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A DISTRIBUTIONAL AND TAXONOMIC
STUDY OF THE KANGAROO RATS
(GENUS DIPODOMYS) OF UTAH

HENRY W. SETZER

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A DISTRIBUTIONAL AND TAXONOMIC
STUDY OF THE KANGAROO RATS
(GENUS DIPODOMYS) OF UTAH

by

Henry W. Setzer



A thesis submitted to the Faculty of the University of Utah in partial fulfillment of the requirements for the degree of Master of Arts.

August 15, 1944

Approved by _____

Sept 25, 1944

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ACKNOWLEDGEMENTS

I am especially grateful to Mr. Stephen D. Durrant. He suggested the problem and gave me the use of the specimens in the Museum of Zoology at the University of Utah. His critical direction and untiring efforts have been a constant source of encouragement.

Drs. A. M. Woodbury, Seville Flowers, William H. Behle and W. P. Cottam have given valuable suggestions and criticisms throughout this work.

Dr. R. V. Chamberlin, Head of the Department of Biology, at the University of Utah, supported the study throughout its course.

I also wish to thank Misses Mary Lou Turner and Beverly Hayes for assistance in preparing the drawings and distribution maps.

I am indebted to the following men and institutions for lending me comparative materials used during the course of this study:

Dr. E. Raymond Hall, Museum of Vertebrate Zoology, University of California.

Dr. H. H. T. Jackson, U. S. Fish and Wildlife Service, Washington, D. C.

Dr. C. Lynn Hayward, Brigham Young University, Provo, Utah.

Dr. J. S. Stanford, Utah State Agricultural College,
Logan, Utah.

Dr. Alfred M. Bailey, Colorado Museum of Natural
History, Denver, Colorado.

Mr. J. Kenneth Douth, Carnegie Museum, Pittsburgh,
Pennsylvania.

Dr. Ross Hardy, Dixie Junior College, St. George,
Utah.

INTRODUCTION

The kangaroo rats (genus Dipodomys) belong to the order Rodentia and to the family Heteromyidae. Phylogenetically they are closely allied to the family Geomyidae, characterized in Utah by the common pocket gopher (genus Thomomys). The family Heteromyidae is represented, in Utah, by two other genera, namely: Perognathus and Microdipodops. The former is known, vernacularly, as the pocket mouse and the latter as the kangaroo mouse. All Utah Heteromyids are characterized by exceptionally large auditory bullae, grooved upper incisors, and fur lined cheek pouches.

The genus Dipodomys was named by Gray, the type species being Dipodomys phillipsii (Gray: 1841). The genus Dipodomys, as understood at the present includes the former genera Dipodops (Merriam: 1890) and Perodipus (Fitzinger: 1867). Elliot (1901: 239) synonymized Dipodops with Perodipus and Grinnell (1919: 203) placed Perodipus with the earlier genus Dipodomys.

Barnes (1922:86-87) lists two kangaroo rats as occurring in Utah but nevertheless retained the old generic name Perodipus for both forms. At that time these two rats were known as Perodipus montanus utahensis and Perodipus longipes. In Barnes' revised edition (1927:107-108) these same

two forms were still the only ones recognized for the state. They were now named Dipodomys ordii utahensis and Dipodomys ordii longipes, being synonymized by Goldman (1917:109).

There were no extensive collections of mammals made, in Utah, prior to the early 1920's. Previous to that time, however, collections were made by biologists attached to Army Survey parties, the U. S. Biological Survey, and the American Museum of Natural History. From the 1920's to the present the Museum of Vertebrate Zoology, University of California, Brigham Young University, Utah State Agricultural College, University of Utah, Carnegie Museum, U. S. Biological Survey (now the U. S. Fish and Wildlife Service), and others have made quite extensive collections throughout the state.

As a result of this latter work many new mammals have been added to the known fauna of Utah. Instead of only two races of kangaroo rats as listed by Barnes (loc. cit.) this paper treats twenty-three geographic races of four species. Dipodomys deserti which is represented by only one race; Dipodomys merriami by two races; Dipodomys microps by six races; and Dipodomys ordii by fourteen races of which four are herein described as new.

There are no discernable differences between males and females as to size, pelage color, or skull characters.

However, all comparisons were made between animals of like age and like sex. The primary characters for determining animals of like age was the configuration and amount of wear of the cheek teeth. Young animals usually have a tri-rooted deciduous PM₄ tooth. The full adult condition can be recognized by the smooth oval shape and peg-like appearance of PM 4. Only animals which showed this latter condition were used for purposes of comparison.

All measurements are given in millimeters. The measurements of the bullae were taken in the following manner: The length of the bullae is measured from the union between the zygomatic process of the temporal bone and the bulla, to the apex of the invagination of the supraoccipital bone of the same side as seen from the dorsal surface of the skull. The width of the bulla is measured across the bulla ventrally from the superior border of the external auditory meatus to the point adjacent to the border of the bulla at the side of the basioccipital bone, (translated from the French) Durrant and Hall (1939:11).

All comparisons unless otherwise indicated, were made between type series, types, topotypes, and near topotypes.

Records of occurrence are listed by counties from north to south and west to east within the state.

Specimens used in this study from the Colorado Museum

of Natural History are marked CMNH, from U. S. National Museum USNM, from Museum of Vertebrate Zoology, University of California MVZ, from Carnegie Museum CM, from Utah State Agricultural College USAC, from Brigham Young University BYU, from Dixie Junior College DJC, from the personal collection of Dr. Ross Hardy RH, those that have no other designation are in the collection of the Museum of Zoology, University of Utah.

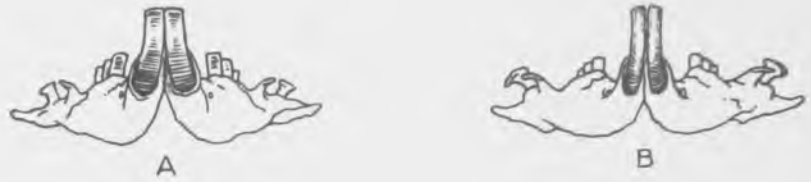


FIG. I

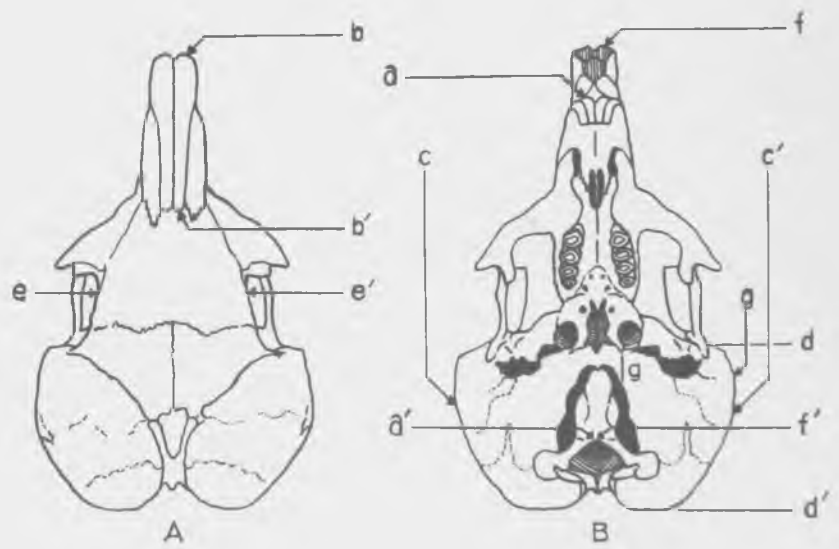


FIG. 2

EXPLANATION OF FIGURES

Fig. 1. Lower jaws, showing difference in shape of lower incisor teeth in two species of Dipodomys. A. Dipodomys microps bonnevilliei, female adult, no. 45286, Mus. Vert. Zool., Kelton, Box Elder County, Utah. B. Dipodomys ordii celeripes, female adult, no. 68062, Mus. Vert. Zool., Tecoma, Elko County, Nevada. Note the flat-faced, chisel-like incisors of microps as contrasted with the rounded, awl-like incisors in ordii. X 2. (Redrawn from Hall and Dale, 1939:49).

Fig. 2. A. Dorsal view and, B. ventral view, of the skull of Dipodomys microps alfredi, male adult, no. 3002, Colo. Mus. Nat. Hist., from Gunnison Island, Box Elder County, Utah, to show points between which cranial measurements were taken. X $1\frac{1}{2}$.

| | | | |
|-------------------|------|-----------------------|------|
| Basal length, | a-a' | Interorbital breadth, | e-e' |
| Length of nasal, | b-b' | Occipitonasal length, | f-f' |
| Greatest breadth, | c-c' | Width of bulla, | g-g' |
| Length of bulla | d-d' | | |

(Redrawn with some modifications of measurements from Hall and Dale, 1939:50).

KEY TO SPECIES OF DIPODOMYS OF UTAH

- Four toes on hind foot 1
1. Extremely large light colored animals,
adults averaging in total length more
than 300 millimeters deserti
- 1a. Medium sized rather dark animals, av-
eraging, in total length, never more
than 250 millimeters merriami
- Five toes on hind foot 2
2. Lower incisors awl-shaped ordii
- 2a. Lower incisors chisel-shaped microps

DIPODOMYS deserti deserti STEPHENS

Original description. - 1887. Dipodomys deserti Stephens, Amer. Nat., vol. 21, p. 42. January 1887.

Type. - Female, no. 314; U. S. Nat. Mus.; Mojave River, San Bernardino County, California; June 29, 1886; collected by F. Stephens.

Range. - Limited in Utah to Beaver Dam Wash, in extreme southwestern Washington County; from whence it extends westward to California and southwestward into Mexico.

Diagnosis. - Size: Largest of Utah Dipodomys (see measurements). Color: Pale, one of the palest of the genus. Tail brush brown, tipped with a white "flag;" dorsal tail stripe pale brown, ventral tail stripe nearly obliterated, being noticeable only in three of the seventeen skins examined. Mid-dorsal skin gland very marked; entire ventral surface, muzzle, sides of face, supraorbital and postauricular patches, and hip stripes, white. Skull: Extremely large.

Remarks. - This rat is known only from the extreme southwestern part of Washington County. The sole known reference to its occurrence is that of Durrant (1943:404). The distribution is of interest in that it has never been taken above the narrows of the Virgin River, where the river traverses the Beaver Dam Mountains. This was suspected by

Durrant (loc. cit.) and substantiated by subsequent trapping by Dr. Ross Hardy of Dixie Junior College. According to Durrant it seems to be limited to the bottoms of the washes in areas of loose shifting sands.

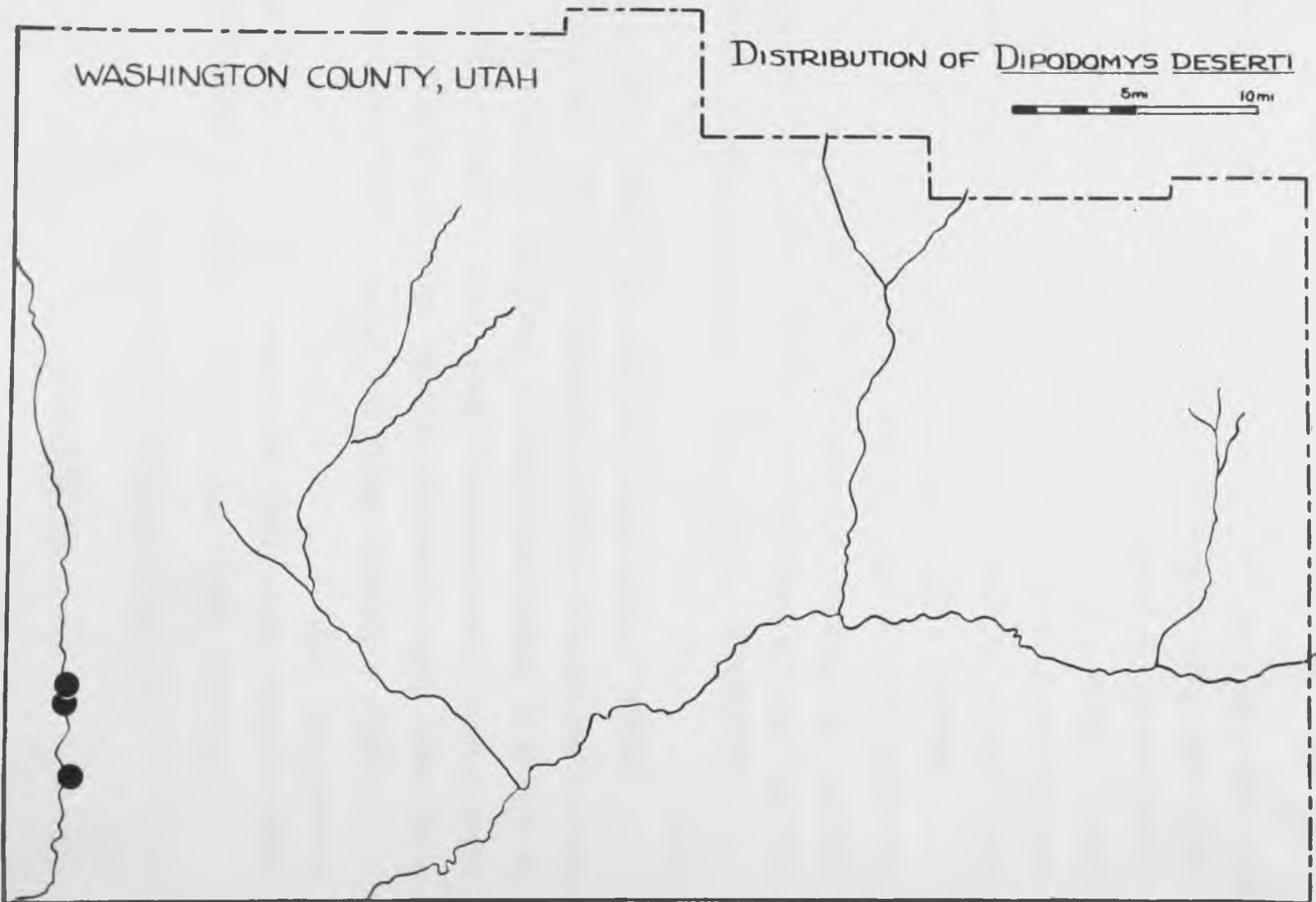
Specimens examined. - Total number 17; 9 skins and skulls, 6 skins only, and 2 skulls only.

Records of occurrence. - Washington County: Beaver Dam Wash, 5 mi. N Utah-Arizona border, 2600 ft., 5; Beaver Dam Wash, 8 mi. N Utah-Arizona border, 2800 ft., 1; Beaver Dam Wash, 4 (RH); Near Terry's Ranch on Beaver Dam Wash, 5 (RH).

WASHINGTON COUNTY, UTAH

DISTRIBUTION OF DIPODOMYS DESERTI

5mi 10mi



MICROPS GROUP

Dipodomys microps alfredi Goldman

Original description. - 1937. Dipodomys microps alfredi Goldman, Proc. Biol. Soc. Wash., vol. 50, pp. 221-222. December 28, 1937.

Type. - Female, adult, no. 262846, U. S. Nat. Mus. Biol. Surv. Coll.; Gunnison Island, Great Salt Lake, Box Elder County, about 4300 ft., Utah; June 1, 1937; collected by Alfred M. Bailey and Robert J. Niedrach, original no. 2994 (after Goldman, original description, type not seen).

Range. - Known only from Gunnison Island, Great Salt Lake.

Diagnosis. - Size: Large (see measurements). Color: Pale for the species, dorsal and ventral tail stripes brownish with an admixture of white hairs, cheek pouches lined anteriorly with blackish hairs. Skull: Large.

Remarks. - This race is lighter in color than any other race of microps found in Utah. This is further evidence that animals that have been or appear to have been isolated on these islands tend toward a pale pelage. Marshall (1940:144-159) mentions repeatedly that mammals isolated on the islands tend toward a pale pelage. It is probable that Gunnison Island is one of the few islands in the lake that

has not been periodically connected with the mainland or another island. However, at some time this island was evidently connected with the mainland but a sufficient length of time has elapsed since to allow alfredi to become differentiated. Marshall (loc. cit.) states that the only other mammal found on the island, Peromyscus maniculatus gunnisoni, is closely related to the mainland form P. m. sonoriensis, and that this may be due to the fact that this rodent has crossed to the island more recently than did D. m. alfredi.

Specimens examined - Total number 11.

Records of occurrence - Box Elder County: Gunnison Island, Great Salt Lake, about 4300 ft., 11 (1, USNM) (10, CMNH).

Dipodomys microps bonnevilliei Goldman

Original description. - 1937. Dipodomys microps bonnevilliei Goldman, Proc. Biol. Soc. Wash., vol. 50, p. 222. December 28, 1937.

Type. - Female, adult, no. 31894/43755, U. S. Nat. Mus. Biol. Surv. Coll.; Kelton, about 4300 ft., Box Elder County, Utah; November 7, 1891; collected by Vernon Bailey, original no. 3490 (after Goldman, original description, type not seen.)

Range. - Western Utah from the Idaho-Utah line,

south to northern Iron County; from the western border of Utah east as far as the western edge of Sevier County.

Diagnosis. - Size: Medium (see measurements). Color: Pale, less black in upper parts than celsus; arietiform markings distinct, external surface of ears white except anterior margin which is brownish black, inside of ear towards tip thinly covered with brownish black hairs, post-auricular patches white and very distinct, hip stripes white but narrow, tail brush not large with the hairs having white bases and black tips; dorsal tail stripe pronounced with an admixture of brown and black hairs, ventral tail stripe as pronounced as the dorsal tail stripe, plantar surfaces of hind feet have well defined brownish black markings. Skull: Large, orbit small.

Remarks. - Specimens from Fish Springs, Juab County, the Old Lincoln Highway, Tooele County, and the area east of Clear Lake, Millard County, (around the margins of the range) show some characters that are not consistent with typical bonnevillei. These specimens are all lighter in color and show great variance in the shape and length of the nasals. It is possible that the lighter color is the result of the action of the highly alkaline soils, on and in which they live, on the hairs. A few specimens approach subten-uis in the narrowness and straightness of the nasals, while

others, far in the majority, show the wide flared nasals of bonnevillei. In the sum total of the characters, they more closely approach bonnevillei than any other form, and it seems advisable at this time to so place all these specimens. Since statistically these forms show no significant differences and as this genus is highly variable, any minor differences may be attributed to individual variation. This race shows the greatest range of variation of any Utah race of microps.

This race is primarily an inhabitant of sandy soils in the desert valleys of western Utah and seems to be closely associated with typical saline desert vegetation characterized by shadscale (Atriplex), greasewood (Sarcobatus), inkweed (Sueda), and others as well as with the non-saline sagebrush (Artemesia).

Specimens examined. - Total number 119; 116 skins and skulls, 3 skins only.

Records of occurrence. - Box Elder County: Utah-Nevada line, east side Ta (= e) coma Range, 4300 ft., 2; Hardup, 1 (USAC); Kelton, 4225 ft., 10 (3, USNM) (7, MVZ); Tooele County: Ibapah, 5000 ft., 21; Parrish Ranch, 5 mi. N Ibapah, 5175 ft., 1; Clifton Flat, 7 mi. SW Gold Hill, 6149 ft., 2; Old Lincoln Highway, 18 mi. SW Orr's Ranch in Skull Valley, 4400 ft., 10; Juab County: 7 mi. S Fish

Springs 4400 ft., 3; Fish Springs, 4400 ft., 3; Millard County: Desert Range Experiment Station, Sec. 9, T. 25S, R. 17W, Salt Lake B. M., 37 (4 BYU); Pine Valley, Sec. 33, T. 25S, R 17W, Salt Lake B.M., 50 mi. W Milford, 5500 ft., 8; 2 mi. E of Clear Lake, 4600 ft., 1; White Valley, 60 mi. W of Delta, 2; 1 mi. SE Gandy, 5000 ft., 2 (MVZ); 4 mi. S Gandy, 5000 ft., 2 (MVZ); Smith Creek, 5400 ft., 6 mi. S. Gandy, 7 (MVZ); 5 mi. S Garrison, 5400 ft., 1 (MVZ); Warm Cove, 55 mi. W Milford, 5500 ft., 5; Sevier County; Aurora, 1 (BYU).

Dipodomys microps celsus Goldman

Original description. - 1924. Dipodomys microps celsus Goldman, Jour. Wash. Acad. Sci., vol. 14, p. 373. September 19, 1924.

Type. - Male, adult, no. 243101, U. S. Nat. Mus. Biol. Surv. Coll.; 6 mi. N Wolf Hole, 3500 ft., Mohave County, Arizona; October 16, 1922; collected by E. A. Goldman; original no. 23411 (after Goldman, original description, type not seen).

Range. - From Washington County, in extreme southwestern Utah in the Virgin River Valley; also possibly in southern Kane County, and in Mohave County, Arizona.

Diagnosis. - Size: Large (see measurements). Color: Dark dorsal hairs black tipped; underparts, muzzle, post-

auricular patches, hip stripes, dorsal surface of hind foot, front feet, and lateral tail stripes, white; arietiform markings, dorsal tail stripes, and ventral surfaces of shank of hind leg blackish; ventral tail stripe and plantar surface of hind feet brownish black. Skull: Large.

Remarks. - This rat occurs in southwestern Utah in the Virgin River Valley and east as far as Hurricane, Washington County. It is a large dark race of microps with a long tail and hind foot, larger than any other race except alfredi. It seems to intergrade, on the Beaver Dam Slope, with woodburyi as is indicated by a series of five skins taken by Hardy. It appears that the route of migration onto the Beaver Dam Slope is around the north end of the Beaver Dam Mountains as is indicated by a single specimen taken by Hardy 1½ mi. NW of Diamond Valley. Hall and Dale (1939:60) state that this form was sought in Nevada in the Meadow Valley Wash and the Valley of the Virgin River but was never taken.

Specimens examined. - Total number 29.

Records of occurrence. - Washington County: 1 mi. W St. George, 2800 ft., 5; W side Black Hill, about ½ mi. W St. George, 3300 ft., 1; Santa Clara Creek, 3 mi. SW St. George, 2800 ft., 13; 5 mi. NW St. George, 2 (1 RH) (1, DJC); 3 mi. S St. George, 1 (RH); St. George, 5 (RH);

Goulds Ranch, Hurricane, 1 (BYU); $1\frac{1}{2}$ mi. NW Diamond Valley, 1 (RH).

Dipodomys microps russeolus Goldman

Original description. - 1939. Dipodomys microps russeolus Goldman, Jour. Mamm., vol. 20, p. 353. August 14, 1939.

Type. - Male, adult, no. 263895, U. S. Nat. Mus. Biol. Surv. Coll.; Dolphin Island, Great Salt Lake, 4250 ft., Box Elder County, Utah; June 5, 1938; collected by William H. Marshall, original no. 65 (after Goldman, original description, type not seen).

Range. - Dolphin Island, Great Salt Lake, Box Elder County, Utah.

Diagnosis. - Among the named races of microps, and from the description of Goldman, this race seems most closely allied to D. m. bonnevilliei. Size: About the same. Color: "Upper parts more rufescent". Skull: "More elongated, with the rostrum and nasals longer, and the auditory bullae less fully inflated".

Remarks. - The type is the only known existing specimen, and since types from the National Museum are not available for study because of the war, the following remarks are drawn from the literature.

Goldman states that Dolphin Island is joined with the mainland by a low bar not likely to be attractive to kanga-

roo rats. However, D. o. marshalli ranges between Stansbury, Carrington, Badger and Bird Islands by means of bars of this same description.

Durrant and Hall (1939:12) point out that a roseaceous color of the pelage is often due to the action of alkaline salts on the hairs. It is possible that the "more rufescent" upper parts mentioned by Goldman, can be explained on the same basis, because of the soils of Dolphin Island which are salty and alkaline in reaction, with some spots probably being very strongly alkaline.

Specimens examined. - None.

Records of occurrence. - Box Elder County: Dolphin Island, Great Salt Lake, 4250 ft., 1 (USNM).

Dipodomys microps subtenuis Goldman

Original description. - 1939. Dipodomys microps subtenuis Goldman, Jour. Mamm., vol. 20, p. 354. August 14, 1939.

Type. - Female, adult, no. 263917, U. S. Nat. Mus. Biol. Surv. Coll.; Carrington Island, Great Salt Lake, 4250 ft., Tooele County, Utah; June 30, 1938; collected by William H. Marshall, original no. 182 (after Goldman, original description, type not seen).

Range. - Badger, Carrington, and Stansbury Islands, Great Salt Lake and probably south through Rush Valley to

Cedar Valley west of Utah Lake, Utah County, Utah.

Diagnosis. - Size: Similar to D. m. bonnevilliei (see measurements). Color: Paler than bonnevilliei. Goldman (1939:354) refers to the upper parts as "near 'pinkish buff' moderately mixed with black". Under parts, fore legs, postauricular patches, supraorbital patches, hip stripe, sides of tail, dorsal surface of hind feet, and base of the tail white; dorsal and ventral tail stripes, arietiform markings, plantar surfaces of hind feet to base of toes blackish; toes of hind feet white. Skull: Goldman (loc. cit.) describes the skull as "similar to bonnevilliei, but longer; rostrum and nasals longer, more slender; maxillary arches more extended antero-posteriorly, the external angles less rounded and more hook like".

Remarks. - This race is found on three of the islands in Great Salt Lake, namely: Badger, Carrington, and Stansbury. These islands are periodically interconnected by bars when the lake level is low, and Stansbury Island has been connected with the mainland for many years. The latter land bridge may serve as a "highway" allowing this form to leave the island or for other forms to enter its range. It appears that this form is not truly insular. A single specimen from Chimney Rock Pass, Utah County, Utah, is here referred to subtenuis. This specimen is sub-adult but shows

the long narrow skull with the thin long nasals which appear to be typical of subtenuis. The color, however, is slightly darker than that of typical subtenuis, but this may be due to juvenile pelage. In all other characters it closely resembles subtenuis and can safely be referred to this race. It appears from this record and other information, such as the work of Hall and Hoffmeister (1942: 51-65) on the form Peromyscus crinitus pergracilis, that the forms on these islands are not truly insular. It is interesting to note, however, that no specimens of Dipodomys microps have ever been taken on the east and southern shores of the lake. During past years students from the University of Utah have collected hundreds of kangaroo rats in this area, inevitably they have always been of the species Dipodomys ordii.

Specimens examined. - Two.

Records of occurrence. - Tooele County: Carrington Island, Great Salt Lake, 4250 ft., 1 (USNM); Stansbury Island, Great Salt Lake, 4250 ft., 1 (USNM); Badger Island, Great Salt Lake, 4250 ft., 1 (USNM); Utah County: Chimney Rock Pass, 40 04' N Lat. 111 56' W Long., Cedar Valley, 1 (BYU).

Dipodomys microps woodburyi Hardy

Original description. - 1942. Dipodomys microps wood-

buryi Hardy, Proc. Biol. Soc. Wash., vol. 55, pp. 89-90.
June 25, 1942.

Type. - Male, adult, no. 4376, Museum of Zoology, University of Utah; in Clistoyucca area on Beaver Dam Slope west of Beaver Dam Mountains, about 3500 ft., Washington County, Utah; October 19, 1940; collected by Ross Hardy, original no. 2169.

Range. - Known only from the west slope of the Beaver Dam Mountains, in the southwestern part of Washington County, Utah.

Diagnosis. - Size: Large (see measurements). Color: Slightly paler than celsus, with less black in the pelage and less extensive black markings. The dorsal and ventral tail stripes in typical woodburyi are light brownish as contrasted to dark black in typical celsus, there seems to be intergradation in this character in some specimens. Skull: Slightly smaller than celsus except for the width of the cutting edge of the upper incisors, which is wider in woodburyi.

Remarks. - Hardy (loc. cit.) mentions the fact that the skulls of the two races (woodburyi and celsus) are much alike, but that the tail length is longer in woodburyi. Available specimens of woodburyi, which include the type and type series, may be separated from topotypes of celsus on

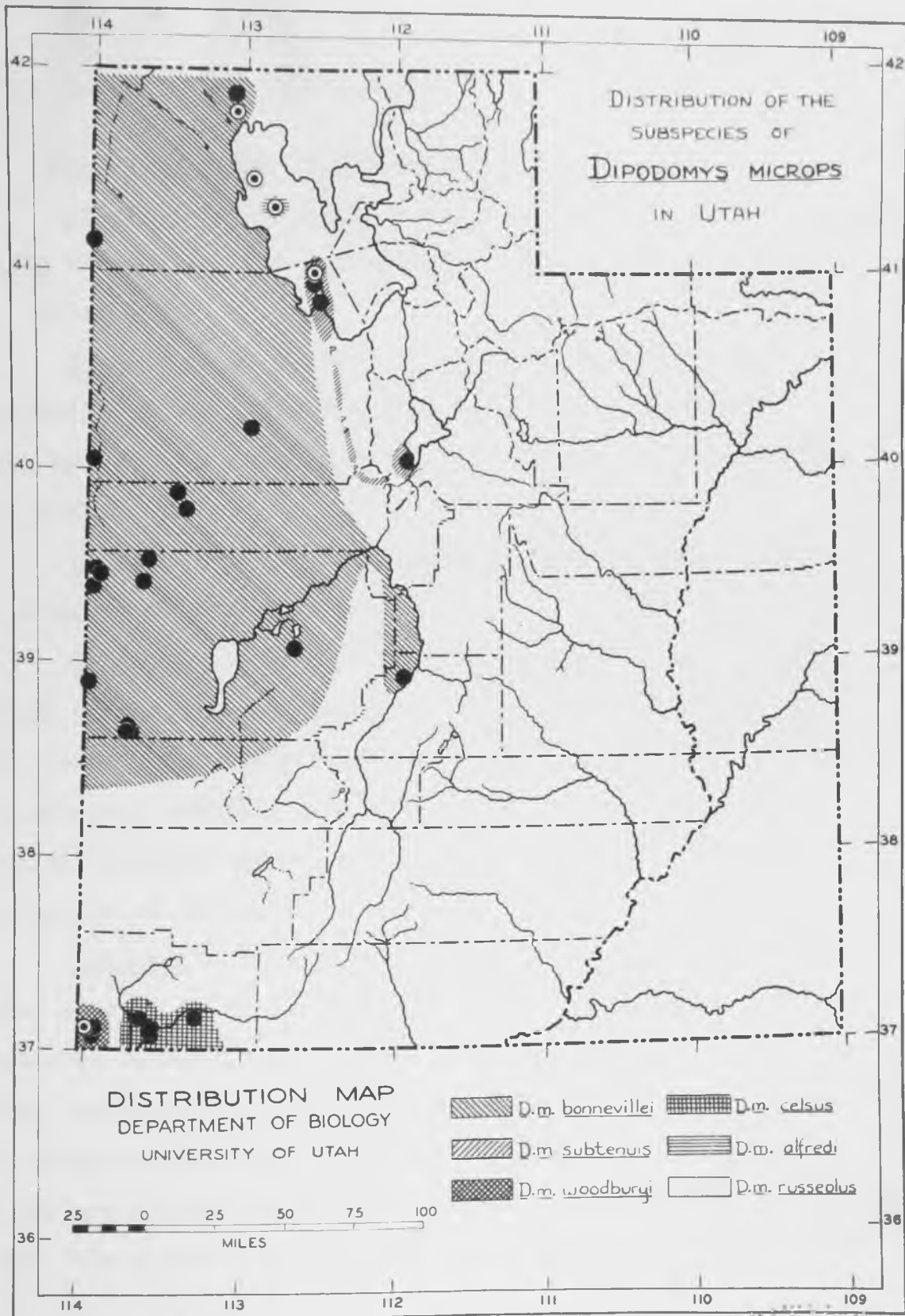
the basis of pelage color. The skulls, however, are so much alike that it is difficult to separate the two races on that basis alone. The skulls of woodburyi average slightly smaller, but the cutting edge of the upper incisors is wider. When first studied, this race was extremely difficult to differentiate from celsus collected in nearby localities. Inasmuch as members of the genus Dipodomys are extremely variable and difficult to differentiate on the basis of slight cranial differences, these skull differences together with other minor differences in other characters may have far greater phylogenetic significance than in other mammalian forms. Topotypical specimens of woodburyi are not clearly differentiated, but show intergrading characters with celsus their nearest neighbor to the east. In view of the above it seems likely that here is encountered a race which is apparently still in the process of differentiation. This study points out that it has gone far enough to be separable, and therefore is accorded subspecific status. Further collection and study of additional specimens from surrounding localities will clarify the problem.

This rat is found in the Joshua Tree (Clistoyucca) area of extreme southwestern Utah. The flora is dominated in this region by creosote (Larrea), blackbrush (Coleogyne),

and mesquite (Prosopis) and represents the northern limit of the Lower Sonoran Life Zone. It is the only place in Utah where the Lower Sonoran is found. The mounds of this animal are usually built at the base of blackbrush and creosote bushes. They are about a foot high and appear to be composed of the dirt excavated from the burrows, rather than being a wind blown deposition. This trait is also characteristic of celsus. The vegetation around the mound is usually trimmed closely while the bushes, under which these mounds are built are practically stripped of their leaves and new shoots.

Specimens examined. - Total number 16; 15 skins and skulls, 1 skin only.

Records of occurrence. - Washington County: Beaver Dam Slope, 10 (RH); 1½ mi. E Beaver Dam Wash, 8 mi. N Utah-Arizona border, 3200 ft., 3; W Slope Beaver Dam Mountains, 3300 ft., 5 mi. N Utah-Arizona border, 1; near Ed Terry Ranch, Beaver Dam Wash, 2 (RH).



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ORDII GROUP

Dipodomys ordii celeripes Durrant and Hall

Original description. - 1939. Dipodomys ordii celeripes Durrant and Hall, Mammalia, Tome III, no. 1, pp. 10-14. March 1939.

Type. - Male, adult, no. 1956, Museum of Zoology, University of Utah; Trout Creek, 4600 ft., Juab County, Utah; May 5, 1937; collected by S. D. Durrant, original number 1168.

Range. - Western Utah, from Utah-Idaho border south to southern Millard County.

Diagnosis. - Size: Small (see measurements). Color: Palest of the species, approaching D. deserti. Skull: Medium, large upper incisors, nasals long and dilated anteriorly, external auditory meatus small and elliptical in shape, styloid processes project anteriorly on the bullae beyond the middle of the external auditory meatus.

Remarks. - This race from the western portion of the state appears to be a resident of the foothills of desert mountains as contrasted to its near neighbor D. o. pallidus which inhabits the valley floors of the Old Lake Bonneville. The range of this race as formerly understood extended east to include Lynndyl and Hinckley, Millard County, Utah, but additional material now places the specimens from the afore-

mentioned localities as intergrades referable by the sum total of characters to pallidus rather than celeripes. Two specimens from 20 mi. SW of Nephi, Juab County, Utah and 10 specimens from U. B. (Yuba) Dam, Sevier River, Juab County, Utah show intergrading characters with utahensis but in the sum total of the characters they more closely resemble celeripes. One specimen from 35 mi. and another from 60 mi. W of Delta, Millard County show intergrading characters with pallidus but in the majority of characters are nearer to celeripes.

Specimens examined. - Total number 69; 67 skins and skulls, 2 skins only.

Records of occurrence. - Tooele County: Ibapah, 5000 ft., 23; Parrish Ranch, 5 mi. N. Ibapah, 5175 ft., 1; Clifton Flat, 7 mi. SW Gold Hill, 6149 ft., 4; Juab County: 20 mi. SW Nephi, 2; Trout Creek, 4600 ft., 20 (1, USAC); U. B. (Yuba) Dam, Sevier River, 5000 ft., 10; Millard County: 35 mi. W of Delta, 1; White Valley, 60 mi. W of Delta, 1; Oak City, 5000 ft., 1; East side of Clear Lake, 4600 ft., 4 (1, USAC); 2 mi. E Clear Lake, 4600 ft., 2.

Dipodomys ordii cinderensis Hardy

Original description. - 1944. Dipodomys ordii cinderensis Hardy, manuscript.

Type. - Male, adult, no. 4611, Museum of Zoology, University of Utah; Diamond Valley, Washington County, Utah; February 13, 1944; collected by Ross Hardy, original no. 2690.

Range. - From Diamond Valley, Washington County, Utah, north through Mountain Meadows, thence east as far as Cedar City, Iron County, Utah, north through the Escalante Desert to Lund, Iron County, and west to near the Utah-Nevada state line.

Diagnosis. - Size: Small (see measurements). Color: Dark, approaching utahensis and panguitchensis but slightly lighter. Skull: Small.

Remarks. - This race inhabits the deserts in northern Washington County and most of Iron County. It is found intergrading with D. o. fetusus near Lund, Iron County, Utah. This race appears to be closer phylogenetically, to utahensis than any of its near neighbors. It can readily be distinguished from celeripes, fetusus, pallidus, and cupidineus on the basis of color alone. However, it is difficult to separate it from panguitchensis and utahensis by color. There are skull and body differences which separate cinderensis from the two latter races. These differences are as follows: The tail length in cinderensis is greater in proportion to body length than in utahensis or panguitchensis, the bullae are longer, wider and deeper than panguitchensis and slightly more so than

in utahensis, maxillary tooth row is longer, foramen magnum is nearly round as compared to elongate in panguitchensis and ovoid in utahensis, narrower across paroccipitals.

Specimens examined. - Total number 74; 73 skins and skulls, 1 skin only.

Records of occurrence. - Iron County: 4½ mi. NW of Summit and 6 mi. W of Parowan, 9 (RH); Escalante Desert, 11 mi. SE Lund, 50 (RH); Cedar City, 2 (BYU); 5 mi. W Cedar City, 1 (USAC); 10 mi. W Cedar City, 1 (USAC); Washington County. - Diamond Valley, 9 (RH); N end of Mountain Meadows, 2 (RH).

Dipodomys ordii cineraceus Goldman

Original description. - 1939. Dipodomys ordii cineraceus Goldman, Jour. Mamm., vol. 20, pp. 352-353. August 14, 1939.

Type. - Male, adult, no. 263890, U. S. Nat. Mus. Biol. Surv. Coll.; Dolphin Island, Great Salt Lake, 4250 ft., Box Elder County, Utah; June 4, 1938; collected by William H. Marshall, original no. 57 (after Goldman, original description, type not seen).

Range. - Dolphin Island, Great Salt Lake, Box Elder County, Utah.

Diagnosis. - Size: Medium (see measurements). Color: Pale, much lighter than utahensis, about the same color as

marshalli, but with more reddish suffusion. Skull: Medium, nasals longer, bullae larger, total length greater than utahensis; slightly larger than marshalli.

Remarks. - This race is found on Dolphin Island in Great Salt Lake associated with D. microps russeolus. Specimens from Kelton, Box Elder County, while closer geographically to cineraceus, are referred by the sum total of characters to marshalli. No available mainland specimens are referable to cineraceus, although the island as mentioned by Goldman (1939:353), is connected to the mainland by a bar which may be a means of communication with the nearby shore. The paucity of material, however, may be significant. Subsequent trapping is necessary before the true insularity of this form can be definitely established. For the present, it is tentatively limited in range, to the type locality.

Specimens examined. - Two.

Records of occurrence - Box Elder County: Dolphin Island, Great Salt Lake, 4250 ft., 2 (USNM).

Dipodomys ordii cupidineus Goldman

Original description. - 1924. Dipodomys ordii cupidineus Goldman, Jour. Wash. Acad. Sci., vol. 14, no. 15, pp. 372-373. September 19, 1924.

Type. - Male, adult, no. 243093, U. S. Nat. Mus. Biol. Surv. Coll.; Kanab Wash at southern boundary of Kaibab Indian

Reservation, Arizona; October 12, 1922; collected by E. A. Goldman, original no. 23384 (after Goldman, original description, type not see).

Range - From northern Arizona, north into southeastern Washington, most of Kane and southern Garfield Counties, Utah. Eastern limit appears to be the Colorado River.

Diagnosis - Size: Large (see measurements). Color: Fairly dark, darker than D. o. longipes, ears brown, dorsal tail stripe with an admixture of black and brown tipped hairs, ventral tail stripe light brown. Skull: large.

Remarks - This large, rather reddish race inhabits the sandy areas of south central Utah. Specimen from near Kanab, Kane County, Utah are typical cupidineus but the animals from the region of Escalante, Garfield County, Utah show intergrading characters with sanrafaeli, the race to the north. These specimen are here placed with cuidineus since the majority of characters show them to be more nearly like the race to the south.

The Colorado River apparently serves as a barrier to the east separating cupidineus from longipes. The river in this region where it forms the boundary between Kane and San Juan Counties, Utah has deep precipitous canyons, at the bottom of which the river flows. The Colorado also serves to prevent nexilis and cupidineus from intergrading in the north-

eastern portion of the latter's range.

Specimens examined. - Total number 50; 48 skins and skulls, 2 skins only.

Records of occurrence. - Washington County: Near Short Creek Road, south of town of Virgin, 18 (RH); Garfield County: Mouth of Galf Creek, Escalante River, 3 (BYU); Ten Mile Spring, 3 (BYU); Escalante 5, (BYU); Kane County: Near Sand Dunes, 7 (RH); Kanab, 3 (2, BYU); 1 mi. S Kanab, 4400 ft., 2; Cottonwood Canyon, 8 mi. NW Kanab, 4800 ft., 1; Near Paria, 1; Willow Tank Springs, 7 (BYU).

Dipodomys ordii fetusus Durrant and Hall

Original description. - 1939. Dipodomys ordii fetusus Durrant and Hall, Mammalia, Tome III, no. 1, pp. 14-16. March, 1939.

Type. - Female, adult, no. 48451, Museum of Vertebrate Zoology, University of California; 2 mi. N Panaca, 4800 ft., Lincoln County, Nevada; June 24, 1931; collected by Ward C. Russell, original number 1658 (after Durrant and Hall, original description, type not seen).

Range. - Southwestern Millard and western Beaver Counties, Utah, thence southwestward into Lincoln County, Nevada.

Diagnosis. - Size: Small (see measurements). Color: Darker than celeripes, but lighter than utahensis. Skull: Upper incisors small, external auditory meatus small, round

and with an evagination on the dorsal border.

Remarks. - This form ranges from south central Lincoln County, Nevada northeast into Utah. As indicated by this study it is limited to west central Utah in Millard and Beaver Counties. Apparently this is a form limited to the low desert regions. The specimens from Utah are not typical but have their affinities definitely with this race. The animals from Warm Cove, Sec. 34, T. 25S, R. 18W, and Pine Valley, Sec. 33, T. 25S, R. 17W, Salt Lake B. M., are intergrades between fetusus and celeripes. As stated above the preponderance of characters are referable to fetusus.

Specimens examined. - Total number 28; 27 skins and skulls, 1 skin only.

Records of occurrence. - Millard County: Pine Valley, Sec. 33, T. 25S, R. 17W, 5000 ft., 16; Warm Cove, Sec. 34, T. 25S, R. 18W, 5500 ft., 2; Desert Range Experiment Station, 50 mi. W Milford, 5252 ft., 10 (1, BYU).

Dipodomys ordii fremonti subsp. nov.

Type. - Female, adult, no. 15661, Carnegie Museum, Pittsburgh, Pennsylvania; Torrey, 7000 ft., Wayne County, Utah; July 19, 1938; collected by W. F. and F. H. Wood, original no. 1562.

Range. - Known only from the type locality.

Diagnosis. - Size: Small (see measurements). Color:

Dark, general over all color, as determined by Dr. D. F. Hoffmeister, is near 16'' Tawny Olive whereas the ochraceous part of the pelage, as determined by Dr. E. R. Hall is Cinnamon Buff, faintly overlaid with blackish (capitalized color terms after Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912), paler on sides with slight suffusion of white, entire ventral surface, dorsal surface of hind foot, postauricular and supraorbital spots, and lateral tail stripes, white; dorsal and ventral tail stripes brownish. Skull: Small with long upper incisors, deep rostrum, temporal process of zygomatic arch bowed laterally, diastema long, and alveolar length of upper molar series long.

Comparisons - From the type and type series of D. o. panguitchensis, fremonti differs as follows: Size about the same. Color: Lighter in all respects, particularly the ears which are light brown in fremonti as compared to black in panguitchensis. Skull: Larger in all measurements, upper incisors longer, rostrum deeper, depth of bullae greater, temporal process of zygomatic arch bowed laterally rather than straight, alveolar length of upper molar series longer, diastema longer.

From the type series and topotypes of D. o. utahensis, fremonti differs as follows: Size: Body longer, tail shorter. Color: Lighter in all respects, especially the ears which are

light brown as contrasted to black. Skull: Foramen magnum larger and with a deeper dorsal evagination, width across condyles greater, temporal process of zygomatic arch bowed laterally rather than straight, generally deeper rostrum, upper incisors longer, diastema longer, and anterior palatine foramina longer.

From the type and type series of D. o. cinderensis, fremonti differs as follows: Size: About the same. Color: Lighter in all respects, with the ears brown rather than black. Skull: Smaller, bullae smaller, supraoccipital wider and foramen magnum larger.

From topotypes of D. o. cupidineus, D. o. longipes, D. o. nexilis, the type and type series of D. o. uintaensis, and D. o. sanrafaeli; this form can readily be distinguished by its smaller size and generally darker color.

Remarks - This hitherto unnamed race of ordii apparently inhabits the upper reaches of the Fremont River in west-central Wayne County, Utah. Although only two specimens are available at this time, these are so distinctly different from any of the named forms, it is apparent that here is an isolated race probably branching from the dark colored stock characterized by utahensis.

The nearest geographic form of Dipodomys ordii, to fremonti, is cupidineus, whose range lies just to the east.

Further collecting will be needed to accurately determine the range of this new race.

Specimens examined. - Two.

Records of occurrence. - Wayne County: Torrey, 7000 ft., 2 (CM).

Dipodomys ordii longipes (Merriam)

Original description. - 1890. Dipodops longipes Merriam, N. Amer. Fauna, no. 3, p. 72. September 11, 1890.

Type. - Male, young adult, no. 17703/24639, U. S. Nat. Mus. (Dept. of Agr. Coll.); Foot of Echo Cliffs, Painted Desert, Arizona; September 22, 1889; collected by C. Hart Merriam, original no. 512 (after Merriam, original description, type not seen).

Range. - From the Echo Cliffs in northern Arizona, north into southern San Juan County, Utah. West to the Colorado River, east to western New Mexico.

Diagnosis. - Size: Large (see measurements). Color: Dark cinnamon, very much like cupidineus but lighter in all respects. Skull: Large.

Remarks. - This large rather reddish race described from northern Arizona and ranging into Utah does not show any truly typical specimens within the confines of the state of Utah. All of the specimens examined were from the north side of the San Juan River, San Juan County, Utah, and showed intergrading

characters with D. o. nexilis its nearest neighbor to the north and east. However, in the majority of characters studied these animals most closely resemble longipes. It is possible that the San Juan River near its confluence with the Colorado River may be a barrier, but it is quite definitely not a barrier farther to the east. This area to the east may be the route by which longipes cross into Utah and thus intergrades with nexilis. There were no known available specimen from the south side of the San Juan River for this study. It is quite possible that the forms from this latter region will be typical longipes.

Specimen examined - Total number 12; 10 skins and skulls, 2 skins only.

Records of occurrence - San Juan County: Bluff, 2; $\frac{1}{2}$ mi. N Bluff, 3300 ft., 7; 1 mi. N Bluff, 3500 ft., 1; Johns Canyon, San Juan River, 5150 ft., 2.

Dipodomys ordii marshalli Goldman

Original description - 1937. Dipodomys ordii marshalli Goldman, Proc. Biol. Soc. Wash., vol. 50, pp. 223-224. December 28, 1937.

Type - Female, adult, no. 262655, U. S. Nat. Mus. Biol. Surv. Coll.; Bird Island, Great Salt Lake, 4300 ft., Tooele County, Utah; June 22, 1937; collected by W. H. Marshall, X-catalog no. 27969 (after Goldman, original description, type

not seen).

Range - Bird, Carrington, Badger, and Stansbury Islands, Great Salt Lake; probably around the western edge of Great Salt Lake north to Kelton, around southern and southeastern edge of lake to the mouth of the Jordan River.

Diagnosis - Size: Medium (see measurements). Color: Pale, approaching pallidus. Skull: Medium, about the same size as utahensis, but cutting edge of upper incisors narrower, smaller than pallidus, its nearest neighbor to the southwest.

Remarks - This race described from Bird Island, Great Salt Lake, and termed by Marshall (1940: 144-159) a representative of isolation has been taken on the nearby mainland. Animals were taken over a number of years from various points on the eastern and southeastern shores of the lake by students from the University of Utah. While no typical specimens were taken, available material does show intergradation between marshalli and utahensis. The majority of studied characters places these animals in the sub-species marshalli. One specimen from Kelton, Box Elder County, Utah, was studied and also referred to this race. These studies lead to the conclusion that here once again is evidence that the Great Salt Lake has not exerted complete isolation as was heretofore believed. This is further corroborated by the work of

Hall and Hoffmeister (1942: 51-65) on the Peromyscus crinitus group. It seems highly improbable that all the islands are centers of distribution for the races that have been named from them; it appears to be mere good fortune that the animals on the islands were collected and studied before a comprehensive study was made of the animals from the surrounding mainland. Some of these forms that have been named from the islands and which have since been shown as present on the mainland are: Dipodomys ordii marshalli, Dipodomys microps subtenuis, and Peromyscus crinitus pergracilis.

Specimens examined. - Total number 41; 34 skins and skulls, 7 skins only.

Records of occurrence. - Box Elder County: Kelton, 4300 ft., 2; Tooele County: Bird Island, Great Salt Lake, 4300 ft., 1 (USNM); Carrington Island, Great Salt Lake, 4300 ft., 1 (USNM); Stansbury Island, Great Salt Lake, 4300 ft., 10 (4,USNM); Salt Lake County: 18 mi W Salt Lake City, 4260 ft., 16; 17 mi. W Salt Lake City, 4320 ft., 7; 16 mi. W Salt Lake City, 4300 ft., 3; 14 mi. W Salt Lake City, 4300 ft., 1.

Dipodomys ordii nexilis Goldman

Original description. - 1933. Dipodomys ordii nexilis Goldman Jour. Wash. Acad. Sci., vol. 23, no. 10, pp. 470-471. October 15, 1933.

Type. - Male, adult, no. 149938, U. S. Nat. Mus. Biol.

Surv. Coll.; 5 mi. W Naturita, Montrose County, Colorado; July 20, 1907; collected by Merritt Cary, original no. 1068. (after Goldman, original description, type not seen).

Range - From Naturita, Montrose County, Colorado, southwest into San Juan County, Utah, north of the San Juan River; northwest into Grand County, Utah, to the Grand River; westward probably as far as the Colorado River in Utah.

Diagnosis - Size: Large (see measurements). Color: Dark, darker than either longipes or cupidineus, that is, there is more dark tipped hair in the pelage. Skull: Large.

Remarks - Goldman remarked in the original description that this race probably intergraded with longipes in Utah. This conjecture is substantiated by this study. Specimen from near Bluff, San Juan County, Utah show characters intermediate between longipes and nexilis. However, these specimen are more referable to longipes. Specimen from near Moab, Grand County, Utah, show intergrading characters with sanrafaeli but more closely approach nexilis and are referred to this race.

In this dry desert section of Utah, Rivers apparently are not good barriers to the distribution of kangaroo rats. The rivers in this section are periodically dry in the late summer months, thus allowing the animals to easily cross them. Davis (1939: 58) states that kangaroo rats cannot swim and concludes that streams of sufficient width which flow con-

stantly are excellent barriers to the further distribution of these animals.

Specimens examined. - Total number 6; 5 skins and skulls; 1 skin only.

Records of occurrence. - Grand County: Cisco, 4 (CM); 18 mi. NE of Moab, 6000 ft., 1; San Juan County: Blanding, 1.

Dipodomys ordii pallidus subsp. nov.

Type. - Male, adult, no. 3526, Museum of Zoology, University of Utah; Old Lincoln Highway, 18 mi. SW Orr's Ranch in Skull Valley, 4400 ft., Tooele County, Utah; June 6, 1940; collected by S. D. Durrant, original no. 1905.

Range. - Low valleys of west central Utah in Tooele, Juab, and Millard Counties.

Diagnosis. - Size: Medium (see measurements)., hind feet long. Color: Light, entire dorsal surface Light Pinkish Cinnamon (capitalized color terms after Ridgway, Color Standards and Color Nomenclature, Washington, D.C., 1912), paler on sides with great suffusion of white, entire ventral surface, dorsal surface of hind foot, postauricular and supraorbital spots, white; hairs of dorsal tail stripe tipped with brown. Skull: Large, auditory bullae long, wide, and well inflated, external auditory meatus long and with an evagination on the dorsal border, nasals long and flared anteriorly.

Comparisons. - From the type and type series of D. o. celeripes, pallidus differs as follows: Body measurements greater, slightly darker, although some specimens are lighter, hairs of dorsal tail stripe tipped with brown instead of black; skull larger, particularly in the length of the nasals which are longer and more flared anteriorly, interorbital width greater, auditory bullae larger, external auditory meatus larger.

From the type series of D. o. fetusus, pallidus differs as follows: Size: about the same. Color: much lighter, plantar surface of hind feet show only indistinct marks, hip stripe wider and more prominent, ventral tail stripe indistinct. Skull: Larger, nasals longer and more flared anteriorly, auditory bullae larger, external auditory meatus larger, palate shorter and broader.

From the type series and topotypes of D. o. marshalli, pallidus differs as follows: Size: About the same, except hind foot which is longer. Color: Lighter, arietiform markings less conspicuous, dorsal and ventral tail stripes less pronounced, the hairs being brown tipped. Skull: Slightly larger, palate longer and narrower, jugal processes heavier, external auditory meatus larger and more deeply evaginated on the anterior border, cutting edge of upper incisors wider, nasals but slightly longer and more flared distally.

From the type series and topotypes of D. o. utahensis, pallidus differs in the following characters: Size: Slightly smaller, hind foot longer. Color: Much lighter in all respects. Skull: Larger, wider across bullae, bullae more inflated ventrally, external auditory meatus more ovoid, nasals longer, palate shorter and wider.

Remarks. - D. o. pallidus is a fairly large sized, light colored race which inhabits the dry low desert valleys of west central Utah.

Among the named races, pallidus most closely approaches marshalli, its nearest neighbor to the north and east. Intergradation with utahensis is encountered in specimens from Clover Creek, Onaqui Mountains, Tooele County, Utah, but the sum total characters refer these latter animals to utahensis. Specimens taken at Lynndyl and Hinkley, Millard County, show intergrading characters with celeripes but more closely approach pallidus. Another area of intergradation is west of Delta, Millard County, where four specimens from 35 and 60 mi. W Delta show intermediate characters between celeripes and pallidus but more nearly resemble celeripes.

Specimens examined. - Total number 34; 33 skins and skulls, 1 skin only.

Records of occurrence. - Tooele County: Old Lincoln Highway, 18 mi. SW Orr's Ranch in Skull Valley, 4400 ft., 9
Juab County: Fish Springs, 4400 ft., 4; 7 mi. S Fish Springs

4400 ft., 4; Millard County: 1 mi. N Lynndyl, 4768 ft., 5; Lynndyl, 4768 ft., 1; Hinckley, 4600 ft., 11.

Dipodomys ordii panguitchensis Hardy

Original description. - 1942. Dipodomys ordii panguitchensis Hardy, Proc. Biol. Soc. Wash., vol. 50, pp. 90-91. June 25, 1942.

Type. - Male, adult, no. 4375, Museum of Zoology, University of Utah; one mile south of Panguitch, 6666 ft., Garfield County, Utah; August 31, 1940; collected by Ross Hardy, original no. 2151.

Range. - Known only from the type locality.

Diagnosis. - Size: Small (see measurements. Color: Dark, slightly darker than utahensis. Skull: Small, averaging slightly larger in most measurements than utahensis.

Remarks. - This dark colored race of ordii is closely allied to D. o. utahensis. The pelage, however, presents a grayer and darker appearance. The tail vertebrae average slightly shorter in proportion to the body length than in utahensis. The skull shows several characters which quite readily set this race off from utahensis. They are as follows: Supraoccipital region is wider, the foramen magnum is elongated dorso-ventrally, and the pterygoid fossae are ovoid as opposed to nearly round in utahensis.

D. o. panguitchensis can be told from D. o. cinder-

ensis by a slightly darker color, shorter tail in proportion to the body, bullae smaller, shorter maxillary tooth row, and the foramen magnum elongate as compared to nearly round.

This race can readily be distinguished from D. o. fetusus, D. o. cupidineus, and D. o. celeripes on the basis of color, panguitchensis being much darker than any of the above.

The upper reaches of the Sevier River Valley, appear to be the range of this form. Natural barriers such as the Cedar Mountains, to the west, high plateau country to the south, and the Paunsaugunt Plateau to the east, and narrow canyons to the north apparently prevent this race from extending its range.

Specimens examined. - Three.

Records of occurrence. - Garfield County: 1 mi. S Panguitch, 6666 ft., 3 (2, RH).

Dipodomys ordii sanrafaeli subsp. nov.

Type. - Female, adult, no. 4612, Museum of Zoology, University of Utah; Price, 5567 ft., Carbon County, Utah; June 5, 1940; collected by Ross Hardy and H. Higgins, original no. 1901.

Range. - Within the confines of the San Rafael Desert in Carbon, Emery, northern Wayne, western Grand, and southwestern Uintah counties, Utah.

Diagnosis - Size: Large (see measurements). Color: Entire dorsal surface Cinnamon Buff (capitalized color terms after Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912), lighter on sides and flanks; entire ventral surface, dorsal surface of hind foot, postauricular and supraorbital spots, hip stripes and lateral tail stripes, white; hairs of dorsal tail stripe mixed brown and black tipped. Skull: Large, bullae large, diastema short, lachrymal processes rather small.

Comparisons - From topotypes of D. o. longipes, sanrafaeli differs as follows: Size: Smaller. Color: More cinnamon, presenting a lighter color, ears lighter. Skull: Smaller, bullae smaller, pterygoid fossae oval rather than round, width across condyles greater, narrower across zygomatic processes of maxillae.

From topotypes of D. o. uintaensis, sanrafaeli differs as follows: Size: About the same but hind foot longer. Color: Lighter, ears lighter, arietiform marks absent, dorsal and ventral tail stripes lighter, plantar surfaces of hind foot show only indistinct markings. Skull: Larger in all measurements, the bullae being noticeably larger, and the lachrymal processes smaller.

From the type series of D. O. priscus, sanrafaeli differs as follows: Size: About the same. Color: Lighter

in all respects; the ventral tail stripe being continuous to the tip of the pencil. Skull: Nasals shorter, bullae longer, wider, and deeper, diastema shorter, alveolar length of upper maxillary tooth row shorter, width across paroccipital processes greater.

From topotypes of D. o. cupidineus, sanrafaeli differs as follows: Size: Larger. Color: Lighter in all respects. Skull: Larger in all measurements.

From one topotype and several near topotypes of D. o. nexilis, sanrafaeli differs as follows: Size: About the same. Color: Lighter in all respects. Skull: Larger in all measurements. The bullae being noticeably larger and the width of the zygomatic processes of the maxillae greater.

Remarks - This large, comparatively light colored race intergrades with D. o. cupidineus in the extreme southern portion of its range, and in the eastern portion with D. o. nexilis. Although these specimen do show intergrading characters they are more referable to sanrafaeli.

The Green River transects the range of this race and theoretically should serve as a barrier. However, specimens from 16 mi. NW of Moab, Grand County, Utah, are referable to this race even though showing intergrading characters with nexilis. It is possible that in this region, the Green River would not serve as a complete barrier since it does

occasionally freeze over, thus allowing the animals to cross. It is known that kangaroo rats do not hibernate but remain more or less active throughout the colder winter months. Man-made conveniences such as bridges may also serve as a means of allowing these animals to cross streams which might otherwise be a barrier to them. Huey (1941: 383) cites examples of pocket gophers (Thomomys) extending their range by means of borrow pits along surfaced roads. It may be that bridges would serve in much the same manner. Further south on the Green River, near the confluence of the Colorado, no bridges are present and the river serves as an excellent barrier.

Specimens examined - Total number 15; 11 skins and skulls, 4 skins only.

Records of occurrence - Carbon County: Price, 5567 ft., 2 (RH); 3 mi. NE of Price, 1 (RH); 12 mi. NE of Price, 2 (CM); Wellington, 1 (RH): Emery County: San Rafael, 21 mi. out, 1 (USAC); 12 mi. SW Green River, 2 (CM); Grand County: 16 mi. NW of Moab, 2 (CM); Wayne County: Notom, 1 (BYU); Garfield County: Kings Ranch, 4800 ft, 3 (1, USAC).

Dipodomys ordii uintaensis subsq. nov.

Type - Male, adult, no. 11634, Carnegie Museum, Pittsburgh, Pennsylvania; Red Creek, 6700 ft., 2 mi. N Fruitland, Duchesne County, Utah; Aug. 15, 1936; collected by J. K. and

M. T. Doult, original no. 3433.

Range - Uinta basin of the White, Green and Duchesne River drainage in Uintah, Duchesne, and eastern Wasatch Counties, Utah.

Diagnosis - Size: Large (see measurements), hind foot short. Color: General over all color as determined by Dr. D. F. Hoffmeister, is near (16"a) Clay Color whereas the ochraceous part of the pelage, as determined by Dr. E. R. Hall, is near (c) Cinnamon Buff, faintly overlaid with dusky (capitalized color terms after Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912), paler on sides with a great suffusion of white. Entire ventral surface, dorsal surface of hind feet, postauricular and supraorbital spots, hip stripes, and lateral tail stripes, white; Dorsal and ventral tail stripes brownish. Skull: Large, with the frontomaxillary suture convex mediad, lachrymal processes large, styloid processes project on the ventral surface of the bullae, beyond the middle of the external auditory meatus, nasals flared anteriorly.

Comparisons - From the type series of D. o. priscus, uintaensis differs as follows: Size: About the same, hind foot shorter.

Color: More cinnamon in upper parts, arietiform markings more distinct and extending on to the nose pad, dorsal

tail stripe wider and darker and extending to the tip of the pencil rather than being absent for the distal third, plantar surface of hind feet much darker, post auricular and supraorbital patches less pronounced. Skull: Styloid processes project on the ventral part of the tympanic bullae well anterior of the middle of the external auditory meatus, depth of foramen magnum, expressed in percentage of width across posterior margin of occipital condyles, greater (86% in uintaensis as compared to 81% in priscus); fronto-maxillary suture convex mediad as opposed to nearly straight; lachrymal processes larger, nasals slightly more flared anteriorly.

From topotypes and near topotypes of D. o. luteolus, uintaensis differs as follows: Size: Slightly larger, hind foot shorter. Color: About the same, dorsal and ventral tail stripes wider and darker, ventral tail stripe continuous to end of pencil, plantar surface of hind feet darker. Skull: Nasals shorter, fronto-maxillary suture convex mediad as opposed to nearly straight, greatest breadth across bullae less, foramen magnum smaller and rounder external auditory meatus more ovoid, width across zygomatic processes of maxillae less, width across posterior margin of occipital condyles less (averaging 6.1 mm. in uintaensis as opposed to 6.8 mm. in luteolus), width across paroccipitals less.

From one topotype and several near topotypes of D. o.

nexilis, uintaensis differs as follows: Size: About the same, hind foot shorter. Color: Lighter in all respects. Skull: Interorbital breadth greater, fronto-maxillary sutures convex mediad as opposed to concave, lachrymal processes larger, nasals slightly more flared distally, narrower across bullae, basal length greater, zygomatic arches bowed laterad as opposed to relatively straight.

From near topotypes of D. o. cupidineus, uintaensis differs as follows: Size: Larger, except hind foot which is about the same length. Color: Lighter in all respects. Skull: Interorbital breadth greater, nasals longer, basal length longer, fronto-maxillary suture convex mediad as opposed to straight.

From topotypes and near topotypes of D. o. longipes, uintaensis differs as follows: Size: About the same except hind foot which is shorter. Color: More admixture of black in the upper parts, giving a general duskier tone, ears darker, dorsal tail stripe generally darker, ventral tail stripe lighter, arietiform markings complete. Skull: Auditory bullae wider, longer and deeper, fronto-maxillary suture convex mediad as opposed to nearly straight, narrower across bullae.

From the type and type series of D. o. sanrafaeli, uintaensis differs as follows: Size: About the same. Color:

More admixture of black in the upper parts, giving a general dusker tone, ears darker, dorsal tail stripe generally darker, ventral tail stripe lighter, arietiform markings complete. Skull: Auditory bullae wider, longer and deeper, fronto-maxillary suture convex mediad as opposed to nearly straight, narrower across bullae.

From the type and type series of D. o. sanrafaeli, uintaensis differs as follows: Size: About the same. Color: Darker in all respects, that is, there is more admixture of black and less cinnamon. Skull: Bullae shorter, narrower, and less inflated, fronto-maxillary suture convex mediad as opposed to concave, zygomatic arches bowed laterad as opposed to nearly straight, foramen magnum nearly round as opposed to very elongated.

Remarks. - This large, rather dark race inhabits the desert valleys of the White, Green, and Duchesne Rivers in northeastern Utah. The nearest race geographically as well as morphologically appears to be D. o. priscus with which it is found intergrading in the northeastern part of its range. It can readily be told from the near neighbor to the south, sanrafaeli, on the basis of color alone. Some of the specimens from the eastern portion of the range were found intergrading with nexilis but were more referable to uintaensis.

Inasmuch as there is evidences of intergradation with

D. o. priscus it is assumed that priscus is present in the state of Utah although there are no available specimens to bear out this conjecture. Tentatively priscus is considered to be present only in the extreme northeastern corner of Utah but subsequent collecting may show this race to extend even further into the state.

Specimens examined. - Total number 35; 34 skins and skulls, 1 skin only.

Records of occurrence. - Duchesne County: 10 mi S of Myton, 1; 20 mi S Myton, 1 (RH); Vernal, 1 (BYU); Red Creek, 6700 ft., 2 mi N Fruitland, 4 (CM); Uintah County: Junction Green and White Rivers, 4800 ft., 2 mi S Ouray, 5 (CM); Pariette Bench, 5000 ft., 8 mi S Ouray, 8 (CM); Desert Springs, 10 mi S Ouray, 4 (CM); Pariette Bench, 12 mi S Ouray, 2 (CM); Jensen, 5 (BYU); E side Green River, 3 mi S Jensen, 4 (CM).

Dipodomys ordii utahensis (Merriam)

Original description. - 1904. Perodipus montanus utahensis Merriam, Proc. Biol. Soc. Wash., vol XVII, pp. 143-144. July 14, 1904.

Type. - Male, adult, no. 55115, U. S. Nat. Mus. Biol. Surv. Coll.; Ogden, Weber County, Utah; July 15, 1893; collected by Vernon Bailey, original no. 4085 (after Merriam, original description, type not seen).

Range. - North of Great Salt Lake to southern Idaho, south along east margin of old lake Bonneville to northern

Sevier County, west to east side Onaqui Mountains, Tooele County, Utah.

Diagnosis. - Size: Medium (see measurements). Color: The darkest ordii in Utah. Skull: Medium, cutting edge of upper incisors wide, interparietal bone large, wide, and very rounded anteriorly, lachrymal processes large.

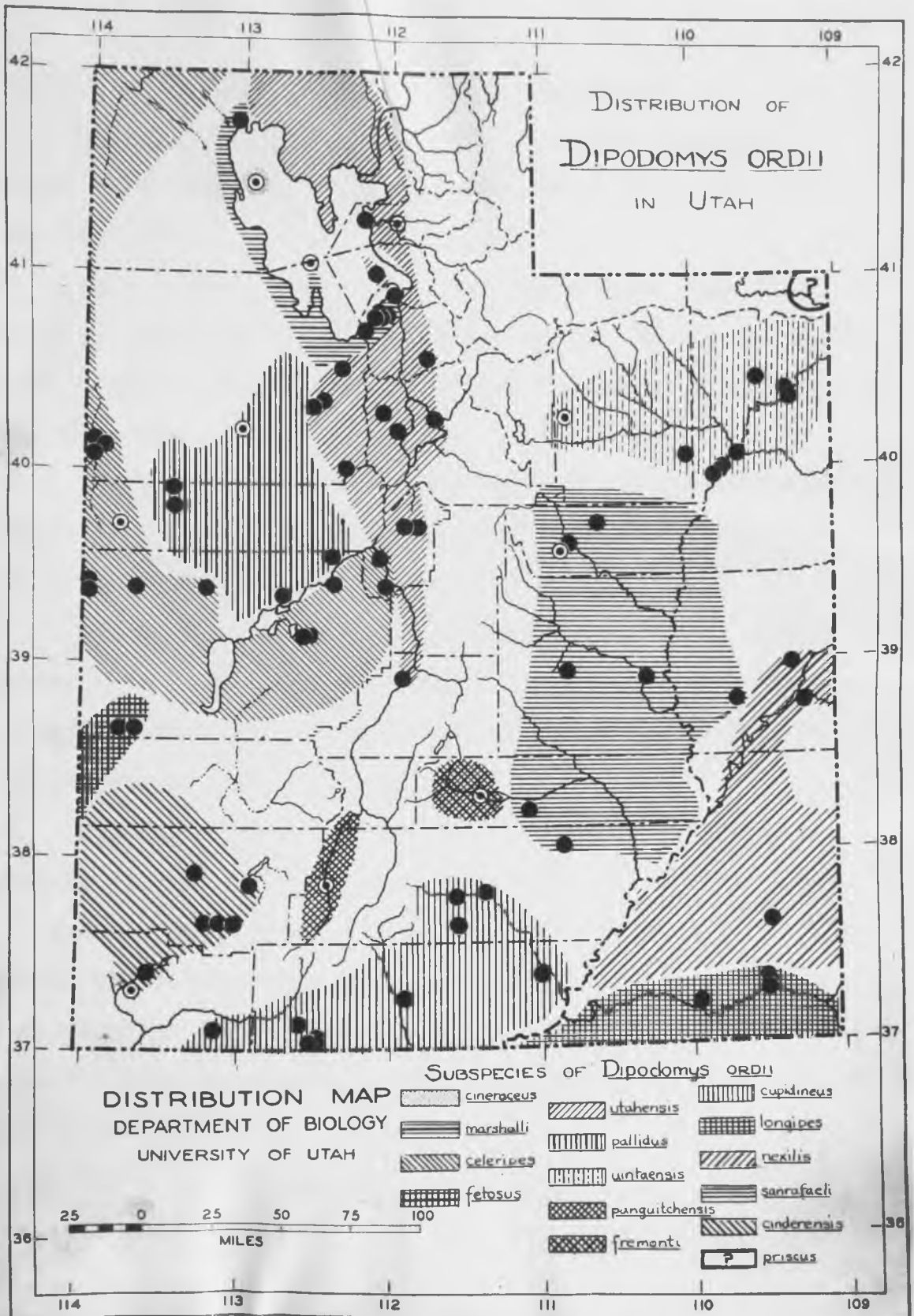
Remarks. - Hall (1931: 5) and Durrant and Hall (1939: 13), both remarked that with the material then available, they were unable to separate D. o. utahensis from D. o. columbianus. This resulted in all specimens from the range ascribed originally to utahensis being placed in synonymy with columbianus. Various other workers, Marshall (1940: 156), Goldman (1939: 352), and Hayward (1936: 139) have retained utahensis in full validity, referring to it as such in their publications. This naturally has led to considerable dispute as well as misunderstanding. At present with the type series, several topotypical series, and much additional material from elsewhere in the range, plus a good topotypical series of columbianus, at hand, it is felt this dilemma can be clarified. According to the findings of this study utahensis while not superficially different can be set off from columbianus by generally darker color, with more admixture of black hairs, much darker and wider dorsal and ventral tail stripes, arietiform marks extend markedly to the nose

pad, ears darker, cutting edge of upper incisors wider, lachrymal processes larger, interparietal bone larger, wider and rounded anteriorly as opposed to small, narrow, and truncate anteriorly in columbianus. Therefore, utahensis is hereby accorded full subspecific status. It is not the purpose of this paper to determine the range or the limits of the range of columbianus, but it must be at least restricted to include the Oregon and Idaho specimens with possibly a small part of the range extending into the extreme northwestern corner of Utah. All specimens from the range of utahensis, some of which heretofore have been classified as columbianus, are all being relegated to the former race. D. o. columbianus is not considered to be represented in the kangaroo rat fauna of Utah as now known.

Specimens examined. - Total number 76.

Records of occurrence. - Box Elder County: Promontory Point, 1 (USNM); Tooele County: Bauer, 4500 ft., 6; St. John, 4300 ft., 4; Little Valley, Sheeprock Mountains, 5500 ft., 1; Clover Creek, Onaqui Mountains, 5500 ft., 1; Juab County: Nephi, 1 (USNM); 4 mi. W of Nephi, 1 (RH); Weber County: Ogden, 4293 ft., 20 (7, BYU) (7, MVZ) (4, USNM); Little Mountain, 1 (USNM); Davis County: Antelope Island, Great Salt Lake, 4250 ft., 5 (USNM); Salt Lake County: Plain, 4 mi. N Draper, 4500 ft., 1; Utah County: Fairfield, Cedar Valley, 4800 ft., 15 (9, BYU); Sand Dunes W of Curtis Station, 4 (BYU); W Lake

Mountains, 9 (BYU); Sevier County: 1 mi. W of Aurora, 5190
ft., 6 (1,USNM).



Dipodomys merriami merriami Mearns

Original description - 1890. Dipodomys merriami Mearns, Bull, Amer, Mus. Nat. Histo., vol. 2, p. 290. February 21, 1890.

Type - Male, adult, no. 2394, Amer. Mus. Nat. Hist.; New River, Maricopa County, Arizona; May 16, 1885; collected by Dr. Edgar A. Mearns (after Mearns, original description, type not seen).

Range - From western Texas west to the Mohave Desert, north into the southwestern corner of Washington County, Utah, west of the Beaver Dam Mountains.

Diagnosis - Size: Medium (see measurements). Color: Lighter than D. m. vulcani. Skull: Supraoccipital narrower, pterygoid fossae more flared, and the width across paroccipitals is greater than in vulcani.

Remarks - These animals now ascribed to merriami were formerly of the race nevadensis described by Merriam (1894: 111) from Pyramid Lake, Nevada. Grinnell (1922: 73-77) synonymized the latter race with merriami. This race is tentatively limited in Utah to the west of the Beaver Dam Mountains while its near geographic neighbor vulcani, inhabits the area east of the mountains.

The two races merriami and vulcani can be separated from each other by means of color. The former race being

generally lighter than vulcani.

Specimens examined. - Total number 53; 44 skins and skulls, 9 skins only.

Records of occurrence. - Washington County: near Ed Terry Ranch, Beaver Dam Wash, 7 (RH); Beaver Dam Wash, W side Beaver Dam Mountain, 11 (6,RH) (5,DJC); 1½ mi. E Beaver Dam Wash, 8 mi. N Utah-Arizona border, 2800 ft., 13; 1½ mi. E of Beaver Dam Wash, 5 mi. N Utah-Arizona border, 2800 ft., 22.

Dipodomys merriami vulcani Benson

Original description. - 1934. Dipodomys merriami vulcani Benson, Proc. Biol. Soc. Wash., vol. 47, pp. 181-184. October 2, 1934.

Type. - Male, adult, no. 56002, Museum of Vertebrate Zoology, University of California; from the lower end of Toroweap Valley (about ½ mi. E of Vulcans Throne), Mohave County, Arizona; November 11, 1932; collected by Annie M. Alexander, original no. 2063 (after Benson, original description, type not seen).

Range. - From Vulcan's Throne, Mohave County, Arizona, north into southern Washington County, Utah, east of the Beaver Dam Mountains.

Diagnosis. - Size: About the same as merriami (see measurements). Color: Dark. Darker than merriami, that is there is more admixture of black tipped hairs in the pelage.

Skull: About the same as merriami (see under diagnosis of merriami).

Remarks. - This race of kangaroo rats apparently ranges north into southern Utah in Washington County. Bole (1936: 1-2) named D. m. frenatus from Toquerville, Washington County, Utah, but failed to compare his material with the already named vulcani of Benson. Comparisons of topotypical and near topotypical specimens proves these two forms to be indistinguishable from one another.

Since the name vulcani of Benson has priority over frenatus of Bole, all Utah specimens east of the Beaver Dam Mountains are here referred to that race. The form frenatus is hereby synonymized under vulcani.

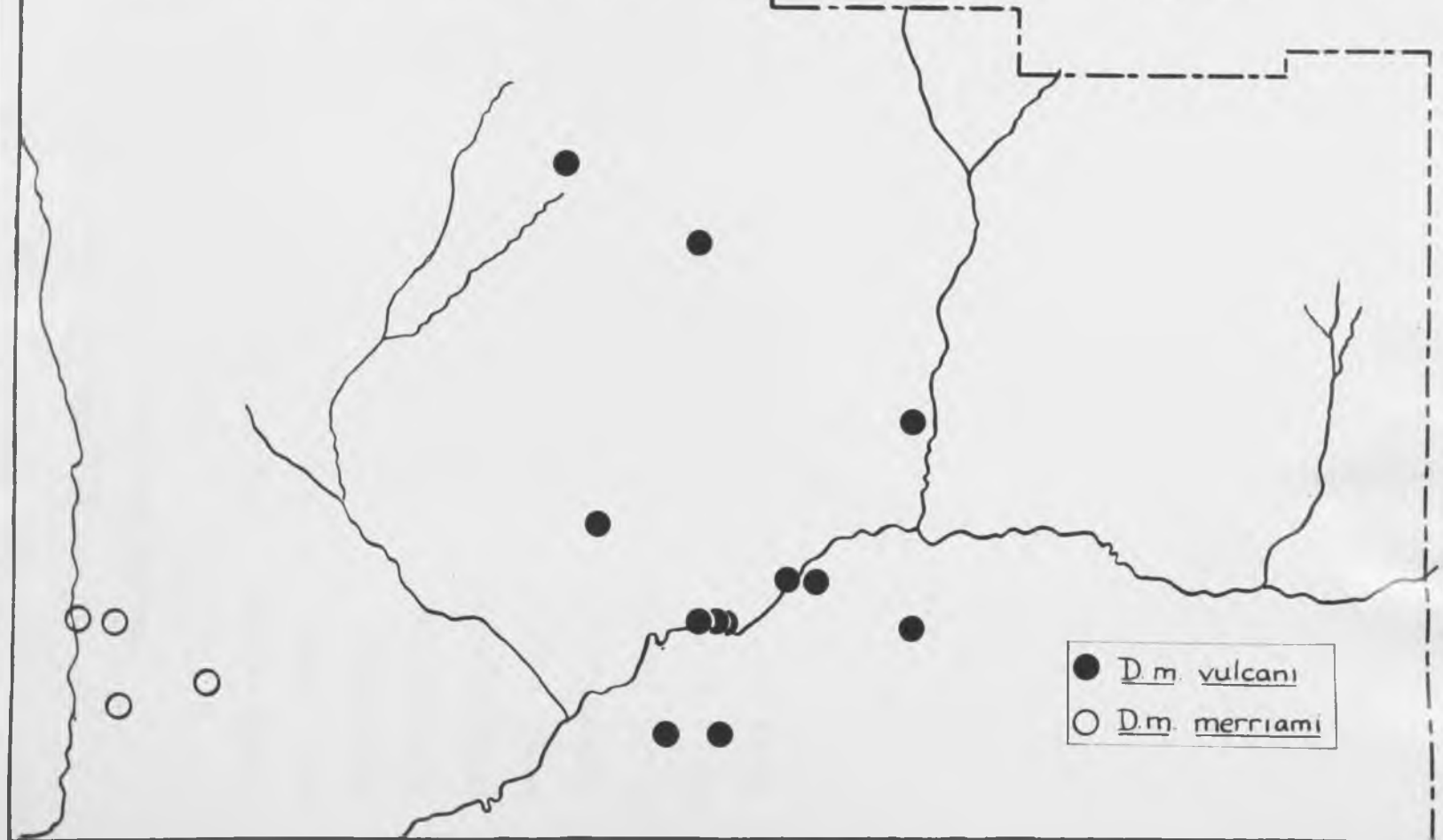
Specimens examined. - Total number 63; 60 skins and skulls, 3 skins only.

Records of occurrence. - Washington County: Diamond Valley, 1 (RH); 5 mi. NW St. George, 1 (DJC); near Bloomington, 1 (RH); 3 mi. S St. George, 18 (2,RH); Veyo, 1 (DJC); St. George, 23, (16,RH), (3,DJC), (3,BYU); Washington, 1 (BYU); $\frac{1}{4}$ mi. W St. George, 2; 1 mi. W St. George, 2800 ft., 3; 7 mi. E St. George, 2; 4 mi. W Hurricane, 9; Toquerville, 1.

WASHINGTON COUNTY, UTAH

DISTRIBUTION OF *DIPODOMYS MERRIAMI*

5mi 10mi



- *D.m. vulcani*
- *D.m. merriami*

Dipodomys deserti deserti

Beaver Dam Wash., Washington County, Utah

| | 4 males | 2 females |
|---------------|------------------|-------------------|
| Total length | 331.0 (328-332) | 312.5 (307-318) |
| Tail length | 196.0 (193-201) | 174.0 (166-182) |
| Hind foot | 55.0 (53- 57) | 54.5 (51- 58) |
| Condylbasal | 28.9 (28.7-29.0) | 28.5 (28.1-28.9) |
| Occipitonasal | 38.9 (36.8-41.0) | 37.15 (37.1-37.2) |
| Nasal length | 16.5 (16.3-17.0) | 16.1 (15.8-16.4) |
| Interorbital | 13.5 (12.7-14.1) | 14.2 (13.9-14.5) |
| Bulla length | 18.9 (18.1-19.5) | 19.45 (19.4-19.5) |
| Bulla width | 13.9 (13.2-14.0) | 13.7 (13.6-13.9) |
| Bulla depth | 14.5 (14.2-14.9) | 14.85 (14.7-15.0) |

Dipodomys merriami

| | <u>merriami</u> | | <u>vulcani</u> | |
|---------------|-----------------------------|-------------|--------------------------------|-------------|
| | Beaver Dam Slope 6 males | | 3 mi. SW St. George 6 males | |
| Total length | 253.5 | (240-266) | 243.0 | (232-256) |
| Tail length | 152.5 | (145-161) | 138.0 | (130-148) |
| Hind Foot | 38.0 | (36- 40) | 38.0 | (32- 40) |
| Condylbasal | 22.6 | (22.4-22.9) | 22.5 | (22.0-23.0) |
| Occipitonasal | 29.7 | (29.4-29.9) | 29.5 | (29.0-30.1) |
| Nasal length | 13.2 | (12.9-13.6) | 13.3 | (12.6-13.9) |
| Interorbital | 13.2 | (13.0-13.9) | 13.05 | (12.6-14.0) |
| Bulla length | 15.2 | (14.8-15.8) | 15.05 | (14.6-15.4) |
| Bulla width | 10.1 | (9.9-10.2) | 10.0 | (9.6-10.4) |
| Bulla depth | 11.8 | (11.5-12.0) | 11.8 | (11.8) |
| | 2 females | | 3 females | |
| Total length | 259.0 | (255-263) | 248.0 | (240-255) |
| Tail length | 153.0 | (147-159) | 139.0 | (134-145) |
| Hind foot | 38.0 | (38) | 37.5 | (36- 39) |
| Condylbasal | 22.2 | (21.5-22.9) | 22.4 | (22.4) |
| Occipitonasal | 29.45 | (29.0-29.9) | 29.6 | (29.6) |
| Nasal length | 13.1 | (12.7-13.5) | 13.6 | (13.4-13.9) |
| Interorbital | 13.05 | (12.7-13.4) | 13.3 | (13.0-13.8) |
| Bulla length | 15.4 | 15.2-15.6) | 15.3 | (14.7-16.1) |
| Bulla width | 10.25 | (10.2-10.3) | 9.9 | (9.6-10.2) |
| Bulla depth | 11.95 | (11.9-12.0) | 11.6 | (11.0-12.0) |

DIPodomys ordii

| | <u>uintaensis</u> | <u>sanrafaeli</u> | <u>cupidineus</u> | <u>nexilis</u> | <u>longipes</u> |
|---------------|-------------------|--------------------------|-------------------|-----------------|-------------------|
| | 2 mi. N Fruitland | 12 mi. SW Green River | 1 mi. S Kanab | Naturita, Colo. | John's Canyon |
| | 3 males | 1 male | 1 male | 1 male | 2 males |
| Total length | 257.0 (253-260) | 265.0 | 227.0 | 261.0 | 251.0 (250-252) |
| Tail length | 145.0 (140-150) | 144.0 | 136.0 | 156.0 | 142.0 (136-148) |
| Hind foot | 40.5 (40-41) | 41.0 | 40.0 | 44.0 | 42.5 (42-43) |
| Condylobasal | 24.3 (24.0-24.7) | 25.1 | 23.6 | 24.5 | 24.4 (24.4) |
| Occipitonasal | 31.5 (31.2-32.1) | 33.0 | 31.2 | 31.6 | 32.1 (32.1) |
| Nasal length | 13.7 (13.2-14.1) | 14.1 | 12.7 | 13.9 | 13.85 (13.8-13.9) |
| Interorbital | 12.9 (12.9) | ----- | 12.0 | 11.4 | 12.1 (12.1) |
| Bulla length | 15.5 (15.1-15.9) | 16.4 | 15.4 | 16.0 | 16.55 (16.0-17.1) |
| Bulla width | 10.0 (9.9-10.1) | 10.7 | 10.0 | 10.6 | 10.5 (10.4-10.6) |
| Bulla depth | 12.3 (12.2-12.5) | 13.1 | 12.7 | 12.9 | 13.1 (12.6-13.6) |
| | No females | 1 female | 2 females | No females | 5 females |
| Total length | | 253.0 | 239.0 (239) | | 241.8 (227-251) |
| Tail length | | 138.0 | 129.5 (121-138) | | 130.0 (113-136) |
| Hind foot | | 42.0 | 39.5 (38-41) | | 40.4 (38-42) |
| Condylobasal | | 25.1 | 23.7 (23.5-24.2) | | 23.9 (23.4-24.5) |
| Occipitonasal | | 32.2 | 30.95 (30.4-31.5) | | 31.3 (31.0-31.7) |
| Nasal length | | 13.5 | 13.35 (13.1-13.6) | | 13.9 (13.2-15.0) |
| Interorbital | | ----- | 12.15 (12.0-12.3) | | 12.84 (12.5-13.4) |
| Bulla length | | 16.9 | 15.85 (15.7-16.0) | | 16.46 (16.1-16.8) |
| Bulla width | | 10.5 | 10.3 (10.2-10.4) | | 10.22 (10.0-10.6) |
| Bulla depth | | 13.1 | 12.5 (12.3-12.7) | | 12.9 (12.8-13.0) |

DIPODOMYS ORDII

| | <u>marshalli</u> | | <u>pallidus</u> | | <u>fetusus</u> | | <u>celeripes</u> | | <u>cineraceus</u> | |
|---------------|------------------|-------------|------------------|-------------|----------------|-------------|------------------|-------------|-------------------|-------------|
| | Stansbury Island | | Old Lincoln Hwy. | | Panaca, Nev. | | Trout Creek | | Dolphin Island | |
| | 2 males | | 7 males | | 6 males | | 4 males | | No males | |
| Total length | 239.5 | (238-241) | 231.0 | (208-240) | 237.0 | (220-249) | 210.0 | (203-225) | | |
| Tail length | 132.0 | (128-136) | 125.0 | (104-138) | 133.0 | (126-140) | 111.25 | (100-121) | | |
| Hind foot | 40.0 | (40) | 41.0 | (40-43) | 42.0 | (40-43) | 40.0 | (39-41) | | |
| Condylbasal | 23.2 | (23.0-23.4) | 23.1 | (22.6-23.4) | 23.8 | (23.5-24.0) | 24.5 | (24.5) | | |
| Occipitonasal | 30.3 | (30.1-30.5) | 30.4 | (29.4-31.0) | 30.9 | (30.6-31.1) | 31.5 | (31.5) | | |
| Nasal length | 13.05 | (13.0-13.1) | 13.5 | (12.8-13.9) | 13.6 | (12.8-14.3) | 12.65 | (11.0-14.1) | | |
| Interorbital | 12.0 | (12.0) | 11.9 | (11.7-12.0) | 11.8 | (11.6-12.2) | 11.45 | (10.7-12.4) | | |
| Bulla length | 14.75 | (14.6-14.9) | 15.2 | (14.8-15.7) | 15.2 | (14.9-15.7) | 14.1 | (14.0-15.4) | | |
| Bulla width | 9.6 | (9.0-10.2) | 9.7 | (9.0-10.1) | 10.2 | (10.0-10.5) | 9.6 | (9.2-10.0) | | |
| Bulla depth | 12.1 | (12.0-12.2) | 12.1 | (11.9-12.3) | 12.3 | (12.1-12.4) | 11.9 | (11.5-12.5) | | |
| | 2 females | | 2 females | | 10 females | | 3 females | | 2 females | |
| Total length | 245.0 | (245) | 240.0 | (229-251) | 229.6 | (224-237) | 224.0 | (219-230) | 229.0 | (228-230) |
| Tail length | 135.0 | (135) | 136.0 | (132-141) | 126.5 | (122-134) | 115.0 | (110-120) | 130.5 | (129-132) |
| Hind foot | 40.0 | (40) | 42.5 | (40-45) | 40.5 | (39-41.5) | 40.3 | (39-42) | 38.5 | (38-39) |
| Condylbasal | 22.95 | (22.8-23.1) | 23.5 | (23.5) | 22.5 | (21.6-23.4) | 23.3 | (22.3-24.0) | 23.3 | (23.0-23.6) |
| Occipitonasal | 30.2 | (30.2) | 30.7 | (30.7) | 29.4 | (28.3-30.3) | 30.23 | (29.0-30.9) | 30.7 | (30.6-30.8) |
| Nasal length | 13.4 | (13.2-13.6) | 12.8 | (12.6-13.0) | 12.9 | (12.2-13.5) | 12.73 | (12.0-13.2) | 13.6 | (13.5-13.7) |
| Interorbital | 11.9 | (11.9) | 11.8 | (11.5-12.1) | 11.6 | (10.9-12.8) | 11.96 | (11.8-12.3) | 11.75 | (11.5-12.0) |
| Bulla length | 15.1 | (15.1) | 14.95 | (14.8-15.1) | 14.67 | (14.1-15.4) | 15.15 | (15.0-15.3) | 14.8 | (14.6-15.0) |
| Bulla width | 9.9 | (9.9) | 9.8 | (9.6-10.0) | 9.9 | (9.3-10.6) | 10.05 | (9.8-10.3) | 10.2 | (10.2) |
| Bulla depth | 12.2 | (12.2) | 12.1 | (12.0-12.2) | 12.0 | (11.2-12.3) | 12.0 | (12.0) | 11.9 | (11.8-12.0) |

cinderensis

Diamond Valley

8 males

| | | |
|---------------|-------|-------------|
| Total length | 237.8 | (227-250) |
| Tail length | 128.5 | (120-138) |
| Hind foot | 40.0 | (38-43) |
| Condylbasal | 22.9 | (22.0-23.4) |
| Occipitonasal | 30.0 | (29.0-31.3) |
| Nasal length | 13.2 | (12.6-14.0) |
| Interorbital | 11.5 | (11.3-11.7) |
| Bulla length | 15.0 | (14.3-15.5) |
| Bulla width | 9.8 | (9.0-10.2) |
| Bulla depth | 12.2 | (11.6-12.7) |

2 females

| | | |
|---------------|-------|-------------|
| Total length | 231.0 | (222-240) |
| Tail length | 126.0 | (118-134) |
| Hind foot | 40.5 | (40-41) |
| Condylbasal | 22.0 | (22.0) |
| Occipitonasal | 28.9 | (28.9) |
| Nasal length | 12.7 | (12.6-12.8) |
| Interorbital | ----- | |
| Bulla length | 14.6 | (14.5-14.7) |
| Bulla width | 9.15 | (9.1- 9.2) |
| Bulla depth | 11.85 | (11.7-12.0) |

DIPODOMYS ORDIIpanguitchensisutahensisfremonti

Panguitch

Ogden

Torrey

2 males

3 males

No males

| | | |
|-------------------|------------------|--|
| 254.5 (252-257) | 245.0 (235-255) | |
| 140.0 (135-145) | 141.0 (135-150) | |
| 40.5 (40-41) | 38.8 (37.8-39.8) | |
| 23.0 (23.0) | 23.6 (22.7-24.5) | |
| 30.3 (30.2-30.4) | 31.1 (30.0-32.2) | |
| 13.4 (13.3-13.5) | 13.7 (13.1-14.1) | |
| 11.95 (11.9-12.0) | 11.7 (11.0-12.1) | |
| 14.35 (14.3-14.4) | 14.5 (14.3-15.0) | |
| 9.6 (9.5-9.7) | 9.6 (9.3-10.1) | |
| 12.1 (12.0-12.2) | 11.8 (11.7-12.0) | |

1 female

2 females

2 females

| | | |
|-------|------------------|-------------------|
| 240.0 | 241.0 (238-245) | 249.0 (246-253) |
| 132.0 | 138.5 (137-140) | 137.0 (132-142) |
| 38.0 | 38.8 (37.8-39.8) | 38.0 (38) |
| 22.8 | 22.9 (22.8-23.0) | 23.3 (23.1-23.5) |
| 29.6 | 29.8 (29.8) | 30.4 (30.3-30.6) |
| 12.7 | 12.8 (12.8) | 13.6 (13.4-13.8) |
| 11.3 | 11.3 (11.2-11.4) | 12.1 (12.1) |
| 14.0 | 14.2 (13.9-14.5) | 14.85 (14.7-15.0) |
| 9.0 | 9.65 (9.4-9.9) | 9.7 (9.6-9.8) |
| 11.9 | 11.8 (11.7-11.9) | 12.1 (12.1) |

DIPODOMYScelsuswoodburyi

1 mi. W St. George

Beaver Dam Slope

3 males

4 males

| | | |
|---------------|-------------------|-------------------|
| Total length | 270.0 (263-280) | 288.0 (282-302) |
| Tail length | 154.0 (150-156) | 166.5 (164-177) |
| Hind foot | 41.3 (40-42) | 43.25 (43-44) |
| Condylbasal | 24.46 (23.8-25.6) | 25.4 (25.1-26.1) |
| Occipitonasal | 30.4 (29.9-31.4) | 31.7 (31.1-32.3) |
| Nasal length | 12.7 (11.9-13.4) | 13.45 (13.0-14.4) |
| Interorbital | 11.4 (10.6-12.2) | 12.05 (11.5-12.6) |
| Bulla length | 15.2 (15.0-15.6) | 15.35 (15.2-15.5) |
| Bulla width | 10.13 (10.0-10.2) | 10.4 (10.1-10.7) |
| Bulla depth | 12.23 (12.0-12.5) | 12.45 (12.0-12.8) |

3 females

1 female

| | | |
|---------------|-------------------|-------|
| Total length | 275.0 (268-281) | ----- |
| Tail length | 156.6 (150-160) | ----- |
| Hind foot | 41.0 (40-42) | 45.0 |
| Condylbasal | 24.5 (24.1-24.9) | 26.4 |
| Occipitonasal | 30.45 (30.1-30.8) | 32.5 |
| Nasal length | 12.66 (12.4-13.0) | 13.5 |
| Interorbital | 11.33 (11.0-11.6) | 13.0 |
| Bulla length | 15.03 (14.5-15.4) | 16.1 |
| Bulla width | 9.9 (9.7-10.2) | 11.1 |
| Bulla depth | 12.3 (11.9-12.6) | 13.1 |

MICROPSbonnevilleialfredi

Desert Range Exp.Sta.

Gunnison Island

17 males

2 males

| | |
|------------------|-------------------|
| 252.0 (222-275) | 278.0 (250-299) |
| 146.0 (110-160) | 162.5 (150-175) |
| 41.5 (40-43) | 44.5 (42-47) |
| 24.05(22.3-25.3) | 25.85 (24.0-27.5) |
| 29.6 (27.7-31.1) | 31.6 (29.6-33.6) |
| 12.05(10.8-13.1) | 12.85 (11.8-13.9) |
| 11.6 (10.6-12.3) | 12.15 (11.5-12.8) |
| 14.6 (13.4-15.7) | 15.75 (14.8-16.7) |
| 9.9 (9.2-10.5) | 10.5 (10.0-11.0) |
| 12.15(11.5-12.8) | 12.65 (12.3-13.0) |

15 females

2 females

| | |
|------------------|-------------------|
| 253.0 (236-283) | 273.5 (270-277) |
| 147.5 (135-170) | 152.5 (150-155) |
| 41.0 (40-43) | 46.5 (45-48) |
| 24.05(23.2-25.0) | 25.7 (25.7) |
| 29.7 (28.7-30.5) | 32.0 (32.0) |
| 12.0 (11.3-12.8) | 12.9 (12.8-13.0) |
| 11.4 (10.8-12.3) | 12.45 (12.0-12.9) |
| 14.7 (13.5-15.6) | 15.9 (15.7-16.1) |
| 9.8 (9.2-10.1) | 10.6 (10.5-10.7) |
| 12.25(11.6-12.9) | 12.55 (12.5-12.6) |

BIBLIOGRAPHY

Barnes, Claude T.

1922. Mammals of Utah. Bull. Univ. of Utah, vol. 12, No. 15. April 1922.

1927. Utah Mammals. Bull. Univ. of Utah, vol. 17 no. 12. June 1927.

Benson, Seth B.

1934. Description of a race of Dipodomys merriami from Arizona. Proc. Biol. Soc. Wash., vol. 47, pp. 181-184. October 2, 1934.

Bole, B. Patterson

1936. A new race of kangaroo rat from southwestern Utah. Scientific Publications of the Cleveland Museum of Natural History. vol. V, no. 1, pp. 1-2. January 17, 1936.

Durrant, Stephen D.

1943. Dipodomys deserti in Utah. Jour. Mamm., vol. 24, no. 3, p. 404. August 1943.

Durrant, Stephen D. and Hall, E. Raymond

1939. Deux sous-espèces nouvelles du rongeur Dipodomys ordii de l'ouest des États-Unis d'Amérique. Mammalia, Tome III, no. 1, pp. 10-17. Mars 1939.

Elliot, D. G.

1901. Sys. N. Am. Mamm., Field Columbian Museum,
Pub. Zool. Ser., II p. 239. 1901.

Fitzinger

1867. Sitzungsber. math-nat. Classe, k. Akad.
Wissensch. Wien, vol. 56, Abth. 1, p. 126.

Goldman, E. A.

1917. New mammals from North and Middle America.
Proc. Biol. Soc. Wash., vol. 30, pp. 107-
116.
1924. Two new kangaroo rats from Arizona. Jour.
Wash. Acad. Sci., vol. 14, no. 15, pp. 372
-373. September 19. 1924.
1931. Three new rodents from Arizona and New
Mexico. Proc. Biol. Soc. Wash., vol. 44,
pp. 133-136. October 17, 1931.
1933. New mammals from Arizona, New Mexico, and
Colorado. Jour. Wash. Acad. Sci., vol. 23,
no. 10, pp. 463-473. October 15, 1933.
1937. Four new mammals from Utah. Proc. Biol.
Soc. Wash., vol. 50, pp. 221-226. December
28, 1937.
1939. Nine new mammals form islands in Great Salt
Lake, Utah. Jour. Mamm. vol. 20, no. 3, pp.
351-357. August 14, 1939.

Gray,

1841. Ann. and Mag. Nat. Histo., vol. 7, p. 521.
August 1841.

Grinnell, Joseph

1919. Four new kangaroo rats from West-central California. Proc. Biol. Soc. Wash., vol. 32, pp. 203-206. December 31, 1919.

1922. A geographical study of the kangaroo rats of California. Univ. Calif. Publ. Zool., vol. 24, no. 1, pp. 1-124.

1922. Revised list of the species in the genus Dipodomys. Jour. Mamm., vol. 2, no. 2, pp. 94-97. May 1921.

Hall, E. Raymond

1931. Critical comments on mammals from Utah, with descriptions of new forms from Utah, Nevada, and Washington. Univ. Calif. Publ. Zool., vol. 37, no. 1, p. 5. April 10, 1931.

Hall, E. Raymond and Dale, Frederick H.

1939. Geographic races of the kangaroo rat, Dipodomys microps. Occasional Papers of the Museum of Zoology, Louisiana State University, no. 4, pp. 47-63. November 10, 1939.

Hall, E. Raymond and Hoffmeister, Donald F.

1942. Geographic variation in the canyon mouse.
Jour. Mamm., vol. 23, no. 1, pp. 51-65.
February 14, 1942.

Hardy, Ross

1942. Three new rodents from southern Utah. Proc.
Biol. Soc. Wash., vol. 55, pp. 87-92. June
25, 1942.

Hoffmeister, Donald F.

1942. New subspecies of the kangaroo rats of the
Dipodomys ordii group from Montana and Wyo-
ming. Proc. Biol. Soc. Wash., vol. 55, pp.
165-168. December 31, 1942.

Huey, Laurence M.

1941. Mammalian invasion via the highway. Jour.
Mamm., vol. 22, no. 4, pp. 383-385. Novem-
ber 13, 1941.

Marshall, William H.

1940. A survey of the mammals of the islands in
Great Salt Lake, Utah. Jour. Mamm., vol.
21, no. 2, pp. 144-159. May 14, 1940.

Mearns, Edgar.A.

1890. Description of supposed new species and
subspecies of mammals from Arizona. Bull.
American Mus. Nat. Hist., Art. XX, pp.
277-307. February 1890.

Merriam, C. Hart

1890. Annotated list of mammals of the San Francisco Mountain Plateau and desert of the Little Colorado in Arizona, with notes on their vertical distribution and descriptions of New Species. N. Amer. Fauna, no. 3, pp. 43-86. August 1890.
1894. Preliminary descriptions of eleven new kangaroo rats of the genera Dipodomys and Perodipus. Proc. Biol. Soc. Wash., vol IX, pp. 109-116. June 21, 1894.
1904. New and little known Kangaroo Rats of the Genus Perodipus. Proc. Biol. Soc. Wash., vol. XVII, pp. 139-146. July 14, 1904.

Stephens, F.

1887. Description of a new species of Dipodomys, with some account of its Habits. The Amer. Nat., vol. XXI, no. 1, pp. 42-49. January 1887.



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