

OCCASIONAL PAPERS OF THE MUSEUM OF  
ZOOLOGY

UNIVERSITY OF MICHIGAN

ANN ARBOR, MICHIGAN

UNIVERSITY OF MICHIGAN PRESS

GEOGRAPHIC VARIATION IN *NEOTOMA LEPIDA*  
IN ARIZONA<sup>1</sup>

BY SETH B. BENSON

KNOWLEDGE concerning the distribution of *Neotoma lepida* in Arizona has grown slowly until recently. In his revision of the wood rats, Goldman (1910) recorded specimens of *Neotoma desertorum* from several localities in Arizona north of the Colorado River. He stated (p. 80) that the ranges of *desertorum* (now known as *lepida*) and *lepida* (now known as *stephensi*) were completely separated by the effective barrier of the Colorado River. In other words *lepida* was not known to occur east or south of the Colorado River. Grinnell (1914: 235-237), however, reported specimens of *N. intermedia desertorum* from three localities on the Arizona side of the Colorado River between The Needles and Picacho. These specimens were identified by Goldman. Grinnell remarked that specimens from opposite sides of the Colorado River did not differ appreciably. Taylor (1918: 96) recorded two specimens of *N. i. desertorum* collected in 1861 by Dr. J. G. Cooper at Fort Mohave, Colorado River. Taylor mentioned that these specimens resembled a series collected by Goldman in 1917 in the Desert of the Little Colorado River. It is prob-

<sup>1</sup> Contribution from the Museum of Vertebrate Zoology, University of California, Berkeley, California.

able, as set forth below, that Cooper's specimens were the first ones collected on the east side of the Colorado River.

Goldman (1927) described *Neotoma intermedia devia* from Tanner Tank in the Painted Desert and listed specimens from localities on the eastern side of the Colorado River as far south as Parker. Later, Goldman (1932: 62) defined the range of *N. lepida devia* as:

. . . a narrow strip along the eastern side of the Colorado River extending from points in the Painted Desert south through the Grand Canyon to Parker, Arizona.

He made no mention of the specimens recorded by Grinnell from Cibola, which is considerably south of Parker. Goldman (*loc. cit.*) also described *N. lepida monstrabilis* from Ryan, Coconino County, ascribing to it a range over Arizona and the adjoining part of Utah north of the Colorado River. This range represents a part of that formerly ascribed to *desertorum*. The most recent record of this group in Arizona is that by Blossom (1933) who described *Neotoma auripila*, from the Agua Dulce Mountains, 9 miles east of Papago Well in southern Pima County, as a member of the *lepida* group, but considered it as specifically distinct from *N. lepida*.

The present study of the geographic variation in *Neotoma lepida* in Arizona is chiefly based upon specimens given to the Museum of Vertebrate Zoology, University of California, by Miss Annie M. Alexander. These specimens have been collected by Miss Alexander and her associates during the past several years from localities in Arizona.

#### *Neotoma lepida monstrabilis* Goldman

The Museum of Vertebrate Zoology contains 49 specimens of *monstrabilis* from Arizona as follows: Coconino County: Grand Canyon Bridge (6 miles west), 3; Lee's Ferry (2 miles west), 2; Slide Reservoir (Kaibab Forest), 1. Mohave County: Kanab Wash, south boundary of Kaibab Indian Reservation, 1; Nixon Spring, Mount Trumbull, 5; Ryan (type locality), 17; Toroweap Valley (head of), 9, (lower end of), 4; Wolf Hole (10 miles north), 4, (6 miles north), 3.

These specimens closely agree with Goldman's original description of *monstrabilis*.

*Neotoma lepida devia* Goldman

The Museum of Vertebrate Zoology contains 38 specimens of *devia* from the following localities in Arizona: Coconino County: Cameron, 6; Grand Canyon Bridge (south side), 2. Mohave County: Above Bill Williams River, Colorado River,

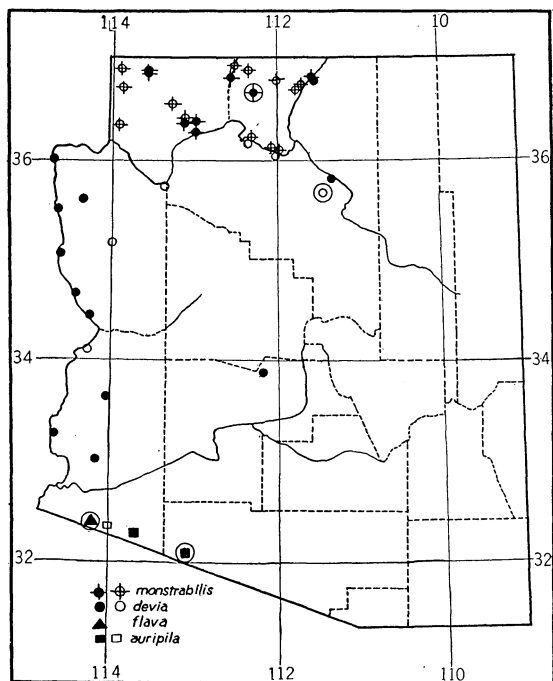


FIG. 1. Map showing stations of occurrence in Arizona of *Neotoma lepida*. Solid symbols represent stations from which the Museum of Vertebrate Zoology has specimens, outline symbols represent other localities from which specimens have been recorded (except Cedar Ranch Wash, Painted Desert, which location I have not found on any of the maps I have examined). Large circles represent type localities.

1; 10 miles below Cibola, Colorado River, 2; Cottonwood Valley, 31 miles north and 2½ miles west of Camp Mohave,

TABLE I  
 COMPARATIVE MEASUREMENTS IN MILLIMETERS OF *NEOTOMA LEPIDA* SHOWING DIFFERENCES BETWEEN THE POPULATION ON  
 EITHER SIDE OF THE COLORADO RIVER AND BETWEEN THE POPULATIONS OF NORTHERN AND SOUTHERN ARIZONA SOUTH  
 OF THE COLORADO RIVER

	Total length	Tail	Hind foot	Bar from notch	Bar from crown	Head and body	Weight in grams	Greatest length of skull	Condylobasal length	Greatest zygomatic breadth	Least interior bital breadth	Length of nasals	Length of incisive foramina	Length of palatal bridge	Length of interparietal	Alveolar length of maxillary tooth-row
<i>Neotoma lepida lepida</i>																
Seventeen specimens from the vicinity of the Colorado River in southern Clark County, Nevada																
Mean	293	130	31	29	.....	163	123	39.0	37.5	20.3	5.1	15.0	8.4	6.9	4.8	8.0
Minimum	255	114	29	27	.....	139	63	36.6	34.7	17.9	4.8	13.9	7.0	6.4	4.3	7.6
Maximum	319	149	33	31	.....	175	167	41.1	39.8	22.0	5.4	15.8	9.1	7.2	5.2	8.4
<i>Neotoma lepida lepida</i>																
Ten specimens from valley of the Colorado River in California between Needles and Pilot Knob																
Mean	290	137	30	.....	.....	153	.....	38.7	37.3	20.0	5.1	14.6	8.4	6.7	4.6	8.0
Minimum	285	124	29	.....	.....	144	.....	37.3	35.9	19.0	4.8	14.0	8.0	6.4	4.1	7.4
Maximum	298	145	32	.....	.....	161	.....	40.2	39.2	20.9	5.4	15.0	8.8	7.1	5.3	8.4
<i>Neotoma lepida devia</i>																
Eight specimens from the Painted Desert																
Mean	276	122	31	.....	25	155	103	38.3	36.7	19.9	5.1	14.4	7.9	7.1	5.6	8.0
Minimum	262	106	30	.....	24	151	89	37.3	35.4	19.2	4.9	13.7	7.5	6.8	5.3	7.7
Maximum	287	130	31	.....	26	160	114	39.2	38.0	21.0	5.2	15.3	8.3	7.5	6.2	8.2
<i>Neotoma lepida devia</i>																
Twelve specimens from the valley of the Colorado River between Hoover Dam Ferry and above Bill Williams River																
Mean	290	132	30	29	24	160	113	38.8	37.4	20.4	5.2	14.7	8.4	6.9	5.4	7.9
Minimum	273	120	29	28	23	148	85	37.7	36.1	19.7	4.9	14.0	8.0	6.4	5.0	7.7
Maximum	314	149	32	31	25	169	142	40.0	38.5	21.8	5.5	15.5	9.1	7.5	5.8	8.2

TABLE I—(Continued)

	Total length	Tail	Hind foot	Ear from notch	Ear from crown	Head and body	Weight in grams	Greatest length of skull	Condylobasal length	Greatest zygomatic breadth	Least interorbital breadth	Length of nasals	Length of incisive foramina	Length of palatal bridge	Length of interparietal	Alveolar length of maxillary tooth-row
<i>Neotoma lepida devia</i>																
Six specimens from Yuma County																
Mean .....	274	133	29	34	25	142	80	37.2	35.6	19.1	4.9	13.6	7.6	6.7	5.2	7.6
Minimum .....	260	130	28	33	24	130	73	36.4	34.5	18.7	4.8	13.0	7.2	6.4	5.1	7.2
Maximum .....	285	141	30	34	25	147	89	38.0	36.9	19.4	5.0	14.3	8.0	7.1	5.4	7.8
<i>Neotoma lepida devia</i>																
Four specimens from New River Valley																
Mean .....	277	130	31	33	27	146	95	36.9	35.2	19.7	5.0	13.7	7.8	6.7	5.1	7.6
Minimum .....	270	123	30	.....	26	142	89	36.5	34.7	19.3	4.9	13.5	7.7	6.4	4.8	7.4
Maximum .....	282	138	31	.....	28	152	104	37.3	35.5	20.4	5.1	14.4	7.9	6.9	5.5	7.9
<i>Neotoma lepida flava</i>																
Two specimens, the type and a subadult topotype, respectively																
No. 62657 .....	293	147	30	31	.....	146	88	37.7	36.0	19.4	5.0	14.2	7.5	6.4	5.3	7.5
No. 62656 .....	268	132	28	31	.....	146	78	35.8	34.3	18.8	5.0	13.3	7.4	6.3	5.7	7.6
<i>Neotoma lepida auripila</i>																
Eleven specimens from southern Yuma and Pima counties																
Mean .....	287	139	30	32	27	148	90	37.0	35.4	19.4	5.0	13.8	7.8	6.4	5.2	7.6
Minimum .....	272	133	29	30	26	136	73	35.8	34.4	18.3	4.7	13.1	7.4	6.0	4.5	7.6
Maximum .....	305	153	30	33	29	160	109	38.9	37.4	20.7	5.2	14.5	8.4	6.8	5.8	8.0

Colorado River, 5; Fort Mohave, Colorado River, 2; Hoover Dam Ferry, Colorado River, 5; Mud Spring, 12 miles WSW of Chloride, 3; foot of The Needles, Colorado River, 3. Yuma County: Base of Castle Dome Peak, 3; Quartzite (10 miles east), 2. Maricopa County: New River Valley, 30 miles north of Phoenix, 4.

The specimens here attributed to *devia* display a large amount of geographic variation. In his original description of *devia* and *monstrabilis* Goldman mentioned several skull characters that served to differentiate the populations on each side of the river. The race dwelling south and east of the river, *devia*, in comparison with *monstrabilis*, possessed a longer interparietal (measured anteroposteriorly), nasals which were narrower posteriorly, and a palatal bridge which was about equal rather than considerably shorter than the incisive foramina. These characters hold true only in the specimens from the vicinity of the type locality. To the west of the type locality and south along the Colorado River the only one of these characters that can still be used to differentiate the populations on either side of the river is the longer interparietal, and there is considerable overlap in the development of this character. There is also a decrease in size of body and an increase in the relative length of the tail in the specimens from the southernmost localities. Yet the populations on either side of the Colorado River differ enough to merit being classed as different subspecies. Thus in Cottonwood Valley the specimens of *lepida* on the Nevada side of the Colorado River are distinctly paler and have shorter interparietals than the specimens of *devia* from the Arizona side.

Specimens from Nevada and California opposite Fort Mohave are distinctly paler than the two specimens taken by Cooper from Fort Mohave. Since the latter agree in color with specimens of *devia* from the Arizona side of the river above and below Fort Mohave, they are probably *devia* rather than *lepida*. The specimens recorded by Grinnell (*loc. cit.*) from the Arizona side of the Colorado River as far south as

Cibola are more richly colored than those from the California side just opposite though, probably because of fading and wear, the difference is not as great as in the specimens from farther north. Although recently collected specimens from the Plomosa and Harquahala Mountains differ from topotypes of *devia* in smaller size, paler color, relatively longer tails, and in the skull characters already mentioned, it appears best to retain them within the race *devia*.

Four specimens from New River Valley, collected in 1934 by Annie M. Alexander and Mary M. Erickson, extend the known range of *Neotoma lepida* a considerable distance to the east in central Arizona. These specimens are here classed with *devia* even though they are smaller, and have relatively longer tails and weaker skulls. They are somewhat duller and darker in color than typical *devia* and considerably darker than the specimens from the Harquahala and Plomosa Mountains. They are not as richly colored as topotypes of *auripila*, although much like them in skull characters.

#### *Neotoma lepida* *flava*, new subspecies

TYPE.—Adult female, skin and skull, No. 62657 Mus. Vert. Zool.; from Tinajas Altas, 1150 feet, Yuma County, Arizona; collected January 17, 1934, by Mary M. Erickson; original number 203.

DISTRIBUTION.—Known only from the type locality. Probably restricted to the southern end of the Tinajas Altas Mountains.

DIAGNOSIS AND COMPARISONS.—A race of *Neotoma lepida* characterized by extremely pallid coloration, small body size, and relatively long tail. Similar to *N. l. auripila* in size, proportions, and skull characters, but distinctly paler; yellowish pigmentation and, especially, dusky pigmentation, less intense. Differs from *N. l. devia* in smaller size, relatively longer tail, paler and brighter color. Differs from *N. l. lepida* in paler color, smaller size, longer interparietal.

COLOR.—(Capitalized color terms after Ridgway, 1912). Hairs of dorsal surface with bases Slate Gray, wide subter-

minal bands Pinkish Buff, tips dusky. Hairs of belly with bases Slate Gray, terminal portions Pale Pinkish Buff. Hairs of chin, breast, inguinal region, and feet white. Most tail hairs white, some in narrow line along dorsal surface dusky, some on proximal part of dorsal surface Pale Pinkish Buff. Most hairs on pinnae white. Skin of pinnae only faintly pigmented. In general, dominant color tone is Pinkish Buff faintly obscured by dusky.

SPECIMENS EXAMINED.—Two from Tinajas Altas, Yuma County, Arizona (1150 and 1640 feet altitude).

REMARKS.—The presence of this pale race of *N. lepida* at Tinajas Altas adds another to the long list of species of mammals possessing pale races at this locality. This example is especially noteworthy in view of the fact that the type locality of *N. l. auripila* is a relatively short distance to the east and Blossom (*op. cit.*: 3) has recorded specimens of *auripila* only 9 miles to the east of Tinajas Altas. The range of *flava* is doubtless closely restricted to the Tinajas Altas Mountains. The specimens of *flava* bear considerable resemblance in color to some topotypes of *Neotoma bella* Rhoads (= *Neotoma lepida lepida*), but are distinct in cranial characters and proportions.

#### *Neotoma lepida auripila* Blossom

The Museum of Vertebrate Zoology contains 12 specimens of *auripila* from the following localities in Arizona: Yuma County: Tule Tank ( $\frac{3}{4}$  mile west), 2; Tule Tank, 1300 feet, 3. Pima County: 9 miles east of Papago Well, 7 topotypes.

Study of these specimens, together with those of *devia*, has convinced me that *auripila* is best regarded as a race of *lepida*; not as a distinct species. The seven topotypes listed above do not possess all the characters given by Blossom as distinguishing *auripila* from *N. l. devia*. Furthermore, specimens of the latter from the southern part of its range exhibit close approach to *auripila* in all characters save color.

The race *auripila*, as shown by our specimens, differs from



*devia*, represented by specimens from Cameron, in the following characters: Skull smaller and lighter; braincase smaller and narrower posteriorly; upper edge of interpterygoid fossa more flaring in anterior part just behind the palate, but more constricted between interpterygoid processes; interparietals broader and shorter; ears slightly larger; tail relatively longer; body smaller; color richer (more buffy).

Specimens from Tule Tank, while not as richly colored as topotypes of *auripila*, are much darker than *flava*, and distinctly darker than *devia* from the Plomosa and Harquahala Mountains. The specimens from New River Valley, here referred to *devia*, while as dark as *auripila* and closely resembling it in cranial characters, are much duller in color.

LITERATURE CITED

BLOSSOM, P. M.

- 1933 A new woodrat from southwestern Arizona and a new rock pocket-mouse from northwestern Sonora. Occ. Pap. Mus. Zool., Univ. Mich., 273: 1-5.

GOLDMAN, E. A.

- 1910 Revision of the wood rats of the genus *Neotoma*. U. S. Dept. Agr., North Amer. Fauna, 31: 1-124, 14 figs., 8 pls.  
1927 A new wood rat from Arizona. Proc. Biol. Soc., Washington, 40: 205-206.  
1932 Review of wood rats of *Neotoma lepida* group. Journ. Mamm., 13: 59-67.

GRINNELL, J.

- 1914 An account of the mammals and birds of the lower Colorado Valley. Univ. Calif. Publ. Zool., 12: 51-294, Pls. 3-13, 9 text figs.

RIDGWAY, R.

- 1912 Color Standards and Color Nomenclature. Washington, D. C.: published by the author, 3, 44, 53 pls.

TAYLOR, W. P.

- 1919 Notes on mammals collected principally in Washington and California between the years 1853 and 1874 by Dr. James Graham Cooper. Proc. Calif. Acad. Sci., fourth ser., 9: 69-121.





