PUBLICATIONS OF THE MUSEUM
TEXAS TECH UNIVERSITY

Two publications of The Museum of Texas Tech University are issued under the auspices of the Dean of The Graduate School and Director of Academic Publications, and in cooperation with the International Center for Arid and Semi-Arid Land Studies. Shorter research papers are published as Occasional Papers, whereas longer contributions appear as Special Publications. Both are numbered separately and published on an irregular basis.

Institutional libraries interested in exchanging publications may obtain the Occasional Papers and Special Publications by addressing the Exchange Librarian, Texas Tech University, Lubbock, Texas 79409. Individuals may purchase separate numbers of the Occasional Papers for $1.00 each from Texas Tech Press, Texas Tech University. Remittance must be enclosed with request. Institutional subscriptions also are available through Texas Tech Press.

OCCASIONAL PAPERS
THE MUSEUM
TEXAS TECH UNIVERSITY

NUMBER 59 17 AUGUST 1979

DISTRIBUTIONAL CHECKLIST OF RODENTS IN CANYONLANDS NATIONAL PARK, UTAH

David M. Armstrong

Students of mammalian distribution have long been fascinated by the Colorado Plateau. The Colorado River system gathers its headwaters in the middle and southern Rocky Mountains and flows to the Sea of Cortez. Along most of their lengths, the Colorado and Green rivers are the only permanent streams and they provide a linear oasis for the dispersal of mesic-adapted species through a vast desert region. Throughout much of their course, however, the rivers lie entrenched in canyons that may extend 5000 feet below the level of the surrounding landscape and doubtlessly form significant barriers to the dispersal of terrestrial animals. Grinnell (1914*a*, 1914*b*) discussed the distribution of birds and mammals along the lower reaches of the Colorado River in Arizona and California. Goldman (1937) described the influence of the river farther north in Arizona, especially in the vicinity of the Grand Canyon. Hoffmeister (1971) reported on mammals of Grand Canyon National Park, and Hoffmeister and Durham (1971) described mammals of the Arizona Strip, that part of Arizona north and west of the Colorado River. In Utah, major studies of the effects of the Colorado and Green rivers on mammalian distribution were published by Kelson (1951) and Durrant (1952). Studies by Durrant and Dean (1959, 1960) at river-level have been especially useful. Benson (1935) examined the mammals of Navajo Mountain, and Hayward *et al.* (1958) described broad patterns of ecological distribution of vertebrates along the upper Colorado River basin. Tanner (1965) reported rodents of

the uranium-mining districts surrounding Canyonlands National Park. Effects of the rivers farther upstream have been discussed by Armstrong (1972) and Long (1965). An account of the ecological distribution of rodents in Canyonland National Park is in preparation. For comments on zoogeographic relationships of mammals in Utah, see Armstrong (1977*b*).

Of particular interest on the Colorado Plateau is the confluence of the Colorado and Green rivers, for the canyons created by these waterways divide southeastern Utah into three disjunct land masses (Fig. 1). The rugged terrain surrounding this area, however, makes it virtually inaccessible by land, as evidenced by the inability of both Kelson (1951) and Durrant (1952) to get within 30 miles of the rivers' junction. Even the early exploratory surveys that provided fundamental knowledge of mammalian distributions elsewhere in the West avoided southeastern Utah. Too rough for railroad builders and too precipitous, rocky, and dry for farming, the region was circumvented both by the Railroad Surveys of the 1850's and the Bureau of Biological Survey in the early 1900's. Only the uranium rush during the 1950's opened the Canyonlands section of the Colorado Plateau to exploration and formal survey. The establishment of Canyonlands National Park in 1964 on 450 square miles of canyons and mesas surrounding the confluence has finally opened the area to scientific exploration. I began an investigation of mammals within the Park during 1971 in order to gather data for a popular faunal account. In the course of this work, several hundred rodent specimens were obtained, which provided detailed distributional information for a hitherto neglected area.

Presented herein is a portion of that work—a systematic account of the rodents of Canyonlands National Park with remarks on the effects of the Colorado and Green rivers on species distribution and differentiation. It is my hope that this paper eventually will lead to more detailed, biosystematic study of species in this area, for such work will enhance markedly our understanding of microevolution in rodents.

Methods

Specimens reported here were obtained in the period 1972 to 1978 and were used to document ecological distribution and to provide information on reproduction and life histories, pelages and molt, ectoparasites, and food habits. This information will be summarized in a handbook of mammals of Canyonlands National Park and vicinity.

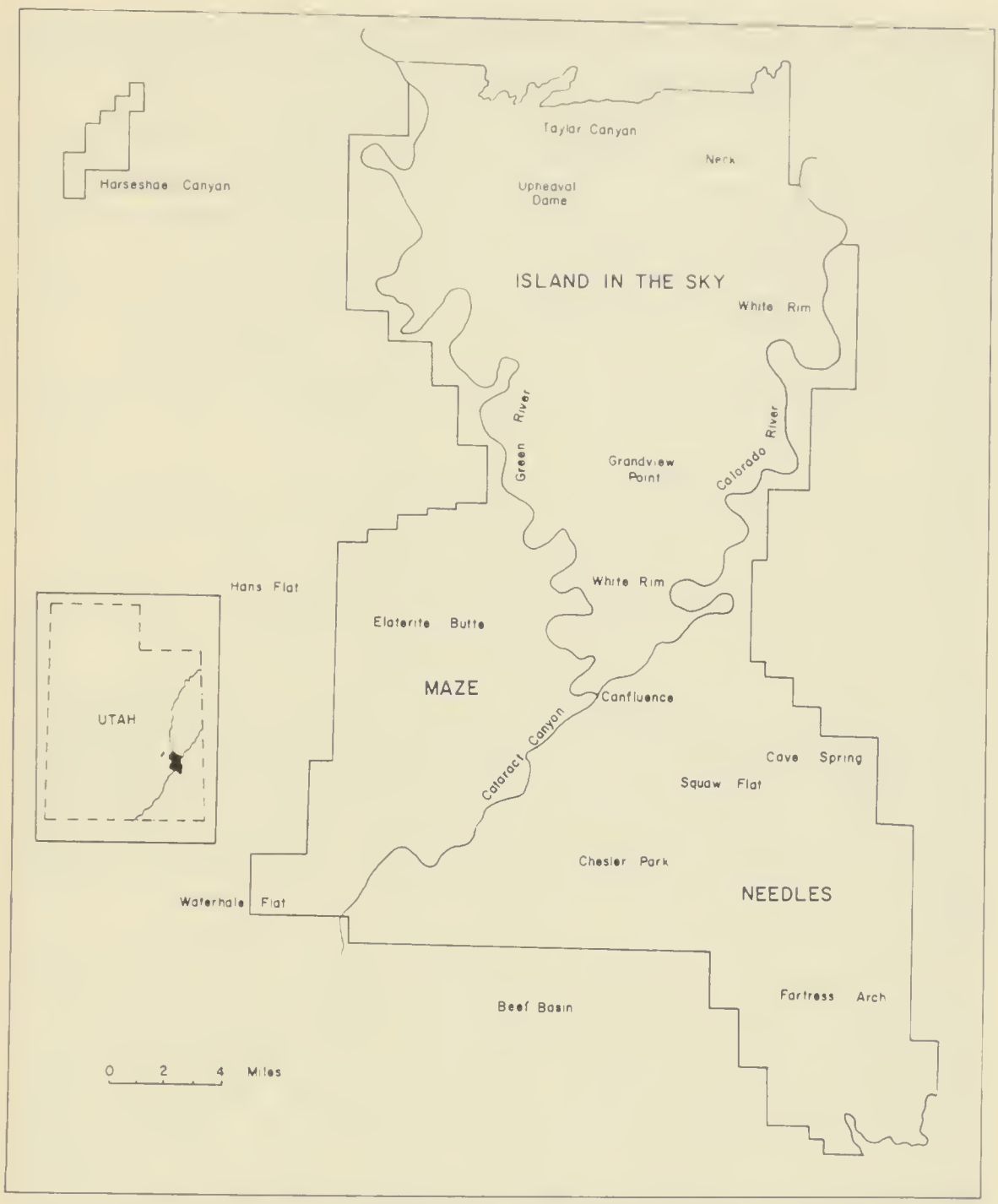

FIG. 1.—Index map of Canyonlands National Park showing localities frequently mentioned in text. Inset shows location of Canyonlands National Park in southeastern Utah.

Rodents collected by snap and livetrapping were prepared as conventional study skins and skulls. Measurements are only of individuals judged to be adults on the basis of toothwear and fusion of cranial sutures (including the suture between the basioccipital and the basisphenoid). Reproductive maturity, which usually precedes morphological maturity, was not deemed a useful criterion of adulthood for present purposes. All measurements reported here are in millimeters; cranial characters, as defined by DeBlase and Martin (1974), were measured by means of dial cali-

pers read to the nearest 0.1 millimeter. Averages are followed by the range, in parentheses, and values for males precede those for females. External measurements are presented in order as read from museum labels: total length, length of tail vertebrae, length of hind foot, length of ear from notch. Weights of field-caught adults are in grams; females known to have been pregnant are not included. Cranial measurements presented herein are those most frequently reported in systematic work on that taxon, to facilitate comparison with the literature.

Specimens examined are listed by administrative district (see Fig. 1): Island in the Sky (San Juan County), Maze (Wayne County), Needles (San Juan County). Within each district, localities are recorded from north to south; those occurring at the same latitude are listed westernmost first. Localities were described in the field from the map "Canyonlands National Park and Vicinity, Utah" (1:62,500, U.S. Geological Survey, 1969), and are annotated with section-township-range. Where localities are in areas not formally surveyed, the Public Land Survey description was interpolated. Elevations, in feet, were estimated from topographic maps with contour intervals of 80 feet. Specimens collected in Canyonlands National Park are deposited in the University of Colorado Museum, The Museum of Texas Tech University, Lubbock, or in a synoptic collection at Park Headquarters, Moab, Utah.

I have examined nearly all rodents in the collections of the University of Utah (UU) and Brigham Young University (BYU) from San Juan, Grand, and Wayne counties, Utah, as well as many from adjacent counties. Specimens from outside the Park are not listed because most were mentioned by Durrant (1952), Hayward *et al.* (1958), or Tanner (1965). The acronyms UU and BYU are noted parenthetically when measurements are given for specimens in either of these collections.

Synonymies have been excluded from the species accounts that follow because they have been presented in both Durrant (1952) and Hall and Kelson (1959). Prior publication of a fine key to Utah rodents by Durrant (1952) also made it unnecessary to reproduce that information here.

Acknowledgments

For help with field work, I thank Charles K. Curlee, S. Scott Panter, William C. Sears, David W. and Peggy Johnson, David Harwood, James G. Owen, and my family, Ann, Jack, and Laura. Michael L. Johnson and James C. Halfpenny have done consider-

able independent work in the Park as graduate research assistants. For access to collections at Brigham Young University, I extend my appreciation to Clyde Pritchett, Hal Black, and C. Lynn Hayward; Annie and John Wyckoff made collections at the University of Utah available to me. Financial support for various phases of this study has come from the Society of the Sigma XI (1972), the Council on Research and Creative Work of the University of Colorado (1973), the Penrose Fund (Grant No. 7615) of the American Philosophical Society (1976), and the Colorado State University-National Park Service Cooperative Studies Unit (1977-1978).

Accounts of Species

Family Sciuridae

Eutamias quadrivittatus (Say)

Colorado Chipmunk

The Colorado chipmunk is the smallest, and probably most abundant, sciurid in Canyonlands National Park and occurs in the southern Rocky Mountains as well as on the Colorado Plateau. These ecologically dissimilar areas each have distinct subspecies. The Colorado chipmunk is present in suitable habitat throughout the Park. Seldom are these animals seen far from the cover of broken rock, and often they are found in saxicolous brushlands and in juniper-pinyon woodland. This is the only one of the five chipmunks in Utah that occurs in Canyonlands. *Eutamias minimus*, the least chipmunk, inhabits the highlands adjacent to Canyonlands on the east, the Abajo and La Sal mountains and Elk Ridge (Lee, 1960). The Uinta chipmunk, *E. umbrinus*, occurs in the Henry Mountains (Lee, 1960), and the cliff chipmunk, *E. dorsalis*, is known from Wayne County, north of the town of Green River (Durrant, 1952:150).

Eutamias quadrivittatus hopiensis Merriam

Distribution.—Much of the Colorado Plateau and Uinta Basin, also throughout Canyonlands National Park.

Measurements.—Seven males, five females from Island in the Sky: 210.6(207-220), 214.8(206-225); 92.7(84-101), 95.4(90-101); 32.4(31-34), 31.8(31-33); 16.4(15-18), 16.6(15-19); weight, 46.64(42.7-51.9), 47.48(42.2-55.5). Five males, 12 females from Needles: 212.8(202-221), 220.0(212-227); 92.0(84-94), 94.1(90-100); 33.0(32-34), 33.2(31-35); 19.0(18-20), 18.3(17-19); weights, 50.80(49.4-54.1),

54.97(47.5-71.7). Two males, two females from Maze: 210, 210, 218, 227; 100, 95, 91, 95; 35, 32, 32, 32; 19, 17, 18, 17; weights, 50.4, 52.2, 59.9, 54.1. Representative cranial measurements are presented in Table 1.

Remarks.—White (1953) reviewed subspecies of *E. quadrivittatus*, giving measurements of animals from Moab. He stated that there was no evidence of geographic variation across the Green and Colorado rivers, and I concur.

Specimens examined (60).—Island in the Sky: head Taylor Canyon, SW ¼ sec. 15, T. 27 S, R. 19 E, 5600 ft., 1; S of the Neck, N ½ sec. 22, T. 27 S, R. 19 E, 5900 ft., 4; White Rim, sec. 13, T. 27 S, R. 19 E, 4500 ft., 11; mouth Lathrop Canyon, NE ¼ sec. 13, T. 28 S, R. 19 E, 3950 ft., 2. Maze: Horseshoe Canyon, sec. 7, T. 27 S, R. 16 E, 5200 ft., 4; NE of Hans Flat, SE ¼ sec. 21, T. 29 S, R. 26 E, 6400 ft., 1; SW of Elaterite Butte, sec. 16, T. 20 S, R. 17 E, *ca.* 5200 ft., 1; Teapot Canyon, sec. 12, T. 31 S, R. 16 E, 5440 ft., 2; Waterhole Flat, sec. 13, T. 31 S, R. 16 E, 5600 ft., 2. Needles: NE ¼ sec. 15, T. 30 S, R. 19 E, 4800 ft., 1; NW ¼ sec. 20, T. 30 S, R. 20 E, 4840 ft., 1; Splittop Campsite, NE ¼ NW ¼ sec. 29, T. 30 S, R. 20 E, 5015 ft., 2; near Cave Spring, NW ¼ NE ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 2; SW of Cave Spring, NW ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 2; NW ¼ NE ¼ sec. 29, T. 30 S, R. 20 E, 5015 ft., 1; NE ¼ sec. 30, T. 30 S, R. 20 E, 5000 ft., 3; S of Squaw Butte, NW ¼ sec. 30, T. 30 S, R. 20 E, 5040 ft., 5; Squaw Slot Campsite, NE ¼ SE ¼ sec. 25, T. 30 S, R. 19 E, 5000 ft., 3; SE ¼ sec. 25, T. 30 S, R. 19 E, 5000 ft., 2; Squaw Canyon, SW ¼ sec. 36, T. 30 S, R. 19 E, 5200 ft., 4; Joint Trail, NE ¼ sec. 7, T. 31 S, R. 19 E, 5300 ft., 5; near Fortress Arch, NW ¼ sec. 28, T. 31 S, R. 20 E, 5440 ft., 1.

Ammospermophilus leucurus (Merriam)

White-tailed Antelope Squirrel

The white-tailed antelope squirrel ranges from southeastern Oregon and adjacent Idaho southward through Baja California, occupying deserts of the Great Basin and the Colorado Plateau north and west of the Grand Canyon of the Colorado. In Canyonlands, this squirrel occurs throughout the Park in suitable habitat, rocks at the edge of sandy grasslands. They seem less likely to inhabit woodland than chipmunks or rock squirrels. Each district of the Park is occupied by a different nominal subspecies of *A. leucurus*. Durrant (1952), Hansen (1955), and Kelson (1951) included this species in the genus *Citellus*.

Ammospermophilus leucurus cinnamomeus (Merriam)

Distribution.—Southeast of Colorado River in Utah and adjacent Colorado and Arizona, as well as in Needles District of Canyonlands National Park.

Comparisons.—From *A. l. pennipes*, *A. l. cinnamomeus* differs in darker, more vinaceous color and, generally, slightly larger cra-

TABLE 1.—*Representative cranial measurements of three species of sciurids.*

	Greatest length of skull	Condylobasal length	Zygomatic breadth	Interorbital constriction	Length of nasals	Condyloalveolar length of mandible	Length of maxillary toothrow
Eutamias quadrivittatus hopiensis, Island in the Sky District							
Mean, 7 ♂♂	34.18	31.70	18.54	7.66	10.24	18.26	5.64
Minimum	33.3	31.0	18.4	7.2	9.9	17.6	5.5
Maximum	34.9	32.2	18.6	8.3	10.6	18.7	5.8
Mean, 5 ♀♀	34.02	31.80	19.06	8.02	10.30	17.96	5.66
Minimum	33.4	30.9	18.8	7.7	10.0	17.0	5.5
Maximum	34.6	32.4	19.4	8.5	10.6	18.5	5.8
Maze District							
DMA 2330, ♂	34.5	32.5	19.4	8.6	10.4	18.1	5.5
DMA 2340, ♂	34.6	32.2	19.2	7.4	10.4	18.4	5.8
Mean, 3 ♀♀	34.70	32.47	19.17	8.80	10.4	18.47	5.53
Minimum	34.3	32.2	18.8	8.6	10.0	18.2	5.4
Maximum	35.1	33.0	19.5	9.2	10.8	18.7	5.6
Needles District							
Mean, 5 ♂♂	34.70	32.38	19.12	8.38	10.38	18.58	5.70
Minimum	33.9	31.6	18.8	7.7	9.6	18.1	5.4
Maximum	35.2	33.2	19.4	8.8	10.9	19.2	5.9
Mean, 12 ♀♀	35.15	32.55	19.33	8.10	10.38	18.69	5.74
Minimum	34.3	31.6	18.8	7.6	9.8	18.5	5.5
Maximum	36.4	33.7	20.0	8.7	11.2	19.1	6.0
Ammospermophilus leucurus cinnamomeus, Needles District							
Mean, 3 ♂♂	40.20	37.60	22.63	10.93	11.90	22.23	7.53
Minimum	39.6	36.8	21.5	9.8	11.0	21.4	7.4
Maximum	40.8	38.6	23.9	11.7	12.5	22.8	7.8
Mean, 4 ♀♀	40.08	37.60	23.52	9.82	11.80	22.80	7.22
Minimum	39.7	37.0	23.0	9.0	11.1	22.3	7.0
Maximum	41.0	38.1	23.8	10.3	12.5	23.9	7.6
Ammospermophilus leucurus notom, Maze District							
Mean, 3 ♀♀	39.93	37.50	22.93	9.47	11.76	21.60	7.50
Minimum	39.8	37.1	22.5	9.0	11.2	21.4	7.0
Maximum	40.2	37.7	23.3	9.9	12.3	22.0	7.8
Ammospermophilus leucurus pennipes, Island in the Sky District							
DMA 2312, ♂	40.6	37.7	24.5	9.0	12.1	22.2	7.3
Mean, 3 ♀♀	40.55	38.03	23.43	9.10	11.70	22.07	7.5
Minimum	40.1	37.1	23.1	8.8	11.5	21.6	7.3
Maximum	41.0	38.8	24.0	9.5	12.0	23.0	7.8

TABLE 1.—*Continued.*

Spermophilus variegatus grammurus Grand and San Juan Counties east of Colorado River (BYU, UU)							
Mean, 5 ♂♂	61.27	58.03	38.32	13.98	21.72	36.68	12.20
Minimum	60.8	57.4	37.7	13.1	20.6	36.1	11.5
Maximum	61.7	58.7	39.4	14.4	22.9	37.9	12.8
Mean, 4 ♀♀	58.68	55.62	36.70	13.55	21.20	34.78	12.00
Minimum	57.4	54.2	35.4	12.9	20.5	34.2	11.8
Maximum	59.5	56.0	37.9	14.0	21.5	35.2	12.6

nial size (see Remarks). For comparison with *A. l. notom*, see account of that subspecies.

Measurements.—Three males, four females from Needles: 216.7(215-220), 225.7(220-232); 64.3(60-71), 66.7(60-70); 41.3(40-42), 39.5(39-40); 16.0(14-18), 16.5(15-18); weights, 107.43(93.8-118.5), 117.18(110.9-127.9). Cranial measurements appear in Table 1.

Remarks.—According to Howell (1938:175), *A. l. pennipes* averages slightly larger cranially than *A. l. cinnamomeus*. McCoy and Miller (1964) and Armstrong (1972:118) showed *A. l. cinnamomeus* in Colorado to be somewhat smaller than *A. l. pennipes*. However, in Utah, Durrant (1952:125) pointed out that skulls of *A. l. cinnamomeus* generally are larger than those of *A. l. pennipes*. Our few data support Durrant's observations.

Specimens examined (9).—NEEDLES: near Cave Spring, NW ¼ NE ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 1; SW of Cave Spring, NW ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 4; W of Squaw Butte, NE ¼ sec. 25, T. 30 S, R. 19 E, 5040 ft., 1; NE ¼ sec. 30, T. 30 S, R. 20 E, 5000 ft., 3.

Ammospermophilus leucurus notom (Hansen)

Distribution.—San Rafael and Dirty Devil drainages and in the Uinta Basin west of the Green River; known in Canyonlands National Park from the Maze District.

Comparisons.—From *A. l. pennipes* and *A. l. cinnamomeus*, *A. l. notom* differs in "redder color lacking practically all white and black bands of the hairs, on the head and dorsum"; rostrum proportionally shorter (Hansen, 1955:275).

Measurements.—One male, four females from Maze: 212, 219.2(210-225); 60, 63.0(59-70); 40, 39.5(39-40); 15, 12.2(10-14); weights, 94.6, 103.18(95.1-112.9). Representative cranial measurements appear in Table 1.

Remarks.—When Hansen (1955) named this subspecies, he ascribed to it a range in the "Uinta Basin, west of Green River, San Rafael Swell, lower drainages of the Dirty Devil River in

Emery and Wayne counties, Utah." He examined specimens from as close to the Maze District as Hanksville. Tanner (1965) contrasted specimens from Temple Mountain (on the San Rafael Swell, Emery County, in the range of *A. l. notom*) and the Yellow Cat Mining District (15 mi. SE Thompson's, Grand County, in the range of *A. l. pennipes*). He noted that squirrels from Temple Mountain had dorsolateral stripes with a pronounced curve or undulation, unlike the straight stripes of Grand County specimens. This distinction is not borne out by our specimens, and I suggest that its presence or absence is at least partly an artifact of preparatory technique.

Specimens examined (5).—MAZE: Hans Flat, SE ¼ sec. 29, T. 29 S, R. 16 E, 6560 ft., 1; SW of Elaterite Butte, sec. 16, T. 30 S, R. 17 E, *ca.* 5200 ft., 1; Teapot Canyon, sec. 12, T. 31 S, R. 16 E, 5440 ft., 1; Waterhole Flat, sec. 13, T. 31 S, R. 16 E, 5600 ft., 2.

Ammospermophilus leucurus pennipes Howell

Distribution.—Grand Valley of the Colorado (see Armstrong, 1972:118) and westward into the region between the Colorado and Green rivers; Island in the Sky District of Canyonlands National Park.

Comparisons.—See accounts of *A. l. cinnamomeus* and *A. l. notom*.

Measurements.—One male, three females from Island in the Sky: 223, 219.7(212-229); 69, 60.7(60-61); 40, 40.7(40-42); 13, 15.0(15-15); weights, 112.4, 115.33(107.0-122.5). Five males, 10 females (BYU) from vicinity of Arches National Park: 219.0(210-227), 209.9(200-220); 60.0(49-65), 62.3(55-71); 39.2(38-40), 38.3(37-40);—, —; weights, 104.3(86-115), 102.3(84-107).

Remarks.—I am unable to assign with any confidence subspecific rank to antelope ground squirrels from Island in the Sky. When specimens in comparable, fresh pelage are sorted by dorsal color, there are two series: pale, reddish buff animals and darker, vinaceous animals. Animals from the Island appear in both series. My uncertainty is not unique. Kelson (1951:33) called *A. leucurus* from Grand County north of the Colorado River *cinnamomeus*, whereas Durrant (1952:124) referred them to *pennipes*. Hansen (1955:276) considered this an area of intergradation between *A. l. notom* and *A. l. pennipes*, and assigned specimens from here to the latter subspecies. I see no consistent cranial distinctions in material from the three districts of Canyonlands National Park. In short, populations of antelope ground squirrels do not seem as distinctive as current nomenclature might lead

one to imagine. A taxonomic revision of *A. leucurus* that is based on a thorough understanding of nongeographic as well as geographic variation is indicated.

Specimens examined (7).—Island in the Sky: Green River, sec. 1., T. 26 S, R. 17 ½ E, 4000 ft., 1: White Rim, SE ¼ sec. 24, T. 27 S, R. 19 E, 4600 ft., 1; NE corner Gray's Pasture, SW ¼ sec. 22, T. 28 S, R. 19 E, 6000 ft., 2; sec. 5, T. 28 S, R. 19 E, 6050 ft., 2.

Spermophilus variegatus (Erxleben)

Rock Squirrel

The rock squirrel occupies semiarid foothills and mountains from Puebla northward to northern Utah and Colorado. In Canyonlands National Park, the animals seem to be nowhere abundant but can be found in colluvial rubble, often about woodlands, at all elevations. I expect that two subspecies occur in the Park.

Spermophilus variegatus grammurus (Say)

Distribution.—Southern Utah and adjacent Colorado, southward through Arizona and New Mexico into Sonora and Chihuahua; Island in the Sky and Needles districts of Canyonlands National Park.

Comparison.—From *S. v. utah*, *S. v. grammurus* differs in paler color dorsally (more buffy, less blackish); venter more cinnamon-colored, less white; and skull averaging smaller.

Measurements.—Five males and five females from Grand and San Juan counties (UU, BYU): 466.4(438-485), 467.0(445-480); 188.8(155-210), 189.7(175-200); 59.0(55-65), 54.4(51.56); 28.5(26-32), 29.4(25-32). For cranial measurements, see Table 1.

Specimens examined (2).—Needles: Squaw Slot Campsite, NE ¼ SE ¼ sec. 25, T. 30 S, R. 19 E, 5000 ft., 1; NE ¼ sec. 30, T. 30 S, R. 20 E, 5000 ft., 1.

Spermophilus variegatus utah (Merriam)

Distribution.—Central and southwestern Utah, the Arizona Strip, and southern Nevada; of probable occurrence in the Maze District of Canyonlands National Park.

Comparison.—See account of *S. v. grammurus* and Durrant and Hansen (1954).

Measurements.—One young male (BYU 4245) from 26 mi. S San Rafael River Bridge, Wayne County: 442, 187, 63, 25; weight, 467. For cranial measurements, see Durrant and Hansen (1954).

Remarks.—Kelson (1951:29) and Durrant (1952:118) restricted the use of the name *S. v. utah* to specimens from along the central mountains of Utah. Both authors commented on the difficulty of identifying to subspecies rock squirrels from Utah, due to broad intergradation. Durrant and Hansen (1954) reviewed subspecies of rock squirrels in Utah and restricted the use of the name *grammurus* to animals from south and east of the Colorado River. Durrant and Dean (1959:82) remarked that two subspecies of rock squirrel occurred in Glen Canyon, *S. v. utah* on the west side of the Colorado River, and *S. v. grammurus* on the east. However, only a single specimen (from the east side of the river) was obtained. Canyonlands National Park is a likely place to obtain the specimens that would clarify local distribution of these two subspecies; however, rock squirrels do not seem to be very abundant in the Park, although they are present in a variety of habitats at all elevations.

Family Geomyidae

Thomomys bottae (Eydoux and Gervais)

Botta's Pocket Gopher

The valley pocket gopher occupies suitable habitat over much of western United States and northern México. Over its range, this species shows complex distributional relationships with other species of *Thomomys*. In Utah, for example, both *Thomomys bottae* and *T. talpoides* occur widely, but at no place are the two species known to be sympatric. *T. talpoides* occupies the higher mountains of the state (including the La Sals and the Abajos) and *T. bottae* inhabits lower areas (although it does occur in some mountains of the Great Basin). Durrant (1946) revised the pocket gophers of Utah and later (1952) used their distributions to reconstruct Pleistocene events in the state.

Throughout the West, pocket gophers generally are abundant animals. Yet none was taken in Canyonlands National Park until 1976, when James C. Halfpenny obtained specimens in Chesler Park and adjacent parts of the Needles District. The animals still are unknown from the Island in the Sky or Maze districts. Wagner and Workman (1961) obtained no pocket gophers in Dead Horse Point State Park.

Thomomys bottae aureus Allen

Distribution.—Four Corners area of Utah, Colorado, Arizona, and New Mexico; Needles District of Canyonlands National Park.

Comparisons.—From *T. b. osgoodi*, *T. b. aureus* differs in larger size both externally and cranially, and darker (more reddish, less yellowish buff) color (after Durrant, 1952:216). From *T. b. howelli*, *T. b. aureus* differs in paler dorsal color (without a middorsal patch of grayish to blackish hairs) and in cranial details (see Goldman, 1936:152). By comparison with a series of specimens of *T. b. aureus* from Bedrock, Montrose County, Colorado, specimens from the Needles were slightly paler dorsally, slightly more grayish yellow and less reddish.

Measurements.—Two males, one female: 218, 229, 214; 63, 72, 69; 28, 28, 22; 5, 5, 5; weights, 124, 133.4, 111. Some cranial measurements of those individuals are: condylobasal length, 38.8, 39.9, 37.0; basilar length, 33.8, 35.0, 32.5; zygomatic breadth, 24.2, 25.1, 23.1; interorbital constriction, 6.8, 7.1, 7.0; mastoid breadth, 19.9, 20.2, 19.1; breadth of rostrum, 9.0, 9.1, 7.8; length of nasals, 13.7, 13.8, 13.1; maxillary toothrow, 8.7, 8.5, 8.3.

Specimens examined (3).—NEEDLES: Joint Trail, NE ¼ sec. 7, T. 31 S, R. 19 E, 5300 ft., 3.

Thomomys bottae howelli Goldman

Distribution.—Occurs in an area bounded by the Colorado and Green rivers and the Book Cliffs; in Colorado, found along the valleys of tributaries of the Colorado south and east of the river (Armstrong, 1972:153).

Comparisons.—From *T. b. osgoodi*, to which it is quite similar in color, *T. b. howelli* differs in larger external and cranial size (see Goldman, 1936:116). For comparison with *T. b. aureus*, see account of that subspecies.

Measurements.—Five males, five females from Arches National Park (BYU): 220.0(210-225), 197.2(182-213); 62.0(57-71), 55.2(51-60); 29.6(28-30), 28.6(27-30);—, —. Representative cranial measurements include: condylobasal length, 38.80(38.0-40.0), 35.26 (34.8-35.6); basilar length, 34.10(33.2-35.2), 30.64(30.2-31.0); zygomatic breadth, 22.98(22.5-23.9), 21.40(21.0-21.7); interorbital constriction, 6.58(6.3-6.9), 6.56(6.3-6.9); mastoid breadth, 19.94(19.3-20.6), 18.98(18.2-19.6); breadth of rostrum, 8.82(8.4-9.4), 7.88(7.5-8.2); length of nasals, 13.80(12.9-14.7), 11.74(11.2-12.2); maxillary toothrow, 8.04(7.9-8.2), 7.70(7.2-8.2).

Remarks.—This is the subspecies to be expected in the Island in the Sky District. Durrant (1952:212) reported specimens from as near the Park as a place 10 mi. N Moab, Grand County.

Thomomys bottae osgoodi Goldman

Distribution.—East-central Utah, west of the Colorado and Green rivers, from the Henry Mountains northward to the Book Cliffs.

Comparisons.—See accounts of *T. b. aureus* and *T. b. howelli.*

Remarks.—This is the subspecies to be expected in the Maze District. At present the locality of record nearest the Park is the type locality, Hanksville, Wayne County, Utah.

Family Heteromyidae

Perognathus apache Merriam

Apache Pocket Mouse

The Apache pocket mouse inhabits desert grasslands of the Colorado Plateau, with extensions into the Rio Grande Valley and through the Deming Plains of New Mexico into northern Chihuahua. In Canyonlands, the animals occur in abundance on the bunchgrass flats of the Needles and Island in the Sky districts.

Perognathus apache caryi Goldman

Distribution.—Utah and Colorado, mostly east of the Green River (and east of the Colorado, south of the confluence), and north of the San Juan.

Comparison.—*P. a. caryi* differs from *P. a. apache* in larger external and cranial size, darker color, and more inflated braincase (after Durrant, 1952:236).

Measurements.—Four males, five females from Needles: 136.8(135-139), 143.6(139-148); 66.0(65-69), 73.2(72-74); 18.8(18-20), 18.0(18-18); 7.0(7-7), 7.0(7-7); weights, 12.60(11.6-13.6), 11.40(10.8-11.8). Seven males, six females from the Island in the Sky District: 136.6(126-144), 137.8(129-147); 66.3(59-69), 66.5(66-70); 17.7(17-18), 17.5(17-19); 7.0(6-8), 7.0(7-7); weights, 13.20(9.5-14.8), 13.68(11.2-16.1). For cranial measurements, see Table 2.

Specimens examined (28).—Island in the Sky: Big Flat, sec. 21, T. 26 S, R. 19 E, 6000 ft., *in* Grand Co., 2; sec. 5, T. 27 S, R. 19 E, 6050 ft., 1; flat SE ¼ sec. 10, T. 27 S, R. 19 E, 5760 ft., 3; NE corner Gray's Pasture, SW ¼ sec. 22, T. 27 S, R. 19 E, 6000 ft., 1; S end Gray's Pasture, sec. 32, T. 27 S, R. 19 E, 5960 ft., 7; SW ¼ sec. 6, T. 28 S, R. 19 E, 6040 ft., 1; Willow Flat, SW ¼ sec. 6, T. 28 S, R. 19 E, 6040 ft., 3. Needles: ¼ mi. SE Cave Spring, NE ¼ sec. 30, T. 30 S, R. 20 E, 5040 ft., 1; SW of Cave Spring, NW ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 2; W of Squaw Butte, NE ¼ sec. 25, T. 30 S, R. 19 E, 5040 ft., 3; S of Squaw Butte, NW ¼ sec. 30, T. 30 S, R. 20 E, 5040 ft., 1; NE ¼ sec. 30, T. 30 S, R. 20 E, 5000 ft., 1; Chesler Canyon at Beef Basin Road, SE ¼ sec. 7, T. 31 S, R. 19 E, 5280 ft., 1.

TABLE 2.—*Representative cranial measurements of two species of* Perognathus.

	Occipitonasal length	Zygomatic breadth	Breadth of interparietal	Breadth across bullae	Length of maxillary toothrow	Length of nasals	Greatest length of skull
Perognathus apache caryi, Island in the Sky District							
Mean, 7 ♂♂	23.03	12.36	4.51	13.83	3.44	8.64	22.69
Minimum	22.4	11.9	4.1	12.9	3.2	8.3	23.2
Maximum	23.8	12.8	4.8	14.9	3.6	9.2	24.8
Mean, 6 ♀♀	23.58	12.42	4.57	13.90	3.57	8.74	24.24
Minimum	22.6	11.6	3.9	13.3	3.4	8.6	23.7
Maximum	24.5	12.7	5.2	14.2	3.7	9.2	24.8
Needles District							
Mean, 4 ♂♂	22.68	11.90	4.35	13.22	3.35	8.50	23.58
Minimum	21.8	11.6	4.3	12.5	3.2	7.9	22.6
Maximum	23.3	12.4	4.4	13.9	3.6	9.2	24.2
Mean, 5 ♀♀	22.52	11.96	4.24	13.06	3.40	8.58	23.30
Minimum	21.4	11.4	3.9	12.4	3.3	8.1	22.0
Maximum	23.1	12.2	4.5	13.6	3.5	9.0	24.1
Perognathus parvus bullatus, Maze District							
Mean, 10 ♂♂	25.10	13.30	4.13	14.70	3.72	9.44	26.09
Minimum	24.4	12.4	3.6	14.0	3.4	9.0	25.2
Maximum	27.5	14.3	4.7	15.3	4.2	10.8	28.5
Mean, 19 ♀♀	24.74	13.28	4.19	14.39	3.88	9.30	25.71
Minimum	23.2	12.7	3.3	13.9	3.5	8.6	24.2
Maximum	26.1	14.0	4.8	15.0	4.1	10.5	26.9

Perognathus parvus (Peale)

Great Basin Pocket Mouse

As the vernacular name implies, this is a species centered on the Great Basin, but it extends into adjacent semidesert areas, in particular the Columbia Plateau, the Snake River Plain, the Wyoming Basin, and the deserts of central Utah. This mouse is known from Canyonlands only from the Maze District, where it is abundant in stands of blackbrush. At Horseshoe Canyon, several individuals were taken in areas of "slickrock" and colluvial rubble. Hayward and Killpack (1958) described geographic variation and distribution of this species in Utah.

Perognathus parvus bullatus Durrant and Lee

Distribution.—San Rafael Desert and adjacent areas, probably bounded by the San Rafael, Colorado, Green, and Fremont rivers

and the highlands of central Utah; Maze District of Canyonlands National Park.

Comparisons.—For comparison with other named kinds of *P. parvus*, see Durrant and Lee (1956) and Hayward and Killpack (1958).

Measurements.—Ten males, 19 females: 169.7(164-176), 171.2(158-174); 88.5(85-92), 91.2(85-102); 21.6(21-22), 21.6(20-23); 7.9(7-8), 7.5(7-8); weights, 16.48(14.4-20.8), 15.43(13.5-18.4). For cranial measurements, see Table 2.

Remarks.—Specimens from the Maze are near topotypes of *P. p. bullatus*; Ekker's Ranch (Robber's Roost), the type locality, is adjacent to Canyonlands National Park on the west.

Specimens examined (32).—MAZE: Horseshoe Canyon, sec. 7, T. 27 S, R. 16 E, 5200 ft., 13; North Point, sec. 36, T. 29 S, R. 16 E, 6400 ft., 1; Hans Flat, SE ¼ sec. 29, T. 29 S, R. 16 E, 6560 ft., 4; SW of Elaterite Butte, sec. 16, T. 30 S, R. 17 E, *ca.* 5200 ft., 1; Waterhole Flat, sec. 13, T. 31 S, R. 16 E, 5600 ft., 13.

Dipodomys ordii Woodhouse

Ord's Kangaroo Rat

Ord's kangaroo rat is the most widespread member of the genus *Dipodomys*, occurring from the plains of Alberta and Saskatchewan to Hidalgo, and from California to Oklahoma. This is a mammal of grasslands where sandy soils permit extensive burrow systems. The animals are present throughout Canyonlands National Park and often are abundant locally. Setzer (1949) revised subspecies of *D. ordii*; two subspecies occur in Canyonlands National Park.

Dipodomys ordii nexilis Goldman

Distribution.—Southeastern Utah and adjacent Colorado, generally north of the San Juan River and southeast of the Colorado; Needles District of Canyonlands National Park.

Comparison.—See account of *D. o. sanrafaeli.*

Measurements.—Nineteen males, 18 females from Needles: 256.5(241-280), 259.5(236-283); 143.3(132-155), 141.4(126-171); 41.8(38-44), 41.8(39-46); 14.3(13-18), 14.4(12-16); weights, 60.19 (50.8-70.7), 60.1(50.3-68.0). For cranial measurements, see Table 3.

Remarks.—Another subspecies, *D. o. longipes*, is found in southeastern Utah south of the San Juan River and east of the Colorado (Durrant and Dean, 1959:87). Setzer (1949:560) observed that *D. o. nexilis* "is apparently not abundant at any place in its range." This certainly is not true in the Needles District.

TABLE 3.—*Representative cranial measurements of two subspecies of* Dipodomys ordii.

	Greatest length of skull	Basilar length	Breadth across bullae	Breadth across maxillary arches	Interorbital constriction	Length of nasals	Length of maxillary toothrow
Dipodomys ordii nexilis, Needles District							
Mean, 17 ♂♂	39.26	24.18	25.16	20.09	12.82	13.86	5.01
Minimum	37.3	23.6	24.1	19.0	12.1	13.1	4.8
Maximum	40.6	25.9	26.0	21.1	14.4	14.6	5.4
Mean, 18 ♀♀	39.51	24.20	25.49	20.57	12.82	14.04	5.05
Minimum	37.7	23.3	24.3	19.2	11.4	12.9	4.9
Maximum	41.0	25.0	26.4	21.9	13.7	15.0	5.4
Dipodomys ordii sanrafaeli							
Island in the Sky District and Deadhorse Point State Park (BYU)							
Mean, 3 ♂♂	39.47	24.36	25.13	20.57	12.87	14.27	5.10
Minimum	39.2	24.1	24.9	20.0	12.3	14.0	5.1
Maximum	40.0	24.9	25.4	21.0	13.2	14.5	5.1
Mean, 4 ♀♀	39.72	24.78	25.42	20.57	12.68	14.22	5.22
Minimum	39.1	24.0	24.9	20.3	12.1	13.7	4.9
Maximum	40.6	26.3	25.8	21.0	13.4	14.7	5.5
Arches National Monument (BYU)							
Mean, 11 ♂♂	39.80	24.51	25.39	20.70	12.98	14.35	5.05
Minimum	38.7	24.0	24.6	19.2	12.1	13.7	4.9
Maximum	40.4	25.1	26.4	21.7	14.2	14.9	5.5
Mean, 6 ♀♀	38.12	24.43	25.07	20.53	12.43	14.30	5.08
Minimum	34.9	23.6	24.1	19.6	11.7	13.3	4.9
Maximum	39.9	25.0	26.4	21.5	13.0	15.1	5.3
Maze District							
Mean, 11 ♂♂	38.62	23.78	24.90	20.17	12.38	13.77	4.69
Minimum	37.6	22.9	24.0	19.2	11.4	13.0	4.0
Maximum	39.5	24.5	25.7	20.9	13.5	14.4	5.1
Mean, 6 ♀♀	38.55	23.64	24.70	20.35	12.35	13.38	4.95
Minimum	37.5	23.1	24.2	19.8	11.2	13.1	4.8
Maximum	40.1	24.1	25.3	20.8	12.8	14.1	5.3

Specimens examined (79).—NEEDLES: rim SW ¼ SE ¼ sec. 10, T. 27 S, R. 19 E, 5600 ft., 1; 7 mi. (by road) N Ranger Station, sec. 18, T. 30 S, R. 19 E, 4940 ft., 3; Salt Creek Wash, NW ¼ NE ¼ sec. 20, T. 30 S, R. 20 E, 4950 ft., 1; ½ mi. N Cave Springs Trail, sec. 20, T. 30 S, R. 19 E, 5100 ft., 4; ½ mi. NE Cave Springs Trail, sec. 20, T. 30 S, R. 19 E, 5100 ft., 3; Cave Springs Parking Area, sec. 20, T. 30 S, R. 19 E, 4900 ft., 2; Salt Creek, ¼ mi. SW Cave Springs Parking Area, sec. 20, T. 30 S, R. 19 E, 4900 ft., 1; Uinta No. 3 Oil Well, NE ¼ NW ¼ sec. 26, T. 30 S, R. 19 E, 5120 ft., 1; Squaw Flat, NE ¼ sec. 25, T. 30 S, R. 19 E, 5100 ft., 2; W of Squaw

Butte, NE ¼ sec. 25, T. 30 S, R. 19 E, 5040 ft., 1; NE ¼ sec. 30, T. 30 S, R. 20 E, 5000 ft., 5; SE ¼ sec. 25, T. 30 S, R. 19 E, 5000 ft., 1; NW ¼ NE ¼ sec. 29, T. 30 S, R. 20 E, 5015 ft., 4; near Cave Spring, NW ¼ NE ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 10; NW ¼ NE ¼ sec. 29, T. 30 S, R. 20 E, 5015 ft., 4; ¼ mi. SE Cave Spring, NE ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 8; Squaw Flat Campsite, NE ¼ SE ¼ sec. 25, T. 30 S, R. 19 E, 5000 ft., 1; Elephant Hill, SE ¼ SW ¼ sec. 27, T. 30 S, R. 19 E, 5120 ft., 1; Chesler Canyon at Beef Basin Road, SE ¼ sec. 7, T. 31 S, R. 19 E, 5280 ft., 5; Joint Trail, NE ¼ sec. 7, T. 31 S, R. 19 E, 5300 ft., 5; Lavender Canyon, SE ¼ sec. 22, T. 32 S, R. 20 E, 5260 ft., 1.

Dipodomys ordii sanrafaeli Durrant and Setzer

Distribution.—Maze and Island in the Sky districts and deserts of the Colorado and Green river drainages of east-central Utah and adjacent Colorado. Durrant (1952:261) specified the range as north of the Colorado River in Utah, but in Colorado Armstrong (1972:183) referred to *D. o. sanrafaeli* animals from the Grand Valley on both sides of the Colorado River.

Measurements.—Three males, four females from Island in the Sky and Deadhorse Point (BYU): 247.3(245-250), 255.8(250-268); 138.7(136-140), 143.5(140-152); 42.7(42-43), 42.2(42-43); 14.7(14-15), 14.8(14-15); weights of two females, 66.5, 65.1. Eleven males, six females from Maze: 249.2(241-262), 252.2(240-267); 135.9(130-145), 137.8(131-147); 41.0(39-42), 41.3(40-43); 13.8(13-14), 13.8(13-15); weights, 55.18(49.8-62.7), 53.85(48.2-58.9). Eleven males, six females from Arches National Park (BYU): 255.0(242-270), 250.1(245-258); 139.6(127-150), 139.8(125-150); 42.9(40-45), 41.5(39-43);—, —. Representative cranial measurements are presented in Table 3.

Remarks.—Animals from the Maze District average smaller in all measurements taken than do specimens from the area between the Colorado and Green rivers. This might indicate intergradation with *D. o. cupidineus*, the subspecies to the south. The Maze population has the pale dorsal color of *D. o. sanrafaeli*, however.

Specimens examined (26).—Island in the Sky: SW ¼ SE ¼ sec. 10, T. 27 S, R. 19 E, 5600 ft., 1; S end of Gray's Pasture, sec. 32, T. 27 S, R. 19 E, 5960 ft., 1; Willow Flat, SW ¼ sec. 6, T. 28 S, R. 19 E, 6040 ft., 1; Lathrop Canyon, sec. 13, T. 28 S, R. 19 E, 4000 ft., 1. Maze: Horseshoe Canyon, sec. 7, T. 27 S, R. 16 E, 5200 ft., 14; North Point, sec. 36, T. 29 S, R. 16 E, 6400 ft., 1; Hans Flat, SE ¼ sec. 29, T. 29 S, R. 16 E, 6560 ft., 3; SW of Elaterite Butte, sec. 16, T. 30 S, R. 17 E, *ca.* 5200 ft., 2; Waterhole Flat, sec. 13, T. 31 S, R. 16 E, 5600 ft., 2.

Family Castoridae

Castor canadensis Kuhl

Beaver

Beaver are known throughout nearly all of the United States and Canada, except for parts of the Desert Southwest, the southern Great Basin, and peninsular Florida. Being semi-aquatic animals, beaver are restricted to areas with continual water supply. Hence, in Canyonlands National Park they are found along the margins of the Colorado and Green Rivers. Brazell *et al.* (1977) reported 105 dens in the Park, 64 of them active. This suggests that beaver may be somewhat less abundant there than in Glen Canyon, where Durrant and Dean (1959:87) estimated 10 active dens per river mile. They were of the opinion that "Glen Canyon possibly contains as large a population of beavers as any area in Utah."

Castor canadensis repentinus Goldman

Distribution.—Colorado River drainage from the Tavaputs Plateau southward to the mouth of the Colorado in the Sea of Cortez (Hall and Kelson, 1959).

Remarks.—No specimens are available from Canyonlands National Park. Geographic variation in beavers is poorly known. A thorough, modern revision of the 24 nominal subspecies is needed. Unfortunately, wide transplants of beaver, made to reestablish the animals in areas where they had been extirpated, may have confused the distributional patterns of genetic variants to the extent that understanding natural patterns of variation may no longer be possible.

Durrant and Dean (1959:88) speculated that the rapids of Cataract Canyon might separate the ranges of *C. c. repentinus* and *C. c. duchesnei* Durrant and Crane. If this were the case, beaver from Canyonlands National Park would be referable to the latter subspecies, which originally was ascribed a range limited to the Duchesne and White rivers in Utah and Colorado (Durrant and Crane, 1948:413).

Family Cricetidae

Reithrodontomys megalotis (Baird)

Western Harvest Mouse

Western harvest mice inhabit the grasslands and shrublands of western North America from Oaxaca to Alberta and from Wiscon-

sin to California. In Canyonlands National Park, the animals are most common in the riparian woodlands along the major washes, such as Salt Creek Wash, and along the Colorado and Green rivers.

Reithrodontomys megalotis aztecus Allen

Distribution.—Colorado Plateau and in the Rio Grande and Arkansas valleys on the western Great Plains. In Canyonlands National Park it occurs in the Needles District.

Comparison.—*R. m. aztecus* differs from *R. m. megalotis* in darker dorsal color and slightly larger skull (after Durrant, 1952:296).

Measurements.—Twelve males, seven females: 140.0(134-146), 148.4(137-159); 67.0(63-74), 70.4(62-74); 17.5(17-19), 17.4(17-19); 15.1(14-17), 16.3(14-19); weights, 11.82(10.0-14.3), 14.89(13.0-17.4). Representative cranial measurements of 12 males and six females include: greatest length of skull, 21.35(20.4-22.2), 21.34(21.0-22.1); condylobasal length, 19.86(19.0-20.5), 20.02(19.0-20.8); zygomatic breadth, 10.70(10.1-11.2), 10.84(10.6-11.0); cranial breadth, 10.27(9.8-10.6), 10.34(10.1-10.6); interorbital constriction, 3.28(3.1-3.5), 3.33(3.1-3.6); length of nasals, 8.16(7.3-8.7), 7.98(7.5-8.5); length of maxillary toothrow, 3.45(3.3-3.7), 3.42(3.3-3.5); depth of skull, 7.96(7.7-8.3), 7.96(7.8-8.2).

Specimens examined (21).—NEEDLES: near Cave Spring, NW ¼ NE ¼ sec. 20, T. 30 S, R. 20 E, 5000 ft., 4; Salt Creek Wash, NW ¼ NE ¼ sec. 29, T. 30 S, R. 20 E, 4950 ft., 1; NW ¼ NE ¼ sec. 29, T. 30 S, R. 20 E, 5015 ft., 2; S of Squaw Butte, NW ¼ sec. 30, T. 30 S, R. 20 E, 5040 ft., 2; NE ¼ sec. 30, T. 30 S, R. 20 E, 5000 ft., 3; SW of Cave Spring, NW ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 9.

Reithrodontomys megalotis megalotis (Baird)

Distribution.—Semiarid interior of western North America from British Columbia to Guanajuato, México. In Canyonlands National Park it occurs west of the Colorado River.

Comparison.—See account of *R. m. aztecus.*

Measurements.—Nine males, four females from the vicinity of Arches National Park (BYU): 138.0(130-143), 140.5(137-145); 65.8(61-72), 67.5(65-70); 17.2(15-18), 16.8(15-18);—, —. Representative cranial measurements of five males and four females from the same locality include: greatest length of skull, 21.20(21.0-21.4), 21.10(20.9-21.4); condylobasal length, 19.85(19.6-20.1), 19.60(19.4-19.9); zygomatic breadth, 10.84(10.5-11.5), 10.93(10.8-11.0); cranial breadth, 10.25(10.2-10.3), 10.30(10.2-10.4); interorbital constriction,

3.16(3.1-3.4), 3.18(3.0-3.3); length of maxillary toothrow, 3.44(3.3-3.5), 3.40(3.2-3.5); depth of skull, 7.94(7.9-8.0), 7.90(7.8-8.1).

Remarks.—This subspecies is to be expected, at least at river level, in the Maze District but has not yet been documented there. The single specimen available from the Island in the Sky is a subadult, hence the use of measurements of animals from Arches National Park and vicinity. These measurements generally are slightly smaller than those for *R. m. aztecus* from the Needles. Kelson (1951:74) referred western harvest mice from both sides of the Colorado River to *R. m. megalotis.*

Specimens examined (1).—Island in the Sky: Green River, sec. 1, T. 26 S, R. 17 ½ E, 4000 ft., 1.

Peromyscus crinitus (Merriam)

Canyon Mouse

The canyon mouse is, as its common name suggests, a characteristic rodent of Canyonlands National Park; perhaps it is the most abundant mammal there. The fact that other species of *Peromyscus* (*P. truei, P. maniculatus*) are more abundant in our collections may reflect the fact that the ecologists' usual predilection is for the more complex habitats that provide insight into subtleties of local distribution. Canyon mice are the only mammals typical of the expanses of slickrock that are the dominant geomorphic feature of much of the Park.

Peromyscus crinitus auripectus (Allen)

Distribution.—Colorado Plateau and the Uinta Basin, east of the Colorado River; in Canyonlands, it occupies the Island in the Sky and Needles districts.

Comparison.—From *P. c. doutti, P. c. auripectus* differs in slightly richer, more buffy (less yellowish) color, in the usual presence of a reddish buff pectoral spot (see Remarks), and in slightly larger external and cranial size.

Measurements.—Five males, three females from Needles: 177.6(171-182), 181.6(180-184); 93.6(90-96), 91.7(90-93); 21.4(20-23), 22.0(22-22); 20.6(20-21), 21.0(20-22); weights, 18.24(16.4-19.6), 17.53(16.4-18.5). Seventeen males, 15 females from Island in the Sky: 175.7(166-185), 178.4(168-185); 92.9(88-100), 94.0(85-98); 21.8(20-22), 20.9(20-22); 21.0(20-22), 21.4(19-22); weights, 17.00(15.0-20.5), 18.61(14.1-22.5). For cranial measurements, see Table 4.

Remarks.—As the subspecific epithet suggests, *P. c. auripectus* is characterized by a buffy patch of hairs in the pectoral region. Such a patch is prominent in 31 of 33 (93.9 per cent) adults from Island in the Sky and in nine of 11 (81.2 per cent) adults from Needles. Of 16 mice in adult pelage from the Maze District, only two have distinct patches; a third individual has an indistinct buffy wash over the entire ventral surface.

Specimens examined (74).—Island in the Sky: Green River, sec. 1, T. 26 S, R. 17 ½ E, 4000 ft., 1; Shafer Canyon, sec. 7, T. 27 S, R. 20 E, 4100 ft., 10; SW ¼ sec. 10, T. 27 S, R. 19 E, 5600 ft., 4; White Rim, sec. 13, T. 27 S, R. 19 E, 4500 ft., 3; W of Island in the Sky Headquarters, NW ¼ sec. 15, T. 27 S, R. 19 E, 5900 ft., 1; head Taylor Canyon, SW ¼ sec. 15, T. 27 S, R. 19 E, 5600 ft., 3; S of the Neck, N ½ sec. 22, T. 27 S, R. 19 E, 5900 ft., 3; rim Shafer Canyon, SE ¼ sec. 15, T. 27 S, R. 19 E, 5950 ft., 2; White Rim, SE ¼ sec. 24, T. 27 S, R. 19 E, 4600 ft., 3; NE corner Gray's Pasture, SW ¼ sec. 22, T. 28 S, R. 19 E, 6000 ft., 1; SW ¼ sec. 36, T. 27 S, R. 18 E, 6000 ft., 1; S of Aztec Butte, sec. 6, T. 28 S, R. 19 E, 6000 ft., 2; sec. 5, T. 28 S, R. 19 E, 6050 ft., 1; SE ¼ sec. 6, T. 28 S, R. 19 E, 6000 ft., 2; Lathrop Canyon, SE ¼ sec. 12, T. 28 S, R. 19 E, 4000 ft., 3; Lathrop Canyon, sec. 13, T. 28 S, R. 19 E, 4000 ft., 4; mouth Lathrop Canyon, NE ¼ sec. 13, T. 28 S, R. 19 E, 3950 ft., 1. Needles: SW ¼ sec. 34, T. 29 ½ S, R. 19 E, 4800 ft., 6; Big Springs Overlook, NE ¼ sec. 15, T. 30 S, R. 19 E, 4800 ft., 3; NW ¼ sec. 23, T. 30 S, R. 19 E, 5000 ft., 1; Big Spring Canyon, NW ¼ sec. 26, T. 30 S, R. 19 E, 5100 ft., 1; SW of Cave Spring, NW ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 3; Squaw Flat Campground, NE ¼ SE ¼ sec. 25, T. 30 S, R. 19 E, 5000 ft., 1; Elephant Hill, SE ¼ SW ¼ sec. 27, T. 30 S, R. 19 E, 5120 ft., 1; Soda Springs, SE ¼ SW ¼ sec. 27, T. 30 S, R. 19 E, 5120 ft., 1; Squaw Canyon, SW ¼ sec. 36, T. 30 S, R. 19 E, 5200 ft., 1; Joint Trail, NE ¼ sec. 7, T. 31 S, R. 19 E, 5300 ft., 8; Chesler Canyon, NW ¼ sec. 8, T. 31 S, R. 19 E, 5300 ft., 1; Chesler Canyon, SW ¼ NW ¼ sec. 8, T. 31 S, R. 19 E, 5350 ft., 2.

Peromyscus crinitus doutti Goin

Distribution.—Colorado Plateau and the Uinta Basin west of the Colorado and Green rivers. In Canyonlands National Park, it occurs only in the Maze District.

Comparisons.—See account of *P. c. auripectus.*

Measurements.—Seven males, six females from Maze: 173.2(170-177), 173.8(167-180); 91.8(88-94), 92.3(91-95); 21.0(20-22), 21.6(21-22); 21.0(19-22), 21.4(21-22); weights, 16.04(15.2-17.5), 18.23 (14.9-24.8). Representative cranial measurements appear in Table 4.

Remarks.—Another subspecies, *P. c. stephensi*, occurs in south-central Utah, to the south of Canyonlands, and northward to Kane County (Durrant and Dean, 1959:89).

Specimens examined (21).—Maze: NE of Hans Flat, SE ¼ sec. 21, T. 29 S, R. 16 E, 6400 ft., 3; SW of Elaterite Butte, sec. 16, T. 30 S, R. 17 E, *ca.* 5200 ft., 5; Teapot Canyon, sec. 12, T. 31 S, R. 16 E, 5440 ft., 13.

TABLE 4.—*Representative cranial measurements of four species of* Peromyscus.

	Greatest length of skull	Condylobasal length	Zygomatic breadth	Interorbital constriction	Length of nasals	Length of maxillary toothrow	Depth of skull
Peromyscus crinitus auripectus, Island in the Sky District							
Mean, 17 ♂♂	24.49	24.03	12.48	4.44	9.62	3.63	8.80
Minimum	25.0	23.3	12.2	4.3	9.1	3.5	8.6
Maximum	25.9	24.8	12.9	4.7	10.0	3.9	9.3
Mean, 15 ♀♀	25.44	23.79	12.47	4.46	9.68	3.64	8.79
Minimum	24.6	23.0	12.2	4.3	9.1	3.5	8.4
Maximum	26.2	24.8	12.7	4.8	10.1	3.8	9.3
Needles District							
Mean, 5 ♂♂	25.44	24.36	12.66	4.60	9.70	3.74	8.90
Minimum	24.8	23.0	12.3	4.5	9.1	3.6	8.7
Maximum	25.9	24.4	13.0	4.8	10.1	3.8	9.1
Mean, 3 ♀♀	25.53	24.46	12.50	4.53	9.33	3.67	8.73
Minimum	25.3	23.6	12.5	4.5	8.6	3.6	8.6
Maximum	25.8	24.2	12.5	4.6	9.9	3.8	8.9
Peromyscus crinitus doutii, Maze District							
Mean, 7 ♂♂	24.97	23.37	12.58	4.50	9.49	3.63	8.71
Minimum	24.5	22.8	12.2	4.3	8.8	3.5	8.6
Maximum	25.4	23.6	13.0	4.7	10.2	3.8	9.0
Mean, 5 ♀♀	25.05	23.32	12.30	4.35	9.44	3.64	8.78
Minimum	24.7	23.0	12.0	4.1	8.9	3.6	8.7
Maximum	25.5	23.8	12.7	4.5	10.0	3.8	9.0
Peromyscus maniculatus nebrascensis, Island in the Sky District							
Mean, 14 ♂♂	24.90	23.60	12.54	3.86	9.78	3.73	9.09
Minimum	24.1	22.8	12.0	3.8	8.5	3.5	8.6
Maximum	25.7	24.5	13.2	4.1	10.3	4.1	9.7
Mean, 19 ♀♀	25.19	23.88	12.52	4.01	10.35	3.74	9.09
Minimum	24.5	23.3	11.7	3.8	9.0	3.5	8.7
Maximum	26.2	24.8	13.2	4.5	10.8	4.0	9.4
Peromyscus maniculatus rufinus, Needles District							
Mean, 15 ♂♂	25.56	24.12	12.71	3.99	10.29	3.87	9.23
Minimum	24.3	23.0	12.2	3.7	9.1	3.7	8.9
Maximum	26.6	25.3	13.2	4.2	10.9	4.1	9.8
Mean, 18 ♀♀	25.92	24.59	12.75	4.08	10.59	3.80	9.14
Minimum	24.6	23.2	12.1	3.9	9.6	3.6	8.7
Maximum	26.9	25.6	13.8	4.3	11.2	4.0	9.4
Peromyscus maniculatus sonoriensis, Maze District							
Mean, 9 ♂♂	24.94	23.88	12.65	3.93	10.03	3.76	9.03
Minimum	23.9	23.2	12.0	3.7	9.3	3.5	8.7
Maximum	25.8	24.4	13.7	4.1	10.6	4.0	9.3

TABLE 4.—*Continued.*

Mean, 6 ♀♀	25.67	24.45	12.98	3.98	10.45	3.75	9.34
Minimum	24.4	23.0	12.1	3.8	9.5	3.5	9.1
Maximum	27.0	25.6	13.5	4.1	11.3	4.1	9.8
Peromyscus boylii rowleyi, Island in the Sky District							
Mean, 4 ♂♂	27.40	26.05	13.43	4.45	10.52	4.40	9.68
Minimum	27.2	25.4	13.3	4.4	9.9	4.2	9.4
Maximum	27.7	26.4	13.5	4.6	11.1	4.5	9.9
DMA 2300, ♀	28.5	27.2	14.5	4.1	11.2	4.3	9.9
Needles District							
Mean, 15 ♂♂	27.70	26.14	13.52	4.37	10.65	4.44	9.59
Minimum	26.7	25.2	13.0	4.0	9.8	4.2	9.1
Maximum	28.5	28.2	14.2	4.7	11.4	4.8	10.2
Mean, 15 ♀♀	27.84	26.16	13.58	4.51	10.83	4.37	9.61
Minimum	26.7	25.2	13.2	4.3	10.0	4.1	8.9
Maximum	28.7	26.7	14.0	4.8	11.5	4.6	10.1
Peromyscus truei truei, Island in the Sky District							
Mean, 16 ♂♂	28.32	26.63	13.59	4.44	10.79	4.33	10.17
Minimum	27.4	25.7	13.1	4.3	10.1	4.1	9.8
Maximum	28.8	27.7	14.0	4.7	11.3	4.6	10.4
Mean, 11 ♀♀	28.60	26.96	13.76	4.43	10.99	4.32	10.05
Minimum	27.7	26.1	13.2	4.3	10.2	4.2	9.7
Maximum	30.0	28.0	14.3	4.5	11.7	4.5	10.7
Maze District							
Mean, 8 ♂♂	28.02	26.61	13.48	4.54	10.88	4.42	10.16
Minimum	27.3	25.1	13.1	4.3	9.9	4.3	9.8
Maximum	28.9	23.0	14.4	4.7	12.0	4.6	10.4
Mean, 8 ♀♀	28.06	26.31	13.66	4.51	10.72	4.35	10.62
Minimum	26.5	25.3	13.2	4.3	10.0	4.1	9.6
Maximum	29.6	28.1	14.4	4.9	11.6	4.5	10.6
Needles District							
Mean, 21 ♂♂	27.84	26.17	13.36	4.46	10.64	4.25	10.12
Minimum	27.1	24.9	12.7	4.2	9.9	4.0	9.8
Maximum	28.7	26.4	13.7	4.8	11.3	4.6	10.5
Mean, 17 ♀♀	28.11	26.37	13.37	4.45	10.76	4.24	10.01
Minimum	27.7	24.9	12.5	4.1	10.0	3.9	9.4
Maximum	29.6	27.9	14.1	4.9	11.6	4.5	10.4

Peromyscus maniculatus (Wagner)

Deer Mouse

The deer mouse is nearly ubiquitous in North America, being absent only in the Southeast, Alaska, and Arctic Canada. The animals are especially abundant in Canyonlands National Park in areas disturbed by man, directly or indirectly, or by geologic

catastrophe. It answers well to the definition of "weed," an opportunistic occupant of ephemeral habitats, and this characterization is hardly unique to Canyonlands (see, for example, Armstrong, 1977*a*).

Peromyscus maniculatus nebrascensis (Coues)

Distribution.—Western part of the Great Plains, from Texas Panhandle to southern Alberta and Saskatchewan, and in the Wyoming and Uinta basins; Island in the Sky District in Canyonlands.

Comparisons.—From *P. m. rufinus, P. m. nebrascensis* differs in slightly smaller average cranial and external size, paler color, middorsum with less pronounced blackish wash, and a pelage that is less reddish overall. From *P. m. sonoriensis, P. m. nebrascensis* differs in slightly smaller size, both externally and cranially, and in more brownish (less grayish) dorsal color.

Measurements.—Fourteen males, 19 females from Island in the Sky: 158.0(151-169), 161.1(153-175); 70.1(65-79), 68.7(62-75); 20.0(19-21), 19.9(18-21); 17.6(17-19), 17.7(17-20); weights, 18.91(16.5-24.0), 20.51(15.2-29.0, N=12). For cranial measurements, see Table 4.

Remarks.—See account of *P. m. sonoriensis.*

Specimens examined (38).—Island in the Sky: Big Flat, sec. 21, T. 26 S, R. 19 E, 6000 ft., *in* Grand Co., 10; Green River, sec. 1, T. 26 S, R. 17 ½ E, 4000 ft., 7; White Rim, sec. 3, T. 27 S, R. 20 E, 4500 ft., 1; junction Shafer Trail and main road, NE ¼ sec. 10, T. 27 S, R. 19 E, 5700 ft., 1; flat, SE ¼ sec. 10, T. 27 S, R. 19 E, 5760 ft., 1; W of Island in the Sky Headquarters, NW ¼ NW¼ sec. 15, T. 27 S, R. 19 E, 5900 ft., 6; head Taylor Canyon, SW ¼ sec. 15, T. 27 S, R. 19 E, 5600 ft., 1; N of Island in the Sky Headquarters, SW ¼ sec. 15, T. 27 S, R. 19 E, 5900 ft., 1; W side Gray's Pasture, W ½ sec. 22, T. 27 S, R. 19 E, 6000 ft., 1; S of the Neck, N ½ sec. 22, T. 27 N, R. 19 E, 5900 ft., 2; NE corner Gray's Pasture, SW ¼ sec. 22, T. 27 S, R. 19 E, 6000 ft., 3; S end Gray's Pasture, sec. 32, T. 27 S, R. 19 E, 5960 ft., 1; Willow Flat, SW ¼ sec. 6, T. 28 S, R. 19 E, 6040 ft., 1; mouth Lathrop Canyon, NE ¼ sec. 13, T. 28 S, R. 19 E, 3950 ft., 1.

Peromyscus maniculatus rufinus (Merriam)

Distribution.—Southern Rocky Mountains and on the Colorado Plateau, from north-central Colorado southward to southern New Mexico and Arizona; Needles District in Canyonlands National Park.

Comparisons.—From *P. m. sonoriensis, P. m. rufinus* differs in darker, more reddish color, and larger average external and cranial size (except zygomatic breadth, which is about the same or

smaller). For comparison with *P. m. nebrascensis*, see account of that subspecies.

Measurements.—Fifteen males, 19 females from Needles: 162.0(156-177), 169.4(154-184); 70.3(57-81), 73.2(65-84); 20.7(19-22), 20.2(19-23); 18.7(17-21), 18.8(17-24); weights, 21.80(17.3-24.7), 24.40(20.0-34.5, *N*=13). For representative cranial measurements, see Table 4.

Remarks.—See account of *P. m. sonoriensis.*

Specimens examined (67).—NEEDLES: SW ¼ sec. 34, T. 29 S, R. 19 E, 4800 ft., 2; 0.7 mi. N Ranger Station, sec. 18, T. 30 S, R. 19 E, 4940 ft., 1; Salt Creek Wash, NW ¼ NE ¼ sec. 20, T. 30 S, R. 20 E, 4950 ft., 1; NE ¼ sec. 30, T. 30 S, R. 20 E, 5000 ft., 11; SW of Cave Spring, NW ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 20; Splittop Campsite, NE ¼ NW ¼ sec. 29, T. 30 S, R. 20 E, 5015 ft., 4; NW ¼ NE ¼ sec. 29, T. 30 S, R. 20 E., 5015 ft., 8; SE of Cave Spring, NE ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 1; ¼ mi. SE Cave Spring, NE ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 7; S of Squaw Butte, NW ¼ sec. 30, T. 30 S, R. 20 E, 5040 ft., 1; sec. 20, T. 30 S, R. 19 E, 5100 ft., 2; Chesler Canyon at Beef Basin Road, SE ¼ sec. 7, T. 31 S, R. 19 E, 5280 ft., 1; Virginia Park, NE ¼ SW ¼ sec. 9, T. 31 S, R. 19 E, 5600 ft., 2; near Fortress Arch, NW ¼ sec. 28, T. 31 S, R. 20 E, 5440 ft., 4; Lavender Canyon, SE ¼ sec. 22, T. 32 S, R. 20 E, 5620 ft., 2.

Peromyscus maniculatus sonoriensis (Le Conte)

Distribution.—Great Basin as well as Colorado Plateau west of the Colorado and Green rivers; Maze District in Canyonlands National Park.

Comparisons.—See accounts of *P. m. nebrascensis* and *P. m. rufinus.*

Measurements.—Nine males, six females from Maze: 159.2(146-172), 164.2(152-181); 71.2(65-80), 74.8(69-89); 20.1(18-21), 20.5(20-21); 17.8(17-18), 18.0(16-20); weights, 20.09(14.7-22.0), 21.02 (16.4-23.2). For representative cranial measurements, see Table 4.

Remarks.—Durrant and Dean (1959:90-91) thought that animals from Glen Canyon on both sides of the Colorado River were of this subspecies, restricting use of the name *P. m. rufinus* in San Juan County to animals from higher elevations. This differs from the usage of Kelson (1951:80) and Durrant (1952:308), who both considered the Colorado River north of the San Juan as a barrier between *P. m. sonoriensis* and *P. m. rufinus.*

The subspecies of *P. maniculatus* in the area are distinguished best by dorsal color. To allow objective comparison of color of study skins, a method suggested by Anderson (1956:87) was used. Mice from all three districts were pooled and a range of dorsal color (adult pelage) from pale to quite dark was noted. One of the paler skins (but not the palest—a specimen from the Island in

the Sky, DMA 1147) was arbitrarily assigned the number 2. One of the darker mice (but not the darkest—a specimen from the Needles District, DMA 1662) was assigned the number 4. With these two specimens as standards, skins were scored for darkness of dorsal color on a scale of 1 to 5. Mean scores, followed by range and sample size, for animals from each district were: Island in the Sky, 1.7 (1-3, N=33), Needles, 2.8 (2-5, N=33), Maze, 1.6 (1-4, N=14).

I am inclined to agree with the earler interpretation and assignment of names as regards animals from Canyonlands National Park. It is true that "deer mice from this region are exceedingly difficult to assign to subspecies" (Durrant and Dean, 1959:90), but specimens from the Needles District do average slightly larger in size and darker in color than those from the Maze. Most animals from the Needles District are neither as dark nor as reddish as are deer mice from the highlands of southeastern Utah. However, *P. m. rufinus* is highly variable in color throughout its range; the local population also is variable, but tends toward the paler end of the variability within this subspecies.

This clearly is a case in which traditional skin and skull taxonomy provides inadequate insight into relationships between populations. A thorough biosystematic study of this situation is needed.

Specimens examined (19).—MAZE: Horseshoe Canyon, sec. 7, T. 27 S, R. 16 E, 5200 ft., 2; North Point, sec. 36, T. 29 S, R. 16 E, 6400 ft., 2; NE of Hans Flat, SE ¼ sec. 21, T. 29 S, R. 16 E, 6400 ft., 4; Waterhole Flat, sec. 13, T. 31 S, R. 16 E, 5600 ft., 10.

Peromyscus boylii (Baird)

Brush Mouse

The brush mouse occurs in southwestern and south-central United States southward through central México to Nicaragua and El Salvador. The common name is appropriate for in Canyonlands National Park this species usually is found under the cover of dense brush—afforded by oak (*Quercus*), *Mahonia*, and even exotic saltcedar (*Tamarix*). Distribution here and throughout much of its range is patchy, and this probably is the least abundant species of *Peromyscus* in Canyonlands. Two subspecies are expected to occur here, although only one has been documented to date.

Peromyscus boylii rowleyi (Allen)

Distribution.—Southward from the Colorado Plateau and southern High Plains to central México; Needles and Island in the Sky districts in Canyonlands National Park.

Comparison.—See account of *P. b. utahensis.*

Measurements.—Four males, one female from Island in the Sky: 197.8(186-202), 209; 102.2(95-108), 107; 22.2(21-23), 23; 20.2(18-22), 20; weights, 24.00(22.6-25.5), —. Fourteen males, 14 females from Needles: 198.2(185-214), 200.8(185-216); 100.8(88-111), 102.3(87-121); 22.5(22-24), 22.3(21-24); 21.1(19-24), 20.9(19-22); weights, 26.22(20.6-30.5), 24.64(19.5-30.1, N=7). For representative cranial measurements, see Table 4.

Specimens examined (62).—Island in the Sky: Green River, sec. 1, T. 26 S, R. 17 ½ E, 4000 ft., 2; head Taylor Canyon, SW ¼ sec. 15, T. 27 S, R. 19 E, 5600 ft., 1; mouth Lathrop Canyon, NE ¼ sec. 13, T. 28 S, R. 19 E, 3950 ft., 5; Lathrop Canyon, sec. 13, T. 28 S, R. 19 E, 4000 ft., 1. Needles: NW ¼ NW ¼ sec. 29, T. 30 S, R. 20 E, 5015 ft., 1; Splittop Campsite, NE ¼ NW ¼ sec. 29, T. 30 S, R. 20 E, 5015 ft., 31; SW of Cave Spring, NW ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 8; NW ¼ NE ¼ sec. 29, T. 30 S, R. 20 E, 5015 ft., 12; ¾ mi. WSW Ranger Residence Area, sec. 36, T. 30 S, R. 19 E, 5000 ft., 1; Squaw Canyon, SW ¼ sec. 36, T. 30 S, R. 19 E, 5200 ft., 3; near Fortress Arch, NW ¼ sec. 28, T. 31 S, R. 20 E, 5440 ft., 4; Lavender Canyon, SE ¼ sec. 22, T. 32 S, R. 20 E, 5620 ft., 12.

Peromyscus boylii utahensis Durrant

Distribution.—Central Utah at moderate elevations on both sides of the Wasatch Mountains and high plateaus; of probable occurrence in the Maze District, Canyonlands National Park.

Comparison.—From *P. b. rowleyi*, *P. b. utahensis* differs in smaller external size, relatively longer tail, darker dorsal color, and generally larger cranial size (see Durrant, 1952:317-318).

Remarks.—*P. boylii* is as yet undocumented in the Maze District but probably occurs there, especially at river-level. Durrant and Dean (1959:91) reported several specimens of *P. b. utahensis* from the west side of the Colorado River in Glen Canyon, northward to River Mile 148 above Lee's Ferry (near Ticabook Creek). Specimens from that area were clearly referable to the distinctive subspecies *P. b. utahensis.*

Peromyscus truei (Shufeldt)

Piñon Mouse

The piñon mouse occupies semidesert woodlands from southern Oregon to Oaxaca in México. Perhaps a more appropriate

common name for this species would be "juniper mouse," for juniper seems to be profoundly important to its natural history (see Douglas, 1969). Piñon mice are abundant throughout Canyonlands National Park, not only in well-developed pygmy-conifer woodland but also in stands of big sagebrush; it also is a common "house mouse" about settlements of Park Service personnel (who show a distinct predilection for the woodland habitats in the mosaic of desert ecosystems).

Peromyscus truei truei (Shufeldt)

Distribution.—Colorado Plateau northward into the Uinta Basin and eastward into the foothills of the southern Rocky Mountains of southeastern Colorado. *P. t. truei* is found in all three districts of Canyonlands National Park; no other subspecies are recognized in the region.

Measurements.—Sixteen males, 11 females from Island in the Sky: 185.5(174-192), 191.6(178-199); 92.5(87-96), 94.1(85-102); 22.8(22-24), 23.1(22-25); 26.5(25-58), 26.4(25-28); weights, 23.6(18.2-27.2), 25.7(22.7-31.2, N=10). Twenty-one males, 18 females from Needles: 189.6(172-201), 190.4(174-215); 92.6(80-105), 93.2(80-104); 23.0(22-24), 23.1(22-25); 25.9(23-28), 25.8(23-28); weights, 22.5(18.2-26.6), 26.2(19.6-25.7, N=10). Eight males, eight females from Maze: 183.9(174-195), 188.0(169-211); 92.4(85-101), 93.7(85-100); 22.2(22-23), 22.4(22-24); 26.0(25-28), 26.1(24-29); weights, 21.48(18.5-24.6), 24.7(17.8-28.5, N=3). Table 4 presents some cranial measurements.

Specimens examined (167).—Island in the Sky: Big Flat, sec. 21, T. 26 S, R. 19 E, 6000 ft., *in* Grand Co., 9; Green River, sec. 1, T. 26 S, R. 17 ½ E, 4000 ft., 3; junction Shafer Trail and Main Road, NE ¼ sec. 10, T. 27 S, R. 19 E, 5700 ft., 2; Island in the Sky Headquarters, NW ¼ sec. 15, T. 27 S, R. 19 E, 6000 ft., 1; dome W side Gray's Pasture, W ½ sec. 22, T. 27 S, R. 19 E, 6000 ft., 2; S of the Neck, N ½ sec. 22, T. 27 S, R. 19 E, 5900 ft., 4; NE corner Gray's Pasture, SW ¼ sec. 22, T. 27 S, R. 19 E, 6000 ft., 2; ½ mi. S Upheaval Dome, NW ¼ sec. 26, T. 27 S, R. 18 E, 5520 ft., 2; SW ¼ SE ¼ sec. 10, T. 27 S, R. 19 E, 5600 ft., 4; sec. 5, T. 28 S, R. 19 E, 6050 ft., 3; Willow Flat, SW ¼ sec. 6, T. 28 S, R. 19 E, 6040 ft., 3; SE ¼ sec. 6, T. 28 S, R. 19 E, 6000 ft., 3; ½ mi. N Grandview Point, sec. 32, T. 26 S, R. 19 E, 6000 ft., 1. Maze: North Point, sec. 36, T. 29 S, R. 16 E, 6400 ft., 6; NE of Hans Flat, SE ¼ sec. 21, T. 29 S, R. 16 E, 6400 ft., 2; Hans Flat, SE ¼ sec. 29, T. 29 S, R. 16 E, 6560 ft., 10; SW of Elaterite Butte, sec. 16, T. 30 S, R. 17 E, *ca.* 5200 ft., 1; Teapot Canyon, sec. 12, T. 31 S, R. 16 E, 5440 ft., 3; Waterhole Flat, sec. 13, T. 31 S, R. 16 E, 5600 ft., 7. Needles: SW ¼ sec. 34, T. 29 ½ S, R. 19 E, 4800 ft., 1; 0.7 mi. N Ranger Station, sec. 18, T. 30 S, R. 19 E, 4940 ft., 1; Salt Creek Wash, NW ¼ NE ¼ sec. 20, T. 30 S, R. 20 E, 4950 ft., 1; ½ mi. N Cave Spring Trail, sec. 20, T. 30 S, R. 19 E, 5100 ft., 1; NW ¼ sec. 23, T. 30 S, R. 19 E, 5100 ft., 2; Squaw Flat, SE ¼ sec. 19, T. 30 S, R. 19 E, 5000 ft., 3; Uinta No. 3 Oil Well, NW ¼ sec. 26, T. 30 S, R.

19 E, 5120 ft., 1; Big Spring Canyon, NW ¼ sec. 26, T. 30 S, R. 19 E, 5100 ft., 1; W of Squaw Butte, NE ¼ sec. 25, T. 30 S, R. 19 E, 5040 ft., 5; S of Squaw Butte, NW ¼ sec. 30, T. 30 S, R. 20 E, 5040 ft., 8; NE ¼ sec. 30, T. 30 S, R. 20 E, 5000 ft., 19; SW of Cave Spring, NW ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 2; Splittop Campsite, NE ¼ NE ¼ sec. 29, T. 30 S, R. 20 E, 5015 ft., 2; NW ¼ NE ¼ sec. 29, T. 30 S, R. 20 E, 5015 ft., 1; near Cave Spring, NW ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 5; S of Cave Spring, NE ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 4; ¼ mi. SE Cave Spring, NE ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 2; Big Spring Canyon, NW ¼ sec. 26, T. 30 S, R. 19 E, 5100 ft., 4; rocks N of Squaw Spring, NE ¼ SW ¼ sec. 25, T. 30 S, R. 19 E, 5120 ft., 2; Squaw Slot Campsite, NE ¼ SE ¼ sec. 25, T. 30 S, R. 19 E, 5000 ft., 3; Park Well, SE ¼ sec. 25, T. 30 S, R. 29 E, 5000 ft., 1; Elephant Hill, SE ¼ SW ¼ sec. 27, T. 30 S, R. 19 E, 5120 ft., 2; SE ¼ sec. 25, T. 30 S, R. 19 E, 5000 ft., 6; Squaw Canyon, SE ¼ sec. 25, T. 30 S, R. 19 E, 5100 ft., 2; S of Squaw Spring, NW ¼ sec. 36, T. 30 S, R. 20 E, 5040 ft., 1; ¾ mi. WSW Ranger Residence Area, sec. 36, T. 30 S, R. 19 E, 5000 ft., 1; Squaw Canyon, SW ¼ sec. 36, T. 30 S, R. 19 E, 5200 ft., 6; Chesler Canyon at Beef Basin Road, SE ¼ sec. 7, T. 31 S, R. 19 E, 5230 ft., 1; Joint Trail, N ½ sec. 7, T. 31 S, R. 19 E, 5300 ft., 5; Chesler Canyon, NW ¼ sec. 8, T. 31 S, R. 19 E, 5300 ft., 3; Virginia Park, NE ¼ SW ¼ sec. 9, T. 31 S, R. 19 E, 5600 ft., 1.

Onychomys leucogaster (Wied-Neuwied)

Northern Grasshopper Mouse

The northern grasshopper mouse is a species most common in grassland and shrub-steppe habitats, ranging from Saskatchewan to Tamaulipas and from Oregon to Minnesota. It is an abundant rodent locally in Canyonlands National Park, especially on areas that formerly were grazed heavily. It is surprising that the species has yet to be taken in the district of Island in the Sky; Wagner and Workman (1961) reported no specimens from Deadhorse Point State Park. Two subspecies are present in Canyonlands.

Onychomys leucogaster melanophrys Merriam

Distribution.—Central valleys of Utah southward to the Arizona Strip. In Canyonlands National Park it occurs in the Maze District.

Comparison.—From *O. l. pallescens*, *O. l. melanophrys* differs in shorter hind foot, slightly darker color, zygomatic arches more flared posteriorly, braincase narrower and shallower, maxillary toothrow shorter, infraorbital foramen relatively narrow, more slitlike (after Durrant, 1952:328—see Remarks).

Measurements.—Specimens of adults from the Maze District are unavailable. Two males, one female (UU) from Ekker's Robber's Roost Ranch, adjacent to the Park on the west: 150, 137, 146; 38, 35, 40; 22, 20, 20; 18, 13, 16. Representative cranial measurements of two males are: greatest length of skull, 28.5, 28.0; condylobasal

length, 27.3, 26.6; zygomatic breadth, —, 15.1; interorbital constriction, 5.0, 4.6; length of nasals, 11.0, 11.0; length of maxillary toothrow, 4.8, 4.6; depth of skull, 10.4, 9.8.

Remarks.—Unfortunately, all specimens available from the Maze District are subadults so it is impossible to compare measurements with populations of adults from other districts. Nonetheless, when subadults from the Maze are compared with those from Needles, the cranial distinctions noted by Durrant (1952:328), and indicated above under Comparisons, hold true. In addition to those characters, the occiput of individuals from Maze is slightly broader. These cranial differences support the recognition of two subspecies in the Park, *O. l. pallescens* in Needles (and probably Island in the Sky), and *O. l. melanophrys* in Maze. Hollister (1914:444) thought the two names synonymous; Benson (1935:451) revived the use of the name *pallescens*.

Specimens examined (8).—MAZE: Horseshoe Canyon, sec. 7, T. 27 S, R. 16 E, 5200 ft., 8.

Onychomys leucogaster pallescens Merriam

Distribution.—Colorado Plateau, occupying adjacent parts of Utah, Colorado, Arizona, and New Mexico. *O. l. pallescens* occurs in the Needles District (and probably Island in the Sky).

Comparison.—See account of *O. l. melanophrys*.

Measurements.—Five males, two females from Needles: 156.4(152-165), 161, 160; 46.2(41-50), 51, 46; 22.4(20-24), 23, 23; 19.4(18-22), 19, 19; weights, 36.65(34.0-40.4), —. Representative cranial measurements of these animals include: greatest length of skull, 28.85(28.4-29.5), 28.5, 28.3; condylobasal length, 27.70(27.2-28.3), 26.8, 27.5; zygomatic breadth, 14.75(14.3-15.4), 14.5, 14.7; interorbital constriction, 5.14(5.0-5.3), 5.2, 5.2; length of nasals, 11.42(10.8-11.8), 11.2, 11.1; length of maxillary toothrow, 4.76(4.7-4.8), 4.8, 4.7; depth of skull, 10.50(10.4-10.7), 10.4, 11.0. Three males, three females from localities in Grand County north of Moab (north and west of the Colorado River, UU): 148.3(142-160), 151.3(150-153); 42.3(40-45), 42.7(42-44); 22.0(22-22), 21.3(20-22); 18.0(17-19), 18.3(18-19). Cranial measurements of three females: greatest length of skull, 28.37(28.0-29.0); condylobasal length, 27.75(26.9-28.6); zygomatic breadth, 14.65(14.4-14.9); interorbital constriction, 4.80(4.8-4.8); length of nasals, 10.80(10.3-11.3); length of maxillary toothrow, 4.60(4.6-4.6); depth of skull, 9.80(9.7-9.9).

Specimens examined (42).—NEEDLES: Big Springs Waterhole, NE ¼ sec. 15, T. 30 S, R. 19 E, 4800 ft., 1; NW ¼ sec. 14, T. 30 S, R. 19 E, 4960 ft., 1; Salt Creek Wash,

NW ¼ NW ¼ sec. 20, T. 30 S, R. 20 E, 4950 ft., 1; S of Squaw Butte, NW ¼ sec. 30, T. 30 S, R. 20 E, 5040 ft., 2; NW ¼ sec. 30, T. 30 S, R. 20 E, 5000 ft., 1; NE ¼ sec. 30, T. 30 S, R. 20 E, 5000 ft., 14; NW ¼ NE ¼ sec. 29, T. 30 S, R. 20 E, 5015 ft., 4; near Cave Spring, NW ¼ NE ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 1; SW of Cave Spring, NE ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 5; Chesler Canyon at Beef Basin Road, SE ¼ sec. 7, T. 31 S, R. 19 E, 5280 ft., 1.

Neotoma lepida Thomas

Desert Woodrat

Neotoma lepida ranges over much of the Colorado Plateau, Great Basin, and Sonoran deserts. In Canyonlands National Park, the animals live in a variety of habitats from woodlands and piles of rubble on slickrock rims to colluvium on riverbanks. This may be the most abundant woodrat in the Park, although the collector's bias against the rather monotonous habitats it often occupies has resulted in only modest sample sizes.

Neotoma lepida sanrafaeli Kelson

Distribution.—From western Colorado southward to Garfield County, Utah; Maze and Island in the Sky districts of Canyonlands National Park.

Measurements.—Five males, one female from Island in the Sky: 278.8(274-285), 282; 119.2(112-126), 121; 31.6(31-33), 30; 29.8(29-31), 29; weights, 118.96(105.5-132.2), 138.8. Eight females (UU) from the vicinity of Ekker's Robber's Roost Ranch (adjacent to Maze on the west): 273.1(260-300); 116.6(110-137); 27.1(23-30); 30.5(28-34). For cranial measurements, see Table 5.

Remarks.—A smaller and darker subspecies, *N. l. monstrabilis*, occurs to the south of Canyonlands, but all specimens from the Park are referable to *N. l. sanrafaeli*. Desert woodrats exist only north and west of the Colorado River, insofar as is known.

Specimens examined (26).—MAZE: Horseshoe Canyon, sec. 7, T. 27 S, R. 16 E, 5200 ft., 3; North Point, sec. 36, T. 29 S, R. 16 E, 6400 ft., 1; Teapot Canyon, sec. 12, T. 31 S, R. 16 E, 5440 ft., 2; Waterhole Flat, sec. 13, T. 31 S, R. 16 E, 5600 ft., 3. ISLAND IN THE SKY: junction Shafer Trail and main road, NE ¼ sec. 10, T. 27 S, R. 19 E, 5700 ft., 1; SE ¼ SE ¼ sec. 10, T. 27 S, R. 19 E, 5600 ft., 2; Shafer Canyon, sec. 7, T. 27 S, R. 20 E, 4100 ft., 2; White Rim, sec. 13, T. 27 S, R. 19 E, 4500 ft., 1; dome W side Gray's Pasture, W ½ sec. 22, T. 27 S, R. 19 E, 6000 ft., 1; White Rim, SE ¼ sec. 24, T. 27 S, R. 19 E, 4500 ft., 1; NE ¼ sec. 32, T. 27 S, R. 19 E, 6000 ft., 2; SW ¼ sec. 36, T. 27 S, R. 18 E, 6000 ft., 1; SE ¼ sec. 10, T. 27 S, R. 19 E, 5600 ft., 2; Lathrop Canyon, SE ¼ sec. 12, T. 28 S, R. 19 E, 4000 ft., 2; mouth Lathrop Canyon, NE ¼ sec. 13, T. 28 S, R. 19 E, 3950 ft., 3; ½ mi. N Grandview Point, sec. 32, T. 28 S, R. 19 E, 6000 ft., 1.

TABLE 5.—*Representative cranial measurements of four species of* Neotoma.

	Condylobasal length	Basilar length	Zygomatic breadth	Interorbital constriction	Length of nasals	Breadth of rostrum	Length of maxillary toothrow	Depth of skull
Neotoma lepida sanrafaeli, Island in the Sky District								
Mean, 5 ♂♂	37.16	31.78	20.10	5.12	14.04	5.80	8.38	14.20
Minimum	35.6	30.1	18.7	4.7	13.9	5.4	8.1	13.6
Maximum	38.5	33.0	20.7	5.3	14.2	6.4	8.8	14.6
DMA 1071, ♀	38.2	32.8	20.2	5.2	13.2	6.0	8.1	14.3
Maze District and Vicinity								
DMA 2385, ♂	38.2	32.5	19.8	4.9	14.9	5.7	8.5	14.4
Mean, 8 ♀♀	37.00	31.59	19.52	4.75	13.84	5.66	8.29	14.13
Minimum	36.4	31.0	19.1	4.5	13.3	5.4	8.0	13.9
Maximum	38.2	32.8	19.8	5.0	14.8	6.0	8.5	14.4
Neotoma albigula laplataensis, Needles District								
DMA 1501, ♀	41.4	35.3	21.8	5.7	16.3	7.2	7.4	15.5
DMA 1561, ♀	44.5	37.8	23.9	5.6	17.2	7.4	8.1	16.1
Neotoma mexicana inopinata, Needles District								
Mean, 12 ♀♀	41.52	35.02	21.58	5.17	17.10	6.58	9.03	14.73
Minimum	39.3	32.8	20.0	4.9	15.9	6.1	8.5	14.4
Maximum	43.2	37.0	22.4	5.6	18.9	7.2	9.3	15.2
DMA 1354, ♂	41.0	34.7	22.5	5.5	17.3	7.3	8.9	14.6
DMA 1607, ♂	44.1	37.8	22.6	4.9	18.5	6.9	8.8	15.9
Neotoma cinerea arizonae, Island in the Sky District								
DMA 1160, ♂	42.1	36.5	23.1	5.4	17.1	6.8	9.0	15.7
DMA 1227, ♀	38.8	32.6	20.8	5.5	15.4	6.5	8.8	
Needles District								
DMA 1403, ♂	45.7	38.9	24.1	5.2	19.1	6.8	9.1	15.5
DMA 1350, ♀	39.4	33.7	21.2	5.7	16.1	6.2	8.8	15.0

Neotoma albigula Hartley

White-throated Woodrat

The white-throated woodrat ranges from central México northward to southern Utah and Colorado. In the northern reaches of its distribution, the species occurs mostly in woodland habitats on rough, broken terrain. Two subspecies range near Canyonlands National Park, but only one has been documented within the Park boundaries, and this was in the Needles District.

Neotoma albigula laplataensis Miller

Comparison.—From *N. a. brevicauda, N. a. laplataensis* differs in smaller external and cranial size and relatively longer tail and hindfoot.

Measurements.—One female maintained in captivity: 277, 127, 27, 29. For cranial measurements, see Table 5.

Remarks.—*N. a. brevicauda* was named by Durrant (1934) from Castle Valley, 15 mi. NE Moab, Grand County, Utah, which is on the east side of the Colorado River. This subspecies is found also in adjacent parts of Colorado in the Dolores-San Miguel drainage (Armstrong, 1972:220). *N. a. laplataensis* was named from the San Juan drainage of Colorado and is known from several localities in San Juan County, Utah, of which the nearest to Canyonlands National Park was a place 12 mi. N Blanding (Durrant, 1952:336). Durrant and Dean (1959:93) reported this subspecies from river miles 78 and 69 (above Lee's Ferry) in Glen Canyon.

Specimens examined (3).—NEEDLES: Cave Spring, NW ¼ SE ¼ sec. 20, T. 30 S, R. 20 E, 5000 ft., 1; SE ¼ sec. 25, T. 30 S, R. 19 E, 5000 ft., 1; SE of Cave Spring, NE ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 1.

Neotoma mexicana Baird

Mexican Woodrat

The Mexican woodrat occurs from Nicaragua northward through much of México to Colorado and Utah. The animals are particularly abundant about rimrock in areas of saxicoline brush. *N. mexicana* is known only from the Needles District in Canyonlands National Park, where it is often taken among rocks in oakbrush-*Mahonia* thickets along with *Peromyscus boylii.*

Neotoma mexicana inopinata Goldman

Distribution.—Four Corners area of Utah, Colorado, Arizona, and New Mexico.

Measurements.—Two males, 12 females, from Needles: 311, 351, 319.1(297-341); 138, 160, 144.8(132-161); 35, 36, 33.5(32-36); 28, 29, 26.9(22-29); weights, 159.9, 170.3, 120.76(93.6-170.1, N=7). Cranial measurements are presented in Table 5.

Specimens examined (46).—NEEDLES: Splittop Campsite, NE ¼ NW ¼ sec. 29, T. 30 S, R. 20 E, 5015 ft., 10; near Cave Spring, NW ¼ NE ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 6; NW ¼ NE ¼ sec. 29, T. 30 S, R. 20 E, 5015 ft., 4; Big Spring Canyon, NW ¼ sec. 26, T. 30 S, R. 19 E, 5100 ft., 1; S of Squaw Butte, NW ¼ sec. 30, T. 30

S, R. 20 E, 5040 ft., 2; NE ¼ sec. 30, T. 30 S, R. 20 E, 5000 ft., 9; near Fortress Arch, NW ¼ sec. 28, T. 31 S, R. 20 E, 5440 ft., 6; SW of Cave Spring, NW ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 1; ¼ mi. SE Cave Spring, NE ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 4; Squaw Canyon, SW ¼ sec. 36, T. 30 S, R. 19 E, 5200 ft., 1; Joint Trail, NE ¼ sec. 7, T. 31 S, R. 19 E, 5300 ft., 2.

Neotoma cinerea (Ord)

Bushy-tailed Woodrat

Unlike other woodrats of Canyonlands National Park, *Neotoma cinerea* is primarily a rodent of mountainous western North America, ranging from the Yukon to Arizona and New Mexico. The animals are not restricted to mountains, however, inasmuch as they are present throughout the Colorado Plateau and over much of the Great Basin. Bushy-tailed woodrats probably occur in all three districts of Canyonlands, although they are undocumented to date in Maze. This species seems to be the least abundant of local species of *Neotoma*.

Neotoma cinerea acraia (Elliot)

Distribution.—Great Basin of Nevada and Utah; it is to be expected in the Maze District.

Comparison.—See account of *N. c. arizonae*.

Remarks.—This subspecies was reported from Hite by Durrant and Dean (1959:95). It probably will be found in the Maze District where suitable habitat prevails.

Neotoma cinerea arizonae Merriam

Distribution.—Four Corners Region of the Colorado Plateau. In Canyonlands, it occurs in the Needles and Island in the Sky districts.

Comparison.—From *N. c. acraia*, *N. c. arizonae* differs in slightly paler color, less bushy tail, shorter hindfoot, generally smaller cranial measurements, and presence of sphenopalatine vacuities (after Durrant, 1952:347).

Measurements.—One male, one female from Needles, followed by one male and one female from Island in the Sky: 370, 300, 324, 272; 171, 140, 142, 134; 39, 37, 39, 39; 34, 32, 34, 33; weight of the latter male, 202.3. Representative cranial measurements are presented in Table 5.

Remarks.—Durrant (1952:345) mapped the range of *N. c. macrodon* Kelson as extending southward to the confluence of the Colorado and Green rivers, thus encompassing the Island in the

Sky District. However, he wrote (pp. 350-351) that the subspecies seemed to be limited to the East Tavaputs Plateau. To my eye, animals from Island in the Sky are indistinguishable from those from Needles, both externally and cranially; there is no suggestion that animals from the Island are, as Durrant's map would suggest, *N. c. macrodon*.

Specimens examined (15).—Island in the Sky: head, Taylor Canyon, SW ¼ sec. 15, T. 27 S, R. 19 E, 5600 ft., 2; NE corner Gray's Pasture, SW ¼ sec. 22, T. 27 S, R. 19 E, 6000 ft., 1; SW ¼ sec. 36, T. 27 S, R. 18 E, 6000 ft., 1; ½ mi. N. Grandview Point, sec. 32, T. 28 S, R. 19 E, 6000 ft., 1; mouth Lathrop Canyon, NE ¼ sec. 13, T. 28 S, R. 19 E, 5950 ft., 1. Needles: SW of Cave Spring, NW ¼ sec. 29, T. 30 S, R. 20 E, 5000 ft., 4; Squaw Slot Campsite, NE ¼ SE ¼ sec. 25, T. 30 S, R. 19 E, 5000 ft., 1; Soda Springs, SE ¼ SW ¼ sec. 8, T. 31 S, R. 19 E, 5300 ft., 1.

Family Erethizontidae

Erethizon dorsatum (Linnaeus)

Porcupine

Porcupines inhabit nearly all forested regions of the United States and Canada except the Southeast. The animals are found in woodlands in Canyonlands National Park where their feeding on bark, especially that of pinyon pine, is quite evident, particularly in parts of the Needles District. Two subspecies are recognized as possibly occurring within the Park.

Erethizon dorsatum couesi Mearns

Distribution.—Desert regions of the Southwest, from southeastern Utah and adjacent Colorado to Sonora and Chihuahua. This is the porcupine to be expected in the Needles District.

Comparison.—See account of *E. d. epixanthum*.

Remarks.—No specimens have been collected in Canyonlands National Park, although signs of porcupines are present throughout the area, and occasional skeletal material is found. Subspecific designation of local populations is strictly geographical, following Durrant (1952:389). As is true of most other medium-sized mammals, large sample sizes are difficult to obtain and as a result geographic variation is poorly documented. Subspecies of *E. dorsatum* are in need of revision.

Erethizon dorsatum epixanthum Brandt

Distribution.—Western North America from Oregon and California eastward to Saskatchewan and northern New Mexico. In Canyonlands National Park, it is the subspecies to be expected in

the Maze and Island in the Sky districts (see Remarks in account of *E. d. couesi*).

Comparison.—From *E. d. couesi*, *E. d. epixanthum* differs in smaller average size of infraorbital foramina, auditory bullae less inflated, jugals broader dorsoventrally, hamular processes broader, space between auditory bullae and hamulae broader (after Durrant, 1952:391); elsewhere over its range, *E. d. epixanthum* is larger in size than *E. d. couesi* and somewhat darker in color (Armstrong, 1972:253).

Specimens examined (1).—Island in the Sky: Lathrop Canyon, NE ¼ sec. 13, T. 28 S, R. 19 E, 3950 ft., 1.

Species of Possible Occurrence

In addition to the rodent fauna documented in Canyonlands National Park, a few species are of possible occurrence or may have occurred there in the recent past.

Spermophilus spilosoma cryptospilotus Merriam.—The spotted ground squirrel is poorly known on the Colorado Plateau. The animals occur on the Great Plains, southward into México. They should perhaps be expected in the Needles District. They have been reported from Monticello (Howell, 1938:130).

Cynomys leucurus Merriam.—White-tailed prairie dogs are distributed primarily throughout the semidesert shrublands of the Wyoming and Uinta basins and in the Grand Valley of the Colorado River. They have been reported from a place 8 mi. NW Moab (Durrant, 1952:107) and might once have been present in what is now the Island in the Sky District of Canyonlands National Park.

Cynomys gunnisoni zuniensis Hollister.—Gunnison's prairie dogs occur on the Colorado Plateau, south and east of the Colorado River, and in adjacent parts of Colorado and New Mexico in semidesert grasslands and shrublands as well as mountain parks. The animals could have occupied the Needles District in former times for they have been reported from as near Canyonlands National Park as a place 10 mi. S La Sal Junction, 6500 ft. (Durrant, 1952:110).

Sciurus aberti navajo Durrant and Kelson.—Abert's squirrel was not reported from Utah until 1947 when Durrant and Kelson named this species; the type specimen was obtained at Kigalia Ranger Station, 30 mi. W Blanding, 8000 ft., San Juan County. This subspecies is limited strictly to stands of ponderosa pine and seems to be restricted in San Juan County to the Abajo Moun-

tains and Elk Ridge (Lee, 1960:108). It is conceivable, albeit unlikely, that Abert's squirrel occurs occasionally in the extreme southeastern portion of the Needles District.

Perognathus flavus hopiensis Goldman.—The silky pocket mouse might eventually be found in the grasslands of the Needles District. This species is known from a place ½ mi. NW Bluff, 4500 ft. (Durrant, 1952:234), which is north of the San Juan River. These mice are distributed widely on the Great Plains and range southward into central México.

Several additional species of desert and semidesert rodents are known from San Juan County. Benson (1935) named *Perognathus longimembris arcus* from Rainbow Bridge, and reported *P. intermedius crinitus* Benson, *Peromyscus difficilis* (Allen), and *Neotoma stephensi relicta* Goldman from there. Durrant and Dean (1959:86) reported *Perognathus intermedius, P. formosus,* and *P. longimembris* from Glen Canyon, all from areas south of the Escalante or San Juan rivers. Although these localities are not far from Canyonlands National Park, I doubt that these species live within its boundaries because of the presence of effective barriers to dispersal. For comments on rivers of extreme southern Utah as barriers, see Armstrong (1977*b*); for discussion of montane mammals of southeastern Utah, see Lee (1960) and Benson (1935).

Zoogeographic Comments

Zoogeography seeks to describe and interpret patterns in the distribution of animals. The Canyonlands Section of the Colorado Plateau is an appropriate place for such pursuits. The master streams and their tributaries present substantial barriers to dispersion. It is a truism to point out that what is a barrier to the dispersal of one species may well be a corridor for another; the Canyonlands present both sorts of phenomena.

Durrant (1952) and Kelson (1951) mapped mammalian distributions in southeastern Utah to define ecogeographic units, which are analogous to the biotic provinces of Dice (1943). The areas were derived by qualitative methods and were seen as distinctive because certain species were restricted to them and because they had acted as centers of differentiation for subspecies. Durrant and Kelson both considered the area known now as Canyonlands National Park as being within the Canyonlands Province of the Colorado Plateau Faunal Area. The faunistic distinctiveness of the three districts of the Park was emphasized; they lay in three

TABLE 6.—*Summary of distribution of subspecies of rodents in Canyonlands National Park. Adjective in parenthesis indicates areographic faunal element with which species is associated (see Armstrong, in press). A question mark denotes taxon of hypothetical occurrence only.*

Subspecies	Island in the Sky	Maze	Needles
Eutamias quadrivittatus hopiensis (Arizonan)	X	X	X
Ammospermophilus leucurus cinnamomeus (Yuman)			X
Ammospermophilus leucurus notom		X	
Ammospermophilus leucurus pennipes	X		
Spermophilus variegatus grammurus (Chihuahuan)	X		X
Spermophilus variegatus utah		?	
Thomomys bottae aureus (Yuman)			X
Thomomys bottae howelli	?		
Thomomys bottae osgoodi		?	
Perognathus apache caryi (Arizonan)	X		X
Perognathus parvus bullatus (Nevadan)		X	
Dipodomys ordii nexilis (Chihuahuan)			X
Dipodomys ordii sanrafaeli	X	X	
Castor canadensis repentinus (Widespread)	X	X	X
Reithrodontomys megalotis aztecus (Chihuahuan)			X
Reithrodontomys megalotis megalotis	X	?	
Peromyscus crinitus auripectus (Yuman)	X		X
Peromyscus crinitus doutti		X	
Peromyscus maniculatus nebrascensis (Widespread)	X		
Peromyscus maniculatus rufinus			X
Peromyscus maniculatus sonoriensis		X	
Peromyscus boylii rowleyi (Chihuahuan)	X		X
Peromyscus boylii utahensis		?	
Peromyscus truei truei (Chihuahuan)	X	X	X
Onychomys leucogaster melanophrys (Nevadan)		X	
Onychomys leucogaster pallescens	?		X
Neotoma lepida sanrafaeli (Yuman)	X	X	
Neotoma albigula laplataensis (Chihuahuan)			X
Neotoma mexicana inopinata (Chihuahuan)			X
Neotoma cinerea acraia (Cordilleran)		?	
Neotoma cinerea arizonae	X		X
Erethizon dorsatum couesi (Widespread)			X
Erethizon dorsatum epixanthum	X	X	

different subcenters of the Canyonlands Province: San Rafael (Maze), Grand Valley (Island in the Sky), and San Juan (Needles). These faunal areas were reevaluated by Armstrong (1977*b*) and their faunal relationships quantified on the basis of distributional patterns of species. In southeastern Utah, the pattern of nominal areas described by Durrant and by Kelson was maintained.

TABLE 7.—*Faunal similarity among districts of Canyonlands National Park. Upper number for each district listed in the stub refers to subspecific level; lower number, to specific level. Values above the diagonal are measures of faunal similarity (see text for explanation); values below the diagonal are actual numbers of taxa in common.*

	Island in the Sky	Maze	Needles
	$N=16$	$N=16$	$N=17$
Island in the Sky		0.438	0.545
		0.937	0.909
Maze	7		0.182
	15		0.848
Needles	9	3	
	15	14	

Studies in Canyonlands National Park allow a better understanding of the relationships among these areas. In some respects these studies suggest stronger faunal affinities among the isolated pieces of southeastern Utah than one might have supposed, given the nature of the barriers to free dispersal in the area.

Table 6 is a list of rodents known or expected to occur in the three districts of Canyonlands National Park. Species generally are present in at least two of the three districts, with the exception of *Perognathus parvus*, which is restricted to Maze, and *Neotoma albigula* and *N. mexicana*, which occur only in Needles. As a result of the wide-ranging distributions for species, faunal similarity between districts is high, as shown in Table 7. The index for similarity used here is $S = 2\ C\ /\ N_1 + N_2$, where C is the number of species or subspecies common to two areas and N_1 and N_2 are the total numbers present in each of the areas under comparison. At the specific level, the strongest resemblance exists between Island in the Sky and Maze; the weakest, between Maze and Needles. Based on a comparison of subspecies, each district harbors a more distinctive fauna, as shown by reduced S values, and the pattern of district relationships shifts: Island in the Sky is now more like Needles than Maze, but Maze and Needles still maintain the greatest degree of difference.

Using the same index and considering all mammals (not just rodents) at the specific level, Armstrong (1977*b*) calculated similarity between the Grand Valley (Island in the Sky) and San Rafael (Maze) subcenters at over 0.950 and mean similarity of approximately 0.900 between those two subcenters (plus the Kaiparowits subcenter) and subcenters east of the Colorado River (San Juan—the Needles District—plus Navajo Mountain and Monument Valley).

I would hesitate, in a zoogeographic analysis, to put too much emphasis on subspecies unless they are quite well marked, and many of the supspecies of the Canyonlands are not. However, some patterns of subspecific differences deserve attention.

Only three subspecies are common to all three districts: *Castor canadensis repentinus* (to which the rivers obviously provide no barrier), *Eutamias quadrivittatus hopiensis*, and *Peromyscus truei truei*. The latter two are widespread subspecies of abundant and euryecious species and have similar habitat requirements (Armstrong, in press). The Maze and Needles districts have no other subspecies in common whereas Island in the Sky and Maze share four additional ones: *Dipodomys ordii sanrafaeli*, *Reithrodontomys megalotis megalotis*, *Neotoma lepida sanrafaeli*, and *Erethizon dorsatum epixanthum*. These subspecies show no ecologic "common denominator" but rather they differ widely in ecological distribution. The Island in the Sky and Needles districts have six additional subspecies in common: *Perognathus apache caryi*, *Onychomys leucogaster pallescens*, *Spermophilus variegatus grammurus*, *Peromyscus crinitus auripectus*, *Peromyscus boylii rowleyi*, and *Neotoma cinerea arizonae*. The first two species occupy grassland; the latter four are saxicolous.

There are three species with different nominal subspecies in each district: *Ammospermophilus leucurus*, *Thomomys bottae*, and *Peromyscus maniculatus*. I consider the subspecies of *A. leucurus*, a denizen of the ecotone between grassland and saxicoline habitats, to be poorly delineated. *T. bottae* is a fossorial species with readily identifiable subspecies, tied firmly to friable soils. *P. maniculatus* is a euryecious species, adaptable to a wide range of habitats, with well-marked subspecies in the area.

The faunas of the three districts differ little with respect to areographic faunal elements represented (see Table 6). Also I see no particular pattern in the ecological distribution of those species that do or do not show subspecific differentiation across the rivers, except that the two terrestrial rodents that show no discernible variation in the Park, *Peromyscus truei* and *Eutamias quadrivittatus*, are those found by Armstrong (in press) to be the most euryecious.

At the specific level, the faunas are not very distinctive. The two species that characterize the Needles District, *Neotoma albigula* and *N. mexicana*, seem to occur in the more mesic saxicoline habitats (see Armstrong, in press). Such habitat restriction would serve to localize these species in Needles even in the absence of barriers to dispersal. The one species limited in the Park to the

Maze District is *Perognathus parvus*, a species of grasslands and shrub steppe. The Great Basin pocket mouse is not known to occur east of the Green River even above Flaming Gorge in southwestern Wyoming (Long, 1965:617). Durrant and Dean (1960:221) pointed out that "it is rather perplexing to understand how this river, which freezes solidly in winter and practically dries up again in summer, can function as such a complete barrier to extension of ranges by" *Perognathus parvus* and *P. fasciatus*.

Both Durrant (1952) and Kelson (1951) observed that the Colorado River system forms a progressively weaker barrier northward. The pattern of distribution of rodent species in Canyonlands National Park supports this contention. Of subspecies held in common by the Needles and Island in the Sky districts, all but *Peromyscus boylii rowleyi* are known to range into Colorado above Grand Junction (Armstrong, 1972). Thus, they may have crossed (or may be crossing) the river barrier well above the canyons. Similarly, species present in both Island in the Sky and the Maze all occur north at least to the town of Green River.

Durrant (1952) pointed out that the Green River sometimes freezes over at Jensen and Ouray. The Colorado River near Grand Junction at low water is a braided stream, replete with islands and sandbars. Few species whose ecological tolerance allows access to the river's banks should find it an impassable barrier. At drier times in the past, the Hypsithermal Interval, for example, flows of both rivers must have been reduced and the ultimate barrier would have been weakened. However, only the most drought-adapted species would have had access to the barrier across desert floodplains or through the colluvium at the bases of canyon walls.

In Canyonlands National Park itself, the ultimate distributional barriers, the rivers, must be quite effective. Their flow is perennial, abundant, and they do not freeze. Among rodents, only the beaver can use the rivers as a corridor and can cross with little difficulty. Riparian vegetation is highly discontinuous in the canyons and provides no dispersal route for associated species (for example, *P. boylii*, *R. megalotis*), although photographs of the canyons taken in the early 1870s and replicated a century later (see Baars and Molenaar, 1971) suggest that riparian vegetation is more nearly continuous today than it once was. For most species throughout most of the Park, the actual barriers to distribution must be ecological. Well developed pinyon-juniper woodland does not occur at river level in the Park and neither does grass-

land. Only the most euryecious mammals of saxicoline brushlands have ready access to the rivers and a potential corridor along them.

Given the substantial barriers that exist, it is somewhat surprising that the subspecies of rodents in the Canyonlands are not more different. Genetic communication among populations of terrestrial rodents in the three districts must be highly indirect. Are the observed similarities the result of gene flow or of selection? These are questions that only biosystematic study can help to resolve.

Literature Cited

Anderson, S. 1956. Subspeciation in the meadow mouse, Microtus pennsylvanicus, in Wyoming, Colorado, and adjacent areas. Univ. Kansas Publ., Mus. Nat. Hist., 9:405-414.

Armstrong, D. M. 1972. Distribution of mammals in Colorado. Monogr., Univ. Kansas Mus. Nat. Hist., 3:x+1-415.

Armstrong, D. M. 1977*a*. Ecological distribution of small mammals in the Upper Williams Fork Basin, Grand County, Colorado. Southwestern Nat., 22:289-304.

———. 1977*b*. Distributional patterns of mammals in Utah. Great Basin Nat., 37:457-474.

———. In press. Ecological distribution of mammals in Canyonlands National Park, Utah. Great Basin Nat., vol. 39.

Baars, D. L., and C. M. Molenaar. 1971. Geology of Canyonlands and Cataract Canyon. Sixth Field Conference, Four Corners Geol. Soc., iv+99 pp.

Benson, S. B. 1935. A biological reconnaissance of Navajo Mountain, Utah. Univ. California Publ. Zool., 40:439-455.

Brazell, R. E., G. W. Workman, and D. D. May. 1977. A preliminary survey on beaver (*Castor canadensis*) in Canyonlands National Park, Utah. Processed report, National Park Service, v+38 pp.

DeBlase, A. F., and R. E. Martin. 1974. A manual of mammalogy. William C. Brown, Dubuque, Iowa, xv+329 pp.

Dice, L. R. 1943. The biotic provinces of North America. Univ. Michigan Press, Ann Arbor, viii+78 pp.

Douglas, C. 1969. Comparative ecology of pinyon mice and deer mice in Mesa Verde National Park, Colorado. Univ. Kansas Publ., Mus. Nat. Hist., 18:421-504.

Durrant, S. D. 1934. A new wood rat from southeastern Utah. J. Mamm., 15:65-67.

———. 1946. The pocket gophers (genus Thomomys) of Utah. Univ. Kansas Publ., Mus. Nat. Hist., 1:1-82.

———. 1952. Mammals of Utah, taxonomy and distribution. Univ. Kansas Publ., Mus. Nat. Hist., 6:1-549.

Durrant, S. D., and H. S. Crane. 1948. Three new beavers from Utah. Univ. Kansas Publ., Mus. Nat. Hist., 1:407-417.

Durrant, S. D., and N. K. Dean. 1959. Mammals of Glen Canyon. Anthropol. Papers, Univ. Utah, 40:73-106.

———. 1960. Mammals of Flaming Gorge Reservoir Basin. Anthropol. Papers, Univ. Utah, 48:209-235.

Durrant, S. D., and R. M. Hansen. 1954. A new rock squirrel (*Citellus variegatus*) from the Great Basin with critical comments on related subspecies. Proc. Biol. Soc. Washington, 67:263-272.

Durrant, S. D., and M. R. Lee. 1956. A new pocket mouse from southeastern Utah. Proc. Biol. Soc. Washington, 69:183-186.

Goldman, E. A. 1936. New pocket gophers of the genus *Thomomys*. J. Washington Acad. Sci., 26:111-120.

———. 1937. The Colorado River as a barrier to mammalian distribution. J. Mamm., 18:427-435.

Grinnell, J. 1914*a*. The Colorado River as a highway of dispersal and center of differentiation of species. Univ. California Publ. Zool., 12:97-100.

———. 1914*b*. The Colorado River as a hindrance to the dispersal of species. Univ. California Publ. Zool., 12:100-107.

Hall, E. R., and K. R. Kelson. 1959. The mammals of North America. Ronald Press, New York, 1:xxx+1-546+79; 2:viii+547-1083+79.

Hansen, R. M. 1955. Two new subspecies of antelope ground squirrels from Utah. J. Mamm., 36:273-277.

Hayward, C. L., and M. L. Killpack. 1958. Distribution and variation of the Utah poulation [*sic*] of the Great Basin pocket mouse. Great Basin Nat., 18:26-30.

Hayward, C. L., D E. Beck, and W. W. Tanner. 1958. Zoology of the Upper Colorado River Basin, I. The biotic communities. Sci. Bull., Brigham Young Univ., Biol. Ser., 1(3):1-74.

Hoffmeister, D. F. 1971. Mammals of Grand Canyon. Univ. Illinois Press, Urbana, 183 pp.

Hoffmeister, D. F., and F. E. Durham. 1971. Mammals of the Arizona Strip including Grand Canyon National Monument. Tech. Ser., Mus. Northern Arizona, 11:1-44.

Hollister, N. 1914. A systematic account of the grasshopper mice. Proc. U.S. Nat. Mus., 17:427-489.

Howell, A. H. 1938. Revision of the North American ground squirrels, with a classification of the North American Sciuridae. N. Amer. Fauna, 56:1-256.

Kelson, K. R. 1951. Speciation in rodents of the Colorado River drainage. Biol. Ser., Univ. Utah, 11(3):vii+1-125.

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

Long, C. A. 1965. The mammals of Wyoming. Univ. Kansas Publ., Mus. Nat. Hist., 14:493-758.

McCoy, C. J., Jr., and P. H. Miller. 1964. Ecological distribution of subspecies of *Ammospermophilus leucurus* in Colorado. Southwestern Nat., 9:89-93.

Setzer, H. W. 1949. Subspeciation in the kangaroo rat, Dipodomys ordii. Univ. Kansas Publ., Mus. Nat. Hist., 1:473-573.

Tanner, W. W. 1965. A comparative population study of small vertebrates in the uranium areas of the Upper Colorado River Basin of Utah. Sci. Bull., Brigham Young Univ., Biol. Ser., 7(1):1-31.

Wagner, F. H., and G. W. Workman. 1961. The wildlife of Deadhorse Point State Park and vicinity. Unpublished report, Wildlife Department, Utah State Univ., 103 pp.

White, J. A. 1953. Taxonomy of the chipmunks, Eutamias quadrivittatus and Eutamias umbrinus. Univ. Kansas Publ., Mus. Nat. Hist., 5:563-582.

Address of author: *Department of Integrated Studies and University Museum, University of Colorado, Boulder, 80309.* *Received 9 August, accepted 20 September 1978.*

ISSN 0149-175X

OCCASIONAL PAPERS
THE MUSEUM
TEXAS TECH UNIVERSITY

NUMBER 60 21 SEPTEMBER 1979

NOTES ON A COLLECTION OF BATS FROM MONTSERRAT, LESSER ANTILLES

J. Knox Jones, Jr., and Robert J. Baker

Although seven kinds of bats have been reported previously from the Antillean island of Montserrat, all apparently were collected incidental to other activities. On the nights of 30 and 31 July 1978, we netted bats over the Belham River on the northwest coast of the island. Six species were taken, one of which is new to Montserrat and several others of which were known from the island by one (in one case) or only a few specimens.

On 30 July, we strung two nets over the river, one near its mouth and the other under gallery forest about a half mile above the mouth. Three nets were set out on the evening of 31 July, all beneath the gallery forest (Fig. 1). At the place we netted, the Belham River was bordered on one side by a golf course and on the other by a sloping hillside on which widely spaced residences were located.

Field work on Montserrat was conducted following a sojourn on the island of Dominica, which was sponsored by The John Archbold Family Trust. Actual expenses on Montserrat were defrayed through the Texas Tech University Foundation. In the following accounts, all measurements are in millimeters. Specimens are on deposit in The Museum at Texas Tech University.

Noctilio leporinus mastivus (Vahl, 1797).—Ten specimens (TTU 31295-31304), nine adults and one volant young, were collected in the two nights we netted over the Belham River, and many more were seen coursing over the river and the small bay at its mouth. Two of four adult females were lactating; the others