

Article V.—DESCRIPTIONS OF FOUR NEW SPECIES
OF THOMOMYS, WITH REMARKS ON OTHER
SPECIES OF THE GENUS.

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In working up a collection of mammals from the San Juan region of Colorado, New Mexico and Utah (see next paper), two apparently very distinct new species of *Thomomys* were recognized. In attempting to define their status and relationships it became necessary to take into account the previously described species, which further involved the consideration of many vexed questions of synonymy. From this investigation has resulted the present paper, which consists essentially of four parts: I, Descriptions of New Species; II, Discussion of various questions of Nomenclature; III, Remarks on Cranial Characters in the genus *Thomomys*; IV, List of Species and Subspecies.

In this connection I wish to express my hearty acknowledgments for the invaluable assistance kindly rendered me by various institutions and persons, through the loan of types and other material to facilitate my investigation. To the authorities of the Academy of Natural Sciences of Philadelphia, through the kind intervention of Mr. Witmer Stone, Curator of Birds and Mammals, for the loan of the historic Townsend specimens which served as the basis of Dr. Bachman's descriptions of his *Geomys borealis* and *G. townsendii*. To Mr. F. W. True, Curator of Mammals at the United States National Museum, for the type of Prof. Baird's *Thomomys laticeps*, and for many of the specimens on which Baird based his revision of the genus in 1857, and which later formed part of the material used by Dr. Coues in his monograph of the genus, including the type of his *Thomomys clusius*—in other words, for authentic specimens of the various forms recognized by these two authors. To Dr. C. Hart Merriam, Chief of the Division of Ornithology and Mammalogy, United States Department of Agriculture, for specimens identified by him as *T. clusius*, and for authentic specimens of his *T. clusius fuscus*. To Prof. C. H.

Gilbert, of the Leland Stanford Junior University, of California, for the series of specimens described below as a new species, under the name *Thomomys monticolus*. And finally to Mr. Gerrit S. Miller, Jr., of Cambridge, Mass., for specimens of Richardson's "*Diplostoma? bulbivorum*," from the type locality of the species, and for permission to publish as inedited matter extracts from an unpublished paper of his on this important discovery.

I.—DESCRIPTIONS OF NEW SPECIES.

Thomomys monticolus, sp. nov.

Size medium. Skull long and narrow. A strong ridge on the inner edge of the outer face of the upper incisors. Claws long and rather slender. Ears prominent. Pelage very long and soft. Above dull pale reddish brown, strongly tinged with gray; below ashy white, sometimes with a faint tinge of buff; feet and tail whitish; mouth parts and entrance to pouches blackish; no white throat spot; ears in a large blackish area, of more than the usual extent.

Measurements.—Total length (from skin), 210 mm.; tail, 55; hind foot, 28; fore foot, 20; middle fore claw (arc), 14.

Skull.—The skull (Pl. I, Figs. 3 and 4) is narrow and elongated, the anteorbital portion especially narrow and slender. Interparietal bone very broad, about half the width of the skull, rounded in front, twice as broad as long. The nasals terminate a little in front of the fronto-intermaxillary suture. Upper incisors with a strong ridge on the inner margin of the outer face.

Total length of skull, 37 mm.; basilar length, 34; greatest breadth, 22; least interorbital breadth, 6; length of nasals, 14; width of nasals at posterior border, 2; length of interparietal bone, 4; its greatest width, 11.

Type, ♂ ad., No. 59, Mus. Leland Stanford Junior University, W. W. Price, coll., Mt. Tallac, El Dorado Co., Cal., Aug. 8, 1892 (altitude, 7500 feet).

This species most resembles in coloration specimens of *T. douglasii* from Ducks, B. C., but is grayer and of a dull pale chestnut instead of yellowish brown above, and purer gray below. The claws are longer and much weaker. The size and form of the interparietal bone is somewhat similar in the two, as are the general form and proportions of the skull. The sulcus at the inner border of the upper incisors is rather more developed, being readily distinguishable without the use of a lens. It is, however, apparently a much larger animal.

T. monticolus differs from Nicasio (Cal.) specimens of *Thomomys bottæ* (= *bulbivorus* Baird, *nec* Richardson—see beyond, pp. 56-58) very markedly in the color and texture of the pelage throughout, lacking entirely the yellowish cast in that species, both above and below. The claws are longer and more curved. It also differs from the Nicasio species in the general form and proportions of the skull, in the latter the skull being short and broad, especially the anteorbital portion, while in *T. monticolus* the whole skull is attenuated, and hence much narrower and longer, giving a slender, lengthened nose, instead of a short broad nose. In Nicasio specimens also the sulcus near the inner border of the incisors is usually obsolete and often wholly wanting. In Plate I are represented skulls of *T. monticolus*, *T. douglasii* and *T. bottæ*, showing the differences in the cranial characters above noted.

This species is based on four specimens, kindly loaned for identification and description by Prof. Charles H. Gilbert, of the Leland Stanford Junior University, at Palo Alto, California. Two are adult and two young, one of the latter being about half grown and the other apparently only a few weeks old. The half-grown one differs but little in color from the adults, being rather paler and grayer. The very young one is dull brownish gray above, passing into clear grayish white below.

Respecting these specimens the collector, Mr. W. W. Price, has kindly furnished me with the following memoranda :

"The specimens of *Thomomys* were taken on Mt. Tallac, at altitudes varying from 6500 feet to 9500 feet. The specimens were abundant in grassy glades and during the day were often seen throwing up earth about their burrows.

"The smallest specimen was taken in level meadow land at the base of Mt. Tallac at about 6500 feet. The largest specimen was taken on the slope of Tallac at about 7500 feet elevation. The other two skins were taken near the summit, at over 9000 feet altitude."

***Thomomys aureus*, sp. nov.**

Size large. Claws strongly developed. Skull, as seen from above, much as in Nicasio (California) specimens of *T. bottæ*, but with many differences in details of structure. Coloration very different from that of any form hitherto described.

Post-breeding Pelage.—Fur short, thin and soft. Above uniform strong sandy yellow or golden with a few dusky-tipped hairs on the crown, and in some specimens along the back; below entirely white to the base of the hairs; muzzle blackish, the dusky tint extending on to the edge of the pouches, there passing into white. A small blackish area below and behind the ear; upper surface of feet white; basal half of tail yellowish, passing into whitish apically.

Breeding Pelage.—Above dull yellowish with a dusky shade due to the plumbeous base of the fur showing through the slight surface wash of yellowish buff; below grayish white, due to the dusky plumbeous basal portion showing through the clear grayish white surface tint.

Measurements.—Average of 12 specimens, from collector's measurements taken in the flesh: Total length, 296 mm.; tail, 66; hind foot, 35.

Skull.—(Pl. I, Figs. 6 and 7.) Similar in size and general outlines to that of *T. bottæ*, but broader in proportion to its length, with the interorbital and rostral portions especially broadened, and the whole skull much more heavily ossified throughout. In respect to the size and form of the interparietal bone, and the posterior extension of the nasal bones, the two forms present much similarity. The auditory bullæ in *T. aureus* are larger and somewhat different in outline; the crown surfaces of the teeth are broader in proportion to their length; the position of both palatine and the infraorbital foramina are more posterior than in *T. bottæ*; and there are minor but very appreciable differences in other parts. In general details the skull of *T. aureus* perhaps more closely approaches that of *T. perpallidus*, but the two are readily separable, aside from the great difference in size. No comparison is necessary with the skull of *T. fulvus*, as shown by a comparison of the figures in Plate I.

An average full-grown skull measures as follows: Total length, 41 mm.; basilar length, 37; greatest breadth, 24; least interorbital breadth, 6; length of nasals, 14.

Type, No. $\frac{5248}{4113}$, Am. Mus. Nat. Hist., Bluff City, Utah, May 12, 1892, Charles P. Rowley, collector.

Thomomys aureus needs no comparison with any of its allies. It is nearly twice the size of *T. fulvus*, and differs from all the other species of the genus in its peculiar deep yellow coloration.

The 12 specimens on which *T. aureus* is based were collected by Mr. Charles P. Rowley, at Bluff City, Utah (altitude 4500 feet), May 10–24, 1892. Two are young adults (probably young of the previous year), the others middle aged or old. Most of the specimens are in molt, and hence in the patchy, transition stage. Two or three have nearly completed the new dress, described above as the post-breeding pelage; several others retain for the most part the preceding pelage, or that of winter (described above as

the breeding pelage); the others are in mixed dress. They thus present a wide range of color variation, those in old worn pelage being yellowish gray, with the dusky under fur showing through the surface, while those in the new dress are deep golden with the pelage of the lower surface entirely clear white to the roots of the hair; others combine both colorations, arranged more or less in patches.

Several females which probably had young show the number of mammæ to be 6, two pairs being pectoral and one pair inguinal, the two axillary pairs found in some of the other species of the genus (as *T. clusius*) being absent.

***Thomomys fossor*, sp. nov.**

Size large. Claws strongly developed. Interparietal large, strongly convex in front; nasals terminating posteriorly on a line with the intermaxillaries.

Above dusky brown, the hairs slightly tinged with gray, the middle of the dorsal region, from the front of the head posteriorly, with a strong wash of very dark chocolate brown; sides grayer with less brown; under surface grayish plumbeous, the hairs slightly tipped with pale buff or whitish (in different specimens). Muzzle plumbeous black, extending laterally into the cheek pouches; chin and middle of throat pure white; the usual blackish aural area, extending posteriorly as a sharply defined black streak; feet whitish; basal two-thirds of tail blackish, passing into clear white at the tip.

Measurements.—Total length, 293 mm.; tail, 64; hind foot, 30. (Average of two adult specimens, male and female, measured by the collector before skinning.)

Skull.—The skull (Pl. I, Figs. 10 and 11) is of about the size and general form of the skull of *T. bulvivorus*, except that the interorbital portion is much broader, and the rostral portion much stouter. The interparietal is large, subtriangular, and the nasals and intermaxillaries terminate posteriorly on the same line.

A large full-grown skull (No. 4120, ♂ ad.) measures as follows: Total length, 40 mm.; basilar length, 37; greatest breadth, 23; least interorbital breadth, 6; length of nasals, 15; interparietal, breadth transversely, 7, anteroposteriorly, 6.

Type, No. $\frac{5249}{1120}$, ♂ ad., Florida, La Plata Co., Colorado (altitude 7200 feet), June 25, 1892, Charles P. Rowley, collector.

This species, in its dark chocolate brown color, and in the posterior termination of the nasals and intermaxillaries on the same line, and in the large size and subtriangular form of the interparietal, is very distinct from any other known to me. It

certainly needs no comparison with any of the species whose habitats immediately adjoin its own.

Thomomys fossor is based on five specimens, two old adults and three nearly adult, collected at Florida, La Plata Co., Colorado (altitude 7200 feet), June 21-26, 1892, by Mr. Charles P. Rowley.

***Thomomys toltecus*, sp. nov.**

Thomomys umbrinus ALLEN, Bull. Am. Mus., V., p. 28, March, 1893.

Above grayish pale rufescent brown, the middle of the back strongly varied with blackish; below pale grayish buff. Feet and tail like the lower surface; tail scantily haired; nose and sides of face blackish; chin and throat nearly concolor with the lower surface; inner edge of cheek-pouches broadly pure white.

Measurements (approximate from unfilled skins).—Total length, 230 mm.; tail vertebræ, 60; hind foot, 27; middle claw of fore foot, 12.

Skull.—(Plate I, Fig. 13.) Total length, 43; basilar length, 40; greatest zygomatic breadth, 27; least interorbital breadth, 7; length of nasals, 14.

Type, No. $\frac{5449}{4308}$, Juarez, northern Chihuahua; Lumholtz Collection, A. D. Meed, collector.

This species is based on six specimens, collected at the Mormon settlement of Juarez, northern Chihuahua (not Sonora as first stated, *antea*, p. 28). They are unfilled, much shrunken skins, with the skulls inside, a part of which have been removed for study, but they prove to be more or less defective, from mutilation of the occipital portion. The best one is that figured in Plate I (Fig. 13). The skulls are heavily ossified, and indicate an animal of about the size of *T. bottæ*. The coloration above is a peculiar pale grayish brown, lighter on the sides and nearly black along the median line of the back. The upper incisors have a slight sulcus at the inner margin of their anterior face.

T. toltecus needs no comparison with *T. fulvus*, its nearest geographical ally, which it exceeds greatly in size, and from which it differs widely in coloration, and radically in cranial characters.

The specimens above described were at first (l. c.) referred to *Thomomys umbrinus*, as defined by Baird, but subsequent study of the group (as detailed below), has shown that at least a portion of

Baird's specimens thus indented by him were really *T. fulvus*; and also that the *T. umbrinus* of Richardson is probably hopelessly unidentifiable, and thus must be ignored.

II.—QUESTIONS OF NOMENCLATURE.

As is well known, the genus *Thomomys* has an unfortunate history, as regards especially the type localities of the six species named by Richardson during the years 1828 to 1839, very few of them being definitely known to even Richardson himself. This, together with the faulty descriptions and lack of proper figures, laid the foundation for endless complications of nomenclature and doubt as to the real nature of Richardson's species. Of the twelve names given to members of this group prior to 1885, six were contributed by Richardson, one by Schinz (who simply re-named arbitrarily one of Richardson's species), one by Eydoux and Gervais, one by Woodhouse, one by Wied, one by Baird, and one by Coues. Two of Richardson's species, however, were simultaneously published by Bachman under Richardson's manuscript names. As shown by Dr. Coues, in his review of the group in 1875, "the literature of the whole subject, so far as original work in determination of species is concerned, focuses only in two authors—Richardson, 1829, and Baird, 1857;" to which of course must now be added a third—Coues, 1875. Various compilers had, in the time between Richardson and Baird, gone over the ground, without of course contributing anything of importance to the subject.

In 1857 the late Professor Baird (*Mam. N. Amer.*, pp. 388-404) recognized eight species of *Thomomys*, as follows:

"1. *Thomomys bulbivorus*.—Coast of California, from Tejon Pass to some distance north of San Francisco.

"2. *Thomomys laticeps*.—Coast of northern California (Humboldt Bay).

"3. *Thomomys douglassii*.—Lower valley of the Columbia River, and Puget Sound.

"4. ? *Thomomys borealis*.—Upper valleys of the Columbia, towards Rocky Mountains; probably at higher elevations than *T. douglassii*.

"5. *Thomomys rufescens*.—Upper Missouri and Saskatchewan.

"6. *Thomomys talpoides*.—Shores of Hudson's Bay.

"7. *Thomomys umbrinus*.—Western Texas and New Mexico, along eastern slope of Rocky Mountains, and along the mountains into Sonora.

"8. *Thomomys fulvus*.—Valley of the Colorado and tributaries, from the San Francisco Mountains to Fort Yuma, and across to San Diego."

"Of these," he adds, "I am inclined to believe that *Thomomys borealis* may hereafter be referred either to *T. douglassii* or to *T. rufescens*. What other combinations may be required can only be ascertained hereafter."

Dr. Coues, in 1875 (Powell's Explor. of the Colorado River, 1875, pp. 243-265), reduced the preceding list to one species with three subspecies, and described an additional species, presenting the following tabular combination (l. c., p. 247):

BAIRD, 1857.		COUES, 1875.	
1. <i>Thomomys bulbivorus</i> .	Pacific coast region..	{	BULBIVORUS..
2. <i>Thomomys laticeps</i>			
3. <i>Thomomys douglassii</i> ..			
4. <i>Thomomys ? borealis</i> ...	Northeren Interior ..	{	TALPOIDES...
5. <i>Thomomys rufescens</i> ..			
6. <i>Thomomys talpoides</i> ...			
7. <i>Thomomys umbrinus</i> ..	Southern Interior and	{	UMBRINUS...
8. <i>Thomomys fulvus</i>			
	Lower California..		

As well marked geographical races of one species not completely differentiated.

Within recent years Dr. Merriam has revived (N. Am. Fauna, No. 3, 1890, p. 71) as a full species the *Thomomys fulvus* of Woodhouse, and described as new *Thomomys perpallidus* (Science, VIII, p. 588, Dec. 24, 1886), from the Colorado Desert, and *Thomomys clusius fuscus* (N. Am. Fauna, No. 5, 1891, p. 69), from the mountains of central Idaho, apparently with good reason. From the material now in hand it is evident that the group as a whole needs careful revision, as regards both the nomenclature and the number and the status of the forms. While it is not proposed to attempt such a revision in the present connection, I venture to offer a few comments on the general subject.

Richardson, in the years 1828 and 1829, described four species referable to the genus *Thomomys*, namely, (1) *Cricetus talpoides*,

(2) *Geomys douglasii* (not "douglassii," as usually written, (3) *Geomys umbrinus*, (4) *Diplostoma? bulbivorum*.

The first (*Cricetus talpoides*) was based on a skin (apparently without skull) "from Hudson's Bay" (Zoöl. Jour. III, 1828, p. 118), "but it was not accompanied by any notice of its precise habitat," though Richardson was "inclined to identify it with a small animal inhabiting the banks of the Saskatchewan" (Faun. Bor.-Am., I, p. 204). Coues in 1875 identified Richardson's animal, satisfactorily to himself, with the Saskatchewan species; and in view of what is at present known of the distribution of the genus in the region north of the United States, the Saskatchewan region may be assumed as the habitat of *T. talpoides*.¹

The second (*Geomys douglasii*) was based on a skin and skull (an old female) obtained, "by Mr. Douglas, near the mouth of the Columbia" (F. B.-A., I, p. 200, pl. xviii c, fig. 1-6, skull). It is added, "These little sand rats are numerous in the neighborhood of Fort Vancouver," situated on the north side of the Columbia River, opposite the mouth of the Willamette, about half-way between the Cascade Mountains and the Pacific Coast. Hence the vicinity of Portland, Oregon, may be taken as the type locality of *T. douglasii*. The figures of the skull are unfortunately too crude to afford decisive characters; yet from these and from the account of the external characters I have little hesitation in accepting Baird's identification of the species, and of referring to it specimens from Fort Steilacoom and northward into British Columbia. (See Plate I, Fig. 1, for an outline drawing of a skull from Ducks, B. C.)

The third (*Geomys umbrinus*) was based on a specimen (a skin with apparently the skull in place) "from Cadadaguio, a town in the southwestern part of Louisiana" (F. B.-A., I, p. 202)—at present, and for many years past, an unknown locality. As Dr. Coues has suggested, "more likely Texas," the probability of this, he adds, being "heightened by the Spanish appearance of the name, as if a corruption of *Cuidad de Aguas*, City of Waters" (l. c., p. 261). Baird referred to it specimens from southern New Mexico and Sonora. Of what Baird's series as a whole may have con-

¹ Very strangely, Richardson in 1836 gave the habitat of his *G. talpoides* as "Florida," and renamed the Saskatchewan animal *G. borealis*. Cf. Rep. Brit. Ass. Adv. Sci., 1836 (1837) p. 156.

sisted I cannot at present state, but two of them (No. $\frac{271}{1688}$, Sand Creek, on Cimarron River, N. Mex., and No. $\frac{149}{1131}$, Santa Cruz, Sonora), are unquestionably referable to *T. fulvus* (Woodh.). Before seeing these specimens I had referred to *T. umbrinus* (see *antea*, pp. 28 and 52) a series of specimens from Juarez, northern Chihuahua, representing a species very different from *T. fulvus*. (See outline figure of skull, Plate I, Fig 13, in comparison with Fig. 5 of same plate, representing skull of *T. fulvus*.) In the absence of a definite locality, and owing to the difficulty of recognizing species in this group from a description of merely the external characters, it would seem better to allow the name *umbrinus* to lapse as undeterminable.

The fourth (*Diplostoma ? bulbivorum*) was based on the skin of a "Camas-rat," from the "banks of the Columbia," an animal said to be very common on the plains of the Multnomah River" (F. B.-A., I, p. 206, pl. xviii *b*, wrongly lettered "*Diplostoma douglasii*"). The large size of this animal, as shown by Richardson's measurements, caused it to prove a stumbling block to Prof. Baird, who assumed that the specimen must have been greatly overstuffed, and that the locality was really somewhere in California. He therefore adopted this name for the "California Gopher," named by Eydoux and Gervais, in 1836, *Oryctomys (Saccophorus) botte*, and this determination was accepted by Coues and generally adopted by subsequent writers. It turns out, however, that neither Baird nor Coues ever saw a specimen of true *T. bulbivorus*, which has strangely escaped collectors till a recent date, and proves to be much the largest species of the genus thus far known, fully equaling in size large specimens of *Geomys bursarius* (see Pl. I, Fig. 14). The discovery of this long lost species is due entirely to my friend, Mr. Gerrit S. Miller, Jr., of Cambridge, Mass., who, in response to my request for specimens of *Thomomys* from the lower Columbia River region has kindly transmitted for examination two fine adult specimens (male and female), collected at Beaverton, Oregon, in May, 1890, identified by him as the true *Diplostoma bulbivorum* of Richardson. In order to give him full credit for this important discovery I requested him to furnish me with something for publication on the subject. He has accordingly done me the great favor to forward

the following extracts from an unpublished paper of his, which I take great pleasure in here introducing :

"Three examples of a *Thomomys* collected at Beaverton, Washington Co., Oregon, in the spring of 1890, by Mr. A. W. Anthony, differ greatly from the California animal commonly called *Thomomys bulbivorus* (Rich.). The Oregon specimens are larger and much darker colored than any California examples that I have seen ; they differ also in the extent of white markings about the mouth and anus, and in certain cranial characters. Most noticeable of the latter is the peculiar form of the pterygoys, which are larger and strongly concave internally, with hamulars converging at the tips, thus very different from the form usually found in the genus.

"Richardson (F. B.-A., I, 1829, p. 206) based his '*Diplostoma ? bulbivorum*' on a specimen said to have come from the Columbia River, which circumstance, in connection with the minute description given, leaves no room for doubt that the Anthony specimens represent this long lost species. . . . The first name based on an animal from California is the *Oryctomys (Saccophorus) bottæ* of Eydoux and Gervais (Mag. de Zool. VI, 1836, p. 23, pl. xxi) The specific name *bottæ* will, as first determined by Baird (Proc. Acad. Nat. Sci. Phila, 1855, p. 335), have to stand for the animal later identified by this author and by subsequent writers in general, with Richardson's *bulbivorus*." (Gerrit S. Miller, Jr., MS.)

As already intimated, I agree emphatically with Mr. Miller's above-given determinations. The Anthony specimens are perhaps a little darker (dusky, almost blackish, with a strong tinge of chestnut) than Richardson's description would lead one to expect ; but the agreement in all other particulars is so complete that, taking into account the color variability of the group in general, there seems to be no room for reasonable doubt in the case ; and that the species which has so long been recognized as *T. bulbivorus* will have to pass in future under the hitherto little known name *bottæ*, based on specimens from the vicinity of Monterey, Cal.

This completes our survey of the first batch of Richardson's species. In 1837 he mentioned a "*Geomys borealis* Rich., sp. nov." (Rep. Brit. Assoc. for 1836, V, 1837, p. 156) as inhabiting "the

plains of the Saskatchewan." *Geomys borealis* Rich. has generally been considered to have been a *nomen nudum* except as described by Bachman in 1839. This, however, seems not to have been strictly the case, as Dr. Richardson further referred to it casually in the Zoölogy of Beechey's Voyage (Zoölogy of the Voyage of the Blossom, 1839, p. 12) under the head of *Geomys townsendii*, where he says: "*Townsendii* differs [from *G. Douglasii*] in having the wood-brown colored back of *borealis*, and is distinguished from the latter by its longer tail. Total length of head and body of *G. Townsendii*, $7\frac{1}{2}$ inches, of tail, $2\frac{3}{4}$ inches. An individual of *G. borealis* of equal size of body, has the tail a very little exceeding an inch in length, and just equal to that of a young specimen of *Townsendii*, whose head and body measures only $5\frac{1}{4}$ inches." These remarks relate, as Richardson states, to "specimens of two kinds of sand-rat taken by Mr. Townsend on the plains of Columbia," which, he says, "Dr. Bachman kindly submitted to my [his] inspection." Nothing, however, is here said about the habitat of *G. borealis*; and the natural inference is that "the two kinds of sand-rat taken by Mr. Townsend on the plains of the Columbia" were his *G. douglasii* and *G. townsendii*.

In the same year (1839) Dr. Bachman published descriptions of two species of *Geomys* based on specimens obtained by Townsend (the same specimens above referred to in the quotation from Dr. Richardson), under "manuscript names" given them sometime previously by Richardson, namely, *Geomys borealis* and *Geomys townsendii* (Journ. Acad. Nat. Sci. Phila., VIII, 1839, pp. 103 and 105). Bachman's *Geomys borealis* was based on two Townsend specimens "procured on the Columbia River," one of which, says Dr. Bachman, "I found identical with one which had been procured by Mr. Douglass, and which was in the possession of Dr. Richardson." As shown by the remarks of Dr. Richardson under *Geomys townsendii*, a part of which have been quoted above (l. c.), Dr. Bachman had submitted these specimens to Richardson, who, as above stated, referred one of them to his *G. douglasii*, for he says: "One, the *G. douglasii*, has a rusty-brown colored fur above, hair brown on the abdomen, and blackish head. Tail, feet and pouches, white. *Townsendii* differs...." etc.

The inference is that Richardson identified one of these specimens as *G. douglasii* and the others as *G. townsendii*. The *G. douglasii* specimen is certainly one of the two specimens on which Bachman based his *G. borealis*, as will appear more fully later when we come to consider Bachman's types. The third Townsend specimen formed the basis of Bachman's "*Geomys townsendii* (Richardson's Manuscripts)," respecting which he says: "I am obliged to confess that I should not have ventured to publish this species as distinct from the preceding on my own responsibility;" but he modestly defers to "the discriminating eye of Dr. Richardson," who was then preparing a monograph (which appears never to have been published) "of this perplexing genus." "As the species, however," he continues, "will be given under the above name, I have found it necessary to indicate it here." Later, however, in Audubon and Bachman's 'Quadrupeds of North America' (III, 1853, p. 198, pl. cxlii), "*Geomys townsendii* Rich." is synonymized under "*Pseudostoma borealis*." The same disposition of *Geomys townsendii* was also made by Baird in 1857 (Mam. N. Am., p. 396), and practically also by Le Conte in 1852, after an examination of the Townsend specimens.

Fortunately these historic specimens are still extant, and through the kind intervention of Mr. Witmer Stone, Curator of Birds and Mammals at the Philadelphia Academy of Natural Sciences, and the courtesy of the Council of the Society, they have been forwarded to me for examination. They each bear two labels, one of which is of recent origin, the other of very early date (at least prior to 1852, as will be shown later). The specimens have been mounted, and were for many years on exhibition, but not recently, as they were later dismounted and placed in drawers. They have unquestionably faded somewhat from exposure to light, but still can be distinguished on comparison with Bachman's descriptions of them published half a century ago. The skulls are still in the skins and thus are unavailable for examination. The earlier (original?) set of labels reads as follows, the numbers, however, being taken from the newer set:

[146.] "*Pseudostoma Townsendii* (Rich.). Rocky Mts. J. K. Townsend."

[147.] "*Pseudostoma Richardsonii*. Rocky Mts. J. K. Townsend." The name "*Richardsonii*" has been cancelled and the name "*Townsendii*" written below in pencil in what appears to be Prof. Baird's handwriting. Apparently "*Richardsonii*" was a *lapsus pennæ* for *Townsendii*.¹

[144.] "*Pseudostoma borealis*. Columbia River. J. K. Townsend." (This specimen is now without its tail, which has apparently become quite recently detached.)

This last is a small specimen, less than half the size of the others, and yet does not show any special marks of immaturity. It has a "deep yellow wash" over the dorsal surface, and is thus evidently "the young specimen" in which "the back had a deep yellow wash," mentioned by Bachman under *Geomys borealis* (l. c., p. 104). It is also beyond doubt the specimen referred to by Richardson (as cited above) to his *Geomys douglasii*.

A careful comparison of the other specimens with Bachman's paper shows that No. 147 is the type of his *G. townsendii*, and that No. 146 is the type of his *G. borealis*. Although No. 147 is rather darker, or more dingy gray, and less washed with yellowish than No. 146, there is nothing to suggest that they are not conspecific, in accordance with the decisions of Bachman, Le Conte, and Baird.

Now a word as to questions of synonymy and type localities involved in the case of *Geomys borealis* Rich. versus *Geomys borealis* Bach. The names are practically of even date, as we must accept *G. borealis* Rich. at 1839 instead of 1837, when it was first named but not described. The only clue to the type locality of *G. borealis* Rich. is that given in his first reference to the species, where it is stated that it "inhabits the plains of the Saskatchewan" (Rep. Br. Ass. Adv. Sci. for 1836, p. 156). Therefore until it is shown that two species of *Thomomys* inhabit the Saskatchewan region, one of which is a short-tailed animal (tail an inch long with a head and body of $7\frac{1}{2}$ inches), agreeing with Richardson's later reference to his *G. borealis*, this name may be

¹ That these early labels were written many years ago is evident from the fact that in a paper on the genus *Geomys*, published in 1852 by Dr. John L. Le Conte (Proc. Acad. Nat. Sci. Phila., 1852, p. 161), Dr. Le Conte says: "There is a third specimen in the Museum of the Academy labeled '*Pseudostoma Richardsonii*, Columbia River, J. K. Townsend,' which only differs...." etc., the reference being obviously to this specimen.

dismissed as a synonym of *Thomomys talpoides*. In fact, it seems evident that Richardson here merely renamed the Saskatchewan animal which he had previously referred to his "*Geomys? talpoides*," based on a specimen received from "Mr. Leadbeater, who obtained it from Hudson's Bay" (F. B.-A., I, p. 204); at the same time, for some unexplained reason, changing the habitat of *talpoides* from "Hudson's Bay" to "Florida."¹

Bachman's *Geomys borealis* was based on two specimens, a large and a small one, the first from the "Rocky Mountains," the other from the "Columbia River," taking the localities as entered on labels still attached to them and written at least prior to 1852. The smaller specimen is evidently referable to *T. douglasii*, as determined long since by Richardson, who may be presumed to have known his own species. The larger one, on which the description is based, came presumably from near Bridger's Pass in the Rocky Mountains. It is not therefore identical with *G. borealis* of Richardson, though so supposed by Bachman. The name is therefore practically preoccupied and must fall; but as Bachman's *G. townsendii*, which is also Richardson's *G. townsendii*, was based on another specimen of the same species, as admitted by Bachman and later claimed by Le Conte and Baird, from an examination of the same specimens, the name *Thomomys townsendii* (Rich.) may stand for the large, rather pale form of *Thomomys*, known to occur in the Bridger country in common with the smaller *T. clusius*.

Among the specimens kindly loaned me by Mr. True from the National Museum is a specimen (No. $\frac{15468}{22943}$, labeled *Thomomys clusius*) from Fort D. A. Russell, Wyoming, collected in June, 1886, which so closely resembles the larger Townsend specimens that it seems unquestionably referable to the same species. This would seem to support the locality, namely, "Rocky Mountains," given on the labels of the larger Townsend specimens, and lead to the inference that they were collected somewhere in what is now southwestern Wyoming.

¹ Dr. Richardson's reference to the species of *Geomys*, in his celebrated 'Report on North American Zoölogy' is as follows: "*Geomys borealis* inhabits the plains of the Saskatchewan, *Douglasii* and *bulbivorus* those of the Columbia, *talpoides* from Florida, *umbrinus* from Louisiana, *Drummondii* from Texas, and *mexicanus*, as the name imports, from Mexico" (Rep. Br. Ass. Adv. Sci. for 1836, 1837, p. 156).

Prof. Baird doubtfully referred a specimen from Canoe Creek, Cal. (No. $\frac{1260}{2225}$), to *Thomomys borealis*. Only the skull is now extant, which is before me. It is that of a quite young animal, and I have little doubt is referable to *T. townsendii*, as Baird's account of the external characters favors this reference. The skull shows that it is not my *T. monticolus* from the mountains of Central California.

Through the kindness of Mr. True I have also before me the type of *Thomomys clusius* Coues (No. 3051, skin with the skull inside), from Bridger's Pass, collected July 28, 1857. As stated by Dr. Coues it is a female, which from the appearance of the teats may have suckled young, and hence is to be regarded as a full-grown animal, though so very small. It is in thin, worn pelage, with patches of the newer coat appearing along the median line of the back, especially anteriorly. I am also indebted to Dr. Merriam for a specimen (No. $\frac{23482}{30900}$) he has identified as *Thomomys clusius* (N. Am. Fauna, No. 5, 1891, p. 69), from Birch Creek, Idaho, and also for others from Bridger's Pass. They differ a little in color from the type of *clusius*, and also among themselves, even irrespective of season. The skull of the type of *clusius* is unfortunately not available for examination.

In 1839 (a memorable year in the history of the genus *Thomomys*), Prince Maximilian zu Wied described his *Thomomys rufescens*, gen. et spec. nov. What may be considered as the type specimen is still extant in this Museum (No. 637), bearing the following on the original label: "*Thomomys rufescens* Wied, Mas. Missouri. Machtohpka indigen." The exact locality is not indicated. In his original account of the species he says: "Diese Wühlmaus ist zalreich in den Prairies des oberen Missouri bis zu den Rocky-Mountains; ich kann aber nicht sagen, wie weit sie südlich und nordlich verbreitet ist" (Nov. Act. Acad. Cæs.-Leop., XIX, pt. i, 1839, p. 382). After over fifty years of exposure as a mounted specimen the color has evidently greatly changed, it in fact closely resembling that of the type of *Geomys townsendii* Bach. (No. 146, Coll. Acad. Nat. Sci. Phila.)! Both have the same faded yellowish gray tint, with the dorsal region strongly washed with yellowish brown, quite unlike the color of unfaded Upper Missouri specimens of *Thomomys*. It has, however, the heavy claws of *T.*

talpoides as distinguished from the thinner smaller claws of the Townsend specimens. The original description calls for an animal not unlike the specimens collected by Dr. Coues (and now before me) at Pembina, Dakota, namely, with the upper parts uniform gray-brown, somewhat mixed with reddish brown and dark gray brown. The dark tint of the gray brown has disappeared, leaving only the reddish brown, which has faded to rather bright yellowish brown. Whether *T. rufescens* is separable, even as a subspecies, from true *talpoides* of the Saskatchewan region I am unable at present to even consider, owing to lack of material.

The type of Prof. Baird's *Thomomys laticeps*, from Humboldt Bay (No. $\frac{573}{1648}$), of which I am able to examine both skin and skull, is evidently closely related to *T. bottæ*, and hence has nothing to do with true *T. bulbivorus*. The skull indicates a very old individual; it is somewhat broken, but enough remains to show the essential characters. It differs from *T. bottæ* (Baird's *T. bulbivorus*) in the much greater breadth and shortness of the rostral portion of the skull, resulting in very short and very broad nasal bones, as pointed out by Baird. I find no skull very nearly approaching it in a large series from Marin Co., California, and from southern California.

T. laticeps also differs from *bottæ* in coloration, as well stated by Baird. For the present it seems proper to recognize *T. laticeps* as a full species, although the comparison of further material may show that it intergrades with *T. bottæ*, as seems not improbable. I refer to it also a series of five specimens from Fort Crook, Cal., collected after the publication of Prof. Baird's 'Mammals of North America,' as they agree essentially in cranial characters and in coloration with the type of *T. laticeps*.

Thomomys clusius fuscus Merriam is apparently more closely related to *T. douglasii* than to *T. clusius*, the points through which it differs from *clusius*—darker coloration, larger size, and thicker, stronger claws—being in the direction of *douglasii*. Judging from Dr. Merriam's description of *clusius* and the two specimens he has kindly sent me for examination, it seems likely to prove a subspecies of *douglasii* rather than of *clusius*, and will be found thus entered in the subjoined list of the species of the genus.

One of the *fuscus* specimens seems quite indistinguishable from examples of *douglasii* from Fort Steilacoom, and Ducks, B. C. The cranial characters, and especially the relative size and the form of the interparietal bone, are very similar in *douglasii*, *clusius* and *fuscus*, and not very different in *talpoides*. The coloration and the size of the claws, however, appear to readily separate *clusius* from the others, which is also the smallest known form of the genus.

III.—CRANIAL CHARACTERS.

It is worthy of note that the cranial characters in the genus *Thomomys* are very important, even when the coloration and external characters may fail to be satisfactorily diagnostic. Prof. Baird had very few skulls for examination at the time he wrote of the group in 1857, and appears to have made very little use of those he did have as a basis for classification. Dr. Coues must have been much better provided in this respect, but his distinctions and generalizations appear to have been based entirely on external features, there being no reference to the skull in his long discussion of the relationships of the various species of previous authors. The importance of the cranial characters for the discrimination of the species of *Thomomys* is evident from a glance at the figures given in the accompanying plate (Pl. I).

The skull varies not only greatly in size and proportions in the different species, but in various important details of structure, as in the shape and relative size of the interparietal bone; in the posterior extension of the nasals as compared with the intermaxillaries; and in the relative development of the muzzle in comparison with the rest of the skull.

In fact, the case is quite parallel to that of the genera *Dipodomys*, *Perodipus* and *Perognathus*, where, especially in the latter genus, Dr. Merriam has found such excellent cranial characters. It is hence evident that the group embraces not one or two species, as believed by Dr. Coues, or eight, as recognized by Prof. Baird, but a considerably larger number, easily characterized by cranial differences, and generally by more or less obvious external features.

The interparietal varies from nearly complete obsolescence, as in *T. bulbivorus* (Fig. 14) to a large subquadrate bone, having a transverse breadth nearly equal to half of the intermastoid breadth of the skull, as in *G. monticolus* (Fig. 3) and *G. douglasii* (Fig. 1). It may form a narrow triangle, with the base formed by the occipital border, and twice as long as broad, as in *G. bottæ* (Fig. 8), or triangular with a broad base (the two extreme diameters about equal), as in *T. fossor* (Fig. 10); or much smaller, but of the same general form, as in *G. perpallidus* (Fig. 12); or rather large and quadrate, as in *T. fulvus* (Fig. 5), or smaller and of the same form, as in *T. aureus* (Fig. 6) and *G. toltecus* (Fig. 13); with, of course, intermediate stages in other species, between these leading types.

The nasal bones may terminate far in advance of the nasal branch of the intermaxillaries, as in *T. bottæ* and *T. aureus*, or on the same line with them, as in *T. fossor*, or, in other species, at various intermediate points. They may be long and narrow, as in *T. monticolus* and *T. douglasii*, or short and narrow, as in *T. fulvus*, or short and broad, as in *T. laticeps*.

The form and position of the various foramina also vary more or less in different species, as do also the size and shape of the hamular processes of the pterygoids, and the outline of the crowns of the molar teeth. The slight sulcus at the inner edge of the anterior surface of the incisors may be nearly or quite obsolete or well developed.

The general size of the skull varies between wide extremes, as shown by a comparison of the skull of *T. fulvus* (Fig. 5) or *T. clusius* (Fig. 2) with the skull of *T. bulbivorus* (Fig. 14).

There is of course more or less individual variation in all of these features, and much variation in size due to age, even after the individual has reached the breeding age; but an effort has been made to eliminate this in selecting skulls for illustration by taking average specimens of the particular species in question. In several instances two skulls of the same species have been figured, for the purpose of showing variations in size, etc., due to age.

IV.—SPECIES AND SUBSPECIES OF THE GENUS
THOMOMYS.

The views reached in the preparation of the present paper may be summarized somewhat as follows, as regards the status of forms and questions of nomenclature. The sequence of the species here adopted is not intended to represent their genetic relationships; it is essentially that of Prof. Baird's list, with interpolations.

1. *Thomomys bulbivorus* (Rich.). — Lower Columbia River. (Beaverton, Washington Co., Oregon, *Miller*; Multnomah Co., Oregon, *Richardson*.)

2. *Thomomys laticeps* Baird.—Northern California. (Humboldt Bay, *Baird*; Fort Crook, Shasta Co., *Feilner*.)

3. *Thomomys bottæ* (E. & G.).—Central and Southern California. (= *T. bulbivorus* Baird, *nec* Rich.)

4. *Thomomys townsendii* (Rich.). — Southwestern Wyoming? (= *Geomys townsendii* Bach. and *G. borealis* Bach., *nec* Rich., the latter in part only.)

5. *Thomomys monticolus* Allen.—Mt. Tallac, El Dorado Co., Cal.

6. *Thomomys douglasii* (Rich.).—Lower Columbia River, and thence northward into British Columbia.

7. *Thomomys douglasii fuscus* (Merriam).—Mountains of Central Idaho.

8. *Thomomys clusius* Coues. — Southwestern Wyoming and Southern and Central Idaho. (Fort Bridger, *Coues*; Snake Plains, *Merriam*.)

9. *Thomomys talpoides* (Rich.).—Saskatchewan region, south to upper Missouri region. (= *Geomys borealis* Rich.; =? *T. rufescens* Wied.)

10. *Thomomys fulvus* (Woodh.).—Southern New Mexico and northern Sonora westward to southern California. (= *T. fulvus* Baird and *T. umbrinus* Baird, the latter at least in part.)

11. *Thomomys perpallidus* Merriam. — Colorado Desert in southern California, and northeastward to the Painted Desert in Arizona (*Merriam*).

12. *Thomomys aureus* Allen.—San Juan region of southeastern Utah.

13. *Thomomys fossor* Allen.—La Plata Co., Colorado (upper San Juan region).

14. *Thomomys toltecus* Allen.—Northern Chihuahua (Juarez).

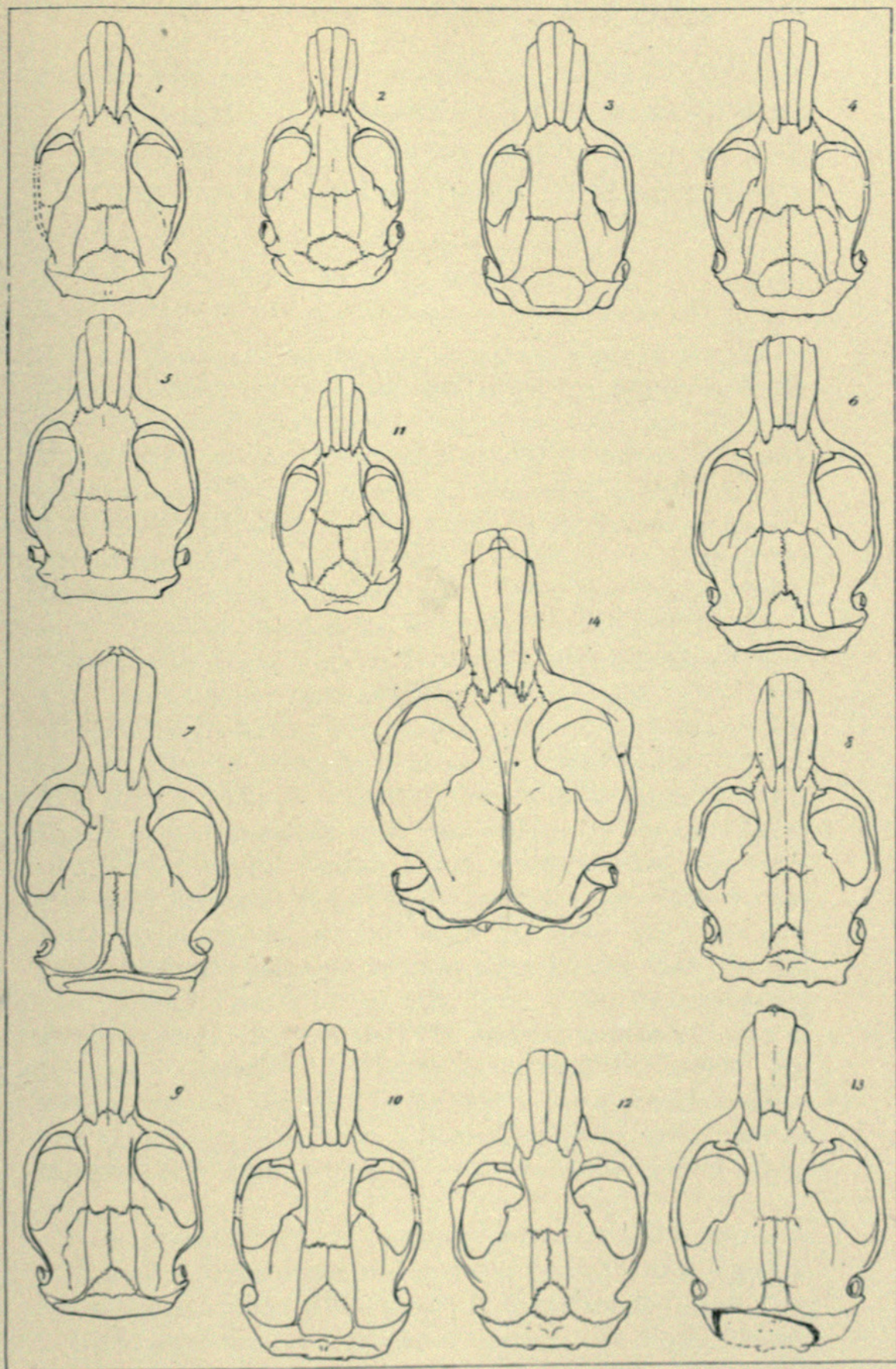
As already stated, *T. laticeps* may prove to be only a subspecies of *T. bottæ*. On the other hand, *T. rufescens* Wied may prove subspecifically separable from *T. talpoides*, as it is quite unlikely that the *Thomomys* occurring as far south as Fort Randall, in South Dakota, will prove strictly identical with the form found over the Saskatchewan Plains. Again, a form of *Thomomys* occurs in Los Angeles, San Bernardino, and San Diego Counties, California, which is quite different from either *T. bottæ* or *T. fulvus*, and apparently intermediate, in both cranial and external characters, between them. Also the form occurring in southeastern New Mexico and western Texas may not be identical with either *T. fossor*, *T. toltecus* or *T. fulvus*. These are left as open questions, to be solved by some future investigator who may chance to have the requisite material.

EXPLANATION OF PLATE I.

(All the Figures are natural size.)

- Fig. 1. *Thomomys douglasii*, No. $\frac{1473}{2125}$,¹ A. M. N. H., Ducks, B. C., Aug. 8, 1889.
- Fig. 2. *Thomomys clusius*, No. $\frac{30900}{23482}$, U. S. Dept. Agl., ♂ ad., Birch Creek, Idaho.
- Fig. 3. *Thomomys monticolus*, No. 86, Leland Stanford University, ♂ ad., Mt. Tallac, El Dorado Co., Cal., Aug. 8, 1892. *Type*.
- Fig. 4. *Thomomys monticolus*, No. 59, Leland Stanford University, Mt. Tallac, Aug., 1892. (A younger specimen than No. 86.)
- Fig. 5. *Thomomys fulvus*, No. $\frac{741}{1168}$, A. M. N. H., ♀ ad., San Francisco Mountain, Arizona, July 22, 1887.
- Fig. 6. *Thomomys aureus*, No. $\frac{4122}{5243}$, A. M. N. H., ♀ ad., Bluff City, Utah, May 12, 1892. *Type*.
- Fig. 7. *Thomomys aureus*, No. $\frac{4128}{5248}$, A. M. N. H., ♂ ad. (very old), Bluff City, Utah, May 18, 1892.
- Fig. 8. *Thomomys bottæ*, $\frac{911}{1733}$, A. M. N. H., ♂ ad., Nicasio, Cal., Feb. 26, 1889.
- Fig. 9. *Thomomys bottæ*, No. $\frac{909}{1731}$, ♀ juv., Nicasio, Cal., Feb. 26, 1889.
- Fig. 10. *Thomomys fossor*, No. $\frac{4120}{5240}$, A. M. N. H., ♂ ad., Florida, La Plata Co., Colorado, June 25, 1892. *Type*.
- Fig. 11. *Thomomys fossor*, No. $\frac{4118}{5238}$, ♀ juv., Florida, La Plata Co., Colorado, June 22, 1892.
- Fig. 12. *Thomomys perpallidus*, No. $\frac{2614}{3335}$, A. M. N. H., ♂ ad., Baregas Springs, Colorado Desert, California, Dec. 21, 1889.
- Fig. 13. *Thomomys toltecus*, No. $\frac{4305}{5440}$, A. M. N. H., adult, Juarez, northern Chihuahua, Autumn, 1890. *Type*.
- Fig. 14. *Thomomys bulbivorus*, No. $\frac{226}{398}$, Coll. Gerrit S. Miller, Jr., ♂ ad., Beaverton, Oregon, May 12, 1890.

¹ The number above the line denotes the skull, and that below the line the skin of the same specimen.



1. *Thomomys douglasii*.
 2. " *clusius*.
 3, 4. " *monticolus*.

5. *Thomomys fulvus*.
 6, 7. " *aureus*.
 8, 9. " *bottæ*.
 10, 11. " *fossor*.

12. *Thomomys perpallidus*.
 13. " *toltecus*.
 14. " *bulbivorus*.



Allen, J. A. 1893. "Descriptions of four new species of *Thomomys*, with remarks on other species of the genus." *Bulletin of the American Museum of Natural History* 5(5), 47–68.

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