) 3¼ mi. S, 2½ mi. W Guadalupe Peak (el. 1341 m).—Water erosion has cut the notch through the eastern ridge of the Patterson Hills along the Williams Ranch Road. The vegetation on the hills is succulent desert, the dry wash in the notch supports riparian vegetation, and the vegetation on the surrounding bajada is desert scrub. Species include *Larrea tridentata*, *Chilopsis linearis*, *Fallugia paradoxa*, *Prosopis glandulosa*, *Acacia neovernicosa*, *Brickellia laciniata*, *Yucca torreyi*, *Agave lecheguilla*, *Parthenium incanum*, and *Viguiera stenoloba*.

24) **Pine Springs Canyon** (el. 1768 m).—Pine Springs Canyon cuts deeply into the eastern escarpment of the mountains. The vegetation on the canyon floor is open canyon woodland with succulent desert on the slopes. Species include *Arbutus xalapensis*, *Juniperus deppeana*, *Quercus grisea*, *Bouteloua curtipendula*, *B. gracilis*, and *Dasyliirion leiophyllum*.

25) **Smith Spring-Smith Canyon** (el. 1829 m).—Smith Spring is approximately one-third of the way up Smith Canyon at the end of a trail starting at Frijole Ranger Station. The vegetation around the spring is riparian woodland becoming more open toward the canyon mouth. Plants include *Juniperus deppeana*, *Quercus grisea*, *Bothriochloa* sp., *Bouteloua gracilis*, *Lycurus phleoides*, and *Panicum obtusum*.

26) **The Bowl** (el. 2377 m).—The Bowl is relict coniferous forest interspersed with hardwoods. In many places the young trees are growing in very dense almost impenetrable stands. The Bowl contains a man-made earthen tank which periodically holds water. Plants in The Bowl include *Pinus ponderosa*, *P. strobiformis*, *Pseudotsuga menziesii*, *Quercus gambelii*, *Muhlenbergia emersleyi*, *M. pauciflora*, and *Agropyron smithii*.

27) **Upper Bear Canyon Trail** (el. 2362 m).—Upper Bear Canyon Trail is a series of switchbacks which traverses a steep rocky slope with thin loose soil. The vegetation is chaparral including *Quercus undulata*, *Cercocarpus montanus*, and *Muhlenbergia pauciflora*.

28) **Upper Dog Ranger Station** (el. 1920 m).—The ranger station is located on the floor of Upper Dog Canyon just north of a point where the canyon becomes considerably narrower. The

deep soil of the canyon floor supports open woodland and large, mixed grass meadows. The vegetation of the washes on the eastern slope of the canyon and the canyon floor is riparian woodland. Open slopes support chaparral and succulent desert vegetation. Riparian woodland includes *Quercus muhlenbergii*, *Acer grandidentatum*, *Arbutus xalapensis*, *Cercocarpus montanus*, *Quercus undulata*, *Ceanothus greggii*, and *Dasylyrion leiophyllum*. Open slopes include *Quercus grisea*, *Cercocarpus montanus*, *Nolina micrantha*, *Agave neomexicana*, *Ceanothus greggii*, *Dasylyrion leiophyllum*, and *Juniperus deppeana*. Grasses on the canyon floor include *Stipa tenuissima*, *Muhlenbergia repens*, *Panicum obtusum*, and *Bouteloua gracilis*.

29) **Williams Ranch House** (el. 1524 m); 30) ½ mi. S, 2½ mi. W **Guadalupe Peak** (el. 1356 m).—The ranch house is located near the mouth of Bone Canyon at the west base of Guadalupe Peak. The vegetation of the bajada around the house is desert scrub, whereas the slopes above are characterized by succulent desert vegetation. Succulent desert forms include *Agave lecheguilla*, *Dasylyrion leiophyllum*, *Parthenium incanum*, and *Bouteloua eriopoda*. Desert scrub includes *Larrea tridentata*, *Prosopis glandulosa*, *Opuntia lindheimeri*, *Sporobolus contractus*, *Setaria leucopila*, *Muhlenbergia porteri*, *Bouteloua gracilis*, and *B. eriopoda*.

31) **Williams Ranch Road Entrance**, 4¼ mi. S, ⅞ mi. E **Guadalupe Peak** (el. 1311 m); 32) 4 mi. S, 1 mi. W **Guadalupe Peak** (el. 1356 m); 33) 4 mi. S, ½ mi. W **Guadalupe Peak** (el. 1341 m); 34) 4¼ mi. S, 1 mi. W **Guadalupe Peak** (el. 1387 m); 35) 4.3 mi. S **Guadalupe Peak** (el. 1349 m); 36) 4 5/16 mi. S **Guadalupe Peak** (el. 1349 m); 37) 4¾ mi. S, ½ mi. W **Guadalupe Peak** (el. 1356 m); 38) 4¾ mi. S, 1¾ mi. W **Guadalupe Peak** (el. 1372 m); 39) 4¾ mi. S, 1¼ mi. W **Guadalupe Peak** (el. 1372 m); 40) 4½ mi. S, ½ mi. W **Guadalupe Peak** (el. 1341 m); 41) 4½ mi. S, ½ mi. E **Guadalupe Peak** (el. 1341 m); 42) 4½ mi. S, ¾ mi. E **Guadalupe Peak** (el. 1326 m); 43) 4¾ mi. S, ½ mi. W **Guadalupe Peak** (el. 1311 m); 44) 4¾ mi. S **Guadalupe Peak** (el. 1326 m); 45) 4¾ mi. S, ½ mi. E **Guadalupe Peak** (el. 1326 m); 46) 5¾ mi. S **Guadalupe Peak** (el. 1311 m); 47) 5¾ mi. S, ½ mi. W **Guadalupe Peak**.—Williams Ranch Road enters near the southeastern corner of the park. The soil is very sandy in lower areas with patches of higher rockier areas. The area is bajada with desert scrub vegetation including *Larrea tridentata*, *Prosopis glandulosa*, *Xanthocephalum sarothrae*, *Sporobolus contractus*, and *Bouteloua eriopoda*.

Hudspeth County

48) **Crossroads**, 9/16 mi. S, 4 5/16 mi. W **Guadalupe Peak** (el. 1219 m); 49) ¾ mi. S, 4 1/16 mi. W **Guadalupe Peak** (el. 1234 m); 50) ¾ mi. S, 4¼ mi. W **Guadalupe Peak** (el. 1204 m); 51) 11/16 mi. S, 4¼ mi. W **Guadalupe Peak** (el. 1204 m); 52) ⅞ mi. S, 4¾ mi. W **Guadalupe Peak** (el. 1196 m); 53) ⅞ mi. S, 4 mi. W **Guadalupe Peak** (el. 1242 m); 54) 1 mi. S, 4¾ mi. W **Guadalupe Peak** (el. 1204 m); 55) 1 mi. S, 3 15/16 mi. W **Guadalupe Peak**.—The Crossroads is the area surrounding the junction of primitive roads due west of Williams Ranch House and immediately north of the central ridge of the Patterson Hills. This area is bajada cut by dry washes. The bajada vegetation is desert scrub with riparian vegetation in the washes. Species include *Larrea tridentata*, *Prosopis glandulosa*, *Fallugia paradoxa*, *Atriplex canescens*, *Opuntia lindheimeri*, *O. leptocaulis*, *O. imbricata*, and *Chilopsis linearis*.

56) **Lewis Well**, 11/16 mi. S, 6¾ mi. W **Guadalupe Peak** (el. 1128 m); 57) 2¼ mi. N, 7¼ mi. W **Guadalupe Peak** (outside of park) (el. 1112 m); 58) 7¼ mi. W **Guadalupe Peak** (el. 1113 m).—Lewis Well is an old water well marked by a windmill tower on the bajada near the western boundary of the park. West of the well is a large, white, gypsum sand dune, patches of crusted gypsum soil, and areas of lacustrine clay. Each of these areas supports distinct plant communities. The bajada near the well is dominated by *Larrea tridentata* and *Prosopis glandulosa*. Lacustrine clay is dominated by *Atriplex canescens* and crusted gypsum soil is dominated by *Cordia hispidissima*. The dominant on the gypsum sand dune is *Bouteloua breviseta*.

59) **Northwest Corner**, 4 mi. N, 5½ mi. W **Guadalupe Peak** (el. 1158 m).—The bajada in the northwest corner of the park has been grazed far less than any other area of the park west or south of the Guadalupe Mountains. This area contains the most well-developed grassland in the Hudspeth County portion of the park and may be an example of the potential natural vegeta-

tion of the creosote bajada of the park. The vegetation is mixed grassland and succulent desert plants including *Bouteloua eriopoda*, *Sporobolus cryptandrus*, *Tridens muticus*, *Aristida pansa*, *Krameria glandulosa*, *Erioneuron pulchellum*, *Dyssodia pentachaeta*, *Viguiera stenoloba*, *Yucca torreyi*, *Prosopis glandulosa*, *Larrea tridentata*, *Opuntia lindheimeri*, *O. phaeacantha*, *O. imbricata*, *O. schottii*, *O. violacea*, *O. leptocaulis*, and *Fouquieria splendens*.

60) Red Sand Dunes, ½ mi. N, 4¾ mi. W Guadalupe Peak (el. 1189 m); 61) 1 7/16 mi. N, 5½ mi. W Guadalupe Peak (el. 1158 m); 62) ½ mi. N, 4½ mi. W Guadalupe Peak (el. 1204 m).—Near the western boundary of the park, due west of Shumard Peak, is an area of wind-deposited quartz sand dunes. The vegetation consists of desert scrub and scattered grasses including *Prosopis glandulosa*, *Atriplex canescens*, *Croton dioicus*, *Dalea scoparia*, *D. terminalis*, *Poliomintha incana*, *Sporobolus contractus*, *S. flexuosus*, *S. giganteus*, *Oryzopsis hymenoides*, *Panicum ramisetum*, and *Penstemon ambiguus*.

63) Southwest Corner, 1⅞ mi. S, 5⅞ mi. W Guadalupe Peak (el. 1135 m); 64) 1¼ mi. S, 5⅞ mi. W Guadalupe Peak (el. 1151 m); 65) 1¼ mi. S, 5 7/16 mi. W Guadalupe Peak (el. 1166 m); 66) 1¼ mi. S, 5 5/16 mi. W Guadalupe Peak (el. 1173 m); 67) 1⅜ mi. S, 4¼ mi. W Guadalupe Peak (el. 1219 m); 68) 1½ mi. S, 6½ mi. W Guadalupe Peak (el. 1128 m); 69) 2¼ mi. S, 6¼ mi. W Guadalupe Peak (el. 1128 m).—The southwest corner of the westernmost section of park, which is due south of Lewis Well, is bajada. This area is subjected to heavy grazing by trespassing cattle. The vegetation is desert scrub dominated by *Larrea tridentata* and *Atriplex canescens*, with scattered hummocks of *Prosopis glandulosa*.

70) Stage Coach Hills, 9/16 mi. S, 4 15/16 mi. W Guadalupe Peak (el. 1219 m); 71) ¼ mi. S, 5⅜ mi. W Guadalupe Peak (el. 1173 m); 72) ½ mi. S, 5½ mi. W Guadalupe Peak (el. 1173 m); 73) 9/16 mi. S, 5 5/16 mi. W Guadalupe Peak (el. 1181 m).—The Stage Coach Hills are a pair of small hills north and slightly east of the central ridge of the Patterson Hills. The vegetation of the bajada surrounding the hills is desert scrub, whereas succulent desert vegetation is found on the hills themselves. Plants include *Coldenia hispidissima*, *C. greggii*, *Larrea tridentata*, *Agave lecheguilla*, *Jatropha dioica*, *Opuntia lindheimeri*, *O. phaeacantha*, *Viguiera stenoloba*, *Sporobolus cryptandrus*, *Bouteloua eriopoda*, *Muhlenbergia porteri*, *Hybiscus denudatus*, *Fouquieria splendens*, and *Selaginella wrightii*.

74) Tank Hill, 1 7/16 mi. N, 4½ mi. W Guadalupe Peak (el. 1234 m); 75) 1⅜ mi. N, 4¼ mi. W Guadalupe Peak (el. 1227 m).—Tank Hill is an isolated hill north of the Patterson Hills and due west of Bartlett Peak. The bajada surrounding the hill was firmly packed quartz and gypsum sands with scattered patches of crusted gypsum soil. The vegetation is desert scrub including *Larrea tridentata*, *Prosopis glandulosa*, *Yucca torreyi*, *Fouquieria splendens*, *Opuntia leptocaulis*, *Croton dioicus*, *Melampodium leucanthum*, *Sporobolus flexuosus*, *S. nealleyi*, *Bouteloua eriopoda*, *Erioneuron pulchellum*, *Coldenia hispidissima*, and *Viguiera stenoloba*.

SPECIES ACCOUNTS

Myotis californicus californicus (Audubon and Bachman), California Myotis

Specimens Examined (13).—CULBERSON COUNTY: McKittrick Canyon, 10 (TCWC); 7 mi. N Pine Springs, 1 (TCWC); Smith Spring, 2 (TTU).

The California myotis occurs at intermediate to low elevations within the park, although it may not be found in the low bajadas to the west of the mountains. This species has a slow, fluttering flight that can be seen as they forage for insects just at dusk. Daytime retreats sought by *M. californicus* include caves, mines, and rock crevices, where they may also hibernate during the colder months of the year. Most of our specimens were taken in mist nets set over water.

All of the specimens examined are adult males taken in the months of June and August. Nine males taken in June had testes that measured 3 in length, whereas two taken in August had testes that measured 4.

We follow Bogan (1975) in use of the name combination *Myotis californicus californicus* for bats from this region. Of other species of bats occurring in the park, *Myotis californicus* is difficult to distinguish from *Myotis leibii*. The braincase arises much more abruptly in *M.*

californicus which is also somewhat paler than *M. leibii* particularly in coloration of the membranes. External and cranial measurements of four adult males are as follows: total length, 75, 76, 74, 83; length of tail vertebrae, 39, 40, 38, 42; length of hind foot, 6, 7, 6, 5; length of ear, 12, 13, 12, 13; length of forearm, 33.2, 32.0, 31.7, 32.8; greatest length of skull, 13.3, 13.9, 13.9, 14.1; zygomatic breadth, 8.2, 8.4, 8.6, 8.8; postorbital constriction, 3.0, 3.1, 3.1, 3.4; breadth of braincase, 6.2, 6.3, 6.3, 6.6; mastoid breadth, 6.9, 7.2, 7.0, 7.2; length of maxillary tooththrow, 4.9, 5.1, 5.1, 5.1; breadth across upper molars, 5.0, 5.3, 5.2, 5.4.

***Myotis leibii ciliolabrum* (Merriam), Small-footed Myotis**

Specimens Examined (5).—CULBERSON COUNTY: Manzanita Spring, 1 (TTU); McKittrick Canyon, 4 (TCWC).

The small-footed myotis has been obtained only at lower elevations along the eastern escarpment of the mountains. The species probably can be expected elsewhere in the park at lower elevations wherever pools of water are available. *M. leibii* seeks daytime roosts mainly in rock crevices and caves and mines.

The five specimens from the park are adult males which were taken in June. Testes measurements for four specimens from the early part of the month were all 3, whereas that of the specimen taken 23 June was 4. The specimen taken on 2 June at Manzanita Spring was undergoing annual molt.

We follow Glass and Baker (1968) for use of this trinomial combination. External and cranial measurements of the four specimens from McKittrick Canyon are as follows: total length, 78, 83, 76, 76; length of tail, 38, 41, 41, 41; length of hind foot, 6, 8, 7, 7; length of ear, 14, 11, 13, 13; length of forearm, 30.8, 33.0, 32.6, 33.8; greatest length of skull, 13.9, 13.5, 13.6, 14.0; zygomatic breadth, 8.5, 8.1, 8.1, 8.7; postorbital constriction, 3.3, 3.1, 3.1, 3.1; breadth of braincase, 6.6, 6.3, 6.0, 6.6; mastoid breadth, 7.0, 6.6, 6.5, 7.1; length of maxillary tooththrow, 5.2, 4.8, 5.1, 5.1; breadth across upper molars, 5.5, 5.1, 5.2, 5.3.

***Myotis thysanodes thysanodes* Miller, Fringed Myotis**

Specimens Examined (19).—CULBERSON COUNTY: Lost Peak, 2 (TTU); Manzanita Spring, 1 (TTU); McKittrick Canyon, 11 (TCWC); Smith Spring, 1 (TTU); The Bowl, 4 (TTU).

The fringed myotis is probably the most common member of the genus occurring in the Guadalupe Mountains National Park. The species can be expected to seek daytime shelter in rock crevices, man-made buildings, and caves and mines. The majority of our specimens were taken in mist nets set over water at night. However, two individuals from Lost Peak were caught by hand in an old mine on the opposite side of the ridge from the Lost Peak Mine. This mine is about a quarter of a mile deep and is almost horizontal with no side shafts. This species may hibernate in caves and mines in the park during the winter months.

Five adult males taken in late May and June all had testes that measured 3 in length. A male taken on 3 July had testes that measured 4, whereas individuals taken on 1 August and 7 August had testes that were 3 and 5 in length, respectively. Three adult females captured in early June each contained a single embryo that measured as follows in crown-rump length: 11 (2 June); 12 (4 June); 8 (6 June). Two females taken on 6 August were postlactating. A male taken on 7 August and a female taken on 8 August were nearing completion of annual molt.

The subspecies *thysanodes*, originally described from Kern Co., California, is widespread in the southwestern United States and clearly includes material from the Guadalupe Mountains National Park. External and cranial measurements of two adult males from McKittrick Canyon are as follows: total length, 82, 84; length of tail, 41, 40; length of hind foot, 10, 9; length of ear, 18, 17; length of forearm, 42.9, 41.4; greatest length of skull, 16.7, 17.0; zygomatic breadth, 10.5, 10.5; breadth of postorbital constriction, 4.1, 4.2; breadth of braincase, 8.0, 7.8; mastoid breadth, 8.2, 8.3; length of maxillary tooththrow, 6.0, 6.5; breadth across upper molars, 6.6, 6.8.

***Myotis velifer incautus* (J. A. Allen), Cave Myotis**

Specimens Examined (5).—CULBERSON COUNTY: McKittrick Canyon, 4 (TCWC); 4 mi. E Pine Springs Camp, 1 (TCWC).

We did not obtain specimens of this species during our studies in the park. However, the species can be expected in the park particularly at lower elevations. *M. velifer* commonly roosts in caves and mines; a population is known at Carlsbad Caverns. It is a hibernating species and may be expected in the park throughout the year.

Four of the specimens from the park were adult males taken on the following dates (testes measurements in parentheses): 4 June (5); 9 June (6); 31 July (4); 1 August (3). The one adult female was not pregnant when taken on 1 August.

Hayward (1970) has reviewed geographic variation in *Myotis velifer*. He concluded, and we concur, that populations from west Texas are assignable to the subspecies *incautus*. External and cranial measurements of two adult males are as follows: total length, 88, 96; length of tail, 40, 45; length of hind foot, 10, 10; length of ear, 15, 14; length of forearm, 43.5, 42.0; greatest length of skull, 16.8, 16.2; zygomatic breadth, 10.4, 10.3; postorbital breadth, 3.7, 3.9; breadth of braincase, 7.2, 7.3; mastoid breadth, 8.4, 8.2; length of maxillary tooththrow, 6.5, 6.3; breadth across upper molars, 6.8, 6.7.

***Myotis volans interior* Miller, Long-legged Myotis**

Specimens Examined (5).—CULBERSON COUNTY: Manzanita Spring, 1 (TTU); McKittrick Canyon, 2 (TCWC); The Bowl, 2 (TTU).

This species of *Myotis* is evidently not abundant in the Guadalupe Mountains National Park. The long-legged myotis occurs in most mountain regions of Trans-Pecos Texas where it evidently prefers high, open montane woodlands (Mollhagen and Baker 1972; Davis 1960). Easterla (1973a; 1973b) found *M. volans* to occur in only two plant habitats in the Chisos Mountains. These were both woodland habitats found at the highest elevations. Four of our five specimens were taken in woodland situations. The fifth specimen was taken at Manzanita Spring along the eastern base of the mountains. At this place the vegetation consists of desert scrub grassland.

Our five specimens are all males and were taken on the following dates: 5 June; 10 June; 23 June; 8 August. Testes measurements for the first two and the last of these individuals were 3, 4, and 4. The specimen taken on 23 June was undergoing annual molt. All specimens were netted at night over water.

Myotis v. interior is the trinomial that is applied to populations of this species occurring in the west-central United States. Our specimens are definitely included in this taxa. External and cranial measurements for two adult males are as follows: total length, 92, 95; length of tail, 44, 45; length of hind foot, 8, 9; length of ear, 12, 12; length of forearm, 38.8, 38.6; greatest length of skull, 14.6, 14.6; zygomatic breadth, 8.9, 8.8; breadth of postorbital construction, 4.0, 3.9; breadth of braincase, 7.5, 7.0; mastoid breadth, 7.8, 7.6; length of maxillary tooththrow, 5.3, 5.2; breadth across upper molars, 5.7, 5.6.

***Lasionycteris noctivagans* (Le Conte), Silver-haired Bat**

Specimens Examined (18).—CULBERSON COUNTY: McKittrick Canyon, 16 (TCWC); The Bowl, 1 (TTU); Thrush Hollow, ¼ mi. S Pratt Lodge in South McKittrick Canyon, 1 (TTU).

This relatively rare species was obtained in relatively high numbers in the Guadalupe Mountains. The species is known in Texas from only a few localities including the Davis Mountains, Bandera County (Davis 1960:51), and on the High Plains. All of these are apparently spring or autumn migrants. The population in the Guadalupe Mountains may be in residence during all of the summer and, if so, it is the only such population in the state. Our specimens, which are all males, were taken during May and June (26 June latest date).

We have specimens from the montane areas of the park and the riparian woodland areas of McKittrick Canyon. In addition, a specimen was taken just north of the Upper Dog Ranger Station at Trail Canyon Tank. The species probably is limited to those areas supporting good

stands of trees within the park because silver-hair bats roost in trees. All of our specimens were obtained in mist nets set over water where the bats were probably coming to drink. The species is migratory and will not be found in the park during the colder months of the year.

Thirteen adult males captured in the first week of June had testes that averaged 5(4–6) in length. None of our specimens evinced molt. External and cranial measurements of five adult males from McKittrick Canyon are as follows: total length, 100, 98, 92, 91, 93; length of tail, 45, 45, 37, 40, 40; length of hind foot, 9, 10, 8, 8, 10; length of ear, 15, 14, 14, 14, 15; length of forearm, 41.9, 39.6, 38.7, 39.8, 38.8; greatest length of skull, 16.4, 16.1, 16.0, 16.0, 16.3; zygomatic breadth, 9.9, 10.0, 9.8, 9.7, 10.2; breadth of postorbital constriction, 4.0, 4.2, 4.1, 4.2, 4.2; breadth of braincase, 7.4, 7.8, 7.6, 7.6, 7.9; mastoid breadth, 8.5, 8.6, 8.5, 8.1, 8.8; length of maxillary toothrow, 5.7, 5.6, 5.7, 5.4, 5.6; breadth across upper molars, 6.5, 6.6, 6.6, 6.4, 6.8.

Pipistrellus hesperus maximus Hatfield, Western Pipistrelle

Specimens Examined (23).—CULBERSON COUNTY: Manzanita Spring, 1 (TTU); McKittrick Canyon, 13 (TCWC); 7 mi. N Pine Springs, 2 (TCWC); Pratt Lodge, McKittrick Canyon, 1 (TTU); Smith Spring, 1 (TTU). HUDSPETH COUNTY: Crossroads, 5 (TTU).

This is one of the most common and widespread species of bats occurring in the park. One can expect to see its fluttering flight anywhere in the park just before darkness during the summer months. The only place that populations of this species may be restricted within the park are in the high montane areas as we did not obtain specimens of this species in The Bowl even with extensive netting. The species does hibernate and, therefore, can be expected to be a year-round resident of the park. It roosts during the day in cracks and crevices, mines, and caves. Our five specimens from Hudspeth County were shot at dusk as they flew over a dry wash. Vegetation in the area consisted of creosote bush, mesquite, four-winged salt bush, and apache plume. All of the remaining specimens except those from north of Pine Springs (no information available for these) were taken in mist nets set over water.

Seven males taken in early June had testes that were 3 in length as did males taken on 20 May, 23 June, and 11 July. Males with testes measuring 2 in length were taken on 20 May (2) and 22 June. A female taken on 8 June contained two embryos that were 10 in crown-rump length. An adult female taken on 31 July was postlactating.

Geographic variation in the western pipistrelle was studied recently by Findley and Traut (1970). They recognized only two subspecies, with the name *P. h. maximus* being applied to populations from east of the Continental Divide. We have followed this arrangement.

Eptesicus fuscus pallidus Young, Big Brown Bat

Specimens Examined (30).—CULBERSON COUNTY: Burned Cabin, head McKittrick Canyon, 1 (TCWC); Grisham-Hunter Lodge, McKittrick Canyon, 1 (TTU); Jct. North McKittrick Canyon and Devil's Den Canyon, 2 (TTU); Manzanita Spring, 2 (TTU); McKittrick Canyon, 9 (TCWC); Pine Springs, 1 (TCWC); 2 mi. NW Pine Springs, 2 (TTU); Smith Spring, 2 (TTU); The Bowl, 9 (6 TTU, 3 TCWC); Thrush Hollow, ¼ mi. S Pratt Lodge in South McKittrick Canyon, 1 (TTU).

This insectivorous species is one of the most common bat species in the park. All of our specimens were shot as they foraged at dusk along canyons or were taken in mist nets at night along flightways. Although all of our specimens were taken from the top or along the eastern slopes of the mountains, this species probably can be expected at any locality in the park where there are pools of fresh water suitable for drinking. Because of the flight abilities of this bat, it is easily capable of foraging over the low bajadas to the west of the mountains before returning to daytime roosts in and near the mountains. Big brown bats will seek daytime shelter in abandoned buildings, rock crevices, and old mines (Barbour and Davis 1969).

In addition to the individuals listed as examined, we banded four bats of this species that were netted in The Bowl on the nights of 7 and 8 August 1973. Also two big brown bats were taken at Trail Canyon Tank just to the north of the park near Upper Dog Canyon Ranger Station (5.6 mi. S, 0.6 mi. W El Paso Gap, Eddy Co., New Mexico).

All six adult females obtained between 1 June and 23 June were pregnant. Each contained a single embryo, which measured 15 (1 June), 12 and 14 (4 June), 10 (6 June), 25 (10 June), and 23 (23 June) in crown-rump length. Testicular lengths of adult male *Eptesicus* obtained during this study were 6 (1 June), 8 (10 June), 6, 7, and 8 (23 June), 9 (12 July), 7 (13 July), 8 (6 August), and 4 (7 August). Adult males undergoing annual molt were taken on 23 June (3 individuals) and 26 June (1). Two flying young-of-the-year were netted on the night of 7 August in The Bowl.

We follow the arrangement of Engels (1936) in use of the subspecific name *E. f. pallidus* for brown bats from this area.

Lasiurus cinereus cinereus (Palisot de Beauvois), Hoary Bat

Specimens Examined (22).—CULBERSON COUNTY: Manzanita Spring, 1 (TTU); McKittrick Canyon, 12 (TCWC); 2 mi. NW Pine Springs, 5 (TTU); The Bowl, 4 (TTU).

The hoary bat is evidently a common inhabitant of the montane and wooded areas of the Guadalupe Mountains during the warmer months of the year. The species is migratory and is absent from the area during those times of the year when freezes occur. This species roosts in trees and, therefore, is most common in wooded areas; however, it is a strong flier and probably could forage throughout the park. We do have one record, Manzanita Spring, that does indicate that it forages away from wooded areas on occasion.

Both sexes are evidently resident in the mountains during at least some of the summer months. We have adult males taken on the following dates: 2 June; 3 June; 6 June; 11 June; 24 June; 26 June; 1 August; 2 August; 8 August; 4 September. Adult females, however, have been taken only on 3 June and 4 September. The adult males (9) taken in June had testes that averaged 4.9 (3–6) in length, whereas those taken in August (5) had testes that measured 6.2 (5–8). The adult female taken on 3 June in McKittrick Canyon carried two embryos that measured 20 in crown-rump length. In addition to the specimens listed above, five individuals of this species were taken just north of the park at the Trail Canyon Tank, 5.6 mi. S, 0.6 mi. W El Paso Gap, Eddy Co., New Mexico. These five specimens (one male and four females) were netted as they came to drink from the tank on the night of 3 June. The four females each contained two embryos that ranged from 14 to 17 in crown-rump length. The adult male had testes that were 4 in length. One individual of this species (male) was banded and released in The Bowl on the evening of 7 August 1973. An adult male netted on 26 June evinced annual molt over much of the dorsum.

The subspecies *cinereus* has a widespread distribution in North America and is currently the only one recognized in this geographic area.

Plecotus townsendii pallescens (Miller), Townsend's Big-eared Bat

Specimens Examined (15).—CULBERSON COUNTY: Lost Peak Mine, 1 (TTU); Manzanita Spring, 1 (TTU); McKittrick Canyon, 4 (TCWC); 7 mi. N Pine Springs, 1 (TCWC); Stone Cabin, near Grisham-Hunter Lodge, 3 (TTU); The Bowl, 4 (TTU); Upper Dog Ranger Station, 1 (TTU).

Additional Record.—CULBERSON COUNTY: Upper Sloth Cave (Davis 1940:74).

Townsend's big-eared bat is not a common species in the Guadalupe Mountains National Park, but it may be expected anywhere in the park at middle and upper elevations. This species commonly seeks refuge in mines or caves during the daytime and will hibernate in them during the winter. Two of our specimens—Lost Peak Mine and Upper Dog Ranger Station—were obtained from a mine and a small test shaft, respectively, as they slept during the day. The three specimens from the Stone Cabin were taken during the daytime as they slept hanging from the rafters. The remaining specimens for which we have data were netted over water, including one that was banded and released in The Bowl on 7 August 1973.

A female obtained on 6 August and the one banded in The Bowl were lactating. Other females obtained on 3 August, 6 August, and 8 August (2) evinced no reproductive activity. Testes lengths for males included the following (date of capture in parentheses): 4 (4 April); 5 (1 June); 6 (12 June); 5 (23 June). An adult female taken in The Bowl on 8 August was molting over most of its dorsum, whereas another female taken on the same night evinced no molt.

Handley (1959) revised the genus *Plecotus*. He assigned all specimens from Trans-Pecos Texas to *P. townsendii pallescens*, although he considered those living outside of the Guadalupe Mountains to be intergrades with *P. t. australis*. We have followed this arrangement. External and cranial measurements of an adult male and female are, respectively, as follows: total length, 90, 102; length of tail, 48, 45; length of hind foot, 10, 6; length of ear, 33, 37; length of forearm, 41.8, 42.9; greatest length of skull, 16.4, 16.6; zygomatic breadth, 8.8, 8.8; postorbital constriction, 3.6, 3.7; breadth of braincase, 7.7, 7.9; mastoid breadth, 9.2, 9.2; length of maxillary toothrow, 4.8, 5.3; breadth across upper molars, 5.6, 6.0.

***Antrozous pallidus pallidus* (Le Conte), Pallid Bat**

Specimens Examined (24).—CULBERSON COUNTY: ½ mi. NNE Grisham-Hunter Lodge, South McKittrick Canyon, 1 (TTU); McKittrick Canyon, 10 (TCWC); 2 mi. NW Pine Springs, 1 (TTU); 4 mi. E Pine Springs Camp, 4500 ft., 2 (TCWC); Pratt Lodge, McKittrick Canyon, 4 (TTU); Smith Spring, 3 (TTU); The Bowl, 3 (TTU).

The pallid bat can be expected throughout the National Park. It probably is a year-round resident, hibernating in the colder months of the year. However, our specimens were all taken in the four months from May to August. All 24 specimens recorded above are males, which indicates that the females are probably forming nursery colonies elsewhere. The pallid bat is considered a common inhabitant of the Chihuahuan Desert lowland, but as our records from The Bowl indicate, it will range to high altitudes.

Average testes length for males by month were as follows (range in parentheses followed by sample size): May, 5.5 (5-6) 6; June, 5.1 (4-6) 9; July, 5.0 (5) 4; August, 7.7 (6-9) 3. Five individuals (two from Pratt Lodge and three from The Bowl) were banded during our studies. A specimen taken on 23 June was just beginning annual molt. New hair is evident under the old over most of the dorsum of four adult males taken on 11 July at Pratt Lodge. A flying young-of-the-year was netted on 7 August 1973 in The Bowl.

Our specimens are assignable to *Antrozous pallidus pallidus* as are most other populations of pallid bats occurring in the Southwest.

***Tadarida brasiliensis mexicana* (Saussure), Brazilian Free-tailed Bat**

Specimens Examined (16).—CULBERSON COUNTY: McKittrick Canyon, 3 (TCWC); Smith Spring, 1 (TTU); The Bowl, 12 (TTU).

The Brazilian free-tailed bat is a powerful flier and can be expected anywhere in the park. However, based on our records this species must confine most of its activity to the montane areas and the eastern slopes of the mountains. This bat seeks daytime retreats in caves, mines, and old buildings; a large colony, which has been declining in recent years, occupies Carlsbad Caverns. Although the population in Carlsbad Caverns includes many adult females and their young, all of our specimens are adult males.

Free-tailed bats have a highly developed migratory pattern and will be found in the park only in the months of April to October. All of our specimens were taken in the months of June and August. In addition to the specimens listed above, 43 males were banded and released in The Bowl on the nights of 7 and 8 August 1973. One specimen also was taken on the night of 4 June just north of the Upper Dog Ranger Station at a place designated Trail Canyon Tank, 5.6 mi. S, 0.6 mi. W El Paso Gap, Eddy Co., New Mexico. Specimens evincing annual molt were taken on 23 June and 26 June, although a second specimen taken 26 June was not molting.

Populations of this species in the western United States and most of Mexico have been assigned to *T. b. mexicana*. This arrangement has been questioned by some recent investigators (Cockrum 1969). However, the systematic review of this species has not been published.

***Tadarida macrotis* (Gray), Big Free-tailed Bat**

Specimens Examined (13).—CULBERSON COUNTY: McKittrick Canyon, 13 (TCWC).

This species has been taken in large numbers only in the Chisos (Easterla 1973b:120) and Guadalupe mountains in west Texas; other records for the species in Texas are based on single

or a few specimens. Our specimens are all adult females taken on two dates—11 June 1968 and 3 August 1970 (LaVal 1973). Our two-year survey has failed to produce additional specimens. The specimens were netted as they were coming to drink in wooded areas of lower South McKittrick Canyon. However, the area described by LaVal (1973) in which the specimens were taken was altered significantly by the floods of 1968. Whether or not a resident population of this rare species occurs in the Guadalupe Mountains National Park is not known. However, it is clear that a few, possibly migrant, individuals do use the park from time to time.

Of 12 females taken on 11 June, eight carried a single embryo each. The embryos ranged from 22 to 30 in crown-rump length and averaged 25.9. The female taken on 3 August was lactating.

This species is considered to be monotypic by modern authors (Husson 1962:258–259). External and cranial measurements of five females are as follows: total length, 130, 139, 130, 129, 126; length of tail, 52, 62, 50, 52, 50; length of hind foot, 12, 13, 12, 12, 12; length of ear, 27, 30, 29, 29, 27; length of forearm 60.8, 61.5, 59.4, 60.8, 61.3; greatest length of skull, 23.7, 23.7, 23.9, 23.2, 23.2; zygomatic breadth, 12.5, 12.5, 12.7, 12.5, 12.6; postorbital constriction, 4.2, 4.3, 4.0, 4.2, 4.2; breadth of braincase, 10.0, 10.0, 10.3, 10.3, 10.3; mastoid breadth, 11.4, 11.6, 11.7, 11.4, 11.5; length of maxillary toothrow, 8.6, 8.6, 8.7, 8.8, 8.3; breadth across upper molars, 8.8, 8.5, 8.8, 9.1, 9.0.

***Sylvilagus audubonii neomexicanus* Nelson, Desert Cottontail**

Specimens Examined (5).—CULBERSON COUNTY: mouth of McKittrick Canyon, 1 (TCWC); Upper Dog Ranger Station, 4 (TTU).

The desert cottontail is abundant throughout the park at lower elevations wherever there is sufficient cover to provide daytime hiding places. Our specimens from Upper Dog Ranger Station at 1920 m are from the highest elevation at which the species is presently known in the park. Although all of the specimens obtained during our studies are from this location, the species was observed at numerous other places including Williams Ranch Road Entrance, along Williams Ranch Road, and Patterson Hills Notch in Culberson County, and Lewis Well and the Crossroads in Hudspeth County. Davis (1940:82) reported sighting this species at Pine Springs, West Dog Canyon, and along the road at the east base of the mountains during his work in the Guadalupe Mountains.

On 27 July 1973, J. E. Cornely obtained a large *Crotalus atrox* near Choza Spring. Examination of the stomach contents of this snake revealed two juvenile *S. audubonii* each measuring approximately 140 in total length. An adult male taken on 31 May 1974 at Upper Dog Ranger Station had testes that measured 35 in length.

We agree with Davis and Robertson (1944:271) that desert cottontails from this part of Texas are best assigned to the subspecies *neomexicanus*. This subspecies was described based upon material from Fort Sumner, New Mexico, and is currently applied to specimens from much of west Texas and eastern New Mexico.

***Sylvilagus floridanus robustus* (Bailey), Eastern Cottontail**

Specimen Examined (1).—CULBERSON COUNTY: The Bowl, 1 (TTU).

The eastern cottontail may be one of the rarest species of mammals currently occurring in the Guadalupe Mountains National Park. Specimens have been recorded only from The Bowl (Davis 1940; Davis and Robertson 1944; Hall and Kelson 1951; Hall 1951b) where it evidently is confined to dense stands of Douglas fir and ponderosa pine. During our work in the areas, only two individuals were seen and this was only for a brief moment as the rabbit quickly disappeared into dense underbrush. Davis (1940) estimated that the population of this rabbit was approximately 50 individuals. The population is certainly no larger today and may be smaller. This taxon occurs only in isolated populations in the Chisos, Chinati, Davis, and Guadalupe mountains of Texas. There certainly is no interchange between these populations at the current time.

Our one specimen was a juvenile obtained on 8 June 1974 as was one specimen taken by Davis (1940) on 11 June.

The taxonomic status of this taxon is currently uncertain. Beginning with Nelson's revision (1909) of the genus, this rabbit was considered a distinct species, *S. robustus*. This taxonomic arrangement prevailed until 1951 when Hall and Kelson (1951:56) presented evidence indicating that this rabbit was best considered to be a member of the widespread species *S. floridanus*. Davis (1960) has chosen, however, to retain the specific status for this rabbit under the name *Sylvilagus robustus*. We have chosen to follow Hall and Kelson's revision until further evidence is available. Clearly, this rabbit is closely related to *S. floridanus* but further study may prove its specific distinctness.

***Lepus californicus texianus* Waterhouse, Black-tailed Jackrabbit**

Specimens Examined (5).—CULBERSON COUNTY: mouth McKittrick Canyon, 5000 ft, 1 (TCWC); Upper Dog Ranger Station, 2 (TTU); Williams Ranch Road Entrance, 1 (TTU). HUDSPETH COUNTY: Lewis Well, 1 (TTU).

The black-tailed jackrabbit is a common inhabitant of the Chihuahuan Desert portions of the park, where its distribution is almost identical with the desert cottontail, *Sylvilagus audubonii*. The highest elevation at which this species has been taken or observed within the park is 1920 m in Upper Dog Canyon. In addition to the localities from which specimens were obtained, individuals of *L. californicus* were observed at the following places: Northwest Corner; Southwest Corner; Patterson Hills Notch; Stage Coach Hills; Crossroads; Williams Ranch House; near Marcus Cabin in West Dog Canyon; near the lower end of Bear Canyon Trail; Nipple Hill. Black-tailed jackrabbits are herbivores and are known to forage on grasses and low brush.

The two adult females taken on 2 and 3 June 1973 were pregnant and lactating. The specimen taken on 2 June contained five embryos—three in the right uterine horn and two in the left. Two of the embryos in the right horn were being reabsorbed. The crown-rump length of the normal embryos was 11. The female taken on 3 June possessed three embryos in the right uterine horn and none in the left. These embryos measured 45 in crown-rump length. A subadult male taken on 25 July 1973 at the Williams Ranch Road Entrance had testes measuring 17 in length and was molting on the posterior portion of the dorsum and onto the flanks.

We have assigned our specimens to the taxon *Lepus californicus texianus* on geographic grounds. This name is currently applied to jackrabbits occurring in much of west Texas, New Mexico, and north-central Mexico (Hall and Kelson 1959:283).

***Eutamias canipes canipes* Bailey, Gray-footed Chipmunk**

Specimens Examined (34).—CULBERSON COUNTY: head of Dog Canyon, 7000 ft, 2 (USNM); Guadalupe Mts., 7000 ft, 3 (USNM); McKittrick Canyon, 5900 ft, 1 (TCWC); The Bowl, 22 (19 TCWC, 3 TTU); Upper Dog Ranger Station, 6 (TTU).

Additional Record.—CULBERSON COUNTY: Guadalupe Mountains, 8000 ft (Davis 1940:78).

The gray-footed chipmunk is confined to the higher elevations of the park; the lowest elevation at which the species has been taken is 1800 m in McKittrick Canyon, which is a mesic, wooded area. The species is evidently most abundant in and near The Bowl and in Upper Dog Canyon. In addition to specimens taken during this study, individuals of this species were sighted at Bush Mountain, near Mescalero Campground, and in the upper portions of South McKittrick Canyon. All capture sites where the gray-footed chipmunk has been seen are in or near forested areas. One specimen was obtained as it climbed in a small Douglas fir tree. The Guadalupe Mountains National Park is the only area in Texas where this chipmunk occurs.

A female taken on 6 August 1973 in The Bowl contained four embryos that measured 28 in crown-rump length. Two females taken on 3 and 9 June in Upper Dog Canyon evinced no gross reproductive activity. Three male gray-footed chipmunks had the following testes length (capture dates in parentheses): 18 (31 May); 17 (31 May); 5 (9 June). Three individuals taken in our study were undergoing molt. A male taken on 31 May was molting in a large band across the dorsum approximately half-way between the head and rump. The other two individuals were

molting in only small areas. A female taken on 3 June was molting on the chest and a female taken on 6 August was molting in two small areas on the rump.

Eutamias canipes is currently considered to occur in restricted montane habitats of the Guadalupe, Sacramento, White, Capitan, and Gallinas mountains of Texas and New Mexico. There is probably little genetic interchange between isolated populations at the present time. Fleharty (1960) recognized a subspecies, *E. c. sacramentoensis*, as occurring in the Sacramentos northward, thus restricting *E. c. canipes* to the Guadalupe Mountains of Texas and adjacent New Mexico. We follow Fleharty's arrangement here.

External and cranial measurements of four specimens (two males, two females) of *E. c. canipes* deposited in the National Museum of Natural History are as follows (holotype given last): total length, 210, 235, 220, 230; length of tail, 96, 105, 97, 104; length of hind foot, 32, 35, 33, 35; greatest length of skull, 33.9, 36.7, 36.0, 36.5; zygomatic breadth, 18.0, 19.2, 19.7, 19.5; interorbital breadth, 7.2, 7.2, 7.8, 8.0; postorbital breadth, 11.4, 11.7, 11.9, 11.6; mastoid breadth, 16.2, 16.7, 17.0, 17.2; length of nasals, 10.3, 11.9, 11.4, 11.6; length of maxillary toothrow, 5.6, 4.7, 5.6, 5.9; length of palatal bridge, 10.9, 12.1, 11.8, 11.8.

***Ammospermophilus interpres* (Merriam), Texas Antelope Squirrel**

Specimens Examined (8).—CULBERSON COUNTY: south of Guadalupe Mountains, 1 (USNM); mouth McKittrick Canyon, 5000 ft, 1 (TCWC); 7 mi. N Pine Springs, 1 (TCWC); below Pine Springs, 2 (TTU); Upper Dog Ranger Station, 3 (TTU).

Additional Records.—CULBERSON COUNTY: Frijole, about 5600 ft (Davis 1940:77); Pine Springs Camp, 5300 ft (Davis 1940:77).

The Texas antelope squirrel is characteristic of the middle to lower elevations of the Guadalupe Mountains National Park. The species has not been taken or seen at elevations higher than 1920 m at Upper Dog Ranger Station. Evidently, this squirrel is restricted to rocky areas along the escarpment of the mountains as pointed out by Findley *et al.* (1975:114). Our three specimens from Upper Dog were trapped near piles of rock. In addition to the places listed above, individuals of this species were sighted on the rocky slope above Williams Ranch House in an area dominated by sotol, lecheguilla, and ocotillo, around Nipple Hill, Northwest Corner, and near the road immediately below Williams Ranch House.

None of the specimens taken during our study evinced reproductive activity. Two females taken on 5 June 1973 were young of the year. An adult male taken on 30 May 1966 was molting in a broad band across the nape of the neck and extending onto the head and shoulders.

The species *Ammospermophilus interpres* occupies a relatively restricted geographic range in Chihuahua and Coahuila, Mexico, Texas, and New Mexico. The species is relatively uncommon within the park, but extensive areas of its preferred rocky desert habitat are included in the park. Unless major environmental changes occur, this species should present no major management problems.

The five species of the genus *Ammospermophilus* occupy allopatric geographic ranges. The distribution of *A. interpres* is approached by that of *A. harrisi* and *A. leucurus* in New Mexico. The relationships of those species (Findley *et al.* 1975) are currently under investigation at the University of New Mexico. For the time being, we considered *A. interpres* to be a distinct, monotypic species. External and cranial measurements of two adult females (mouth of McKittrick Canyon and south of Guadalupe) are as follows: total length, 228, 220; length of tail, 71, 67; length of hind foot, 40, 39; greatest length of skull, 41.5, 41.1; zygomatic breadth, 24.3, 23.4; interorbital constriction, 10.3, 9.8; postorbital constriction, 14.1, 14.5; mastoid breadth, 20.7, 19.6; length of maxillary toothrow, 6.8, 7.2.

***Spermophilus spilosoma marginatus* Bailey, Spotted Ground Squirrel**

Specimens Examined (6).—CULBERSON COUNTY: Williams Ranch Road Entrance, 1 (TTU). HUDSPETH COUNTY: Tank Hill, 1 7/16 mi. N, 4½ mi. W Guadalupe Peak, 1 (TTU); Lewis Well, 4 (TTU).

The specimens of spotted ground squirrel herein reported are the first known from the park area, although Davis and Robertson (1944) reported them from elsewhere in Culberson Co.

This species evidently is confined to the Chihuahuan Desert areas of the western bajada. In addition to the animals obtained during our study, spotted ground squirrels were sighted near the Crossroads and in the Southwest Corner of the park. The specimen taken at Williams Ranch Road Entrance was trapped under a creosote bush where the ground was rocky. Two specimens from Lewis Well were trapped in sandy soil west of the well where gypsum sand dunes enter the park. The spotted ground squirrel does not appear to be abundant in the park.

A female taken at Tank Hill on 15 August 1974 was lactating, whereas two females taken at Lewis Well on 18 and 19 May 1974 evinced no reproductive activity. A female from the Williams Ranch Road Entrance had four placental scars in the left uterine horn when trapped on 26 July 1973. A male from Lewis Well had testes that were 17 long on 19 May 1974. This male evinced molt on the head and shoulders; the remainder of the pelage evidently was old as it was faded and harsh in appearance.

The type locality for the subspecies *marginatus* is Alpine, Brewster Co., Texas. Clearly, our material from Guadalupe Mountains National Park is indistinguishable from spotted ground squirrels from this region of Texas.

Spermophilus variegatus grammurus (Say), Rock Squirrel

Specimens Examined (17).—CULBERSON COUNTY: Guadalupe Mountains, 2 (USNM); 2 mi. E mouth of McKittrick Canyon, 5000 ft, 1 (TCWC); ¼ mi. up McKittrick Canyon, 5300 ft, 1 (TCWC); McKittrick Canyon, 5900 ft, 1 (TCWC); 7 mi. N Pine Springs, 2 (TCWC); 1½ mi. S Pine Springs, 1 (TCWC); Pratt Lodge, 1 (TCWC); Upper Dog Ranger Station, 7 (TTU); West Dog Canyon, 1 (TCWC).

Additional Record.—CULBERSON COUNTY: Frijole, about 5600 ft (Davis 1940:76).

Rock squirrels are the most common sciurid occurring in the park and are abundant particularly in areas of rock outcroppings. The species was abundant in Upper Dog Canyon during our studies where they fed on the berries of *Juniperus deppeana* and acorns and found refuge in the numerous rocky areas. Davis (1940:77) recorded seeing an individual of this species ascend the vertical flowering stalk of a century plant and feed on the fruit of the plant. Bailey (1905:85–86) records this species as feeding on the berries of *Juniperus pachyphloea*, acorns of the gray oak, cactus fruits (*Opuntia engelmanni* and *Cereus stramineus*), and walnuts (*Juglans rupestris*). In addition to the localities listed above, individuals of this species were seen near the Burned Cabin at the head of McKittrick Canyon, in Shumard Canyon above the Williams Ranch House, and near the Williams Ranch House. On 24 June 1973, a rock squirrel was seen drinking from the horse tank in the corral at Frijole. Davis (1940) reported seeing this species at 7000 ft above Pine Springs Canyon and along the north rim of North McKittrick near the state line. Based upon our own and earlier records, therefore, this species occurs as low as 1524 m along the west face of the mountains and to at least 5000 ft (1524 m) along the east slope and as high as 7000 ft (2134 m) in suitable habitats. Bailey (1905) concluded that the species occurred between 4000 (1220 m) and 7000 ft in the Guadalupe.

A female taken at Upper Dog Ranger Station on 26 June 1974 contained five embryos that measured 18 in crown-rump length, whereas another female taken on 26 June 1973 at this place carried four embryos that measured 5. Testes of a male taken on 31 May 1974 were 16 long. This male was evidently undergoing molt on its head region. The remainder of the pelage appeared to be extremely worn. A nonpregnant female taken on 27 July 1974 had completed molt on the anterior half of its body and was in the process of molting in the remaining areas, being particularly evident on its rump.

The name *Spermophilus variegatus grammurus* is the scientific name applied to most rock squirrels occurring in Trans-Pecos Texas and New Mexico. Our specimens lack the black head region as do other members of this subspecies (Howell 1938:143).

Cynomys ludovicianus (Ord), Black-tailed Prairie Dog

Specimen Examined (1).—CULBERSON COUNTY: near Guadalupe Mountains, 1 (USNM).

Although this species once occurred in numerous areas in the vicinity of the Guadalupe Mountains, evidently only one melanistic individual that was once held in the National Zoo was

ever preserved. The species has been extirpated from the area occupied by the park through the direct activity of man. Prairie dogs were eradicated by means of poison because they were believed to directly compete with cattle for food in the short-grass prairies.

Bailey (1905:89-90) reported seeing prairie dogs on the main ridge of the mountains in New Mexico and into Dog Canyon in Texas. The name of this canyon was derived from the presence of this species. Davis (1940:77-78) did not collect any specimens but did see active colonies at the base of Nipple Hill, 3 mi. N of Nipple Hill along U.S. Highway 62-180, and near the entrance of Pine Springs Canyon. He also reported seeing a group of old burrows at the mouth of McKittrick Canyon. Clearly, a number of widely scattered colonies of this species once existed in the Guadalupe Mountains National Park. A recent attempt by Roger Reisch of the National Parks Service to re-introduce this species near Nipple Hill was unsuccessful. If a future attempt to re-introduce prairie dogs is planned, the most promising location is the site of an abandoned town near Pine Springs where remnants of the old mounds are still evident. At the present time a corral for visitors' horses occupies this site. A prerequisite for successful establishment of a new prairie dog town would be the relocation of this corral.

Hollister (1916:19-21), in his revision of the genus, pointed out that the distinction between the two subspecies—*C. l. ludovicianus* and *C. l. arizonensis*—of black-tailed prairie dog was based upon average differences in cranial measurements and color. He admitted that the subspecies were weakly defined and that one individual specimen could not be allotted with any certainty. Recently, Pizzimenti (1975) has reviewed members of this genus and he has decided, based upon his studies, to consider *C. ludovicianus* as a monotypic species. We have followed this latter arrangement.

***Thomomys bottae guadalupensis* Goldman, Botta's Pocket Gopher**

Specimens Examined (17).—CULBERSON COUNTY: Bear Canyon Pump House, 1 (TTU); Burned Cabin, head of McKittrick Canyon, 5 (TCWC); Dog Canyon, 6800 ft, 2 (USNM); Manzanita Spring, 1 (TTU); McKittrick Canyon, 4 (USNM); Nipple Hill, 1 (TTU); mouth Pine Springs Canyon, 1 (TCWC); Upper Bear Canyon Trail, 2 (TTU).

This species of pocket gopher occurs at moderate to high elevations within the park. Although no specimens were obtained from the top of the mountains, the specimens from Upper Bear Canyon Trail were taken near the summit and pocket gopher activity, undoubtedly of this species, was noted near the summit of Guadalupe Peak, Bush Mountain, Blue Ridge Campground, and Lost Peak. *T. bottae* occurs in shallow, rocky soil often in association with *Agave lecheguilla*. This pocket gopher frequently feeds on the roots of lecheguilla and will kill individual plants.

Thomomys bottae guadalupensis was described originally by Goldman (1936), with the holotype from McKittrick Canyon, although we did not find any pocket gophers in this area during our survey. The subspecies was distinguished on the basis of pale coloration and details of cranial morphology. As currently understood, this taxon is confined to the Guadalupe Mountains. It is worthy of note that we did not find this species to be abundant anywhere within the park. However, we believe that this subspecies will be in no danger as long as its preferred food of lecheguilla remains abundant.

External and cranial measurements of two adult males (holotype given first) from McKittrick Canyon and two adult females from Burned Cabin, respectively, are as follows: total length, 218, 218, 195, 200; length of tail, 64, 64, 60, 58; length of hind foot, 29, 29, 29, 28.5; greatest length of skull, 38.2, 38.0, 34.6, 37.0; zygomatic breadth, 23.7, 23.3, 21.7, 22.3; interorbital breadth, 6.7, 6.8, 7.2, 6.7; squamosal breadth, 19.9, 18.9, 15.0, 15.4; length of nasals, 12.4, 13.8, 11.3, 13.0; palatal length, 23.8, 24.7, 21.9, 23.2; length of maxillary toothrow, 8.1, 8.5, 7.3, 7.8.

***Pappogeomys castanops parviceps* Russell, Yellow-faced Pocket Gopher**

Specimens Examined (5).—CULBERSON COUNTY: 7 mi. N Pine Springs, 1 (TCWC); mouth Pine Springs Canyon, 1 (TCWC). HUDSPETH COUNTY: 1½ mi. N, ¼ mi. W Guadalupe Peak, 2 (TTU); Lewis Well, 1 (TTU).

Additional Record.—CULBERSON COUNTY: foot of Pine Canyon (= Pine Springs Canyon), Guadalupe Mts., 5740 ft (Russell 1968).

During our work in the Guadalupe Mountains National Park, we took specimens of the yellow-faced pocket gophers at only two localities, both in the western portion of the park. Although we extensively searched the area of Pine Springs Canyon where the species had been taken previously, we did not find any evidence that the species currently occurs there. The two localities where we trapped members of this taxon were areas of firmly packed quartz and gypsum sand, with scattered patches of crusted gypsum soil. The species did not appear to occur outside of these soil types at these two places. Our specimens were relatively pale in coloration, probably corresponding to the light coloration of the soil in which they lived.

An adult female taken on 17 August contained a single embryo that measured 40 in crown-rump length and a female taken on 7 August carried two embryos that measured 10. Two females taken on 14 August and 7 October were nonpregnant.

External and cranial measurements of four adult females (one from each locality listed, in order listed) were as follows: total length, 238, 243, 242, 238; length of tail, 66, 62, 75, 62; length of hind foot, 33, 33, 33, 32; condylobasal length, 44.0, 44.5, 43.8, 44.7; zygomatic breadth, 26.6, 27.7, 27.8, 27.9; interorbital constriction, 7.0, 7.0, 6.6, 6.8; mastoid breadth, 25.8, 25.8, 25.8, 26.3; squamosal breadth, 20.3, 19.4, 19.2, 19.0; length of nasals, 14.6, 15.4, 15.8, 15.3; length of maxillary toothrow, 9.3, 8.9, 8.7, 8.8; palatal length, 29.3, 30.1, 29.4, 30.2. These measurements are in agreement with those given by Russell (1968:674) for *P. c. parviceps*; therefore, we assign them to that subspecies.

Pappogeomys castanops perplanus (Nelson and Goldman), Yellow-faced Pocket Gopher

Specimens Examined.—None.

Additional Record.—CULBERSON COUNTY: foot of Pine Canyon (= Pine Springs Canyon), Guadalupe Mts., 5740 ft (Russell 1968:653).

In Russell's (1968) recent revision of the genus *Pappogeomys*, he divided the subspecies of *P. castanops* into two groups—*excelsus* subspecies-group and *subnubilus* subspecies-group. The two groups were distinguished mainly on the basis of cranial size, especially measurements of cranial length, with the *excelsus* subspecies-group being much the larger. Russell (1968) believed that the two subspecies-groups occurred sympatrically in Pine Springs Canyon with no evidence of intergradation. Of the two adult females in a series of five specimens in the Academy of Natural Sciences in Philadelphia from the foot of Pine Springs Canyon, he assigned one to *P. c. perplanus* in the *excelsus* subspecies-group and one (plus the three younger specimens) to *P. c. parviceps* in the *subnubilus* subspecies-group. He assigned one adult female to *P. c. perplanus* because of its large size (condylobasal length, 48.2) and the other to *P. c. parviceps* because of its much smaller size (condylobasal length, 45.3).

During our work in the Guadalupe Mountains, we never obtained *P. castanops* east of the mountains although we searched extensively for their mounds and trapped several *Thomomys bottae* in the area. Changing environmental conditions or intraspecific competition may have eliminated this species from east of the mountains in the park at least for the present time.

Perognathus flavus gilvus Osgood, Silky Pocket Mouse

Specimens Examined (21).—CULBERSON COUNTY: 3 1/16 mi. S, 1 1/4 mi. W Guadalupe Peak, 1 (TTU); 4 3/8 mi. S, 1 1/8 mi. W Guadalupe Peak, 1 (TTU); Marcus Cabin, West Dog Canyon, 1 (TTU); Nipple Hill, 2 (TTU); Patterson Hills Notch, 1 (TTU); Williams Ranch Road Entrance, 9 (TTU). HUDSPETH COUNTY: 1 mi. S, 3 15/16 mi. W Guadalupe Peak, 1 (TTU); Lewis Well, 1 (TTU).

Additional Record.—CULBERSON COUNTY: 7 mi. N Pine Springs, 5300 ft (Davis and Robertson 1944:268).

The silky pocket mouse occurs in grassland and desert habitats in the park. The highest elevation at which we obtained a specimen was 1905 m in West Dog Canyon. Most of our specimens were taken on the desert bajadas west and south of the mountains. At the Williams Ranch Road

Entrance, where our largest sample was obtained, the vegetation is dominated by creosote bush and mesquite with grasses of the genera *Sporobolus* and *Bouteloua*. All pocket mice are basically granivores and divide the seed resources on the basis of size, availability, and species preference.

A female taken on 17 June evinced two placental scars. Females taken on 19 August, 6 October, and 7 October were nonpregnant. Testes measurements for males were as follows (dates of capture in parentheses): 6 (25 July); 5 (26 July); 4 (28 July); 3 (6 October). Specimens taken on 17 June and 25 July were undergoing seasonal molt. In both specimens, molt had progressed onto the posterior third of the dorsum.

Until recently (Wilson 1973), two species of silky pocket mouse—*P. flavus* and *P. merriami*—were recognized in the area of the Guadalupe Mountains National Park. However, Wilson (1973) and later Findley et al. (1975) presented data to show that the two species intergrade and that populations previously called *P. merriami gilvus* were intermediate between the two species. We have followed this arrangement pending additional data. Wilson (1973) favored retention of the subspecific name *gilvus* for the intermediate populations.

The silky pocket mouse is the smallest of the four species of *Perognathus* occurring in the park. It can be distinguished easily from the other species by its overall size and soft silky pelage. External and cranial measurements of three males and two females, respectively, from the Williams Ranch Road Entrance are as follows: total length, 104, 113, —, —, 99; length of tail, 50, 54, —, —, 45; length of hind foot, 12, 16, 16, 11, 15; length of ear, 5, 6, 6, 7, 6; greatest length of skull, 20.8, 20.8, 21.0, 19.5, 19.6; zygomatic breadth, 10.6, 11.1, 10.9, 10.2, 10.1; interorbital breadth, 4.4, 4.3, 4.3, 4.1, 3.9; mastoid breadth, 12.3, 12.0, 12.3, 11.3, 11.4; length of maxillary tooththrow, 2.8, 3.0, 2.9, 2.9, 2.8; interparietal width, 3.9, 3.3, 3.4, 2.7, 3.1; interparietal length, 2.8, 2.8, 2.8, 2.4.

Perognathus hispidus paradoxus Merriam, Hispid Pocket Mouse

Specimen Examined (1).—CULBERSON COUNTY: head of Dog Canyon, 6800 ft, 1 (USNM).

The only specimen of this species that has been taken in the park was obtained by Vernon Bailey in 1901. This specimen was taken near Bailey's camp at approximately 6800 ft near a place that we would term Upper Dog Ranger Station.

Because this species was not taken during Davis' or our survey, we believe that this species has been extirpated from the park. We would suggest that this extirpation may have been caused by overgrazing or increasing environmental aridity which have altered the grassy habitat of this species.

This is the largest-sized species of pocket mouse that has occurred in the Guadalupe Mountains National Park. Measurements for the species are given by Glass (1947).

Perognathus intermedius intermedius Merriam, Rock Pocket Mouse

Specimens Examined (30).—CULBERSON COUNTY: Nipple Hill, 1 (TTU); Williams Ranch House, 20 (TTU); Williams Ranch Road Entrance, 1 (TTU). HUDSPETH COUNTY: Crossroads, 1 (TTU); 11/16 mi. S, 4¼ mi. W Guadalupe Peak, 1 (TTU); ¾ mi. S, 4 1/16 mi. W Guadalupe Peak, 2 (TTU); 1 mi. S, 3 15/16 mi. W Guadalupe Peak, 2 (TTU); Northwest Corner, 2 (TTU).

Additional Record.—CULBERSON COUNTY: 7 mi. N Pine Springs (Davis and Robertson 1944:268).

The rock pocket mouse occurs in the grassland and desert habitats of the park, although it is evidently most abundant on the desert bajadas west of the mountains. The highest elevation that we have taken a specimen is 1646 m at Nipple Hill. This species was taken basically in areas where creosote bush, mesquite, and saltbush dominate the vegetation.

Two nonpregnant females were taken on 15 June and 13 July.

Perognathus intermedius and *P. penicillatus* are intermediate in size between the smaller *P. flavus* and larger *P. hispidus* from the park. The two former species can be distinguished easily from the latter two on the basis of external and cranial size. However, we have found it to be

extremely difficult to distinguish *P. intermedius* and *P. penicillatus* especially in the field. To identify our material, we have used the characteristics given by Hoffmeister and Lee (1967:367-368). These characteristics seem to separate specimens of the two species from the park quite easily in the laboratory.

We have applied the same *P. intermedius intermedius* to our specimens following Hall and Kelson (1959:501). External and cranial measurements of two males and three females from Williams Ranch House are, respectively, as follows: total length, 188, 174, 168, 165, —; length of tail, 109, 100, 99, 96, —; length of hind foot, 22, 20, 19, 19, 20; length of ear, 7, 8, 7, 8, 8; greatest length of skull, 25.3, 24.8, 23.2, 23.6, 23.4; zygomatic breadth, 12.3, 12.5, 11.8, 11.6, 12.1; interorbital breadth, 6.3, 6.3, 6.1, 5.8, 6.1; mastoid breadth, 13.3, 13.2, 12.6, 12.5, 13.0; length of maxillary toothrow, 3.8, 3.4, 3.5, 3.5, 3.5; interparietal width, 7.7, 7.0, 7.2, 7.3, 7.2; interparietal length, 3.7, 3.4, 3.1, 3.0, 2.8.

Perognathus penicillatus eremicus Mearns, Desert Pocket Mouse

Specimens Examined (83).—CULBERSON COUNTY: ½ mi. S, 5½ mi. W Guadalupe Peak, 10 (TTU); ½ mi. S, 4¾ mi. W Guadalupe Peak, 1 (TTU); 3 1/16 mi. S, 1¾ mi. W Guadalupe Peak, 1 (TTU); ¾ mi. S, 2¾ mi. W Guadalupe Peak, 5 (TTU); 4¾ mi. S, ½ mi. W Guadalupe Peak, 12 (TTU); Nipple Hill, 2 (TTU); Williams Ranch Road, 4¾ mi. S, ½ mi. E Guadalupe Peak, 7 (TTU); Williams Ranch House, 1 (TTU); Williams Ranch Road Entrance, 15 (TTU). HUDSPETH COUNTY: Crossroads, 11 (TTU); 1 7/16 mi. N, 4½ mi. W Guadalupe Peak, 1 (TTU); ¾ mi. S, 4 1/16 mi. W Guadalupe Peak, 1 (TTU); 11/16 mi. S, 4¾ mi. W Guadalupe Peak, 1 (TTU); 7/8 mi. S, 4 mi. W Guadalupe Peak, 5 (TTU); 1¼ mi. S, 5¾ mi. W Guadalupe Peak, 1 (TTU); 1¼ mi. S, 5 7/16 mi. W Guadalupe Peak, 3 (TTU); 1¾ mi. S, 5¾ mi. W Guadalupe Peak, 2 (TTU); Lewis Well, 2 (TTU); Stagecoach Hills, 2 (TTU).

The desert pocket mouse can be expected in the grassland and desert habitats of the park. It is most abundant west of the mountains, but has been taken at Nipple Hill east of the mountains. Nipple Hill is also the highest elevation at which the species was taken in the park. This species occupies much the same habitat in the park as *P. intermedius* and has been taken with it at six localities including Nipple Hill, Williams Ranch Road Entrance, Williams Ranch House, ¾ mi. S, 4 1/16 mi. W Guadalupe Peak, 11/16 mi. S, 4¾ mi. W Guadalupe Peak, and the Crossroads. It is of interest to note that *P. penicillatus* was the most abundant species at Williams Ranch Road Entrance, whereas *P. intermedius* was the more abundant at Williams Ranch House. Generally, *P. penicillatus* was the more abundant of the two species in the park.

Females carrying minute embryos were taken on 28 May (3 embryos) and 26 July (no number given). None of the four females taken between 5 and 7 October evinced reproductive activity. Testes measurements for males of *P. penicillatus* were as follows (dates of capture in parentheses): 6 (21 May); 6 (13 July); 4 (28 July); 4 (22 August). A female taken on 26 July was undergoing seasonal molt on the posterior portion of the dorsum.

We follow Hoffmeister and Lee (1967) in application of the name *Perognathus penicillatus eremicus* to desert pocket mice from the park. External and cranial measurements for one male and three females, respectively, from Williams Ranch Road Entrance are as follows: total length, 152, 155, 164, 164; length of tail, 90, 84, 85, 90; length of hind foot, 22, 25, 22, 21; length of ear, 8, 8, 8, 8; greatest length of skull, 25.8, 24.7, 25.2, 25.0; zygomatic breadth, 14.1, 13.1, 13.2, 13.5; interorbital breadth, 6.7, 6.2, 6.5, 6.3; mastoid breadth, 13.6, 12.7, 12.7, 12.8; length of maxillary toothrow, 3.7, 3.5, 3.6, 3.7; interparietal width, 7.5, 7.2, 7.4, 7.0; interparietal length, 3.6, 4.0, 3.5, 3.4.

Dipodomys merriami merriami Mearns, Merriam's Kangaroo Rat

Specimens Examined (436).—CULBERSON COUNTY: ½ mi. S, 2¾ mi. W Guadalupe Peak, 11 (TTU); 3 1/16 mi. S, 1¾ mi. W Guadalupe Peak, 7 (TTU); ¾ mi. S, 2¾ mi. W Guadalupe Peak, 10 (TTU); 4¼ mi. S, 1 mi. W Guadalupe Peak, 37 (TTU); 4 5/16 mi. S Guadalupe Peak, 24 (TTU); 4¾ mi. S, 1½ mi. W Guadalupe Peak, 4 (TTU); 4¾ mi. S, ½ mi. W Guadalupe Peak, 56 (TTU); 4½ mi. S, ½ mi. W Guadalupe Peak, 23 (TTU); 4½ mi. S, ½ mi. E Guadalupe Peak, 21 (TTU); 4½ mi. S, ¾ mi. E Guadalupe Peak, 1 (TTU); 4¾ mi. S Guadalupe Peak, 13 (TTU);

4 $\frac{1}{2}$ mi. S, $\frac{1}{2}$ mi. E Guadalupe Peak, 28 (TTU); 5 $\frac{1}{2}$ mi. S Guadalupe Peak, 1 (TTU); Patterson Hills Notch, 8 (TTU); 7 mi. N Pine Springs, 9 (TCWC); Williams Ranch House, 4 (TTU); Williams Ranch Road Entrance, 40 (TTU). HUDSPETH COUNTY: Crossroads, 38 (TTU); 4 mi. N, 5 $\frac{1}{2}$ mi. W Guadalupe Peak, 3 (TTU); 1 7/16 mi. N, 4 $\frac{1}{2}$ mi. W Guadalupe Peak, 6 (TTU); $\frac{1}{2}$ mi. N, 4 $\frac{3}{4}$ mi. W Guadalupe Peak, 8 (TTU); $\frac{1}{2}$ mi. N, 4 $\frac{1}{2}$ mi. W Guadalupe Peak, 6 (TTU); $\frac{1}{2}$ mi. S, 5 $\frac{3}{8}$ mi. W Guadalupe Peak, 8 (TTU); $\frac{1}{2}$ mi. S, 5 $\frac{1}{2}$ mi. W Guadalupe Peak, 16 (TTU); 11/16 mi. S, 4 $\frac{3}{4}$ mi. W Guadalupe Peak, 4 (TTU); 1 mi. S, 3 15/16 mi. W Guadalupe Peak, 3 (TTU); 1 $\frac{1}{4}$ mi. S, 5 $\frac{3}{8}$ mi. W Guadalupe Peak, 2 (TTU); 1 $\frac{7}{8}$ mi. S, 5 $\frac{3}{8}$ mi. W Guadalupe Peak, 9 (TTU); Lewis Well, 22 (TTU); Stagecoach Hills, 4 (TTU).

Merriam's kangaroo rat is the most common kangaroo rat in the park. It is distributed widely at lower elevations and is able to utilize the hard rocky desert floor as well as the deeper sandy areas. Because of their desert adaptation and adaptation for saltation, kangaroo rats are of prime interest to park visitors and individuals could be caged easily in an interpretive center. Such interpretive displays in conjunction with an educational program in understanding signs made by kangaroo rats should prove of value to the park visitors.

The diets of Ord's and Merriam's kangaroo rats were the subject of an extensive study published in this volume (O'Connell 1977) and the interested person is referred to her work. In summary, she found the diet of *D. merriami* to consist of seeds, greenery, and insects. Relative to the diet of *D. ordii*, *D. merriami* eats greater quantities of insects, especially in the winter months.

Reproductive data for females are discussed below. In a sample of 27 females collected on 23 and 24 February, none was pregnant; in a sample of 28 females collected on 22 March, none was pregnant; in a sample of six females collected on 20 April, none was pregnant. In a sample of 11 females collected on 17 to 21 May, 10 were not pregnant and one female contained two embryos with a crown-rump length of 3. In a sample of seven females collected on 30 June, five were not pregnant and two contained two embryos each with a crown-rump length of 4 and 12. A female collected on 26 July was not pregnant. In a sample of 35 females collected on 8 to 23 August, 22 were not pregnant and 13 were pregnant with two embryos each. Crown-rump length for the embryos of each female were 2, 3, 4, 15, 18, 23, 24, 24, 29, 29, 32, 33, and 37. In a sample of 14 females collected on 5 to 7 October, none was pregnant. From these data it would appear that the normal number of embryos per litter is two and it appears unlikely that a single female produces more than one litter per year. In every case observed above, a single embryo was found in each horn of the uterus. The onset of breeding appears to be toward the end of May and to cease before October.

Testicular length for males was as follows (mean, range in parentheses, and number): February, 10 (4-13) 24; March, 9 (4-12) 37; April, 8 (6-11) 5; May, 11 (9-12) 11; June, 10 (5-13) 13; July, 9 (4-12) 8; August, 11 (6-13) 31; October, 5 (4-9) 12. The above data suggest that males have enlarged testes from February to August during which time most males have scrotal testes. During October the testes size is reduced and none of the males had scrotal testes.

Specimens were observed in molt from February to October.

We have followed the systematic arrangement of Lidicker (1960) in applying the name *Dipodomys merriami merriami* to our specimens from the park.

Dipodomys ordii ordii Woodhouse, Ord's Kangaroo Rat

Specimens Examined (75).—CULBERSON COUNTY: 4 $\frac{3}{4}$ mi. S, $\frac{1}{2}$ mi. W Guadalupe Peak, 1 (TTU); 4 $\frac{3}{4}$ mi. S Guadalupe Peak, 1 (TTU); 5 $\frac{1}{2}$ mi. S Guadalupe Peak, 2 (TTU); Williams Ranch Road Entrance, 23 (TTU). HUDSPETH COUNTY: Crossroads, 2 (TTU); 2 $\frac{7}{8}$ mi. N, 7 $\frac{1}{2}$ mi. W Guadalupe Peak, 3 (TTU); 1 $\frac{3}{8}$ mi. N, 4 $\frac{1}{4}$ mi. W Guadalupe Peak, 1 (TTU); $\frac{1}{2}$ mi. N, 4 $\frac{3}{4}$ mi. W Guadalupe Peak, 20 (TTU); 7 $\frac{3}{4}$ mi. W Guadalupe Peak, 1 (TTU); 9/16 mi. S, 5 5/16 mi. W Guadalupe Peak, 1 (TTU); 1 $\frac{1}{2}$ mi. S, 6 $\frac{1}{2}$ mi. W Guadalupe Peak, 1 (TTU); 1 $\frac{7}{8}$ mi. S, 7 $\frac{1}{8}$ mi. W Guadalupe Peak, 8 (TTU); Lewis Well, 10 (TTU); Stagecoach Hills, 1 (TTU).

Our records indicate that *Dipodomys ordii* is associated with the deeper sandy areas on the western side of the park and within this localized habitat the species is relatively abundant. All specimens were collected between the elevations of 1230 to 1350 m.

The diets of Ord's kangaroo rat and Merriam's kangaroo rat are described in detail in this volume (O'Connell 1977), and anyone interested in specifics is referred to her work. Briefly, this species eats seeds, greenery, and insects, with the major portion of the diet consisting of seeds (mainly of grasses). Ord's kangaroo rat is primarily an opportunistic feeder.

In a sample of five females collected on 23 and 24 February, only one was pregnant carrying an embryo measuring 7 in crown-rump length in each horn of the uterus. Two females taken on 18 May, a female taken on 29 June, and a female taken on 25 July were not pregnant. In a sample of six females taken on 10 to 22 August, two were pregnant. Each pregnant female contained an embryo in each horn of the uterus with the crown-rump length of the embryos being 4 for those of one female and 35 for the other. In a sample of three females from 7 October, one female contained a minute embryo in each horn and the other two were not pregnant. Testicular length for nine males collected in February ranged from 9 to 12, for a male collected in March it was 12, for three males collected in May it was 8, 13, and 12. Ten males collected in August had testicular lengths that ranged from 8 to 14 and the testicular length of a male collected in October was 11.

Specimens were observed in molt during June and August.

According to the most recent revision of this species by Setzer (1949), *Dipodomys ordii ordii* is the subspecies occurring in the Guadalupe Mountains National Park. *D. ordii* and *D. merriami* are similar in external size and coloration; however, the two species are distinguished easily because *D. ordii* has five toes on its hind feet, whereas *D. merriami* has only four.

Dipodomys spectabilis baileyi Goldman, Banner-tailed Kangaroo Rat

Specimens Examined (3).—CULBERSON COUNTY: 4 5/16 mi. S Guadalupe Peak, 1 (TTU). HUDSPETH COUNTY: 3/8 mi. S, 4 1/16 mi. W Guadalupe Peak, 1 (TTU); 11/16 mi. S, 4 3/4 mi. W Guadalupe Peak, 1 (TTU).

Specimens of the banner-tailed kangaroo rat were obtained from the park for the first time during our study. Our collecting data suggest that this species is limited to the western and southwestern boundaries of the park. This is the largest of the kangaroo rats found in the park and is distinguished easily from the other two species by the large tuft of white hairs on the distal portion of the tail. Banner-tailed kangaroo rats build conspicuous dens that form mounds with several large entrances. Such mounds are infrequent where we observed banner-tailed kangaroo rats in the park but if some mounds prove to be accessible to park visitors, they would provide a unique ecological feature for observation.

A female collected on 23 March did not contain embryos. Testicular length of males was 14 for a specimen obtained on 29 June and 16 for a specimen from 15 August. Individuals collected on 29 June and 15 August were molting.

There has not been a recent systematic review of this species and we follow Hall and Kelson (1959) in assigning our specimens to *D. s. baileyi*.

Reithrodontomys megalotis megalotis (Baird), Western Harvest Mouse

Specimens Examined (34).—CULBERSON COUNTY: 4 7/8 mi. S, 1/8 mi. E Guadalupe Peak, 1 (TTU); Marcus Cabin, West Dog Canyon, 1 (TTU); Pine Springs Campground, 1 (TTU); The Bowl, 3 (2 TCWC, 1 TTU); Upper Dog Ranger Station, 27 (TTU); Williams Ranch Road, 4 1/4 mi. S, 1 mi. W Guadalupe Peak, 1 (TTU).

The western harvest mouse occurs at moderate to high elevations throughout the park wherever grass occurs. Apparently, it is most common at moderate elevations, but has been taken during our study and by Davis (1940:79–80) in grassy meadows in The Bowl. Harvest mice are basically granivorous and are probably dependent upon the presence of grass for their continued existence in the park. Population estimates for this species in the park are given by August et al. (1977).

A female taken on 19 August in Upper Dog Canyon contained five embryos that measured 16 in crown-rump length, whereas females taken on 26 January, 6 April, and 24 July evinced no

reproductive activity. Testes lengths for males were as follows: April, 4, 4; June, 5, 7, 8; July, 10; August, 8, 9. A female taken on 18 August was in subadult pelage. None of our 14 skins was from individuals undergoing seasonal molt.

The subspecies *R. m. megalotis* is widespread in the western United States and northern Mexico. This name has been applied to all members of the species from Trans-Pecos Texas. The last systematic revision of the group was by Howell (1914).

***Peromyscus boylii rowleyi* (J. A. Allen), Brush Mouse**

Specimens Examined (95).—CULBERSON COUNTY: Bush Mountain, 3 (TTU); ½ mi. NNE Grisham-Hunter Lodge, South McKittrick Canyon, 1 (TTU); Guadalupe Mountains, 7800 ft, 1 (USNM); Guadalupe Mountains, Dog Canyon, 6800 ft, 2 (USNM); Guadalupe Mountains, head of McKittrick Canyon, 7800 ft, 1 (USNM); Guadalupe Peak Campground, 1 (TTU); 4¾ mi. S, ½ mi. W Guadalupe Peak, 1 (TTU); 5½ mi. S Guadalupe Peak, 1 (TTU); Junction North McKittrick Canyon and Devil's Den Canyon, 1 (TTU); Lost Peak, 1 (TTU); Marcus Cabin, West Dog Canyon, 1 (TTU); McKittrick Canyon, 8 (TCWC); Nipple Hill, 1 (TTU); Pine Springs Campground, 1 (TTU); Pratt Lodge, McKittrick Canyon, 2 (TTU); Smith Canyon, 4 (TTU); The Bowl, 30 (19 TCWC, 11 TTU); Upper Dog Ranger Station, 23 (TTU); Williams Ranch Road Entrance, 1 (TTU).

The brush mouse can be expected throughout the park, with the possible exception of the lowland desert areas of the western portion. The westernmost record that we have in our material is from 4¾ mi. S, ½ mi. W Guadalupe Peak at an elevation of 1356 m. The brush mouse is evidently most abundant at moderate to high elevations in the park because our largest samples are from The Bowl and Upper Dog Ranger Station. During the summer of 1973 when we trapped intensively in McKittrick Canyon for more than a week, the rodent populations were extremely low, with only four *Peromyscus boylii* and one *P. pectoralis* being obtained. These specimens were taken on rocky hillsides, where sotol and agave predominated under low oak trees. This habitat was similar to a number of areas where the species was taken elsewhere in the park. In The Bowl, the brush mouse was taken under large stands of conifers, but succulents were not present. A number of specimens were trapped in a log cabin in The Bowl. In the area of Williams Ranch Road Entrance, no oaks or conifers were present but the brushy vegetation was dominated by creosote bush with scattered mesquite.

Of the seven species of the genus *Peromyscus* occurring in the park, *P. boylii* is evidently the most common. Pregnant females of *P. boylii* were taken on the following dates: 22 March, three embryos (4 in crown-rump length); 6 April, minute (no number given); 23 June, two embryos (23); 6 August, four embryos (4). Nonpregnant females were obtained in May, June, and July. Testes measurements for adult males obtained in our study are as follows: 22 March, 12; 31 May, 4, 12; 1 June, 5; 2 June, 10; 3 June, 13; 4 June, 14; 5 June, 11; 9 June, 10, 12; 13 June, 8; 23 June, 11; 6 August, 14, 15, 15, 15. Four adult females were found to evince molt on various areas of the dorsum on the following dates: 12 June; 23 June; 25 June; 6 August.

We follow Schmidly (1973) in assigning our specimens to *P. b. rowleyi*. Relationships of all *Peromyscus* occurring in the park will be discussed in a subsequent publication.

***Peromyscus difficilis nasutus* (J. A. Allen), Rock Mouse**

Specimens Examined (39).—CULBERSON COUNTY: Blue Ridge, 1 (TTU); Blue Ridge Campground, 3 (TTU); Bush Mountain, 4 (TTU); Guadalupe Peak Campground, 4 (TTU); Guadalupe Mountains, McKittrick Canyon, 7800 ft, 1 (USNM); Lost Peak, 3 (TTU); Mescalero Campground, 2 (TTU); Pine Springs Campground, 1 (TTU); The Bowl, 6 (3 TCWC, 3 TTU); Upper Dog Ranger Station, 16 (TTU).

Additional Record.—CULBERSON COUNTY: 2 mi. E Pine Springs (Diersing and Hoffmeister 1974:213).

The rock mouse occurs at moderate to high elevation within the park. Our lowest record of occurrence of this species is 1768 m at Pine Springs Campground. However, Diersing and Hoffmeister (1974) reported two specimens from 2 mi. E of Pine Springs which is at an approxi-

mate elevation of 1600 m. As the common name of this mouse suggests, it was generally taken in rocky situations; at many of the higher elevation localities it was taken sympatrically with *P. boylii*.

Two females containing embryos were taken during our study. One taken on 3 June carried four that measured 4 in crown-rump length and one taken on 1 July carried five that measured 3. The average testes length of three males taken on 30 May was 8.3, of six males taken on 9 to 11 June was 9.8, and of a single male trapped on 26 June was 7. Adults that evinced molt were taken on 30 May (2), 3 June, and 10 June.

The rock mouse was first reported as occurring in Texas, based upon specimens from 2 mi. E Pine Springs and McKittrick Canyon (Diersing and Hoffmeister 1974:213). Our additional specimens confirm the presence of the species and indicate that it is relatively abundant and occurs throughout the Guadalupe Mountains of Texas. We follow the systematic arrangement of Hoffmeister and de la Torre (1961) in using the name *Peromyscus difficilis nasutus* for these mice. Relationships of *Peromyscus* occurring in the park will be discussed in a subsequent publication.

Peromyscus eremicus eremicus (Baird), Cactus Mouse

Specimens Examined (42).—CULBERSON COUNTY: ½ mi. S, 2¾ mi. W Guadalupe Peak, 6 (TTU); 3 1/16 mi. S, 1¾ mi. W Guadalupe Peak, 1 (TTU); ¾ mi. S, 2¾ mi. W Guadalupe Peak, 1 (TTU); 4 mi. S, ½ mi. W Guadalupe Peak, 2 (TTU); Williams Ranch Road, 4¼ mi. S, 1 mi. W Guadalupe Peak, 11 (TTU); Williams Ranch Road, 4 5/16 mi. S Guadalupe Peak, 2 (TTU); Williams Ranch Road, 4¾ mi. S, ½ mi. E Guadalupe Peak, 4 (TTU); 5½ mi. S Guadalupe Peak, 1 (TTU); Nipple Hill, 2 (TTU); 7 mi. N Pine Springs, 2 (TCWC). HUDSPETH COUNTY: Crossroads, 6 (TTU); ¾ mi. S, 4 1/16 mi. W Guadalupe Peak, 3 (TTU); Northwest Corner, 1 (TTU).

This species occurs in most areas of the xeric lowlands of the park. It is particularly abundant in the rocky areas of the western portion of the park where desert scrub vegetation, including creosote bush and mesquite, dominates. Many specimens were taken on bajadas where *Dipodomys merriami* was also captured. On the eastern side of the park the vegetation around Nipple Hill and north of Pine Springs contained more grasses.

Three adult females taken on 26 January, 20 May, and 15 August were not pregnant. Three adult males had testes lengths of 9, 12, and 11 on 26 January, 15 August, and 23 August, respectively.

We have followed the subspecific arrangement given in Hall and Kelson (1959:607) for this species. Relationships of all *Peromyscus* occurring in the park will be discussed in a subsequent publication.

Peromyscus leucopus tornillo Mearns, White-footed Mouse

Specimens Examined (20).—CULBERSON COUNTY: ½ mi. S, 2¾ mi. W Guadalupe Peak, 1 (TTU); 5½ mi. S Guadalupe Peak, 2 (TTU); 5¾ mi. S, ½ mi. W Guadalupe Peak, 1 (TTU); Marcus Cabin, West Dog Canyon, 1 (TTU); Pine Springs Campground, 5 (TTU); Williams Ranch Road Entrance, 2 (TTU); Williams Ranch Road, 4¾ mi. S, ½ mi. E Guadalupe Peak, 5 (TTU). HUDSPETH COUNTY: Crossroads, 1 (TTU); Lewis Well, 1 (TTU); Stage Coach Hills, 1 (TTU).

Additional Record.—CULBERSON COUNTY: Frijole, about 5600 ft (Davis 1940:80).

The white-footed mouse appears to occur at moderate to low elevations throughout the park, but nowhere is it abundant. The species evidently is most common in the grassy areas near the Pine Springs Campground and in the desert scrub vegetation along Williams Ranch Road. The highest elevation at which we recorded this species was 1905 m in West Dog Canyon where the vegetation was mixed grassland with riparian vegetation along the washes.

An adult female taken on 24 July contained a single embryo that measured 7 in crown-rump length; another female taken on 6 October was pregnant but the number of embryos was not recorded. Nonpregnant adult females were taken on the following dates: 26 January; 22 March;

20 May; 7 October. Three adult males collected on 26 January had testes lengths of 12, 13, and 13. A specimen taken on 26 January evidenced molt in a small area on the head and neck; the remainder of the pelage was adult.

Our *P. leucopus* are pale in coloration and should be assigned to *P. i. tornillo* which was originally described from El Paso, El Paso County, Texas (Mearns 1896). Relationships of all *Peromyscus* occurring in the park will be discussed in a subsequent publication.

Peromyscus maniculatus blandus Osgood, Deer Mouse

Specimens Examined (63).—CULBERSON COUNTY: ½ mi. S, 2¾ mi. W Guadalupe Peak, 1 (TTU); ¾ mi. S, 2½ mi. W Guadalupe Peak, 1 (TTU); 4 mi. S, ½ mi. W Guadalupe Peak, 5 (TTU); 4.3 mi. S Guadalupe Peak, 1 (TTU); 4¾ mi. S, ½ mi. W Guadalupe Peak, 1 (TTU); Williams Ranch Road, 4½ mi. S, 1 mi. W Guadalupe Peak, 2 (TTU); Williams Ranch Road, 4¾ mi. S, ½ mi. E Guadalupe Peak, 11 (TTU); 5½ mi. S Guadalupe Peak, 4 (TTU); Williams Ranch Road, 5¾ mi. S, ½ mi. W Guadalupe Peak, 5 (TTU); Nipple Hill, 1 (TTU); Patterson Hills Notch, 3 (TTU); 7 mi. N Pine Springs, 1 (TCWC); Williams Ranch Road Entrance, 9 (TTU). HUDSPETH COUNTY: Crossroads, 9 (TTU); Lewis Well, 1 (TTU).

The deer mouse occurs in xeric lowland areas in much the same areas as *Peromyscus eremicus*. On the western bajadas, it was captured among creosote bush and mesquite. The area around Lewis Well was somewhat more sandy than other areas in the western portion of the park, but our specimen was taken in an area of desert scrub vegetation. Two specimens were taken along the eastern front of the mountains in areas that are xeric but contain more grasses than the western lowlands.

Adult males were taken with the following testes measurements (dates of capture in parentheses): 9 (22 March); 10 (19 May); 8 (20 May); 7 (30 June); 10 (12 July); 14 (13 July); 12 (26 July); 12, 13 (10 August); 11 (22 August); 10, 11 (6 October). An adult female trapped on 13 July was carrying three embryos that measured 10 in crown-rump length. Two subadults captured on 13 July were molting from subadult to adult pelage.

Of the 19 skins that we have available, 16 are the light gray coloration typical of *Peromyscus maniculatus blandus*. However, the other three specimens (one each from Williams Ranch Road Entrance, 4¾ mi. S, ½ mi. E Guadalupe Peak, and Crossroads) are predominately buffy in color. Because the majority of specimens resemble *P. m. blandus* in color, we have assigned our specimens to this subspecies. Relationships of all *Peromyscus* occurring in the park will be discussed in a subsequent publication.

Peromyscus pectoralis laceianus Bailey, White-ankled Mouse

Specimens Examined (20).—CULBERSON COUNTY: 7 mi. N Pine Springs, 15 (TCWC); Manzanita Spring, 1 (TTU); Nipple Hill, 2 (TTU); 0.3 mi. N, 0.5 mi. E Pratt Cabin, McKittrick Canyon, 1 (TTU); Upper Dog Ranger Station, 1 (TTU).

We found the white-ankled mouse to be relatively uncommon during our survey of the park's mammals. Specimens were obtained at only four localities along the eastern and northern boundaries of the park. The habitats in which this species was taken include woodlands and grasslands at Nipple Hill and Manzanita Spring and riparian woodland in McKittrick Canyon and at Upper Dog Ranger Station. It is probably significant that we did not obtain this species at higher elevations or on the desert lowlands of the western portion of the park.

Adult females taken on 26 January and 15 July were nonpregnant. Adult males captured on 3 June, 23 June, and 29 July had testes that measured 11, 11, and 12, respectively. An adult male taken on 23 June was molting over much of its dorsum.

The most recent systematic review of this species was by Schmidly (1972:113–138) and we have followed his subspecific arrangement. Relationships of all *Peromyscus* occurring in the park will be discussed in a subsequent publication.

Peromyscus truei truei (Shufeldt), Piñon Mouse

Specimens Examined (4).—CULBERSON COUNTY: Marcus Cabin, West Dog Canyon, 3 (TTU); Upper Dog Ranger Station, 1 (TTU).

Our specimens of the piñon mouse are the first recorded from the state of Texas. The nearest previous record was 15 mi. S Weed, Otero Co., New Mexico, in the southern part of the Sacramento Mountains (Findley et al. 1975). The only two localities of record are at intermediate elevations (1905 m and 1920 m) in the extreme northern portion of the park. Throughout its geographic range the piñon mouse is most common in piñon-juniper woodlands. Our specimens were taken in riparian woodlands that included the juniper, *Juniperus deppeana*, and in West Dog Canyon the piñon pine, *Pinus edulis*.

One of our specimens is an adult female that was carrying four embryos measuring 5 when captured on 24 July. This specimen was also molting on the lower flanks. A male taken on 2 June had testes measuring 11.

The most recent systematic review of this species was by Hoffmeister (1951). Relationships of all *Peromyscus* occurring in the park will be discussed in a subsequent publication.

Onychomys torridus torridus (Coues), Southern Grasshopper Mouse

Specimens Examined (63).—CULBERSON COUNTY: ½ mi. S, 2¾ mi. W Guadalupe Peak, 1 (TTU); ¾ mi. S, 2¾ mi. W Guadalupe Peak, 2 (TTU); 4 mi. S, 1 mi. W Guadalupe Peak, 7 (TTU); 4¼ mi. S, 1 mi. W Guadalupe Peak, 4 (TTU); 4 5/16 mi. S Guadalupe Peak, 2 (TTU); 4¾ mi. S, ½ mi. E Guadalupe Peak, 16 (TTU); 5½ mi. S Guadalupe Peak, 5 (TTU); 7 mi. N Pine Springs, 1 (TCWC); Williams Ranch Road Entrance, 8 (TTU). HUDSPETH COUNTY: Crossroads, 7 (TTU); 1¾ mi. N, 4¼ mi. W Guadalupe Peak, 5 (TTU); 2¼ mi. S, 6¼ mi. W Guadalupe Peak, 2 (TTU); Lewis Well, 2 (TTU).

The southern grasshopper mouse is found at lower elevations in the desert habitat of the park. Because it is almost entirely carnivorous, it is unique among the rodents of the park. Its primary food source is insects (Horner et al. 1964; Bailey and Sperry 1929), but other food items include scorpions, other arthropods, and mammals. Grasshopper mice have a remarkable behavior associated with the killing of prey (Bailey and Sperry 1929; Cole and Wolf 1970; Cyr 1972; Horner et al. 1964). With mammals which are nearly as large as grasshopper mice, individuals of *Onychomys* attack this prey from behind and bite them through the cranium, which results in instant death. *Onychomys* also has special means of handling arthropods which have protective devices such as scorpions, whip scorpions, and beetles of the genera *Eleodes* and *Chlaenius*. When attacking scorpions and whip scorpions, they bite off the tail before killing the animal. With *Eledoes* and *Chlaenius* (beetles which emit defensive secretions), *Onychomys* grabs these

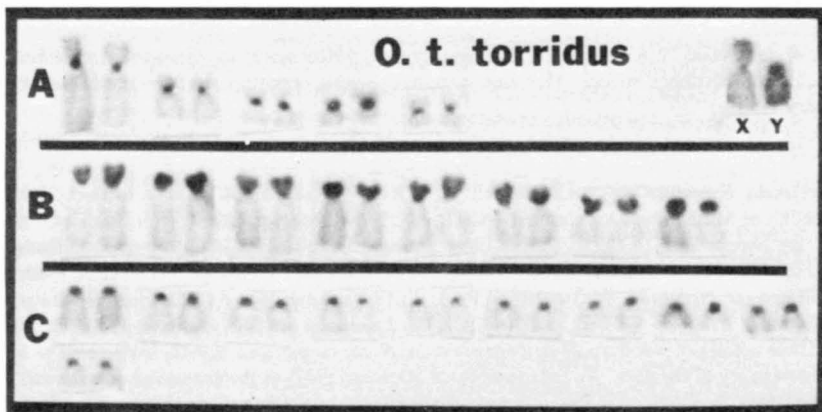


Fig. 6. C-band karyotype of *Onychomys torridus*, male, from the Crossroads, Guadalupe Mountains National Park, Texas.

beetles with its forepaws and jams its abdomen into the sand to avoid contact with the secretions. Information concerning the unique predatory behavior of this species would probably prove of interest to park visitors who wish to learn more about the park's ecosystem.

Although limited data have been published on the chromosomal variation in *O. torridus*, data from Baker's laboratory suggest several different chromosomal races occur within this species. Therefore the karyotype characteristic of individuals from the park is presented in Fig. 6.

Pregnant females have been collected in June, July, and August. Date of collection, number of embryos, and crown-rump length are as follows: 29 June, four embryos with crown-rump length of 16; 25 July, three embryos of 18; 26 July, four embryos of 15; 10 August, three embryos of 24; 20 August, four embryos of 7. Nonpregnant females were collected on 20 August and on 6 and 7 October. Date of collection and testicular length (in parentheses) of adult males were 10 August (11 and 16); 22 August (15); 23 August, (10, 18, and 23); 7 October (5). Adults were observed molting in July and October.

The literature relevant to this species is reviewed by McCarty (1975) and is an excellent source for reference to the biology of *Onychomys torridus*.

***Sigmodon hispidus berlandieri* Baird, Hispid Cotton Rat**

Specimens Examined (19).—CULBERSON COUNTY: Guadalupe Mountains, 1 (USNM); Guadalupe Mountains, Dog Canyon, 6800 ft, 3 (USNM); Marcus Cabin, West Dog Canyon, 1 (TTU); Pine Springs Campground, 4 (TTU); Smith Canyon, 3 (TTU); Upper Dog Ranger Station, 4 (TTU); Williams Ranch House, 1 (TTU); Williams Ranch Road, ½ mi. S, 2½ mi. W Guadalupe Peak, 1 (TTU). HUDSPETH COUNTY: Lewis Well, 1 (TTU).

Hispid cotton rats are known from low to moderate elevations within the park, with Upper Dog Canyon being the highest locality from which they have been taken. The species is most abundant in the grassy areas along the eastern slopes and northern interior canyons of the mountains. However, three specimens were taken along the west slope. Two of these from Williams Ranch House area were taken from local grassy situations. The specimens from Lewis Well was taken in an *Atriplex-Larrea* scrub area. The presence of *S. hispidus* on the west side of the Guadalupe escarpment may be an indication of more widespread grasslands at an earlier time. This species was not reported previously from within the park.

Four pregnant hispid cotton rats (number of embryos in parentheses) were taken on 23 June (4, 5) and 25 July (3, 4). The following testes measurements were recorded from males captured in the park: 26 January, 20; 23 June, 24; 25 June, 20; 23 July, 18; 19 August, 17; 7 October, 17. Two juvenile specimens (both females) were taken on 26 January at the Pine Springs Campground. Two adult specimens (23 June and 19 August) were undergoing seasonal molt when captured.

The subspecies, *S. h. berlandieri*, is currently regarded as occurring throughout west Texas and most of northern Mexico. The latest systematic review of cotton rats from this area was by Bailey (1902a).

***Neotoma albigula albigula* Hartley, White-throated Woodrat**

Specimens Examined (38).—CULBERSON COUNTY: Guadalupe Mountains, 1 (USNM); Guadalupe Mountains, Dog Canyon, 6800 ft, 1 (USNM); Marcus Cabin, West Dog Canyon, 2 (TTU); Nipple Hill, 1 (TTU); 7 mi. N Pine Springs, 5300 ft, 7 (TCWC); Upper Dog Ranger Station, 20 (TTU); Williams Ranch House, 1 (TTU). HUDSPETH COUNTY: Crossroads, 3 (TTU); 4 mi. N, 5½ mi. W Guadalupe Peak, 1 (TTU); Tank Hill, 1 (TTU).

Additional Record.—CULBERSON COUNTY: Frijole, about 5600 ft (Davis 1940:81).

Three species of woodrats (*Neotoma albigula*, *N. mexicana*, and *N. micropus*) occur within the boundary of the park. An extensive study (Cornely 1977) of the ecological distribution of these species is published in this volume and we will only briefly summarize his results in the following three accounts.

Neotoma albigula occurs around the perimeter of the mountains and on the floors of Upper Dog and West Dog canyons which penetrate the mountain mass. On the west side of the park

the white-throated woodrat is found primarily in or along edges of dry washes extending westward from the mountains. The white-throated woodrat is the species which has built most of the conspicuous woodrat dens within the park. These dens are constructed of any available material and would serve as an excellent item of interest for park visitors. Of particular interest should be the role that these nests play as a unique ecological situation that benefits many of the park's other species of animals.

Number and size of embryos and date of collection of pregnant females were as follows: 20 May, 2 embryos with a crown-rump length of 38; 27 June, 1 embryo with a crown-rump length of 37; 29 July, 1 embryo with a crown-rump length of 40; 26 August, 5 embryos with a crown-rump length of 2. A post-lactating female was collected on 3 June. Adult females containing no embryos were collected on 15, 25, and 27 June. Testes length for males and dates collected were as follows: 31 May, 7; 2 June, 11, 11; 26 June, 15; 29 June, 19; 23 July, 13; 20 August, 7; 26 August, 7. Adult specimens were molting on 20 and 27 May, 27 June, and 23 July.

We follow Hall and Kelson (1959) in assigning these to *N. albigula albigula*. Even though *N. albigula* and *N. mexicana* form a contact zone in Upper Dog Canyon, a chromosomal analysis failed to reveal any indication of hybridization between the two species. *Neotoma albigula* and *N. micropus* are also in contact in the southwestern part of the park (Cornely 1977); however, chromosomal analysis failed to reveal any hybridization in the specimens that we obtained.

Neotoma mexicana mexicana Baird, Mexican Woodrat

Specimens Examined (32).—CULBERSON COUNTY: Guadalupe Mountains, 7000 ft, 4 (USNM); 5½ mi S Guadalupe Peak, 1 (TTU); The Bowl, 6 (5 TTU, 1 TCWC); Upper Dog Ranger Station, 15 (TTU). HUDSPETH COUNTY: ¾ mi. S, 4¼ mi. W Guadalupe Peak, 1 (TTU); 11/16 mi. S, 4¼ mi. W Guadalupe Peak, 2 (TTU); ¾ mi. S, 4¾ mi. W Guadalupe Peak, 1 (TTU); ⅞ mi. S, 4 mi. W Guadalupe Peak, 1 (TTU); 1¼ mi. S, 5 7/16 mi. W Guadalupe Peak, 1 (TTU); Lewis Well, 1 (TTU).

Additional Record.—CULBERSON COUNTY: 7 mi. N Pine Springs, 5300 ft (Davis and Robertson 1944:270).

Neotoma mexicana is distributed throughout Guadalupe Mountains National Park at elevations above 1500 m. The Mexican woodrat is saxicolous and builds its nests in inaccessible rock crevices where they would not be observed by park visitors. This species does frequent wooden houses such as the cabin in The Bowl and perhaps might be observed by park visitors under such circumstances. Cornely (1977) has detailed the ecological distribution of this species. Mexican woodrats in the log cabin in The Bowl were observed eating acorns which they had gathered in large quantities.

Dates of collection of pregnant females and reproductive data are as follows: 4 June, 2 embryos (crown-rump length, 18), 2 (5); 20 August, 2 (40); 26 August, 3 (22). Adult females containing no embryos were collected on 3 June and 20 August. Testicular lengths for adult males were 19 and 20 for two males collected on 4 June, 17 for a 6 August specimen, and 15 for a specimen from 8 August. Molting was observed for adult specimens collected in June and August.

We have followed Hall and Kelson (1959) for our systematic arrangement of this species.

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

Specimens Examined (5).—CULBERSON COUNTY: 4 mi. S, ½ mi. W Guadalupe Peak, 2 (TTU); 4¾ mi. S, ½ mi. E Guadalupe Peak, 2 (TTU). HUDSPETH COUNTY: Crossroads, 1 (TTU).

The southern plains woodrat has a limited distribution within the park and is first recorded for the park based on the specimens collected during our survey (see Cornely, this volume for a detailed analysis of the habitat of the species). *N. micropus* is restricted to the lower elevations in the southwestern quarter of the park and is locally abundant. As is the case with *N. albigula*, this species builds conspicuous dens under prickly pear, cholla, and possibly other large plants, but its limited distribution in the park makes the houses of this species less likely to be viewed by park visitors. Although *N. micropus* and *N. albigula* are in contact in the southern portion of the park, there is virtually no sympatry between them.

A female collected on 23 August contained three embryos with a crown-rump length of 30. An adult female collected on 9 August contained no embryos.

We follow Birney (1973) in assigning our specimens to *N. m. canescens*.

***Microtus mexicanus guadalupensis* Bailey, Mexican Vole**

Specimens Examined (82).—CULBERSON COUNTY: Blue Ridge, 1 (TTU); Guadalupe Mountains, 10 (USNM); Guadalupe Peak Campground, 4 (TTU); The Bowl, 41 (32 TCWC, 9 TTU); Upper Dog Ranger Station, 26 (TTU).

The Mexican vole is a montane species probably occurring no lower in the mountains than 1920 m at Upper Dog Ranger Station. Although this species is locally abundant, it is restricted to open montane meadows. Because this habitat is limited in the park, the status of this vole and its habitat will need continued monitoring. The population of Mexican voles in the Guadalupe Mountains National Park is isolated from other populations of the species, with the nearest population being on the Sacramento Mountains of New Mexico. This species is best considered a relict with Rocky Mountain affinities and is therefore one of the unique features of the park. Because of the unique and precarious status of this species, an intensive study of its biology has been undertaken by Wilhelm (1977).

One female taken on 8 August contained three embryos that measured 4 in crown-rump length. Males were found to have the following testes measurements (dates of capture in parentheses): 7, 3 (5 April); 8.5, 10 (6 April); 11 (2 June); 4 (4 June); 9 (1 July); 11 (21 July); 9 (7 August); 10 (26 August). A nonpregnant adult female taken on 11 June evinced a seasonal molt over most of its posterior dorsum. Another female taken on 9 August was molting on the dorsum, but it was impossible to determine whether this was a seasonal or maturational molt.

The taxon *Microtus mexicanus guadalupensis* was described originally by Bailey (1902b) on the basis of specimens from the Guadalupe Mountains. As this taxon is currently understood, populations occurring in the Manzano, Capitan, and Sacramento mountains in New Mexico are also included in it. The status of all of these populations is being reviewed by D. E. Wilhelm. External and cranial measurements of the male holotype (USNM 109, 191), three adult male topotypes, and means (extremes in parentheses) for four adult female topotypes are as follows: total length, 152, 145, 147, 150, 142.5 (130–150); length of tail vertebrae, 34, 34, 34, 33.8 (30–36); length of hind foot, 20, 19, 19, 20, 18.8 (18–19); greatest length of skull, 27.1, 25.6, 25.8, 26.1, 25.2 (24.7–25.8); zygomatic breadth, 16.0, 14.6, 15.2, 15.5, 14.8 (14.4–15.1); interorbital constriction, 3.4, 3.1, 3.2, 3.3, 3.2 (3.1–3.3); mastoid breadth, 12.4, 12.0, 11.8, 12.1, 11.6 (11.3–11.8); length of nasals, 7.1, 7.2, 7.2, 7.5, 7.1 (7.0–7.2); length of maxillary toothrow, 7.3, 6.2, 6.4, 6.3, 6.3 (6.1–6.9); length of palatal bridge, 5.7, 5.8, 5.5, 5.2, 5.6 (5.4–5.7).

***Erethizon dorsatum couesi* Mearns, Porcupine**

Specimens Examined (3).—CULBERSON COUNTY: Bone Springs, 1 (TTU); The Bowl, 1 (TTU); Upper Dog Ranger Station, 1 (TTU).

Additional Record.—CULBERSON COUNTY: Burned Cabin, head of McKittrick Canyon, 7500 ft (Davis 1940:82).

Although we obtained only three specimens of porcupine during our work in the park, it is quite common in the area. It can be expected anywhere in the park where there is sufficient woody vegetation to meet its dietary needs. For example, we saw individuals at the north end of the Patterson Hills and in the Patterson Hills Notch where some riparian vegetation occurs along the washes, with creosote bush and mesquite being the dominant shrubs. Individuals also were sighted near Frijole and several places in McKittrick Canyon. The individuals sighted at Frijole on 15 May were an adult accompanied by a young.

This is one of the more conspicuous species of mammal occurring in the park and should be included in any interpretative program for the park. Evidence of the activity of this species can be seen on many of the trees where they have gnawed away the bark. Porcupines will take refuge in trees or rock dens (see Davis 1940:82). Because this species is awkward and slow-moving on the ground and unable to escape easily when treed, extra precautions must be taken to protect them from park visitors.

The specimen from Bone Springs consists of a partial skull that was picked up. The other two specimens were nonpregnant females taken on 4 and 9 June.

We follow Hall and Kelson (1959:782) in assigning our specimens to *E. d. couesi* on geographic grounds.

Canis latrans texensis Bailey, Coyote

Specimens Examined.—None.

Our search of the literature and museum collections has revealed no record of specimens of the coyote being taken within the boundaries of the park. Davis and Robertson (1944:265) report the species from elsewhere in Culberson County. We heard coyotes at night and received reports from park personnel of sightings of coyotes within the park during our work in the area, but we did not obtain a specimen. Clearly, this species is present within the park, but has escaped collection because of its secretive habits. It is probably one of the more abundant and certainly one of the most significant predators occurring within the park.

Coyotes were heard howling at night by our field parties at the following locations: McKittrick Canyon Parking Lot; Williams Ranch Road Entrance; Crossroads; Northwest Corner; Red Sand Dunes. Dave Cunningham reported to us that there are coyotes in West Dog Canyon and at Coyote Peak. John Chapman reported seeing a coyote cross the road with a freshly killed rabbit near McKittrick Canyon, and Cornely inspected a pup that had been killed on the highway near the Williams Ranch Road Entrance on 13 August 1974.

Coyotes from the Guadalupe Mountains National Park most likely belong to the subspecies *C. l. texensis* as this is the subspecies to which Davis and Robertson (1944:265) and Jackson (1951:279) assigned other specimens from Culberson County.

Canis lupus monstrabilis Goldman, Gray Wolf

Specimen Examined (1).—CULBERSON COUNTY: Guadalupe Mountains, summit of mountains near New Mexico line, 1 (USNM).

The only specimen of the gray wolf from the park is a skull which was obtained by Vernon Bailey on 24 August 1901. The following is a quotation from his field notes which are on file at the National Bird and Mammal Laboratories, Department of the Interior: "These big wolves are said to be especially troublesome in the Guadalupe Mountains and to kill much stock, mostly calves and cows. One ranchman said they had killed over 40 head of cattle for him in the past three years and that he had been unable to kill any of the wolves. The skull sent in shows their size to be very large. The color of this one was light gray." This species has been extirpated from the park probably as the result of predator control activities.

This specimen was assigned to the subspecies *C. l. monstrabilis* by Goldman (1944:468). Cranial measurements for this specimen are as follows (specimen unsexed but undoubtedly a male): condylobasal length, 247.0; zygomatic breadth, 141.0; interorbital constriction, 44.1; postorbital constriction, 40.5; mastoid breadth, 84.5; length of nasals, 95.3; length of maxillary toothrow, 104.7; palatal length, 128.3.

Urocyon cinereoargenteus scottii Mearns, Gray Fox

Specimens Examined (4).—CULBERSON COUNTY: Bear Spring, 5700 ft, 1 (TCWC); McKittrick Canyon, 1 (TCWC); The Bowl, 8200 ft, 1 (TCWC); Upper Dog Ranger Station, 1 (TTU).

The gray fox is evidently one of the more abundant carnivores occurring in the Guadalupe Mountains National Park. All specimens examined were obtained in wooded or canyon situations. Our specimen was trapped, using sardines for bait, along the road leading to the ranger station in Upper Dog Canyon. Davis (1940:76) reported that the individual from Bear Spring was shot as it stalked a cottontail. A fox was observed by Cornely on 9 June 1974 near Bush Mountain, and another was sighted by Baker at Pine Springs Campground in August 1974.

The specimen from Upper Dog Ranger Station was an adult male that possessed testes measuring 17 in length when taken on 31 May.

As currently understood, the name *Urocyon cinereoargenteus scottii* is applied to gray foxes from the park. The subspecies has a widespread occurrence throughout the southwestern United States and northern Mexico. External and cranial measurements of a specimen from The Bowl (female) and one from Bear Spring (male) are as follows: total length, 940, 1080; length of tail, 395, 468; length of hind foot, 129, 142; length of ear, 76, 83; greatest length of skull, 121.1, 131.3; condylobasal length, 114.7, 128.0; zygomatic breadth, 65.2, 66.9; interorbital constriction, 22.4, 26.7; postorbital constriction, 28.0, 27.9; mastoid breadth, 43.4, 46.2; length of maxillary toothrow, 46.4, 53.9; length of palate, 56.9, 63.3.

Ursus americanus amblyceps Baird, Black Bear

Specimens Examined.—None.

Additional Record.—The Bowl (Davis 1940:74).

In 1901, Bailey found bears to be common on the upper slopes of the almost inaccessible canyons of the Guadalupe Mountains. In the head of McKittrick Canyon they had worn paths to their feeding areas on the oak and juniper ridges and to waterholes in upper portions of the canyon. Evidence of feeding activity of bears was present throughout the upper parts of the canyon and on the adjacent ridges. Bailey (1905:188) believed that the bears were feeding on acorns, juniper berries, and berries of *Berberis fremontii* in August.

Davis (1940:74) estimated the black bear population in the Guadalupe Mountains to be not greater than 25 individuals in the late 1930s. He also had reports of the species in upper McKittrick Canyon as well as Blue Ridge, Frijole, and the rim of the mountains about 5 miles SE of Guadalupe Peak.

During 1973–74, a bear and bear sign were observed in The Bowl and Upper Dog Canyon. Roger Reisch estimated that there was only a single bear in the park at this time. Clearly, the population of black bear in the Guadalupe Mountains has declined significantly in recent years. This is probably due to hunting pressures. However, with complete protection of the areas within the park, the black bear population can be expected to increase again with immigrants reaching the area from the Sacramento Mountains in New Mexico where there is a significant population.

The subspecies *U. a. amblyceps*, which is believed to occur throughout west Texas and New Mexico, was described based upon material from Grant Co., New Mexico (see Hall and Kelson 1959:866–867).

Ursus arctos Linnaeus, Grizzly Bear

Specimens Examined.—None.

The only known specimen of the grizzly bear in Texas is from the Davis Mountains taken in 1890 (Bailey 1905; Davis 1974). It is supposed that this bear may have entered the area from New Mexico by way of the Guadalupe. Bailey (1932:362–363) believed that specimens “indicate a probable range for the species along the Guadalupe, Sacramento, White, Capitan, Manzano, and possibly the Jemez Mountains . . .” of New Mexico. He stated that “in 1901, while camped at the head of Dog Canyon in the Guadalupe Mountains near the New Mexico and Texas boundary line, the writer found tracks of very large bears that were evidently of the grizzly group, though apparently no grizzlies had been killed there for some time.” Bailey received a report from the Forest Service of grizzlies in the Guadalupe in 1909. We believe that there is sufficient evidence to include the grizzly bear in the historic mammalian fauna of the Guadalupe Mountains, although there were probably never large numbers of the species in the area.

Because of the large size of grizzlies and the fact that they kill some livestock, they were quickly exterminated from most of their former range. They most certainly were gone from the Guadalupe early in this century.

Numerous species and subspecies have been described for grizzly bears. However, modern writers agree that there is only one species involved in the complex. The subspecific arrangement within the species awaits thorough review.

Bassariscus astutus flavus Rhoads, Ringtail

Specimens Examined (3).—CULBERSON COUNTY: Lower McKittrick Canyon, 0.2 mi. N, 0.4 mi. W Pratt Lodge, 5150 ft, 1 (TTU); The Bowl, 1 (TCWC); Upper Dog Canyon, 1 (TTU).

The ringtail is probably quite common in the park but it seldom is seen because it frequents rocky, inaccessible habitats. The two specimens that we obtained were found dead, but not as the result of our activity. The specimen from The Bowl was a skeleton picked up by Davis (1940). Davis (1940) reported signs of this species as being abundant in The Bowl and along the cliffs of McKittrick Canyon. He found by examination of the feces that insects constituted a large part of the diet of this species. Ringtails have been observed on the stone fence around the house at Frijole.

One of our specimens consists of an unsexed skeleton picked up on 24 June 1974. The other specimen (Upper Dog Canyon) was prepared as a standard museum skin and skull. This individual is a nonpregnant adult female found on 29 November 1975.

Standard cranial measurements of the unsexed individual from The Bowl are as follows: greatest length of skull, 81.8; condylobasal length, 79.0; zygomatic breadth, 52.9; interorbital constriction, 16.4; postorbital constriction, 16.9; mastoid breadth, 36.0; length of maxillary tooththrow, 30.7; palatal length, 36.7. We assign our specimens to *B. a. flavus* which occupies a wide geographic range in Texas, Oklahoma, New Mexico, Colorado, and northeastern Mexico (Hall and Kelson 1959:881).

Procyon lotor mexicanus Baird, Raccoon

Specimens Examined (4).—CULBERSON COUNTY: 0.3 mi. N, 0.5 mi. E Pratt Lodge, McKittrick Canyon, 1 (TTU); Upper Dog Ranger Station, 3 (TTU).

The raccoon apparently has not been reported from the Guadalupe Mountains previously. However, we found the species to be relatively abundant in the riparian communities in the canyons along the eastern slopes and northern interior canyons of the mountains. They are already a nuisance at the Pine Springs Campground, where they raid the trash cans. In addition to the places listed, raccoons were sighted in West Dog Canyon, in main McKittrick Canyon, and Frijole. This species can be expected anywhere in the park where sources of water are associated with wooded areas.

Two specimens from Upper Dog Ranger Station are unsexed, pick-up skulls. The other two specimens are nonpregnant, subadult females.

We have assigned our specimens to *Procyon lotor mexicanus* based upon distributional data. Goldman (1950:54) assigned a specimen from El Paso to this subspecies; Bailey (1905:194) allocated a specimen from Pecos to *mexicanus*. Based upon this evidence, it seems likely the subspecies *mexicanus* inhabits the Guadalupe Mountains, but the final decision must await the obtaining of adult specimens from the area.

Mustela frenata neomexicana (Barber and Cockerell), Long-tailed Weasel

Specimens Examined.—None.

No specimens of the long-tailed weasel were obtained during our work. However, Mr. Roger E. Reich sighted a specimen on or about 23 September 1975 at a place 3.2 mi. S, 3.4 mi. W Guadalupe Peak on the Hudspeth-Culberson County line. Although this location is just outside of the park boundary, it clearly indicates that long-tailed weasels are living in the area. In addition to sighting the animal, Reich also collected some fecal material at a presumed den. The fecal material is composed almost entirely of insect hard parts. In recent years, long-tailed weasels also have been observed in the vicinity of Calsbad Caverns and on ranches adjacent to the Guadalupe Mountains National Park. Davis and Robertson (1944) reported a specimen from near Kent in southern Culberson County. This individual was noted to be eating a woodrat (*Neotoma albigula*) prior to collection.

We follow Hall (1951a:333-338) in assigning long-tailed weasels from this region to *Mustela frenata neomexicana*.

Taxidea taxus berlandieri Baird, Badger*Specimens Examined*.—None.

No specimens of badger were taken during our study. However, the diggings of this species were sighted at a number of places, especially near the base of El Capitan in the vicinity of Guadalupe Spring. Tony Burgess saw a badger on Williams Ranch Road in the summer of 1973. Bailey in his 1901 field notes (on file at National Fish and Wildlife Laboratories) stated that "A few badger holes found all over the Mts." Davis and Robertson (1944) recorded several sightings in southern Culberson County although no specimens were obtained. Long (1972:750) reports a specimen from Carlsbad, Eddy County, New Mexico. Clearly the badger has been, and remains, a member of the mammalian fauna of the park.

We follow the taxonomic arrangement given by Long (1972) for the North American badger.

Spilogale gracilis leucoparia Merriam, Spotted Skunk

Specimens Examined (2).—CULBERSON COUNTY: Pine Springs, 1 (TCWC); Williams Ranch House, 1 (TTU).

Spotted skunks are relatively rare (possibly due to their secretive habits) throughout Trans-Pecos Texas. They are inhabitants of rocky and brushy areas and may be expected wherever these occur in the park. Our specimen from Williams Ranch House was trapped in a live trap baited with sardines. The trap was placed in a wash immediately above the house. The specimen is an adult male that possessed testes measuring 20 in length when taken on 16 June.

Van Gelder (1959) recognized a single species of spotted skunks in the United States under the name *S. putorius*. Specimens from the Guadalupe Mountains clearly fall within the geographic range of *S. p. leucoparia* as he defined it. Subsequently, Mead (1967, 1968a, b) has presented convincing evidence that two species of spotted skunks occur in the United States, with the names *S. gracilis* for the western species and *S. putorius* for the eastern. We have chosen to follow Mead's evidence for use of the specific name *gracilis* and have followed Van Gelder's use of the subspecific name.

Mephitis mephitis varians Gray, Striped Skunk

Specimens Examined (5).—CULBERSON COUNTY: 7 mi. N Pine Springs, 3 (TCWC); Upper Dog Ranger Station, 1 (TTU); Williams Ranch House, 1 (TTU).

Although specimens of striped skunks are available only from intermediate elevations in the park, the species has been sighted at the Patterson Hill Notch, near Grisham-Hunter Lodge in South McKittrick Canyon, and in The Bowl indicating that the striped skunks may be expected anywhere in the park. This species feeds primarily on insects and small vertebrates. As pointed out by Findley et al. (1975), the striped skunk is highly susceptible to highway mortality; therefore, with increased vehicular traffic in the park, this species may be affected.

Both of our specimens from the park are subadults. The female taken on 4 June was non-pregnant; the male had testes measuring 20 when taken on 15 June.

Mephitis mephitis varians occurs from Nebraska to northern Mexico. This was the name applied by Davis and Robertson (1944:264) to specimens from the area although they stated that specimens from 7 mi. N Pine Springs exhibited some characteristics of *M. m. estor* which occurs to the west. External and cranial measurements of two females from 7 mi. N Pine Springs are as follows: total length, 712, 629; length of tail, 350, 308; length of hind foot, 65, 66; greatest length of skull, 70.2, 66.4; condylobasal length, 65.0, 63.2; zygomatic breadth, 41.6, 40.8; interorbital constriction, 19.1, 20.0; postorbital constriction, 17.9, 18.8; mastoid breadth, 35.6, 34.9; length of maxillary tooththrow, 20.8, 21.6; palatal length, 27.0, 25.6.

Conepatus mesoleucus mearnsi Merriam, Hog-nosed Skunk

Specimens Examined (8).—CULBERSON COUNTY: Burned Cabin, head of McKittrick Canyon, 1 (TCWC); McKittrick Canyon, 4 (TCWC); The Bowl, 3 (2 TCWC, 1 TTU).

The hog-nosed skunk may be the most abundant of the three species of skunks occurring in the Guadalupe Mountains National Park. Hog-nosed skunks may be expected to occur any-

where within the park boundaries, although it will be most abundant in areas of high insect populations, which it uses as its main source of food. Members of this species have been seen at Frijole and Blue Ridge Campground in addition to the places listed above. Considerable digging activity of this species was noted, during our work, along the road leading to Pratt Lodge in McKittrick Canyon.

Our specimen from The Bowl is a subadult male obtained on 8 June 1974. Testes of this individual were 13 in length.

The subspecies *C. m. mearnsi* is currently considered to occur throughout most of Texas, adjacent New Mexico, and northern Mexico. External and cranial measurements of an adult male (Burned Cabin) and female (McKittrick Canyon), respectively, are as follows: total length, 605, —; length of tail, 238, —; length of hind foot, 70, 65; length of ear, 27, 23; greatest length of skull, 74.2, 67.7; condylobasal length, 69.2, 62.6; zygomatic breadth, 47.4, 41.2; interorbital constriction, 23.2, 21.7; postorbital constriction, 18.7, 18.8; mastoid breadth, 39.9, 36.8; length of maxillary toothrow, 21.9, 20.5; palatal length, 29.5, 27.2.

***Felis concolor azteca* Merriam, Mountain Lion**

Specimens Examined.—None.

Evidently no specimens of the mountain lions have been preserved from the Texas portion of the Guadalupe Mountains, although the species has occurred there in the past and probably still occurs in limited numbers. Bailey in his notes (on file at National Fish and Wildlife Laboratories) stated that mountain lions were "Common in the Mts. where the numerous rock cliffs and canyons furnish them excellent cover. Fresh tracks seen above and below our camp in the head of Dog Canyon. Panthers are said to kill a good deal of stock, mainly colts, and most of the ranchmen keep hounds for hunting them and other 'varments.'" Bailey (1932:289) stated that "during 1916 the hunters of the Bureau of Biological Survey killed 9 [mountain lions] in the Guadalupe Mountain region," of New Mexico.

Davis (1940:76) noted mountain lions rarely occurred in the Guadalupe Mountains of Texas. He did examine the skin of a mountain lion that had been killed several years earlier near Burned Cabin in upper McKittrick Canyon. We believe that several mountain lions (probably less than five) have been at least part-time residents of the park in recent years. In 1973, a female and two yearlings were reportedly killed just north of the park boundary in New Mexico. These lions were allegedly killing sheep and then returning to the safety of the park. In the summer of 1975, an almost identical incident occurred in the same area. This time an adult lion was captured, tranquilized, and removed from the area. One of the problems with the Guadalupe Mountains National Park is that it is too small to completely contain the normal home range of many of the larger, wide-ranging species such as the mountain lion. During the summer of 1973, one of us (Cornely) saw large cat tracks, probably of this species, in The Bowl. We also received two other reliable reports of mountain lion tracks being seen in The Bowl at other times during the same summer.

The major source of food of this species in the Southwest is mule deer (Davis 1974:134). With the increasing population of this food item in the park, the mountain lion can be expected to continue to include the park within its current distribution as long as there are populations of this cat in areas adjoining the park.

The taxonomic status of mountain lions occurring in the park is somewhat in question. Goldman (1946) in his systematic review of the species assigned specimens from central and southern Hudspeth County to *F. c. stanleyana*. The nearest record to the park was a specimen from 25 mi. north of Van Horn (stated to be in Hudspeth County by Goldman). In this same work Goldman assigned specimens from New Mexico to *F. c. azteca*, including one from Queen in southwestern Eddy County. Davis (1940) assigned the skin that he had examined from Burned Cabin to *F. c. azteca*; however, without stating a reason Davis and Robertson (1944) assigned this same specimen to *F. c. stanleyana*. We tentatively have assigned the mountain lions that occur in the park to *F. c. azteca* because, based upon all reports that we have received, they are entering the park from the north in New Mexico and not from the south. However, documented specimens are needed before this assignment can be made definite.

***Felis rufus baileyi* (Merriam), Bobcat**

Specimen Examined (1).—CULBERSON COUNTY: The Bowl, 1 (TCWC).

The only specimen available from the Guadalupe Mountains is a male collected on 22 June 1939 in The Bowl. However, we had reports and a sighting of bobcats during our work in the area. On 16 August 1973, one of us (Cornely) saw a bobcat cross the road just inside the park in Upper Dog Canyon at 5:00 p.m. Another bobcat wandered into the yard of the ranger in Upper Dog Canyon in the summer of 1973. This individual had numerous porcupine quills embedded in its face and obviously had not eaten for a long time. It died after all efforts to help it failed. The rangers also reported the presence of bobcats in West Dog Canyon. Several bobcats have been trapped in recent years just north of the park in New Mexico according to local ranchers. Bailey in his notes (on file at National Fish and Wildlife Laboratories) indicated that bobcats were common in the mountains and that he saw numerous tracks and a few skins at ranches. Davis (1940:76) found by examination of scats that bobcats in The Bowl were living in late June almost entirely upon small mammals, especially rabbits.

We follow Anderson (1972:386–387) in use of the generic name *Felis* for bobcats previously known under the name *Lynx*. The subspecific name *F. r. baileyi* has been applied to bobcats throughout the southwestern United States and northern Mexico. Cranial measurements of our specimen are as follows: greatest length of skull, 119.5; condylobasal length, 108.3; zygomatic breadth, 83.8; interorbital breadth, 23.9; postorbital breadth, 39.6; mastoid breadth, 55.9; length of maxillary toothrow, 35.6; palatal length, 45.8.

***Cervus elaphus merriami* Nelson, Merriam's Elk**

Specimens Examined.—None.

There are apparently no verified records of the native elk in Texas. However, Bailey (1905) wrote "several old ranchmen have told me, they ranged south to the southern part of the Guadalupe Mountains, across the Texas line. I could not get an actual record of one killed in Texas, or nearer than 6 or 8 miles north of the line. . . ." Later, Bailey (1932), writing about New Mexico, stated "Merriam's elk is now probably extinct; certainly it no longer occurs in New Mexico. Forty years ago it was common in the Sacramento, White, and Guadalupe Mountains east of the Rio Grande. . . ." According to Murie (1951), Merriam's elk ranged through only a few mountain areas of Arizona, New Mexico, and Texas, isolated by surrounding arid lands. We believe that it is relatively safe to include the native elk, *C. e. merriami*, as a member of the mammalian fauna of the Guadalupe Mountains. This subspecies probably became extinct prior to 1900 in the area.

We follow McCullough (1969) in use of the specific name *C. elaphus* for North American elk. We have followed McCullough (1969) and Findley et al. (1975) in considering Merriam's elk to be a subspecies of the more wide-ranging *C. elaphus*. The exact taxonomic status of this elk will never be determined but our arrangement seems most logical to us. *Cervus elaphus merriami* was apparently larger than *C. e. nelsoni* and *C. e. roosevelti*, had more massive antlers, and paler coloration.

***Cervus elaphus nelsoni* Bailey, Rocky Mountain Elk**

Specimen Examined (1).—CULBERSON COUNTY: Upper Dog Ranger Station, 1 (TTU).

Forty-four Rocky Mountain elk were introduced into the Guadalupe Mountains in 1928 (Davis and Robertson 1944). They were imported from the northern Rockies by Judge J. C. Hunter and associates and released in McKittrick Canyon. In 1934 (Wright and Thompson 1934) the herd numbered approximately 60. At that time the elk were concentrated on the slopes of McKittrick Canyon near the streambed and were destroying the vegetation. In 1938 (Davis 1940) the size of the herd was reportedly approximately 400. It is very unlikely that the herd could have increased that rapidly. We estimate the present elk population to be 150 or less.

During our work we observed elk throughout the high country, with the notable exception of the Guadalupe Peak–El Capitan area. They have been sighted in Upper Dog Canyon, West Dog Canyon, Cox Tank, Frijole, Bush Mountains, and The Bowl. In addition to the above areas, Davis (1940) observed elk on Blue Ridge and in McKittrick Canyon.

The Guadalupe elk herd is probably the southernmost free-ranging population of Rocky Mountain elk. Although the ingestion of succulent vegetation provides some water for the elk and mule deer in the Guadalupe, they may be under serious stress from lack of water during the driest months of the year.

In the summer of 1975, two young of the year were observed in Pitchfork Canyon behind Upper Dog Ranger Station. Although this is proof that the elk are successfully reproducing, the status herd is questionable and is currently the subject of intensive study. Although introduced, the elk are a valuable component of the fauna of Guadalupe Mountains National Park. Nothing is more exciting to the back country hiker than the sudden appearance of a magnificent bull elk, which is one reason why the elk is the one mammal that park visitors often ask about.

Odocoileus hemionus crooki (Mearns), Mule Deer

Specimens Examined (7).—CULBERSON COUNTY: McKittrick Canyon, 2 (TCWC); Smith Spring, 1 (TTU); The Bowl, 1 (TCWC); Upper Dog Ranger Station, 3 (TTU).

The mule deer is extremely abundant in the park and its numbers can be expected to continue to increase with protection. The major natural predators of mule deer—mountain lions and wolves—have been greatly reduced in numbers or eliminated from the region. We observed mule deer throughout the park area, but the species was observed most often along the slopes and on top of the mountains in areas of dense brush and trees. Mule deer are browsers; their food habits have been studied extensively in the New Mexico portion of the Guadalupe Mountains (Anderson et al. 1965, 1970; Snyder 1961; Kittams et al. 1977).

All of our specimens are skulls that were picked up from individuals that probably died of natural causes. Davis (1940:84) reported a specimen carrying a near full-term fetus when taken on 27 June. During our work, a fawn was observed watering at the horse corral at the Upper Dog Ranger Station on 29 May.

We follow Cowan (1956:334) in use of the subspecific name *crooki* for mule deer from the park. Mule deer can be distinguished from the white-tailed deer because their antlers fork dichotomously, with prongs being about equal in size, whereas in those of the white-tailed deer the prongs appear to arise vertically from a main beam.

Odocoileus virginianus texanus (Mearns), White-tailed Deer

Specimens Examined.—None.

We know of no scientific specimens of the white-tailed deer from the Guadalupe Mountains National Park. However, Bailey made the following entry in his field notes during his work in the area in 1901 (notes on file with National Bird and Mammal Laboratories, Department of the Interior): "A few white-tail deer are said to be found along the east side of the Guadalupe Mts. but they are rare. A ranchman who had lived in the Mts. for 15 years said he had seen but 3 or 4. No doubt they straggle across from the edge of the Staked Plains where they are common." During our work in the park, mule deer were found to be extremely common but no white-tailed deer were sighted. We can find no justification for the following statement by Davis (1974:257), at least for areas within the park boundaries: ". . . in the Guadalupe Mountains the white-tail occurs almost entirely in the foothills; the mule deer, in the higher mountains." We believe that this species was never abundant in the Guadalupe Mountains and the few individuals present were probably extirpated by hunting pressures by man.

According to Kellogg (1956:35), most of the white-tailed deer in Texas are assignable to the subspecies *O. v. texanus*. We have followed this arrangement.

Antilocapra americana americana (Ord), Pronghorn

Specimen Examined (1).—New Mexico Guadalupe Mountains, at east base of mountains, 1 (USNM).

The only record of a pronghorn from near the park is based upon a skull picked up by Bailey in 1901. Writing about this species in his notes (on file with National Bird and Mammal Laboratories, Department of the Interior), Bailey stated: "A few antelope remain on the plains along the sides of the Guadalupe Mts. and come up on the foothills and in the side valleys. We saw

tracks in Dog Canyon just below our camp. A skull with horns was picked up at the east base of the Mts." Nelson (1925) estimated the pronghorn populations of Culberson and Hudspeth counties to be 75 and 125, respectively, but none was reported from the area of the park. Buechner (1950) plotted the distribution of pronghorns in Trans-Pecos Texas but all herds were from either to the south or to the west of the park. Buechner (1950) also presents detailed ecological and life history data for this species in Trans-Pecos Texas. Evidently, pronghorns, which are basically a grassland species, were never abundant in this area. The species was extirpated from the area probably by hunting pressures or by grazing pressures of cattle.

The specimen is from near the zone of intergradation between *A. a. americana* and *A. a. mexicana*. We have followed Bailey's (1932) assignment of this specimen to the former subspecies. The skull is that of an adult male, with the following measurements: condylobasal length, 275.5; palatal length, 160.5; length of maxillary tooththrow, 70.0; squamosal breadth, 80.7; length of nasals, 107.0; length of horn core, 40.6; breadth of horn core, 23.4.

Bison bison bison (Linnaeus), Bison

Specimens Examined.—None.

According to Allen (1877), the bison did occur in Texas west of the Pecos River but by 1840 they "no longer ranged west of the Pecos River, either in Texas or New Mexico. . . ." Allen (1877:526) reports that on a survey of the area led by Pope in 1854, "Mr. J. H. Byrne, in his diary of the expedition, reports meeting *bois de vache* 'for the first time' at Camp No. 10, near Ojo del Cuerdo, or Salt Lakes, west of the Guadalupe Mountains, and in the Valley of the Rio Grande. This is the only allusion to buffalo or buffalo 'sign' contained in the narrative. . . ." Findley et al. (1975:335) report a specimen from Carlsbad, Eddy County, New Mexico.

We believe that the bison did occur during historical times in the area now occupied by the Guadalupe Mountains National Park, at least at lower elevations where grassland areas were found. The numbers may have never been great and they were probably gone from the area by the middle of the 19th century.

Ovis canadensis mexicana Merriam, Mountain Sheep

Specimens Examined (3).—CULBERSON COUNTY:McKittrick Canyon, Guadalupe Mountains, 2 (USNM); Guadalupe Mountains, 1 (USNM).

Bailey (1905:70–75) reports hunting mountain sheep in the Guadalupe Mountains. The stomachs of two individuals that he shot contained *Cercocarpus parvifolius*, *Philadelphus microphyllus*, common wild onion, and a small amount of grass. Bailey's field notes (on file at the National Bird and Mammal Laboratories, Department of the Interior), written during his work in August 1901, state that: "Mountain sheep are fairly common in the rough part of the range south of Dark Canyon, mainly south of the Texas line. We found where they had been in the head of Dog Canyon and McKittrick, and Mr. Frank who lives in Gunsight Canyon told me that they were common around his place and in Double Canyon. Mr. Frank has lived in these Mts. for about 15 years and has probably killed more sheep than anyone else in the range, merely shooting them when they came in sight of his ranch when he needed meat, never more than 5 at a time, or 2 in warm weather, as he could not use the meat of a greater number. . . . He thinks the sheep have increased and are more numerous now than 15 years ago. He has counted 30 in a band but usually finds them in small bands of 5 to 10, sometimes all old rams, or all ewes and kids, or in mixed bands."

Davis and Taylor (1939) and Davis (1940) estimated that no more than 25 bighorns were in the Guadalupe Mountains in the late 1930s. They had reports of sightings of mountain sheep in 1939 from the east rim of the mountains above Frijole, near El Capitan, north rim of McKittrick Canyon, and west rim of mountains near Guadalupe Peak. Davis (1940) also saw two mounted heads that were from sheep taken in 1909 on Guadalupe Peak. Gross (1960) summarizes records of bighorns in the Guadalupe Mountains between 1940 and 1960. Only a few scattered reports were received during this time.

Mountain sheep no longer occur in the Guadalupe Mountains. The species undoubtedly was eliminated from the area by the activities of man. The exact causes of their extermination are

unknown, but were probably one or a combination of hunting pressures, diseases introduced by domestic sheep, or grazing competition of domestic livestock. Of the three specimens preserved from the Guadalupe Mountains, two are large, adult males with magnificent sets of horns. The other skull is that of a much younger unsexed individual. The Guadalupe Mountains are well within the geographic range of *O. c. mexicana* as currently understood (Hall and Kelson 1959:1031).

Serious consideration should be given to a reintroduction of this unique species to the park. Sighting this magnificent species would be a treat for the backpackers and hikers and the addition of this species would help return the park ecosystem to its original condition. Care should be taken concerning the possible origin of the stock for reintroduction, with the reintroduced stock being most like those that were extirpated. A careful evaluation of the extent and condition of potential mountain sheep habitat must be completed before reintroduction plans are undertaken. Also the potential for spread of disease from domestic sheep to the introduced population must be evaluated.

DISCUSSION

Our field work and survey of the literature indicate that 65 species of mammals have occurred in the area now occupied by the Guadalupe Mountains National Park during historic times. Of the 65 species, 13 species are bats, three rabbits, 29 rodents, 14 carnivores, and six artiodactyls. Another nine species possibly occur or possibly have occurred in the park including *Notiosorex crawfordi*, *Myotis evotis*, *Euderma maculatum*, *Lasiurus borealis*, *Spermophilus mexicanus*, *Tamiasciurus hudsonicus*, *Onychomys leucogaster*, *Vulpes macrotis*, and *Dicotyles tajacu* (an individual, probably from an introduced population, was reportedly sighted in the park).

Extirpated Species

Of the 65 species known from the park, nine are believed to have been extirpated from the area. Most, if not all, of these species have disappeared as the direct result of human activity.

Cynomys ludovicianus.—Bailey (1905) reported prairie dogs to be abundant along the main ridge of the mountains in Dog Canyon, which derived its name from the numerous colonies of this species in the area. Davis (1940) reported scattered "towns" along the eastern edge of the mountains. The species is no longer present in the park although there are colonies in the general area. Prairie dogs were removed from the area by direct human activity through the use of poisons because they were believed to directly compete with cattle for food.

Perognathus hispidus paradoxus.—Only one specimen of this species has been taken from the park area. Hispid pocket mice are primarily grassland inhabitants. The species was probably eliminated from the area by alteration of this habitat either by overgrazing or environmental changes.

Canis lupus monstrabilis.—According to Bailey gray wolves were especially troublesome in the Guadalupe Mountains and were said to kill much stock. One specimen was preserved from the park area. This species was extirpated from the park as the result of predator control activities.

Ursus arctos.—The grizzly bear probably has occurred in the Guadalupe Mountains in the past. The species has been removed from much of its

former geographic range, probably because of its large size and the fact that it does kill some livestock.

Cervus elaphus merriami.—The geographic range of this extinct subspecies of elk once included the Guadalupe Mountains. This subspecies probably was removed by the increasing aridity of the region and hunting pressures.

Odocoileus virginianus texanus.—White-tailed deer were never abundant in the park area and probably were removed by hunting pressure.

Antilocapra americana americana.—Bailey reported seeing pronghorn along the sides of the Guadalupe Mountains and in the foothills. The species was probably never abundant in the area. They probably were eliminated by hunting pressure and habitat alteration.

Bison bison bison.—The bison was probably removed from the area of the park by hunting or environmental change by the middle of the 19th century.

Ovis canadensis mexicana.—Mountain sheep were relatively common in the mountains during Bailey's survey in 1901. Herds of 30 individuals were reported to Bailey by local ranchmen. Davis, in 1940, estimated that no more than 25 bighorns remained in the mountains. Mountain sheep undoubtedly were eliminated from the area by a combination of hunting pressures of man, diseases introduced by domestic sheep, and grazing competition of domestic livestock.

Species Rare in the Park

Five species are rare in their distribution in the Guadalupe Mountains National Park. Four of these five species are confined to the montane regions of the park. This is definitely the most fragile habitat in the park. The montane habitat essentially represents an island that is in dynamic equilibrium with the Chihuahuan Desert and grassland that surrounds it on three sides.

Sylvilagus floridanus robustus.—This is probably the rarest species still occurring in the park. It is evidently confined to the Douglas fir and ponderosa pine stands in The Bowl. The taxon is confined to Chisos, Chinati, Davis, and Guadalupe mountains of Texas. There is evidently no interchange between these populations at this time; therefore, if the population in the Guadalupe Mountains is lost, no natural repopulation would be expected.

Eutamias canipes canipes.—Gray-footed chipmunks are confined to the wooded areas of the higher elevations of the park. This taxon is known only from the Guadalupe Mountains; therefore, its existence must be protected. *E. c. sacramentoensis*, the only other subspecies of this species, is known only from the Sacramento, White, Capitan, and Gallinas mountains of New Mexico, indicating the very restricted distribution of the entire species.

Ammospermophilus interpres.—The Texas antelope ground squirrel occupies a relatively restricted geographic range in northern Mexico, Texas, and New Mexico. Within the park this species occurs in the lower grassland

and desert areas. The species is relatively rare within the park, but extensive areas of its preferred rocky desert habitat are included in the park. However, because these areas will be receiving heavy human impact, the status of this unique species should be monitored in the future.

Thomomys bottae guadalupensis.—This taxon of pocket gopher is endemic to the Guadalupe Mountains. Nowhere did we find this gopher to be abundant. It is distributed primarily in the montane and valley areas, but we did obtain a specimen near Nipple Hill. We believe that this species will be in no real danger as long as its preferred food of lecheguilla remains abundant.

Microtus mexicanus guadalupensis.—This subspecies of the Mexican vole is restricted to the Guadalupe Mountains of Texas and the Manzano, Capitan, and Sacramento mountains in New Mexico. There is no evidence for genetic interchange among these populations at the present time. Although this species is locally abundant in the Guadalupe Mountains National Park, it is restricted to open montane meadows. Because this habitat is limited in the park and subject to heavy human usage, the status of the Mexican vole and its habitat will need continued monitoring.

Mammalian Faunal Relationships within the Park

Within the park, we recognize four mammalian distributional zones (Fig. 7). These are based upon major vegetational types (Gehlbach 1967, undated; Warnock undated) and the distribution of some indicator species of mammals. For a species to be a good indicator, it should be relatively abundant and its distribution should be restricted, or nearly so, to the zone for which it is an indicator. The four zones that we recognize and their indicator species of mammals are as follows: desert—*Dipodomys merriami*, *D. spectabilis*, *Spermophilus spilosoma*, *Onychomys torridus*, and *Neotoma micropus*; grassland—*Perognathus hispidus*, *Sigmodon hispidus*, and *Reithrodontomys megalotis*; riparian woodland—*Procyon lotor*; montane—*Sylvilagus floridanus*, *Peromyscus boylii*, *Neotoma mexicana*, and *Microtus mexicanus*.

The grassland habitat was found to contain the most mammalian species (41) and the montane the least with 27 (Table 1). The number of mammalian species shared between habitats is shown in the upper portion of Table 1. The highest Burt Coefficient of Similarity between habitats was between the Montane and Riparian Woodland. The Grassland Zone had a relatively high coefficient with all habitats. The lowest coefficient was between the Montane and Desert zones which share only eight mammalian species. Clustering of the Burt Coefficients (Fig. 8) using the Unweighted Pair Group Method Using Arithmetic Means groups Desert and Grassland mammalian faunas together and the Riparian Woodland clusters closely with the Montane.

These results indicate that the Desert and Montane mammalian faunas are quite distinct. The Grassland mammalian fauna seems to be transitional

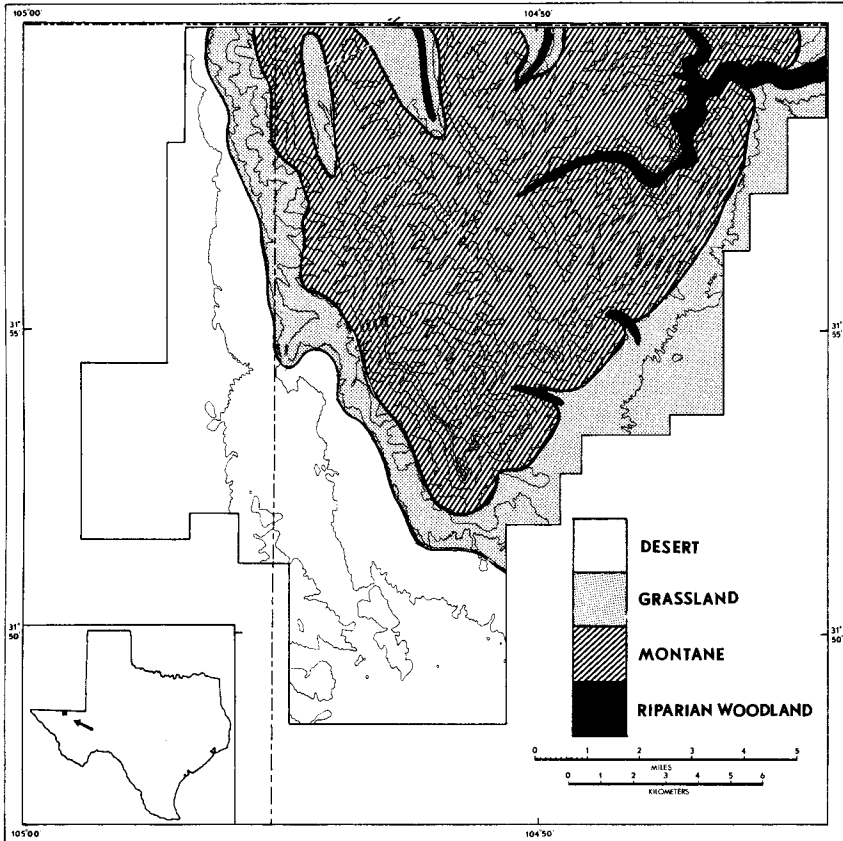


Fig. 7. Mammalian distributional zones in the Guadalupe Mountains National Park, Texas. See text for discussion.

TABLE 1. Similarity of mammalian faunas occurring in the four mammalian distributional zones recognized in the Guadalupe Mountains National Park, Texas. Boldface numbers on the diagonal represent the total number of mammalian species occurring in each zone. The numbers above the diagonal represent the number of species shared between zones, whereas the numbers below the diagonal represent the Burt Coefficients of Similarity between the zones.

Distributional Zone	Desert	Grassland	Riparian woodlands	Montane
Desert	31	24	12	8
Grassland	67	41	24	18
Riparian Woodland	39	67	31	22
Montane	28	53	76	27

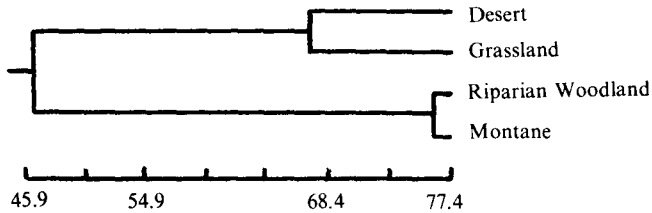


Fig. 8. Phenogram resulting from the clustering (Unweighted Pair Group Method Using Arithmetic Means) of Burt Coefficients of Similarity among mammalian distributional zones as given in Table 1.

between that of the Desert and Montane-Riparian Woodland faunas. This would account for high number of species in the grasslands and high coefficients with all other faunas. However, we have chosen to recognize this zone because there are some mammalian species which are limited to the grassland and would probably be eliminated from the park if the Grasslands are eliminated. The Montane and Riparian Woodland mammalian faunas are the most similar. This is reasonable because the habitats are in close geographic proximity and both represent relatively mesic habitats.

It is the Montane mammalian fauna that gives the Guadalupe Mountains National Park its unique character. Several species present in this area are at, or near, the southern limit of their distribution and represent a southern attenuation of the Rocky Mountain fauna of New Mexico. This montane island at the edge of the Chihuahuan Desert, and in dynamic equilibrium with it, is one reason that park was preserved and is the reason that a sound management plan must be developed and followed for the park.

Comparisons of Mammalian Faunas from Guadalupe Mountains National Park with those from Other Geographic Areas

We compared the mammalian fauna of the Guadalupe Mountains National Park with other specific areas from which we believe a relatively complete mammalian fauna is known. We chose areas within the same geographic region as the Guadalupe Mountains as follows (references in parentheses are those used to develop the faunal list given in Table 2): Big Bend National Park, Texas (Borell and Bryant 1942; Easterla 1973a, 1973b); Sierra Vieja Mountains, Texas (Blair and Miller 1949; specimens in collection at Texas Tech University); Davis Mountains, Texas (Blair 1940; specimens in collection at Texas Tech University); northwestern Chihuahua, Mexico (Anderson 1972); Sacramento Mountains, above 5000 ft, New Mexico (Findley et al. 1975); Tularosa Basin below 5000 ft, New Mexico (Blair 1941; Findley et al. 1975); Lubbock County, Texas (Bailey 1905; Davis 1974; specimens in collection at Texas Tech University). The Big Bend National Park, Sierra Vieja Mountains, and Davis Mountains represent

TABLE 2. Species of mammals occurring in selected geographic areas of Texas, New Mexico, and Chihuahua. A plus sign indicates that the species has been recorded from the given area. Records are taken from literature cited in text and specimens deposited in The Museum of Texas Tech University.

Species	Guadalupe Mountains National Park	Big Bend National Park	Sierra Vieja Mountains, Texas	Davis Mountains, Texas	Northwestern Chihuahua, Mexico	Sacramento Mountains, New Mexico	Tularosa Basin, New Mexico	Lubbock County, Texas
<i>Didelphis virginiana</i>		+						+
<i>Notiosorex crawfordi</i>		+		+				+
<i>Cryptotis parva</i>								+
<i>Sorex nanus</i>						+		
<i>Sorex vagrans</i>						+		
<i>Mormoops megalophylla</i>		+	+	+				
<i>Leptoncyteris nivalis</i>		+						
<i>Myotis auriculus</i>					+			
<i>Myotis californicus</i>	+	+	+		+		+	
<i>Myotis leibii</i>	+	+	+	+	+			
<i>Myotis lucifugus</i>					+	+		
<i>Myotis thysanodes</i>	+	+	+	+	+	+		
<i>Myotis velifer</i>	+	+	+	+	+			
<i>Myotis volans</i>	+	+	+	+	+	+	+	
<i>Myotis yumanensis</i>		+	+	+	+			
<i>Pipistrellus hesperus</i>	+	+	+	+	+	+		
<i>Lasiurus borealis</i>			+	+	+			+
<i>Lasiurus cinereus</i>	+	+	+	+	+	+		+
<i>Lasionycteris noctivagans</i>	+			+		+		+
<i>Eptesicus fuscus</i>	+	+	+	+	+	+		
<i>Plecotus phyllotis</i>					+			
<i>Plecotus townsendii</i>	+	+	+		+	+		
<i>Euderma maculatum</i>		+						
<i>Antrozous pallidus</i>	+	+	+	+	+		+	
<i>Tadarida brasiliensis</i>	+	+	+	+	+	+	+	+
<i>Tadarida femorosacca</i>		+						
<i>Tadarida macrotis</i>	+	+	+	+		+	+	
<i>Eumops perotis</i>		+						
<i>Sylvilagus audubonii</i>	+	+	+	+	+		+	+
<i>Sylvilagus floridanus</i>	+	+	+	+	+	+		+
<i>Lepus californicus</i>	+	+	+	+	+		+	+
<i>Lepus collotis</i>					+			
<i>Eutamias canipes</i>	+					+		
<i>Eutamias dorsalis</i>					+			
<i>Eutamias minimus</i>						+		
<i>Ammospermophilus interpres</i>	+	+	+				+	
<i>Spermophilus mexicanus</i>		+		+				
<i>Spermophilus spilosoma</i>	+	+		+	+		+	+
<i>Spermophilus tridecemlineatus</i>						+		+

TABLE 2. (continued)

Species	Guadalupe Mountains National Park	Big Bend National Park	Sierra Vieja Mountains, Texas	Davis Mountains, Texas	Northwestern Chihuahua Mexico	Sacramento Mountains, New Mexico	Tularosa Basin, New Mexico	Lubbock County, Texas
<i>Spermophilus variegatus</i>	+	+	+	+	+	+	+	
<i>Cynomys ludovicianus</i>	+		+	+			+	+
<i>Tamiasciurus hudsonicus</i>						+		
<i>Sciurus nayaritensis</i>					+			
<i>Thomomys bottae</i>	+	+	+	+		+	+	
<i>Thomomys umbrinus</i>					+			
<i>Pappogeomys castanops</i>	+	+	+	+		+	+	+
<i>Geomys arenarius</i>							+	
<i>Geomys bursarius</i>								+
<i>Castor canadensis</i>		+				+		
<i>Perognathus flavescens</i>							+	
<i>Perognathus flavus</i>	+	+	+	+	+		+	+
<i>Perognathus hispidus</i>	+			+	+		+	+
<i>Perognathus intermedius</i>	+				+		+	
<i>Perognathus nelsoni</i>		+	+	+				
<i>Perognathus penicillatus</i>	+	+	+	+	+		+	
<i>Dipodomys merriami</i>	+	+	+	+	+		+	
<i>Dipodomys nelsoni</i>					+			
<i>Dipodomys ordii</i>	+	+		+	+		+	+
<i>Dipodomys spectabilis</i>	+		+	+	+		+	
<i>Reithrodontomys fulvescens</i>		+		+	+			
<i>Reithrodontomys megalotis</i>	+		+	+	+	+	+	+
<i>Reithrodontomys montanus</i>				+	+			+
<i>Peromyscus boylii</i>	+	+		+	+	+		
<i>Peromyscus difficilis</i>	+					+	+	
<i>Peromyscus eremicus</i>	+	+	+	+	+		+	
<i>Peromyscus leucopus</i>	+	+		+	+		+	+
<i>Peromyscus maniculatus</i>	+	+	+	+	+	+	+	+
<i>Peromyscus pectoralis</i>	+	+	+	+				
<i>Peromyscus truei</i>	+					+	+	
<i>Baiomys taylori</i>					+			
<i>Onychomys leucogaster</i>				+	+	+	+	+
<i>Onychomys torridus</i>	+	+		+	+		+	
<i>Sigmodon fulviventer</i>					+			
<i>Sigmodon hispidus</i>	+			+	+		+	+
<i>Sigmodon ochrognathus</i>		+	+	+				
<i>Neotoma albigula</i>	+	+	+	+	+	+	+	+
<i>Neotoma mexicana</i>	+			+	+	+		
<i>Neotoma micropus</i>	+	+	+	+			+	+
<i>Microtus longicaudus</i>						+		
<i>Microtus mexicanus</i>	+					+		
<i>Zapus princeps</i>						+		

TABLE 2. (continued)

Species	Guadalupe Mountains National Park	Big Bend National Park	Sierra Vieja Mountains, Texas	Davis Mountains, Texas	Northwestern Chihuahua, Mexico	Sacramento Mountains, New Mexico	Tularosa Basin, New Mexico	Lubbock County, Texas
<i>Erethizon dorsatum</i>	+	+	+	+	+	+	+	+
<i>Canis latrans</i>	+	+	+	+	+	+	+	+
<i>Canis lupus</i>	+	+		+		+		
<i>Urocyon cinereoargenteus</i>	+	+	+	+	+	+		+
<i>Vulpes macrotis</i>		+		+	+		+	
<i>Vulpes velox</i>								+
<i>Vulpes vulpes</i>								+
<i>Ursus americanus</i>	+	+		+		+		
<i>Ursus arctos</i>	+			+	+			
<i>Bassariscus astutus</i>	+	+	+	+		+		
<i>Procyon lotor</i>	+	+	+	+	+	+		+
<i>Mustela frenata</i>	+					+		+
<i>Spilogale putorius</i>	+	+	+	+	+		+	+
<i>Mephitis macroura</i>		+	+	+	+			
<i>Mephitis mephitis</i>	+	+	+	+	+		+	+
<i>Conepatus mesoleucus</i>	+	+	+	+				
<i>Taxidea taxus</i>	+	+	+	+	+			+
<i>Felis concolor</i>	+	+	+	+	+	+	+	
<i>Felis rufus</i>	+	+	+	+	+	+	+	+
<i>Odocoileus hemionus</i>	+	+	+	+	+	+	+	
<i>Odocoileus virginianus</i>	+	+		+	+	+		+
<i>Cervus elaphus</i>	+							
<i>Dicotyles tajacu</i>		+	+	+				
<i>Antilocapra americana</i>	+	+	+	+	+			+
<i>Bison bison</i>	+			+	+			+
<i>Ovis canadensis</i>	+	+			+			

other mountain ranges in Trans-Pecos Texas. Northwestern Chihuahua is a part of the Chihuahuan Desert south of the Rio Grande. The Tularosa Basin is a low-lying desert region which is a northern extension of the Chihuahuan Desert and contains the White Sands National Monument. The Sacramento Mountains are the southern extension of the Rocky Mountains in New Mexico which most closely approaches the Guadalupe Mountains. Lubbock County, Texas, is located in the southern Great Plains.

The total mammalian fauna of the Guadalupe Mountains National Park shows the highest similarity with that occurring in the Davis Mountains, Texas (Table 3). High similarity is also shown to the total mammalian fauna

TABLE 3. Similarity of the total mammalian faunas occurring in eight selected geographic areas of Texas, New Mexico, and Chihuahua. Boldface numbers on the diagonal represent the total number of mammalian species occurring in each area. The numbers above the diagonal represent the number of species shared between areas, whereas the numbers below the diagonal represent the Burt Coefficients of Similarity between the area.

Geographic Areas	Guadalupe Mountains National Park, Texas	Big Bend National Park, Texas	Sierra Vieja Mountains, Texas	Davis Mountains, Texas	Northwestern Chihuahua, Mexico	Sacramento Mountains, New Mexico	Tularosa Basin, New Mexico	Lubbock County, Texas
Guadalupe Mountains National Park, Texas	65	49	43	53	47	34	37	30
Big Bend National Park, Texas	0.77	65	45	55	43	28	31	25
Sierra Vieja Mountains, Texas	0.76	0.78	50	47	37	23	28	22
Davis Mountains, Texas	0.80	0.83	0.80	67	50	29	35	33
Northwestern Chihuahua, Mexico	0.73	0.67	0.65	0.76	64	24	31	28
Sacramento Mountains, New Mexico	0.62	0.51	0.49	0.52	0.44	44	17	17
Tularosa Basin, New Mexico	0.70	0.58	0.63	0.64	0.58	0.40	42	22
Lubbock County, Texas	0.57	0.48	0.49	0.62	0.54	0.40	0.54	40

of the Big Bend National Park and Sierra Vieja Mountains, Texas. Intermediate similarity values were obtained with northwestern Chihuahua and the Tularosa Basin, New Mexico, and the lowest similarity values were found to be with the mammalian faunas of the Sacramento Mountains, New Mexico, and Lubbock County, Texas. A clustering of the similarity coefficients (Fig. 9) shows the four Trans-Pecos mountain ranges in one cluster, with the Guadalupe Mountains National Park being the most distinct of the group. The remaining four geographic areas form a series with decreasing similarity to these mountains—northwestern Chihuahua, Tularosa Basin, Lubbock County, and Sacramento Mountains.

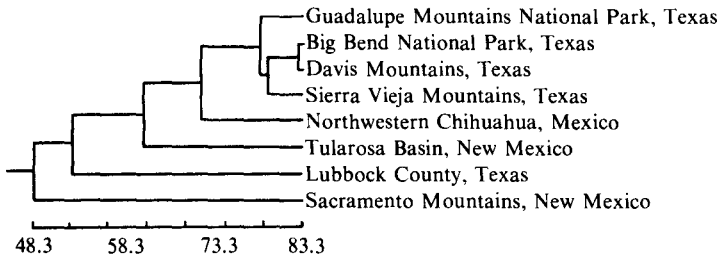


Fig. 9. Phenogram resulting from the clustering (UPGMA) of Burt Coefficients of Similarity among the total mammalian faunas of selected geographic areas in Texas, New Mexico, and Chihuahua as given in Table 3.

These results indicate that the total mammalian fauna of the Guadalupe Mountains National Park should be considered most closely related to that of other montane regions of Trans-Pecos Texas. The mammalian fauna is most distinct from those of the Sacramento Mountains and Lubbock County but 23 and 30 species, respectively, are shared between these areas and the Guadalupe Mountains National Park.

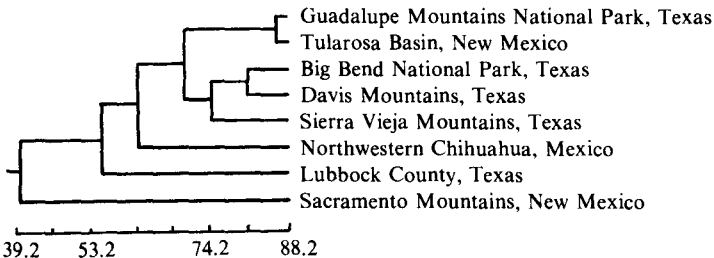


Fig.10. Phenogram resulting from the clustering (UPGMA) of Burt Coefficients of Similarity among the rodent faunas of selected geographic areas in Texas, New Mexico, and Chihuahua as given in Table 4.

TABLE 4. Similarity of rodent faunas occurring in eight selected geographic areas of Texas, New Mexico, and Chihuahua. Boldface numbers on the diagonal represent the total number of rodent species occurring in each area. The numbers above the diagonal represent the number of rodent species shared between areas, whereas the numbers below the diagonal represent the Burt Coefficients of Similarity between areas.

Geographic Areas	Guadalupe Mountains National Park, Texas	Big Bend National Park, Texas	Sierra Vieja Mountains, Texas	Davis Mountains, Texas	Northwestern Chihuahua, Mexico	Sacramento Mountains, New Mexico	Tularosa Basin, New Mexico	Lubbock County, Texas
Guadalupe Mountains National Park, Texas	29	18	16	23	19	13	24	13
Big Bend National Park, Texas	0.69	23	15	21	14	8	16	9
Sierra Vieja Mountains, Texas	0.68	0.78	18	17	10	7	15	8
Davis Mountains, Texas	0.79	0.81	0.72	29	21	10	21	15
Northwestern Chihuahua, New Mexico	0.67	0.55	0.43	0.74	28	8	18	12
Sacramento Mountains, New Mexico	0.53	0.37	0.37	0.41	0.33	20	10	7
Tularosa Basin, New Mexico	0.86	0.64	0.67	0.75	0.65	0.43	27	14
Lubbock County, Texas	0.57	0.45	0.46	0.65	0.53	0.38	0.64	17

TABLE 5. Species of mammals occurring in the Guadalupe Mountains National Park, Texas, listed according to faunal units as described by Hoffmann and Jones (1970:364-365).

Southwest species (26)	
<i>Myotis californicus</i>	<i>Perognathus penicillatus</i>
<i>Myotis thysanodes</i>	<i>Dipodomys merriami</i>
<i>Myotis velifer</i>	<i>Dipodomys spectabilis</i>
<i>Pipistrellus hesperus</i>	<i>Reithrodontomys megalotis</i>
<i>Antrozous pallidus</i>	<i>Peromyscus boylii</i>
<i>Sylvilagus audubonii</i>	<i>Peromyscus difficilis</i>
<i>Lepus californicus</i>	<i>Peromyscus eremicus</i>
<i>Ammospermophilus interpres</i>	<i>Peromyscus pectoralis</i>
<i>Spermophilus spilosoma</i>	<i>Peromyscus truei</i>
<i>Spermophilus variegatus</i>	<i>Onychomys torridus</i>
<i>Pappogeomys castanops</i>	<i>Neotoma albigula</i>
<i>Perognathus flavus</i>	<i>Bassariscus astutus</i>
<i>Perognathus intermedius</i>	<i>Conepatus mesoleucus</i>
Montane species (7)	
<i>Myotis volans</i>	<i>Neotoma mexicana</i>
<i>Plecotus townsendii</i>	<i>Microtus mexicanus</i>
<i>Eutamias canipes</i>	<i>Ovis canadensis</i>
<i>Thomomys bottae</i>	
Steppe species (4)	
<i>Cynomys ludovicianus</i>	<i>Dipodomys ordii</i>
<i>Perognathus hispidus</i>	<i>Neotoma micropus</i>
Southern species (3)	
<i>Tadarida brasiliensis</i>	<i>Sigmodon hispidus</i>
<i>Tadarida macrotis</i>	
Deciduous forest species (2)	
<i>Sylvilagus floridanus</i>	<i>Peromyscus leucopus</i>
Widespread species (23)	
<i>Myotis leibii</i>	<i>Mustela frenata</i>
<i>Eptesicus fuscus</i>	<i>Spilogale putorius</i>
<i>Lasiurus cinereus</i>	<i>Mephitis mephitis</i>
<i>Lasionycteris noctivagans</i>	<i>Taxidea taxus</i>
<i>Peromyscus maniculatus</i>	<i>Felis concolor</i>
<i>Erethizon dorsatum</i>	<i>Felis rufus</i>
<i>Canis latrans</i>	<i>Odocoileus hemionus</i>
<i>Canis lupus</i>	<i>Odocoileus virginianus</i>
<i>Urocyon cinereoargenteus</i>	<i>Cervus elaphus</i>
<i>Ursus americanus</i>	<i>Antilocapra americana</i>
<i>Ursus arctos</i>	<i>Bison bison</i>
<i>Procyon lotor</i>	

We also compared these same geographic areas using only their rodent faunas. Rodents may be somewhat better indicators of faunal resemblance

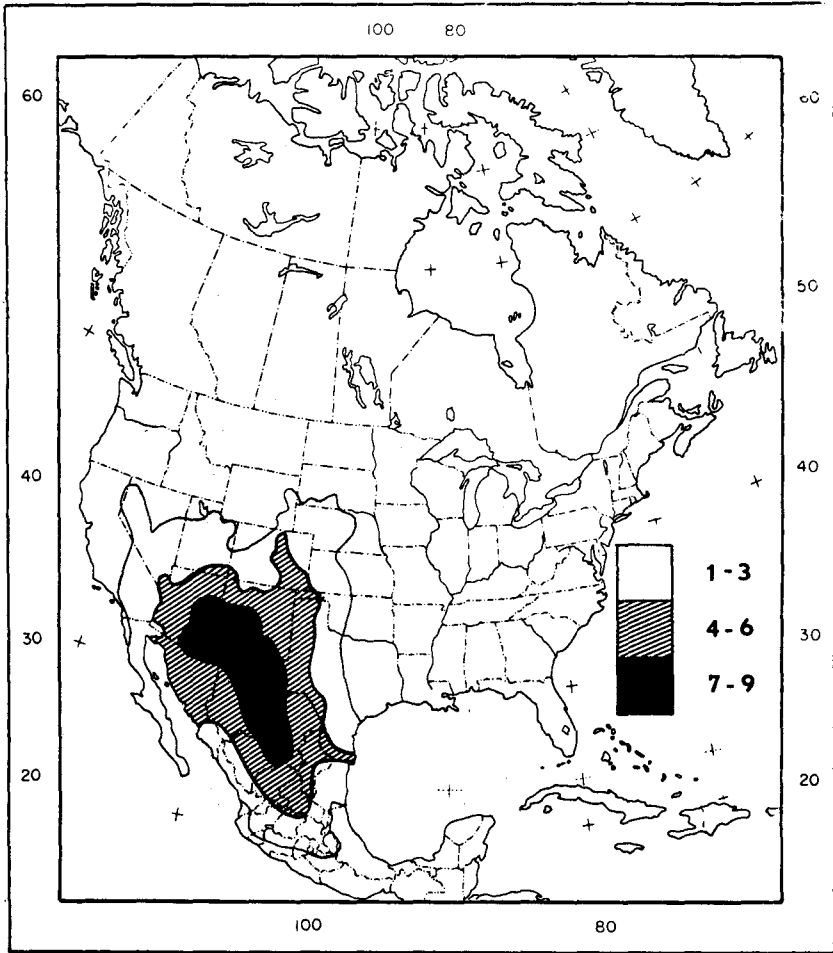


Fig. 11. Superimposed geographic distributions of sciurid, heteromyid, and geomyid rodents with affinities to the Southwest that occur in the Guadalupe Mountains National Park.

because they are less vagile, are highly affected by the environment, and generally do not have widespread geographic ranges. This changes the relationships among the areas slightly. The rodent fauna of the Guadalupe Mountains National Park shows the highest similarity to the rodent fauna of the Tularosa Basin (Table 4). The Tularosa Basin is a desert area lying to the northwest of the lowland areas of the western portion of the park. Similarity remains high with the Davis Mountains.

Intermediate similarity values were obtained between the rodent faunas of the Big Bend National Park, Sierra Vieja Mountains, and northwestern

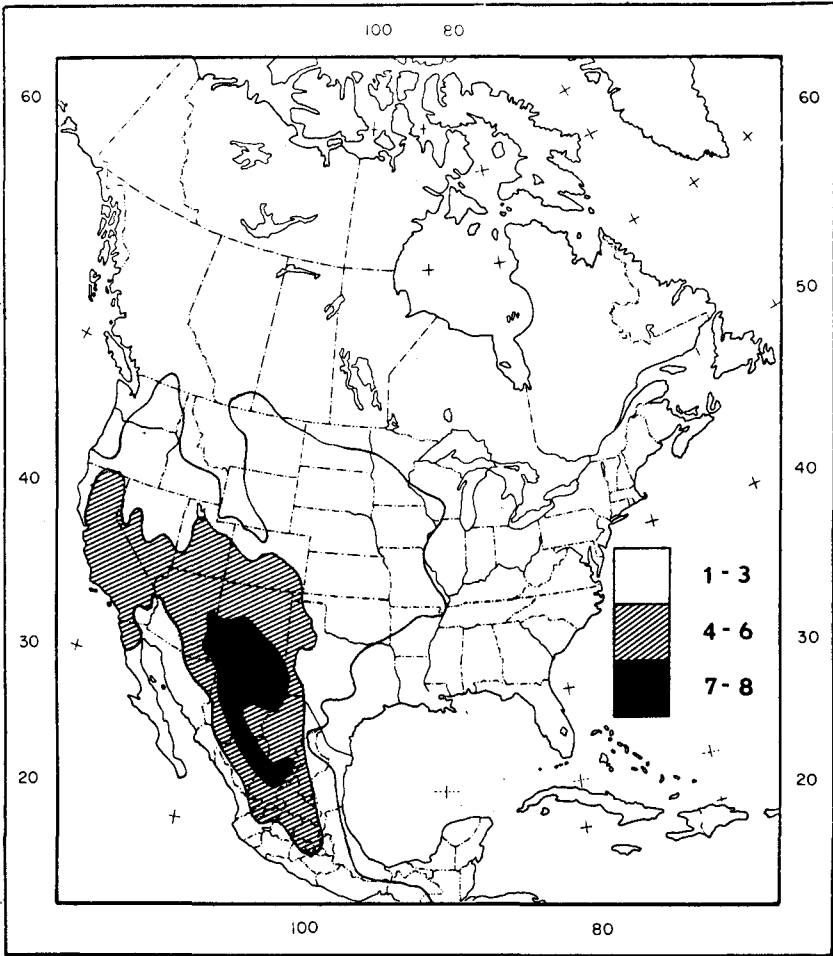


Fig. 12. Superimposed geographic distributions of cricetid rodents with affinities to the Southwest that occur in the Guadalupe Mountains National Park.

Chihuahua. These more southern areas lack montane and grassland forms such as *Microtus mexicanus* and *Eutamias canipes* that are present in the park and the Guadalupe Mountains National Park lacks southern arid-adapted species such as *Perognathus nelsoni*. The lowest similarity coefficients were obtained with the Sacramento Mountains, which lacks the desert species, and Lubbock County, which lacks the desert and montane species.

Clustering of these similarity values for the rodent fauna (Fig. 10) shows the Guadalupe Mountains closely clustered with the Tularosa Basin and in a major cluster with the three Trans-Pecos mountain ranges (Big Bend National Park, Davis Mountains, and Sierra Vieja Mountains). This cluster

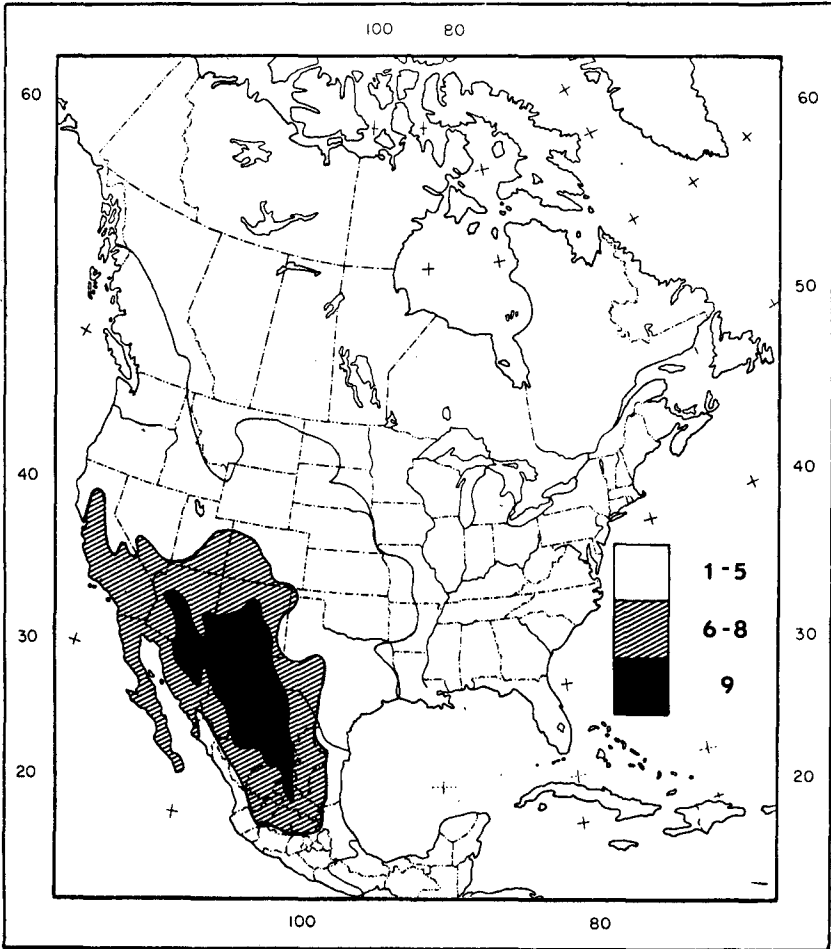


Fig. 13. Superimposed geographic distributions of chiropterans, lagomorphs, and carnivores with affinities to the Southwest that occur in the Guadalupe Mountains National Park.

is progressively further from rodent faunas of the other three areas—northwestern Chihuahua, Lubbock County, and Sacramento Mountains.

The Guadalupe Mountains National Park's rodent fauna is dominated by desert-adapted species; however, it does contain some unique species. The total rodent fauna shows a rather distant relationship to a true grassland rodent fauna and even less with a true montane rodent fauna.

The 65 species of mammals native to the Guadalupe Mountains National Park discussed in this account are from six faunal units (Table 5) as described by Hoffmann and Jones (1970:364–365). The faunal units represented are

Southwest (26 species), Montane (7), Steppe (4), South (3), Deciduous Forest (2), and Widespread Species (23). Widespread Species are those with broad geographic ranges and are of little value in determining the relationships of a fauna.

Figures 11-13 show the superimposed geographic ranges of the species believed to have Southwestern affinities. The sciurid, heteromyid, and geomyid rodents occurring in the park have a center of distribution in the Chihuahuan and eastern portion of the Sonoran deserts. The cricetid rodents of the park are centered basically on the Chihuahuan Desert and the

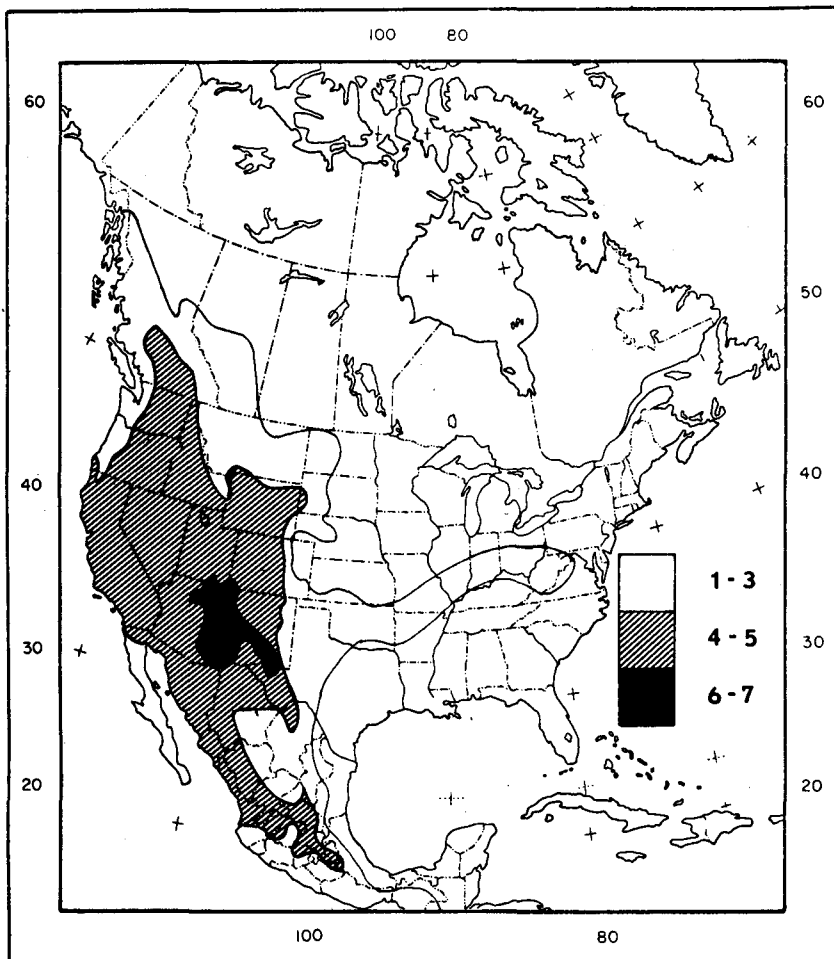


Fig. 14. Superimposed geographic distributions of mammals with montane affinities that occur in the Guadalupe Mountains National Park.

nonrodent species center on the Chihuahuan and eastern Sonoran deserts. The seven montane species shown in Fig. 14 have a center of distribution that includes the southern Rocky Mountains and southwestern desert ranges. Although these are animals from high elevations, they represent primarily the southwestern extension of this faunal unit. The four Steppe species from the park (Fig. 15) have a distributional center on the southern Great Plains and northern Chihuahuan Desert. In the desert regions, these species are occurring basically in desert grasslands as we have seen in the park.

The species of mammals from the South are basically tropical and sub-

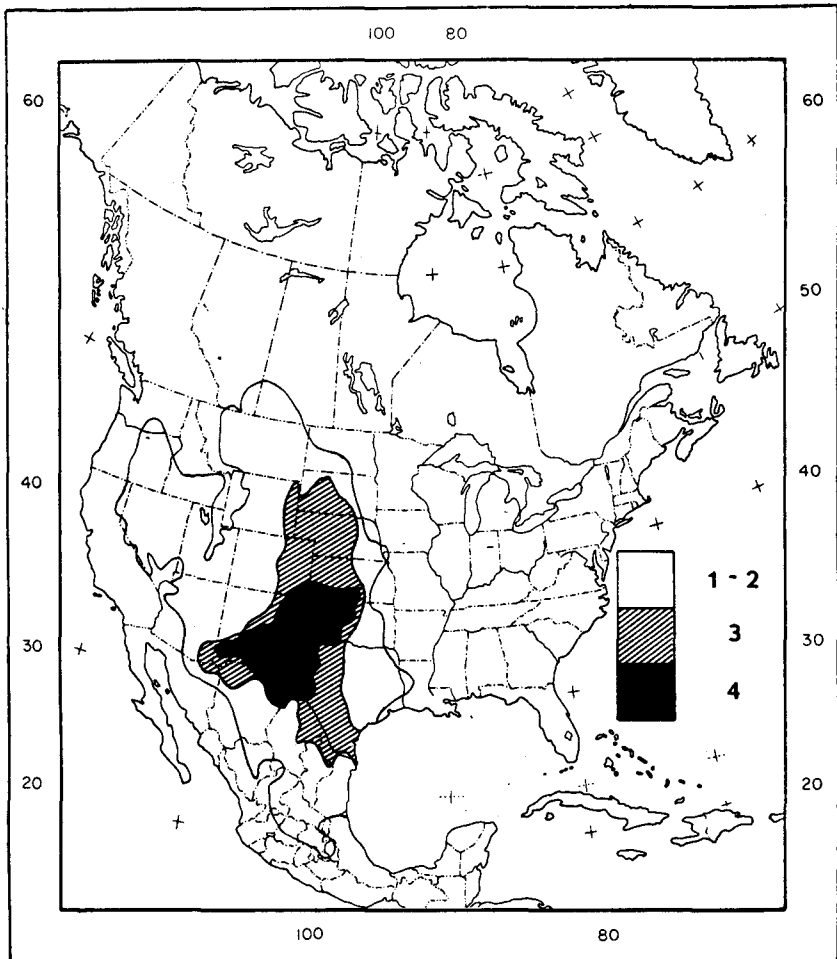


Fig. 15. Superimposed geographic distributions of mammals with Steppe affinities that occur in the Guadalupe Mountains National Park.

tropical in distribution. The two species of *Tadarida* are migratory and occur in the park only during the summer months; they overwinter in central Mexico or farther south. The hispid cotton rat is a species that is still expanding its geographic range northward. The two species with affinities to the deciduous forest (*Sylvilagus floridanus* and *Peromyscus leucopus*) have relatively wide ranges but almost always occur in forested areas.

The mammalian fauna of Guadalupe Mountains National Park is predominately Southwestern in affinities, with the Chihuahuan Desert forms being the chief component. The montane faunal unit, although third in number of species (seven), contains relatively few of the total mammalian species in the park. However, it was for the preservation of this unique faunal component, which occupies a mountaintop island, for which the Guadalupe Mountains National Park was established.

Recommendations

This survey must be considered as a starting point, which supplies baseline data, and is not an end in itself. With this in mind, we have submitted the following recommendations to the National Park Service for future work and development of the park.

1. An inventory of the larger mammals in the park should be undertaken. These animals (such as the elk, mule deer, bear, coyote, bobcat, mountain lion, and fox) have an important role in the ecosystem. It is essential to the success of resource management in the park that more information is gathered concerning these animals.

2. It is essential that the status of the elk herd be fully investigated. Knowledge of their food habits, age structure of the herd, reproductive success, herd movements, and water stress is needed.

3. A program of continuous monitoring of mammalian populations with scheduled periodic censuses should be established. A combination of grid trapping supplemented with general trapping with live traps is recommended for detecting population trends in small mammals. For monitoring the larger mammals a combination of aerial census, field observations, and fecal pellet group analysis could be used. The following sites are recommended for periodic censusing: Upper Dog Canyon Ranger Station; The Bowl; Nipple Hill; Pratt Lodge—McKittrick Canyon; entrance to Williams Ranch Road; Lewis Well; Crossroads at the north end of the Patterson Hills.

4. Special efforts must be made during census procedures to monitor the status of the species that are rare in the park: *Microtus mexicanus guadalupensis*; *Sylvilagus floridanus robustus*; *Thomomys bottae guadalupensis*; *Eutamias canipes canipes*; *Ammospermophilus interpres*. Careful monitoring of these mammals may prevent their loss from the park.

5. The grid now established in Upper Dog Canyon should be made permanent. Additional permanent population grids should be established at the following sites: The Bowl; between Nipple Hill and Choza Spring or Pine Springs Canyon; Williams Ranch House; Lewis Well. Periodic live trapping

on these grids would yield much valuable data and detect population trends.

6. The following areas are considered to be the most biologically significant from the standpoint of mammals in Guadalupe Mountains National Park: Upper Dog Canyon; The Bowl; Nipple Hill area; Lewis Well; McKittrick Canyon; every spring and waterhole in the park.

7. The zones of contact between *Neotoma albigula* and *N. mexicana* in Upper Dog Canyon and between *N. albigula* and *N. micropus* north of the Patterson Hills should be monitored periodically to note any shifts in the zones. Such shifts may indicate changing environmental conditions.

8. Data from periodic censuses should be used to test the computer model under development for remote sensing of the park. Remote sensing should prove especially useful in the monitoring of vole habitat.

9. A special effort should be made to determine if the following mammals occur within the park boundaries: *Notiosorex crawfordi*; *Myotis evotis*; *Euderma maculatum*; *Lasiurus borealis*; *Spermophilus mexicanus*; *Tamiasciurus hudsonicus*; *Onychomys leucogaster*; *Vulpes macrotis*; *Dicotyles tajacu*.

10. High priority should be given to repairing or rebuilding the boundary fences on the south and west sides of the park. During the mammal survey, a large number of cattle have been observed within the park boundaries. The number of trespassing cattle has increased in the last two years and they have recently been observed at the west base of the Guadalupe escarpment. This area of the park recovers from grazing very slowly in the total absence of livestock; therefore, it is imperative that the fences be repaired and the cattle removed.

11. One of the real joys for tourists, especially children, is seeing deer and other wildlife at Pine Springs Campground and Upper Dog Canyon campsite. Several times we have observed unleashed dogs chasing deer and other mammals away. Every effort should be made to enforce the existing leash law at the park. A little thoughtfulness on the part of pet owners will allow everyone to share the experience of viewing some of the park's wildlife. This is not a criticism of the current park personnel as we have observed them enforcing the leash laws. Perhaps, pets should be excluded from the park. If people want to take their pets on vacation, they can stay at private campgrounds and leave their pets there while visiting the National Park.

12. Most of the endangered species that occur in Guadalupe Mountains National Park probably occur in Carlsbad Caverns National Park as well. We would strongly recommend that a mammal survey be conducted in Carlsbad Caverns National Park. This research would provide valuable information which should be included in the final environmental statement for the master plan proposed for Carlsbad Caverns National Park. If the endangered species are present in Carlsbad Caverns National Park, a management program consistent in both parks could be developed which would increase the possibilities of preserving the species for future generations.

LITERATURE CITED

- ALLEN, L. A. 1877. History of the American bison, *Bison americanus*. *Annu. Rep. U.S. Geol. Surv. for 1875* 9:443-590.
- ANDERSON, A. E., W. A. SNYDER, and G. W. BROWN. 1965. Stomach content analyses related to condition in mule deer, Guadalupe Mountains, New Mexico. *J. Wildl. Manage.* 29:352-366.
- . 1970. Indices of reproduction and survival in female mule deer, Guadalupe Mountains, New Mexico. *Southwest. Nat.* 15:29-36.
- ANDERSON, S. 1972. Mammals of Chihuahua: taxonomy and distribution. *Bull. Am. Mus. Nat. Hist.* 148:149-410.
- AUGUST, P. V., J. W. CLARKE, M. H. MCGAUGH, and R. L. PACKARD. 1977. Demographic patterns of small mammals: a possible use in impact assessment. This volume.
- BAILEY, V. 1902a. Synopsis of the North American species of *Sigmodon*. *Proc. Biol. Soc. Wash.* 15:101-116.
- . 1902b. Seven new mammals from western Texas. *Proc. Biol. Soc. Wash.* 15:117-120.
- . 1905. Biological survey of Texas. *North Am. Fauna* 25:1-222.
- . 1932. Mammals of New Mexico. *North Am. Fauna* 53:1-412.
- BAILEY, V., and C. C. SPERRY. 1929. Life history and habits of the grasshopper mice, genus *Onychomys*. *U.S. Dep. Agric., Tech. Bull.* 145:1-19.
- BAKER, R. J. 1970. Karyotypic trends in bats. Pages 65-96 in W. A. Wimsatt, ed. *Biology of Bats*, Academic Press, New York, 406 pp.
- BARBOUR, R. W., and W. H. DAVIS. 1969. *Bats of America*. Univ. Press Kentucky, Lexington, 286 pp.
- BIRNEY, E. C. 1973. Systematics of three species of woodrats (genus *Neotoma*) in central North America. *Misc. Publ. Mus. Nat. Hist., Univ. Kans.* 58:1-173.
- BLAIR, W. F. 1940. A contribution to the ecology and faunal relationships of the mammals of the Davis Mountains region, southwestern Texas. *Misc. Publ. Mus. Zool., Univ. Mich.* 46:1-39.
- . 1941. Annotated list of mammals of the Tularosa Basin, New Mexico. *Am. Midl. Nat.* 26:218-229.
- BLAIR, W. F., and C. E. MILLER, JR. 1949. The mammals of the Sierra Vieja region, southwestern Texas, with remarks on the biogeographic position of the region. *Tex. J. Sci.* 1:67-92.
- BOGAN, M. A. 1975. Geographic variation in *Myotis californicus* in the southwestern United States and Mexico. *Wildl. Res. Rep., Fish and Wildlife Serv.* 3:1-31.
- BORELL, A. E., and M. D. BRYANT. 1942. Mammals of the Big Bend area of Texas. *Univ. Calif. Publ. Zool.* 48:1-62.
- BUECHNER, H. K. 1950. Life history, ecology, and range use of the pronghorn antelope in Trans-Pecos Texas. *Am. Midl. Nat.* 43:257-354.
- COCKRUM, E. L. 1969. Migration in the guano bat, *Tadarida brasiliensis*. Pages 303-336 in J. K. Jones, Jr., ed. *Contributions in mammalogy. Misc. Publ. Mus. Nat. Hist., Univ. Kans.* 51:1-428.
- COLE, H. F., and H. H. WOLFE. 1970. Laboratory evaluation of aggressive behavior of the grasshopper mouse (*Onychomys*). *J. Pharm. Sci.* 59:969-971.
- CORNELY, J. E. 1976. Checklist of Mammals, Guadalupe Mountains National Park, Texas. Texas Tech Press, Lubbock, Texas, 4 pp.

- _____. 1977. Ecological distribution of woodrats (genus *Neotoma*) in Guadalupe Mountains National Park, Texas. This volume.
- COWAN, I. MCT. 1956. What and where are the mule and black-tailed deer? Pages 334-359 in W. P. Taylor, ed. *The Deer of North America*. Stackpole Co., Harrisburg, Pa., 668 pp.
- CYR M. 1972. Predatory behavior of the grasshopper mouse, *Onychomys torridus*. Ph. D. Thesis, Univ. California Los Angeles.
- DAVIS, W. B. 1940. Mammals of the Guadalupe Mountains of western Texas. *Occas. Pap. Mus. Zool., Louisiana State Univ.* 7:69-84.
- _____. 1960. The mammals of Texas. *Bull. Game and Fish Commission*, Austin, Texas 41:1-252.
- _____. 1974. The mammals of Texas. *Bull. Tex. Parks and Wildl. Dep.* 41(revised):1-294.
- DAVIS, W. B., and J. L. ROBERTSON, JR. 1944. The mammals of Culberson County, Texas. *J. Mammal.* 25:254-273.
- DAVIS, W. B., and W. P. TAYLOR. 1939. The bighorn sheep of Texas. *J. Mammal.* 20:440-455.
- DIERSING, V. E., and D. F. HOFFMEISTER. 1974. The rock mouse, *Peromyscus difficilis*, in western Texas. *Southwest. Nat.* 19:213.
- EASTERLA, D. A. 1973a. Ecology of the 18 species of Chiroptera at Big Bend National Park, Texas. Part I. *Northwest Missouri State Univ. Studies* 34:1-53.
- _____. 1973b. Ecology of the 18 species of Chiroptera at Big Bend National Park, Texas. Part II. *Northwest Missouri State Univ. Studies* 34:54-165.
- ENGELS, W. L. 1936. Distribution of races of the brown bat (*Eptesicus*) in western North America. *Am. Midl. Nat.* 17:653-660.
- FINDLEY, J. S., and G. L. TRAUT. 1970. Geographic variation in *Pipistrellus hesperus*. *J. Mammal.* 51:741-765.
- FINDLEY, J. S., A. H. HARRIS, D. E. WILSON, and C. JONES. 1975. Mammals of New Mexico. Univ. New Mexico Press, Albuquerque, 360 pp.
- FLEHARTY, E. D. 1960. The status of the gray-necked chipmunk in New Mexico. *J. Mammal.* 41:235-242.
- GEHLBACH, F. R. 1967. Vegetation of the Guadalupe escarpment, New Mexico-Texas. *Ecology* 48:404-419.
- _____. Undated. Description and development of the living landscape of Guadalupe Mountains National Park Texas. Rep. National Park Service, U.S. Dep. Inter., Santa Fe, New Mexico.
- GLASS, B. P. 1947. Geographic variation in *Perognathus hispidus*. *J. Mammal.* 28:174-179.
- GLASS, B. P., and R. J. BAKER. 1968. The status of the name *Myotis subulatus* Say. *Proc. Biol. Soc. Wash.* 81:257-260.
- GOLDMAN, E. A. 1936. New pocket gophers of the genus *Thomomys*. *J. Wash. Acad. Sci.* 26:111-120.
- _____. 1944. Classification of wolves. Pages 389-507 in S. P. Young and E. A. Goldman eds. *The Wolves of North America*. American Wildlife Institute, Washington, D.C. 636 pp.
- _____. 1946. Classification of the races of the puma. Pages 175-302 in S. P. Young and E. A. Goldman eds. *The Puma, Mysterious American Cat*. Wildlife Institute, Washington, D.C., 358 pp.

- _____. 1950. Raccoons of North and Middle America. *North Am. Fauna* 60:1-153.
- GROSS, J. E. 1960. History, present, and future status of the desert bighorn sheep (*Ovis canadensis mexicana*) in the Guadalupe Mountains of southeastern New Mexico and northwestern Texas. *Trans. Desert Bighorn Council* 4:66-71.
- HALL, E. R. 1951a. American weasels. *Univ. Kans. Publ., Mus. Nat. Hist.* 4:1-466.
- _____. 1951b. A synopsis of the North American Lagomorpha. *Univ. Kans. Publ., Mus. Nat. Hist.* 5:119-202.
- HALL, E. R., and K. R. KELSON. 1951. Comments on the taxonomy and geographic distribution of some North American rabbits. *Univ. Kans. Publ., Mus. Nat. Hist.* 5:49-58.
- HANDLEY, C. O., JR. 1959. A revision of American bats of the genera *Euderma* and *Plecotus*. *Proc. U.S. Natl. Mus.* 110:95-246.
- HAYWARD, B. J. 1970. The natural history of the cave bat, *Myotis velifer*. *Western New Mexico Univ. Res. Sci.* 1:1-74.
- HOFFMANN, R. S., and J. K. JONES, JR. 1970. Influence of late-glacial and post-glacial events on the distribution of Recent mammals on the Northern Great Plains. Pages 355-394 in W. Dort, Jr., and J. K. Jones, Jr., eds. Pleistocene and Recent environments of the central Great Plains. Univ. Press Kansas, 433 pp.
- HOFFMEISTER, D. F. 1951. A taxonomic and evolutionary study of the piñon mouse, *Peromyscus truei*. *Illinois Biol. Monogr.* 21:1-104.
- HOFFMEISTER, D. F., and L. DE LA TORRE. 1961. Geographic variation in the mouse *Peromyscus difficilis*. *J. Mammal.* 42:1-13.
- HOFFMEISTER, D. F., and M. R. LEE. 1967. Revision of the pocket mice, *Perognathus penicillatus*. *J. Mammal.* 48:361-380.
- HOLLISTER, N. 1916. A systematic account of the prairie dogs. *North Am. Fauna* 40:1-37.
- HORNER, B. E., J. M. TAYLOR, and H. A. PADYKULA. 1964. Food habits and gastric morphology of the grasshopper mouse. *J. Mammal.* 49:644-660.
- HOWELL, A. H. 1914. Revision of the American harvest mice (genus *Reithrodontomys*). *North Am. Fauna* 36:1-97.
- _____. 1938. Revision of the North American ground squirrels. *North Am. Fauna* 56:1-256.
- HUSSON, A. M. 1962. The bats of Suriname. *Zool. Verhand.* 58:1-282.
- JACKSON, H. H. T. 1951. Classification of the races of the coyote. Pages 229-315 in S. P. Young and H. H. T. Jackson, eds. *The Clever Coyote*. Stackpole Co., Harrisburg, Pa., 411 pp.
- KELLOGG, R. 1956. What and where are the whitetails? Pages 31-55 in W. P. Taylor, ed. *The Deer of North America*. Stackpole Co., Harrisburg, Pa., 668 pp.
- KITTAMS, W. H., S. L. EVANS, and D. C. COOKE. 1977. Food habits of mule deer on foothills of Carlsbad Caverns National Park. This volume.
- LA VAL, R. K. 1973. Occurrence, ecological distribution, and relative abundance of bats in McKittrick Canyon, Culberson Co., Texas. *Southwest. Nat.* 17:357-364.
- LIDICKER, W. Z., JR. 1960. An analysis of intraspecific variation in the kangaroo rat, *Dipodomys merriami*. *Univ. Calif. Publ. Zool.* 67:125-218.
- LONG, C. A. 1972. Taxonomic revision of the North American badger, *Taxidea taxus*. *J. Mammal.* 53:725-759.
- MCCARTY, R. 1975. *Onychomys torridus*. *Mamm. Species* 59:1-5.

- MCCULLOUGH, D. R. 1969. The Tule elk: its history, behavior, and ecology. *Univer. Calif. Publ. Zool.* **88**:1-191.
- MEAD, R. A. 1967. Age determination in the spotted skunk. *J. Mammal.* **48**:606-616.
- . 1968a. Reproduction in eastern forms of the spotted skunk (genus *Spilogale*). *J. Zool.* **156**:119-136.
- . 1968b. Reproduction in western forms of the spotted skunk (genus *Spilogale*). *J. Mammal.* **49**:373-390.
- MEARNS, E. A. 1896. Preliminary diagnoses of new mammals from the Mexican border of the United States. *Proc. U.S. Natl. Mus.* **18**:443-447.
- MOLLHAGEN, T., and R. H. BAKER, 1972. *Myotis volans interior* Miller in Knox County, Texas, *Southwest. Nat.* **17**:97.
- MURIE, O. J. 1951. The Elk of North America. Stackpole, Co., Harrisburg, Pa., 376 pp.
- NELSON, E. W. 1909. The rabbits of North America. *North Am. Fauna* **29**:1-314.
- . 1925. Status of the pronghorned antelope, 1922-1924. *Bull. U.S. Dep. Agric.* **1346**:64.
- O'CONNELL, M. A. 1977. Co-existence between two species of kangaroo rate (genus *Dipodomys*) in the Guadalupe Mountains National Park, Texas. This volume.
- PIZZIMENTI, J. J. 1975. Evolution of the prairie dog genus *Cynomys*. *Occas. Pap. Mus. Nat. Hist., Univ. Kansas* **29**:1-73.
- RUSSELL, R. J. 1968. Revision of pocket gophers of the genus *Pappogeomys*. *Univ. Kans. Publ., Mus. Nat. Hist.* **16**:581-776.
- SCHMIDLY, D. J. 1972. Geographic variation in the white-ankled mouse, *Peromyscus pectoralis*. *Southwest. Nat.* **17**:113-138.
- . 1973. Geographic variation and taxonomy of *Peromyscus boylii* from Mexico and the southern United States. *J. Mammal.* **54**:111-130.
- SETZER, H. W. 1949. Subspeciation in the kangaroo rat, *Dipodomys ordii*. *Univ. Kans. Publ., Mus. Nat. Hist.* **1**:473-573.
- SNYDER, W. A. 1961. A chemical analysis of 13 major deer forage plants from the Guadalupe Mountains of New Mexico and their adequacy for maintaining deer. M.S. Thesis, New Mexico State Univ., Las Cruces, 58 pp.
- VAN GELDER, R. G. 1959. A taxonomic revision of the spotted skunks (genus *Spilogale*). *Bull. Am. Mus. Nat. Hist.* **117**:229-392.
- WARNOCK, B. H. Undated. Plant communities of the Guadalupe Mountains in Texas and nearby Carlsbad Caverns National Park. Rep. submitted to Carlsbad Caverns National Park, Carlsbad, New Mexico.
- WILHELM, D. E. 1977. Status of the Guadalupe Mountains vole, *Microtus mexicanus guadalupensis*. This volume.
- WILSON, D. E. 1973. The systematic status of *Perognathus merriami* Allen. *Proc. Biol. Soc. Wash.* **86**:175-192.
- WRIGHT, G. M., and B. H. THOMPSON. 1934. Wildlife management in the national parks. *Fauna Natl. Parks* **2**:viii, 1-142.

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