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A SYSTEMATIC ACCOUNT OF THE PRAIRIE-DOGS

BY

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF BIOLOGICAL SURVEY,
Washington, D. C., November 16, 1915.

SIR: I have the honor to transmit herewith for publication as North American Fauna No. 40, a systematic account of the prairie-dogs of North America, by Mr. N. Hollister, Assistant Curator of Mammals, of the United States National Museum. This review of the group is based largely upon material in the collection of the Biological Survey. Prairie-dogs are distributed over a large part of the Great Plains and Rocky Mountain regions. Their colonies often number thousands of individuals, and their destruction of grasses and other forage plants makes them of considerable economic importance. Drastic measures are frequently necessary to prevent their destroying crops of grain and hay. The Biological Survey is engaged in exterminating these rodents in national forests and on the public domain. The definite information in this report in regard to the several species and their distribution, as indicated by maps, will materially aid in efforts, National or State, to control or exterminate them.

Respectfully,

HENRY W. HENSHAW,
Chief, Biological Survey.

HON. DAVID F. HOUSTON,
Secretary of Agriculture.

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A SYSTEMATIC ACCOUNT OF THE PRAIRIE-DOGS.

By N. HOLLISTER.

INTRODUCTION

The prairie-dog is a true ground squirrel, or spermophile, and its common designation "dog" is most unfortunate from the standpoint of exact science. The name is now so generally used, however, that any attempt to substitute one more appropriate would be futile. The animals may be conveniently divided into two general classes—the black-tailed prairie-dogs (subgenus *Cynomys*, three forms of two species) and the white-tailed prairie-dogs (subgenus *Leucocrossuromys*, four forms of three species).

DISTRIBUTION, HABITS, AND ECONOMIC RELATIONS.

Early explorers of the Western States were much impressed by the peculiar habits of the prairie-dog, one of the most abundant and conspicuous mammals over much of what was then "Louisiana" and the region of the upper Missouri River. Their journals and narratives contain numerous references to this spermophile under such names as prairie-dog, petit chien, wishtonwish, barking squirrel, and prairie squirrel, together with long accounts of the "dog-towns" and the social habits and notes of alarm of the animals. As usual in the case of a new and interesting animal, these accounts are partly true and partly erroneous, having been drawn from actual observation supplemented by stories of travelers, settlers, and Indians.

Prairie-dogs are distributed over a large part of the Great Plains and Rocky Mountain regions of the United States and southward into northern Mexico. This actual area is relatively small, however; the animals are found in no other region. Though the several forms are constantly extending their ranges into new valleys and pushing out into new pastures on the plains, the animal has penetrated into only a small area of the Great Basin, and seems sharply restricted by its specialized nature from occupying any great part of the humid eastern plains, the northern prairies of Canada, the Tropics, or the immense stretches beyond the Rockies.

The habits of the black-tailed species and, to a slightly less degree, those of the more mountain-loving white-tailed forms, are decidedly social. The great size of the "dog-towns" on the plains has indeed been one of the principal subjects of comment by early travelers. The villages sometimes extend for many miles and the number of individuals inhabiting a big town is enormous. While in certain localities the white-tailed species are almost as gregarious as the black-tailed forms, in others their dens are much more scattered and the animals live in solitary families. These differences in habit are due mainly to variations in local habitat. In certain parts of the mountainous ranges of *Cynomys gunnisoni* and of *C. leucurus*, the country is broken and otherwise unsuited to sustain large numbers of the animals, and the creatures necessarily live much as do certain rock squirrels of the genus *Citellus*, in isolated pairs or widely separated families.

The prairie-dog is not strictly a hibernating animal except at high altitudes or in the more northern regions where the great depth of snow and the extreme severity of winter make hibernation a virtual necessity. In the more southerly parts of the Great Plains there is actually no period of hibernation. In the central Plains States hibernation is partial and irregular, and even in the extreme north the animals are not infrequently seen out on fine winter days, though they hibernate for long periods during severe weather. In the higher mountainous habitat of the white-tailed forms the villages are often covered for many weeks with a great depth of snow, and activity on the part of the prairie-dogs is, therefore, out of the question. In such regions the animals are rarely seen after November or they may retire even by middle October. In the higher parts of the New Mexican range prairie-dogs cease to appear above ground by approximately the first of December, although, if conditions are favorable, they are out on fine days throughout the winter. In the Green River Basin, Wyoming, Vernon Bailey saw *Cynomys leucurus* eating sage-brush tips on snow a foot deep in zero (Fahrenheit) weather, and also after a night when the temperature had fallen to 22° below zero.

The burrows vary greatly according to local necessities. In some regions the mounds heaped up around entrances to dens are enormous, while in others they are smaller or almost wanting. Much rainfall necessitates high mounds, constant care, and incessant work by the industrious animals until the safety of the home is insured. The mounds in such cases are often especially well made and the earth is very hard packed. Each double armful of wet dirt which is pushed into position by the animal is rammed and packed into a firm condition by repeated drives with the nose; the body, in curved

position, with shoulders bent, acts as a powerful machine to drive the hammerlike muzzle into the earth.

While at times virtually omnivorous, the prairie-dog finds its principal food in grasses and other green plants. Roots and stems are eaten as well as the tender leaves. In times of scant vegetation, or during a drought, the villages are almost destitute of plant life, so closely is every living bit cropped.

Prairie-dogs are unquestionably responsible for great annual damage to crops and pasturage. In certain areas the destruction amounts to virtually the entire forage. Crops of grain and cultivated hay are often entirely ruined unless drastic preventive measures are taken. In other out-of-the-way places the animals do not interfere in the least with the operations of man.

In captivity prairie-dogs eat almost any food, and are especially fond of cakes and fruit; watermelon also is relished.

NATURAL ENEMIES.

Among the principal natural enemies of the prairie-dog are the badger, coyote, black-footed ferret, eagle, rough-legged hawk, and raven. Prairie-dog meat furnishes much of the food of individuals of these species that live in close proximity to the villages. Many absurd stories of the joint occupation of dens by prairie-dogs, rattlesnakes, and burrowing owls have been written, but careful observers have found that whatever the relation between these denizens of the plain may be—and the creatures are often found together in the villages—it is anything but advantageous to the prairie-dog, and large numbers of its young are destroyed by the unwelcome visitors.

NOMENCLATURE.

Several systematic mammalogists early bestowed technical names on the prairie-dog, in some cases basing both names and descriptions wholly upon published accounts in explorers' narratives. The resulting confusion in both zoology and nomenclature was considerable. Systematists supposed the newly discovered prairie-dog to be a species of marmot, and the first technical name properly proposed for it, *Arctomys ludovicianus*, the Louisiana marmot, was given by George Ord in the second American edition of Guthrie's Geography, 1815. Ord's description was drawn from a stuffed specimen of the prairie-dog in Peale's Museum, and his account of the habits of the animal was taken chiefly from the history of Lewis and Clark's expedition, with supplemental observations from the narratives of Pike and Brackenridge. The specimen examined by Ord in Peale's Museum was certainly the skin collected by Lewis and Clark, and

later, 1823, more fully described by Say.¹ This was doubtless the first specimen of the prairie-dog to reach any museum, and Lewis and Clark are probably entitled to the credit for the actual discovery of the species.

Rafinesque, in 1817, proposed the new genus *Cynomys* for the "barking squirrel" of Lewis and Clark, calling the species *Cynomys socialis*. At the same time he provisionally named the "petit chien" of these authors *Cynomys grisea*, not knowing that it too was a "barking squirrel." Warden, in his Historical Account of the United States, 1819, named the species *Monax missouriensis*, basing his description on information obtained in the narratives of late explorers, particularly Maj. Pike; and Harlan, 1825, based still another name, *Arctomys latrans*, on the barking squirrel of Lewis and Clark. These names have now been fixed in the synonymy of one species, but there was considerable confusion regarding the nominal species and their nomenclature up to the time of publication of Baird's Mammals of North America, 1857. In this work two species of *Cynomys* were recognized, one black-tailed and one white-tailed. Baird, who in 1855 had first described his *Spermophilus gunnisoni*, a species of the white-tailed group of prairie-dogs, from Colorado, still, in 1857, entertained considerable doubt as to whether his new species was distinct from a still more recently discovered white-tailed prairie-dog from Wyoming. To this latter form he thought the older name *Arctomys columbianus* of Ord, based on the "burrowing squirrel" of Lewis and Clark, might be applied, should further investigation establish its validity.

The next authoritative work on the group was Allen's Monograph of the Sciuridæ, 1877. In this work, as in his previous list of American Sciuridæ,² Dr. Allen recognized two species of prairie-dogs, the *ludovicianus* of Ord and a white-tailed species to which he applied the name *Cynomys columbianus* (Ord), treating *gunnisoni* of Baird as a synonym. As later pointed out by Dr. Merriam,³ the name *columbianus* really belongs to a spermophile of the genus *Citellus*, and Baird's name *gunnisoni* is the earliest valid name for any member of the group of white-tailed prairie-dogs. Dr. Merriam had been able the previous year to substantiate Baird's suspicions of many years before regarding the existence of two distinct species of white-tailed prairie-dogs, and had named the Wyoming form *Cynomys leucurus*. The same year Dr. Mearns described a southwestern form of the *ludovicianus* type as *Cynomys arizonensis*, and in 1892 Merriam added *C. mexicanus* to the list of known species of the genus. The Sevier River valley white-tailed prairie-dog remained unknown, so far as systematists were concerned, until it was described and named by Dr. J. A. Allen in 1905.

¹ Long's Exped. Rocky Mts., I, pp. 451-452, 1823.

² North Amer. Fauna No. 5, pp. 39-42, 1891.

³ Proc. Boston Soc. Nat. Hist., XVI, p. 294, 1874.

In the present paper two subgenera of *Cynomys* are recognized. These are equivalent to the black-tailed and the white-tailed groups. One new subspecies is described and one currently recognized name is placed in synonymy, leaving the number of recognized forms at seven, the same as in the last (1912) general list of North American mammals.¹

PELAGES AND MOLTS.

In all prairie-dogs, except *Cynomys mexicanus*, there are two well-marked annual molts over the entire animal, except on the tail, where there is only a single renewal each year. The two coats are the harsh, thin, summer pelage and the soft, heavily underfurled winter pelage. In southern States, where the spring molt takes place much earlier than in the North, the two renewals are conspicuous. Farther north and at greater altitudes, where the season is shorter, the summer coat is so little worn and the fall renewal so subtle that the autumnal change is difficult to detect.

In general, the spring molt begins on the pectoral region and axillæ, and the entire underparts from front to back are completely renewed before any real molt is visible above. On the upperparts, the head and shoulders, with occasional irregular areas on the back, renew first, and the renewal progresses posteriorly. Considerable wear is apparent over the anterior half of the back before the tail is in fresh coat. It is quite common to find museum specimens in full summer coat except for the tail, which retains the old pelage of the previous winter. In late summer or early autumn, at about the time when the tail is at last in full fresh pelage, the winter coat begins to appear on the extreme posterior parts of the body. The renewal of the underfur progresses anteriorly in a regular definite area, and the fresh, soft winter coat gradually covers the whole body. The autumnal renewal thus exactly reverses the order of progression in spring. The whole process is much as if there was a continuous summer change of hair which started at the nose in spring, worked backward to the tail, reversed, and in fall traveled forward to the nose again. The tail, midway in the route of this process, receives only one coat annually.

There is, naturally, a considerable variation in the season of renewal according to latitude or altitude. Breeding females are always slow to acquire the fresh coat, renewal being greatly retarded by lack of excess vitality. Young animals of the first year do not molt or renew at the same dates as do adult males and nonbreeding females which have lived over one winter. The molt of *Cynomys mexicanus* appears to be much more complex than in the more northern forms and is almost continuous. Some individuals of this species show parts of three distinct pelages.

¹ Miller, G. S., jr., Bull. 79, U. S. Nat. Mus., pp. 294-295, 1912.

MATERIAL AND ACKNOWLEDGMENTS.

This revision of the prairie-dogs is based upon a study of 876 specimens, almost all of which are well-prepared skins and skulls.¹ A few skeletons and odd skulls also have been examined. The liberal policy of American museums has made it possible to assemble practically all the study material of the group preserved in American collections, including the types and type series. Thanks for these courtesies are especially due Dr. J. A. Allen, American Museum of Natural History; Mr. Samuel Henshaw and Mr. Outram Bangs, Museum of Comparative Zoology; Mr. Edward R. Warren, Colorado Springs, Colo.; and Mr. Charles B. Cory and Mr. W. H. Osgood, Field Museum of Natural History. Mr. Warren's private collection of Colorado specimens of *Cynomys leucurus* and *C. gunnisoni* has been of especial value and help. In the lists of specimens examined the source is indicated of all material from localities not represented in the United States National Museum collections.

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Genus *CYNOMYS* Rafinesque.

1817. *Cynomys* Rafinesque, Amer. Monthly Mag., II, p. 45.
 1819. *Monax* Warden, Stat., Pol., and Hist. Acc. U. S., I, p. 226. Type, *Monax missouriensis* Warden (= *Cynomys ludovicianus*).
 1827. *Cynomys* Lesson, Manuel de Mamm., p. 244 (pro *Cynomys* Rafinesque).
 1894. *Cynomomus* Osborn, Science, XXIII, p. 103 (pro *Cynomys* Rafinesque).
 1899. *Mameynomiscus* Herrera, Sin. Vulg. Cient. Vert. Mexicanus, p. 22 (pro *Cynomys* Rafinesque).

Type species.—*Cynomys socialis* Rafinesque (= *Arctomys ludovicianus* Ord).

Diagnosis.—Like *Citellus*, but with cheek teeth relatively much larger; maxillary tooth rows strongly convergent posteriorly; molariform teeth with protocone much more hypsodont; and crown of last upper molar with well-developed mesostyle and accompanying additional transverse ridge.

General characters.—Size as in larger species of *Citellus* or greater; form stout; tail short, rarely more than one-fourth the total length; ears short, not extending beyond fur of winter pelage; cheek pouches moderate. Wrist and heel heavily furred; a tuft of hair in center of

¹ The material examined has been assembled from collections as follows:

U. S. National Museum, Biological Survey collection.....	465
U. S. National Museum proper.....	221
American Museum of Natural History, New York, N. Y.....	81
Museum of Comparative Zoology, Cambridge, Mass.....	47
Collection of E. R. Warren, Colorado Springs, Colo.....	44
Field Museum of Natural History, Chicago, Ill.....	18
Total number of specimens.....	876

palm of foot usually extending forward to phalangeal tubercles; manus with five distinct claws, the claw of pollex well developed, subequal to claw of outer (fifth) toe. Mammaræ 8 to 12. Skull rather broad and heavily built; sinciput high and rounded; squamosal arm of zygoma widely spreading; occipital crest well developed; sagittal crest moderate anteriorly, but well developed posteriorly in old adults; antorbital foramen subtriangular, with strongly developed tubercular process. Molar series strongly convergent posteriorly; teeth very large and greatly expanded laterally; first premolar large, sometimes nearly equal to second; crown pattern of molars essentially as in true *Citellus*, but teeth with higher crowns and deeper grooves; molars and premolars with protocone much more hypsodont; m^3 with additional transverse ridge extending (from mesostyle) across outer half of center of crown; upper incisors sometimes with very indistinct groove along inner face.

Color pattern.—Simple; body unmarked, not sharply bicolor. Upperparts reddish brown, buffy, or grayish, finely lined with darker or lighter hair-tips; underparts paler, clear buff or pale cinnamon. More or less well-marked dark areas above and below eye; tail conspicuously tipped with black or white.

Geographic distribution.—Rocky Mountain and Great Plains regions of the United States and northern Mexico. From the Milk River near the Canadian boundary in northern Montana south to northern San Luis Potosi, Mexico; east to the Missouri River in North Dakota and to about the ninety-seventh meridian in Nebraska and Oklahoma; west to the Rocky Mountains in Montana, to the valleys of central Utah, and to the border of the Grand Canyon on the Hualpai Indian Reservation, Arizona (figs. 1 and 2).

Remarks.—The prairie-dog is a true ground squirrel, or spermophile; there is no real evidence of the frequently suggested close relationship between *Cynomys* and *Marmota*.

In an article by Prof. K. A. Satunin in the *Mitteilungen des Kaukasischen Museums*, volume IV, pages 175 to 193, 1909, the conclusion is reached that *Colobotis* Brandt, currently recognized as a subgenus of *Citellus*, is a synonym of *Cynomys*. Through the kindness of Mr. Oldfield Thomas, I have been able to examine, from the collection of the British Museum, skulls of the type species of *Colobotis*—*Citellus fulvus* (Lichtenstein). It is at once apparent that *Cynomys* is even less closely related to *Colobotis* than to *Citellus* proper, and that it is unquestionably an error to use the generic name *Cynomys* for any of the Old World spermophiles. *Colobotis* is exceedingly like true *Citellus* and differs generically from *Cynomys* in the same characteristics, especially in the less complicated last upper molar, lack of the striking internal hypsodontism of the molariform teeth, and in the nearly parallel-sided palate.

List of Species and Subspecies with Type Localities.

Subgenus CYNOMYS.

<i>Cynomys ludovicianus ludovicianus</i> (Ord).....	Upper Missouri River.
<i>ludovicianus arizonensis</i> Mearns.....	Point of Mountain, Arizona.
<i>mexicanus</i> Merriam.....	La Ventura, Coahuila, Mexico.

Subgenus LEUCOCROSSUROMYS.

<i>Cynomys leucurus</i> Merriam.....	Fort Bridger, Wyoming.
<i>parvidens</i> Allen.....	Buckskin Valley, Utah.
<i>gunnisoni gunnisoni</i> (Baird).....	Cochetopa Pass, Colorado.
<i>gunnisoni zuniensis</i> nobis.....	Wingate, New Mexico.

Key to Species and Subspecies.

- a.¹ Tail tipped with black; jugal bone heavy, thickened, the outer face at angle of ascending branch presenting a broad triangular surface (*Cynomys*).
- b.¹ Black on tail covering most of distal half; tail longer; audital bullæ large and greatly inflated; posterior border of inflected angle of mandible nearly at right angle to axis of jaw *C. mexicanus* (p. 21).
- b.² Black on tail confined to distal third; tail shorter; audital bullæ smaller and less inflated; posterior border of inflected angle of mandible at angle of about 45° to axis of jaw.
- c.¹ Coloration above in fresh summer pelage dark pinkish cinnamon; audital bullæ smaller; anterior face of maxillary root of zygoma deeply emerginate, *C. l. ludovicianus* (p. 14).
- c.² Coloration above in fresh summer pelage more vinaceous-cinnamon; audital bullæ larger; superior surface of maxillary root of zygoma very broad, not deeply emarginate anteriorly..... *C. l. arizonensis* (p. 19).
- a.² Tail tipped and bordered with white; jugal bone weak, thin, and flat, the outer surface at angle of ascending branch only very slightly thickened, the margin rounded, not distinctly triangular (*Leucocrossuromys*).
- b.¹ Terminal half of tail white, without dark center.
- c.¹ Size larger; coloration in summer buffy or grayish (not reddish or rich cinnamon); skull with less interorbital breadth..... *C. leucurus* (p. 24).
- c.² Size smaller; coloration in summer reddish or rich cinnamon (not buffy or grayish); skull with greater interorbital breadth..... *C. parvidens* (p. 27).
- b.² Terminal half of tail with gray center, bordered and tipped with white.
- c.¹ Size smaller, with smaller hind foot; coloration more buffy and blackish, less pinkish cinnamon and ochraceous..... *C. g. gunnisoni* (p. 29).
- c.² Size larger, with larger hind foot; coloration more pinkish cinnamon and ochraceous, less buffy and blackish..... *C. g. zuniensis* (p. 32).

Subgenus CYNOMYS Rafinesque.

Characters.—Size large; tail comparatively long, averaging more than one-fifth the total length, and tipped with black; mammæ 8. *Skull*: Angular and massive; general shape of occipital region, viewed from behind, oval; jugal bone heavy, thickened, the outer surface at angle of ascending branch very broad, triangular, with inferior vertex produced far downward; maxillary root of zygoma correspondingly strengthened, the shelf and suprajugal arm much thickened. Teeth larger, more expanded laterally, than in species of the white-tailed group.

FIG. 1.—Distribution of subgenus *Cynomys*: 1, *Cynomys ludovicianus ludovicianus*; 2, *C. l. arizonensis*; 3, *C. mexicanus*.

CYNOMYS LUDOVICIANUS (ORD).

[Synonymy under subspecies.]

Characters.—Differs from *Cynomys mexicanus* in more reddish coloration and shorter tail; black area on terminal portion of tail much more restricted; skull with smaller audital bullæ and less developed triangular plate of jugal; teeth larger.

Subspecies.—Two subspecies of *Cynomys ludovicianus* are here recognized, the typical form, occupying a large part of the Great Plains region from Montana to Texas; and *C. l. arizonensis*, the more arid southwest, in New Mexico, Arizona, and adjacent portions of Mexico and southwestern Texas.

CYNOMYS LUDOVICIANUS LUDOVICIANUS (ORD).

BLACK-TAILED PRAIRIE-DOG.

(Pl. I, figs. 1, 4; Pl. II, figs. 1, 4; Pl. V, fig. 1; Pl. VI; Pl. VII, figs. 1, 7, 8.)

1815. *Arctomys ludoviciana* Ord, Guthrie's Geogr., 2d Amer. ed., II, pp. 292, 302.
 1817. *Cynomys socialis* Rafinesque, Amer. Monthly Mag., II, p. 45, November. (Plains of the Missouri.)
 1817. *Cynomys ? grisea* Rafinesque, Amer. Monthly Mag., II, p. 45, November. ("On the Missouri.")
 1819. *Monax missouriensis* Warden, Stat., Pol., and Hist. Acc. U. S., I, p. 226. ("The Missouri country." Based largely on the account of "Major Pike, in his expedition through Louisiana.")
 1822. *Arctomys missouriensis* Desmarest, Mammalogie, pt. 2, p. 329.
 1825. *Arctomys ludoviciani* Harlan, Fauna Amer., p. 305.
 1825. *Arctomys latrans* Harlan, Fauna Amer., p. 306. (Plains of the Missouri.)
 1827. *Spermophilus ludovicianus* Lesson, Manuel de Mamm., p. 244.
 1827. *Cynomys socialis* Lesson, Manuel de Mamm., p. 244 (syn.).
 1827. *Spermophilus griseus* Lesson, Manuel de Mamm., p. 245.
 1827. *Cynomys griseus* Lesson, Manuel de Mamm., p. 245 (syn.).
 1827. *Cynomys griseus* Lesson, Manuel de Mamm., p. 260.
 1829. *Arctomys ludovicianus* Cuvier, Règne Animal, I, p. 197.
 1829. *A[rc]tomys missouriensis* Fischer, Syn. Mamm., p. 345.
 1829. *A[rc]tomys griseus* Fischer, Syn. Mamm., p. 345.
 1829. *Arctomys (Spermophilus?) ludovicianus* Richardson, Fauna Boreali-Amer., pt. 1, p. 154.
 1829. *C[yn]omys cinereus* Richardson, Fauna Boreali-Amer., pt. 1, p. 155 (pro *grisea* Rafinesque, 1817).
 1845. *Cynomys cinereus* Schinz, Syn. Mamm., II, p. 64 (syn.).
 1855. *Monax missouriensis* Giebel, Die Säugethiere, p. 630 (syn.).
 1857. *Cynomys ludovicianus* Baird, Gen. Rep. North Amer. Mamm., pp. xxv, 331.
 1905. *Cynomys pyrrhotrichus* Elliot, Proc. Biol. Soc. Washington, XVIII, p. 139, April 18. (White Horse Spring, Woods County, Oklahoma; type in Field Mus. Nat. Hist., Chicago.)

Type locality.—Upper Missouri River ("vicinity of the Missouri, and throughout the greater part of Louisiana").

Geographic distribution.—Great Plains region of western United States, south from near the Canadian border in Montana to west-

central Texas (Mason County to eastern Pecos Valley); east to about the ninety-seventh meridian in Nebraska, Kansas, and Oklahoma; west to the Rocky Mountains in central Montana, Wyoming, and Colorado, and in extreme eastern New Mexico. Chiefly Upper Sonoran, but also ranging into Transition and Lower Sonoran Zones. Introduced colonies exist, or have been reported as formerly existing, in Sac County and at Burlington, Iowa; near Monroe, Louisiana; at Seneca, South Carolina; and on Nantucket Island, Massachusetts.

Characters.—Skull with superior surface of maxillary root of zygoma bordering premaxillary and frontal bones narrow, sharply emarginate anteriorly; audital bullæ comparatively small. Coloration in fresh summer coat less vinaceous-cinnamon than in *Cynomys ludovicianus arizonensis*.

Color.—*Adult in full fresh summer pelage*: Upperparts from nose to between eyes, between ears, nape, and over entire body above, dark pinkish cinnamon, finely lined with black and buff. Individual hairs black at base, followed by buffy white, then cinnamon, with subterminal band of buff, and, in unworn condition, narrow tip of blackish. Mixed with these are numerous wholly black and half-black hairs, rather longer than the ordinary pelage, the chief cause of black streaking. Upper lip, sides of nose, and eye ring buff or buffy white; whiskers black; cheeks and sides of head buffy or vinaceous-cinnamon, with numerous blackish hairs; arms above, sides of body, and legs above pale ochraceous-cinnamon; feet buffy. Tail above for about two-thirds its length like back, below paler vinaceous-cinnamon; terminal third chiefly black or blackish brown above and below, with extreme tip of lighter blackish brown. Underparts of body from chin to near tail whitish or buffy white. Nails blackish, tipped with light horn. Iris hazel. *Adult in full fresh winter pelage*: Pelage much thicker, softer, and longer than in the summer coat; less ochraceous or pinkish cinnamon, more buff and gray. Upperparts grayish cinnamon (mixed pale cinnamon, whitish, and black). Individual hairs intense black at bases, then pale buff, with subterminal band of cinnamon and tip of almost pure white. Mixed throughout this pelage, as in the summer coat, are numerous long overlying hairs of black. Forehead with considerable blackish; tail as in summer. Underparts dark buff or pale cinnamon, the hairs black at bases, whitish midway, and broadly tipped with pale cinnamon-buff. *Juvenile pelage*: Upperparts clear ochraceous-cinnamon, with admixture of a few white and blackish hairs; underparts whitish or pale buffy yellow; tail clear ochraceous-cinnamon, broadly penciled with black; bases of many of the black pencil hairs pure white.

Both the summer and the winter coats rapidly fade and wear, and the resulting variations in color are considerable. Specimens are frequently greatly affected by the color of the soil, and numerous

examples are considerably reddened or darkened by stain, either on the upper and lower body or uniformly throughout the pelage. Specimens in complete fresh summer coat are rather uncommon as the vernal molt is so slow that the forward parts, renewed first, are already considerably worn before the tail, last to renew, is in full fresh coat.

Molt.—The spring molt and renewal are very conspicuous but the fall molt, especially in northern localities, is often obscure. There is considerable variation in the dates of renewal but the following schedule is about the average for northern and central Great Plains States: Late March and early April skins are worn, pale, and faded, but already show some signs of molt and renewal on the underparts, where the first new hair appears on the pectoral region and axillæ. May specimens have completely renewed below and the renewal has commenced on the head, shoulders, and in irregular patches on the back. June specimens are almost completely in fresh coat, but still show, as a rule, some of the old pelage on the rump and tail. July and early August skins are usually completely renewed, except for a few in which the tails above are still in the winter coat. The hair of the body is short and harsh, and rapidly becomes broken, worn, and faded. Late August adults show considerable progress in the fall renewal; the winter underfur and long soft hair is appearing on the lower back, and the animal looks generally lighter colored. The tails are fully renewed. November specimens are in complete new fur, and the hair on the tails still appears fresh and unworn after its single annual renewal; all traces of the summer coat have disappeared. In December skins, the coat has thickened, grown longer, and appears considerably lighter in color. This is in part due to fading, but is also caused by the general effect of the long white underfur showing through the reddish hair tips.

Skull and teeth.—The skull of *Cynomys ludovicianus ludovicianus* differs from that of *C. l. arizonensis* in its distinctly smaller audital bullæ and narrow, deeply emarginate anterior face of maxillary root of zygoma. It may readily be distinguished from skulls of *C. leucurus* (whose range meets that of *C. ludovicianus* in parts of Wyoming) by its slightly larger size, smaller bullæ, more notched anterior face of maxillary root of zygoma, less flattened zygoma (muscle attachment reaching farther forward, nearly or quite to plane of first tooth), generally heavier mandible, lighter postorbital processes, and small auditory meatus. The incisors vary in color from white to deep yellow in specimens from one locality. The variation in size and shape of skull among specimens of the same sex and age from one locality is remarkable (see Pl. VI).

Measurements.—Averages of 13 adult males from South Dakota: Total length, 388 (360–415); tail vertebræ, 86 (75–98); hind foot,

62 (61-83). *Skull*: Condylobasal length, 59.8 (57.2-62.6); zygomatic breadth, 45 (42.9-48.1); mastoid breadth, 28.5 (27.5-31); length of nasals, 23.8 (22-25); length of mandible, 45.9 (43-49.4); maxillary tooth row, alveoli, 16.6 (16-17.5). Females average very slightly smaller than males, but the difference in size is, as a rule, barely perceptible. For detailed measurements of specimens, see page 34.

Weight.—The weights of adult examples of *C. l. ludovicianus* are recorded in collectors' field catalogues as follows: Alma, Nebraska, October 21, ♂, 3 lbs., ♀, 2 lbs. 4 oz.; Tilyou's Ranch, Montana, October 1, ♀, 2 lbs. 3 oz.

Type specimen.—Ord's description of this prairie-dog was drawn from a stuffed skin in Peale's Museum, Philadelphia, supplemented by notes from the narrative of Lewis and Clark. This specimen was without doubt the identical skin which later on was more fully described by Say.¹ It has long since been lost sight of.

Remarks.—As explained in the account of the pelage changes, there is considerable seasonal color variation in the common prairie-dog, but a comparison of specimens in exactly the same state of pelage from all parts of the animal's range proves the absence of any constant geographical differences. There is likewise a remarkable uniformity in size, the averages and extremes of long series from northern States being virtually identical with measurements of specimens from Texas. The alleged form from Oklahoma, described by Dr. Elliot as *Cynomys pyrrotrichus*, is not subspecifically distinguishable from *C. l. ludovicianus*. Specimens from this region are commonly stained by the red soil, and sometimes so naturally as almost to defy detection as a stain. Numerous examples, however, show the telltale red soil on the toes and feet, and a careful microscopic examination of the hairs often shows the particles composing the stain, which can be perceptibly lightened by a moment's washing with alcohol or benzine. There are, furthermore, absolutely normally colored specimens from various parts of the area included in the distribution of the "red-haired" prairie-dogs, and all the young specimens are indistinguishable from juvenile examples from the Dakotas and other parts of the range of the species. Reddish skins, in all respects like the specimens of "*pyrrotrichus*" from Oklahoma, are not infrequently found in other parts of the prairie-dog's range where soil conditions are favorable for producing such a stain.

On the basis of skull characters the subspecies *ludovicianus* is typical over the northern parts of its general distribution, in Montana, the Dakotas, and Wyoming. The "area of intergradation" with *C. l.*

¹ See Guthrie's Geog., 2d Amer. ed., p. 303, under "Columbia Marmot," where Ord states that "A stuffed skin of the Louisiana Marmot is in the Museum of Mr. Peale." Also, Say, in Long's Exped. to Rocky Mts., I, p. 452, 1823.

arizonensis is large, and skulls from Nebraska, Kansas, Oklahoma, and Texas are sometimes difficult to distinguish. As here mapped the range of *C. l. ludovicianus* includes the entire area where typical examples most frequently occur. The characters separating *arizonensis* are slight and are only average. For example, in an examination of 120 adult skulls from Montana, the Dakotas, Arizona, and Chihuahua, about 80 per cent can readily be placed with their proper form; comparing 115 skulls from Wyoming, Nebraska, and New Mexico, about 75 per cent are easily determinable; 31 skulls from Colorado and extreme western Texas (west of Pecos River) still show about 75 per cent readily distinguishable; while of 56 skulls from Kansas and Texas east of the Pecos, there are just about 50 per cent which can be differentiated, and the characters are relatively hard to distinguish satisfactorily.

An albinistic specimen, entirely white, from the Central Park Menagerie, New York, has been examined in the collection of the American Museum of Natural History.

Specimens examined.—Total number, 290, as follows:

Colorado: Boulder County, 1; Colorado Springs, 1;¹ Denver, 1; Don Carlos, 1; Fremont County, 1;² Larimer County, 4;³ Loveland, 3; Monon (Baca County), 2;¹ Olney (Otero County), 4; Pueblo, 1; Rockvale, 2;³ Soda Springs, 2;⁴ Springfield, 2.¹

Kansas: Arkansas River, 1; Banner, 8; Cairo, 2; Coyote Station, 1;⁴ Fort Hays, 8;⁴ Garden City, 2;² Garden Plain, 1; Hoxie, 1; Long Island, 3;³ Pendennis (Lane County), 1; Republican River, 1; Trego County, 6.

Massachusetts: Nantucket, 2 (introduced).⁴

Montana: Billings, 1; Boxelder Creek, 1; Calf Creek, 1;³ Craig (10 miles northwest of), 1; Darnall's Ranch, 1; Fort Assinniboine, 5; Fort Custer, 3; Glendive, 6; Great Falls, 2; Milk River (near mouth), 2; Newland, 2; Pompey's Pillar, Yellowstone River, 1; Shelby Junction, 4; Teton River, 2; Tilyou's Ranch, 1.

Nebraska: Alma, 2; Birdwood Creek, 3; Columbus (Platte County), 1; Kennedy, 3; Platte River, 4.

New Mexico: Chico Springs, 1; Koehler Junction, 2; Pecos, 1; Tompkin's Lake, 2.

North Dakota: Glenullin, 2; Little Missouri River, 1; Medora, 7.

Oklahoma: Beaver River, 4;^{2,3} Chattanooga, 1; Mount Scott post office, 3; Neutral Strip, 5;^{2,3} Ponca Agency, 2; White Horse Spring, 5 (including type of "*pyrrhotrichus*").²

South Dakota: Armour, 1; Buffalo Gap, 8; Cheyenne River (Custer County), 2;³ Corral Draw, 3;³ Edgemont, 2; Fort Pierre, 6; Fort Pierre to Badlands, 15 (skulls); Fort Randall, 11; Phinney (Cheyenne River), 1; Pine Ridge Indian Reservation, 1;² Rapid City, 10; Upper Missouri River, 3 (skulls and skeletons).

Texas: Brazos River, 1; Colorado, 1; Fort Chadbourne, 1;⁴ Henrietta, 4; Lipscomb, 1; Llano Estacado, 1; Mason, 9; Monahans, 1; Red River, 2; Stanton, 2; Texline, 1; Vernon, 11; Wichita Falls, 3.

¹ Collection E. R. Warren.

² Collection Field Mus. Nat. Hist.

³ Collection Amer. Mus. Nat. Hist.

⁴ Collection Mus. Comp. Zool.

Wyoming: Arvada (Powder River Valley), 2; Camp Carling (=Fort Russell, near Cheyenne), 2; Cheyenne, 6; Deer Creek, 1; Douglas, 4; Fort Fetterman, 2; Ishawooa, 4; Newcastle, 4; Pine Bluff, 2; Pole Creek, 7; Sage Creek, 11.¹

CYNOMYS LUDOVICIANUS ARIZONENSIS MEARN'S.

ARIZONA PRAIRIE-DOG.

(Pl. I, figs. 2, 5; Pl. II, fig. 2; Pl. V, fig. 2.)

1890. *Cynomys arizonensis* Mearns, Bull. Amer. Mus. Nat. Hist., II, no. 4, p. 305, February 21.

1892. *C[ynomys] ludovicianus arizonensis* Merriam, Proc. Biol. Soc. Washington, VII, p. 158, July.

Type locality.—Point of Mountain, near Willcox, Cochise County, Arizona.

Geographic distribution.—Southeastern Arizona, southern and central New Mexico, southwestern Texas, and adjacent portions of Sonora and Chihuahua, Mexico. North to San Pedro and Santa Rosa, New Mexico; east to the Pecos Valley; west to Huachuca, Arizona; south to San Diego and Casas Grandes, Chihuahua, and to Presidio County, Texas.

Characters.—Like *Cynomys ludovicianus ludovicianus* but averaging very slightly larger, and brighter colored; skull with larger audital bullæ, and with superior surface of maxillary root of zygoma bordering premaxillary and frontal bones very broad, not deeply emarginate, the zygoma as viewed from above not branching at sharp angle from rostrum.

Color.—Almost precisely as in the typical subspecies, but averaging slightly brighter vinaceous-cinnamon in fresh summer pelage.

There is a single wholly melanistic specimen from south of the Guadalupe Mountains, in Texas, in the National Museum collection.

Molt.—Specimens showing excessive molt are more common than in the northern subspecies, and molting examples frequently exhibit strange patterns of coloration. There are frequent mixtures of the faded, left-over winter coat and the fresh reddish summer coat. Excessive wear before any renewal sometimes leaves large parts of the animal entirely black, the hair having been worn away completely except for the black underfur. Specimens in the much-worn pelage of late summer, before any evidence of fall renewal, frequently present a curious appearance: the color is pale ochraceous or yellowish buff and the hairs appear brittle and dead, often matted and twisted as if scorched by excessive heat.

January and February skins are in the long, soft, faded winter pelage. In the lower levels the spring molt occurs earlier than in the more northern race, and the animals are usually in full fresh summer coat, except for the tail, between the first part and middle of May. The short, stiff, summer coat rapidly wears and is much changed

¹ Collection Amer. Mus. Nat. Hist.

before the hair of the tail has renewed. At higher altitudes the pelage is not completely renewed until the middle of July. When the summer pelage is acquired this late the animals have molted again and renewed into full fall pelage by the first of October, while specimens from the lower levels, which acquired the summer pelage much earlier, are sometimes as late as November in attaining the same condition.

Skull and teeth.—The skull of *C. l. arizonensis* differs from that of *C. l. ludovicianus* in the very broad surface of the superior maxillary arm of the zygoma, bordering the ascending branch of the premaxilla and the frontal bone, which in the typical examples is nearly twice as wide as in *C. l. ludovicianus*, less sharply emarginate anteriorly, and rather more convex on the outer surface along the jugal. As a result the maxillary arm of the zygoma appears to leave the rostrum at a much less sharp angle than in the northern form. The audital bullæ average considerably larger than in typical *ludovicianus*. Teeth essentially as in the northern race.

Measurements.—Averages of 19 adult males from southeastern Arizona: Total length, 388 (350–412); tail vertebræ, 89 (78–100); hind foot, 62 (57–65). *Skull*: Condylbasal length, 60 (56.6–64); zygomatic breadth, 44 (41–47.2); mastoid breadth, 27.3 (26.1–29.5); length of nasals, 24 (22.3–25.4); length of mandible, 45.2 (42.8–47.2); maxillary tooth row, alveoli, 16.2 (15.5–17). Females average slightly smaller. For detailed measurements of specimens, see page 35.

Weight.—Three male specimens from Altuda, Texas, July 30, have the following weights recorded in collector's field catalogue: 2 lbs. 2 oz., 2 lbs. 6 oz., and 2 lbs. 8 oz.

Type specimens.—There are two cotypes, in the American Museum of Natural History, New York: Skin (No. 2509, ♀ ad.), from Point of Mountain, near Willcox, Arizona, April 9, 1885; and skin and skull (No. $2118\frac{1}{2}$, ♂ ad., teeth considerably worn), from Dragoon Summit, Arizona, May 3, 1885; both collected by Dr. Edgar A. Mearns. Dr. Mearns later¹ restricted the type locality to Point of Mountain, and listed No. $12118\frac{1}{2}$ as the type specimen. Two female specimens collected on the same date bear this skin number of the American Museum. One has a skull numbered 12162, but the other, without a skull number, bears a red type label, like No. 2185 from Dragoon Summit.

Remarks.—This is a slightly characterized form, barely recognizable except for average skull characters. Remarkable as it may seem, there are specimens from near the type region which can be matched in every particular with examples of typical *ludovicianus* from Montana. Nevertheless, as mentioned under the preceding form, about

¹ Mearns, E. A., Bull. 56, U. S. Nat. Mus., p. 339, 1907.

80 per cent of the skulls examined from the two extremes are readily determinable. The very slight average increase in size and the slightly more vinaceous summer coat are of such trivial degree that alone they would be valueless as characters for subspecific separation. Throughout southeastern Arizona and over most of the New Mexican range of the form the skull characters are well marked, but in western Texas such a strong tendency toward *C. l. ludovicianus* appears as to make identification of single specimens or unsatisfactory series virtually impossible. I have therefore considered the range of the form restricted to the region from the Pecos Valley south and west, where 75 per cent or more of the skulls are determinable. The area of intergradation with the subspecies *ludovicianus* is so extensive (from Texas to Nebraska) that it is really larger than the range of either subspecies in its *typical* form.

Specimens examined.—Total number, 184, as follows:

Arizona: Bonita, 1; Dos Cabezas, 1; Dragoon Summit, 1 (cotype);¹ Fort Huachuca, 10; Huachuca Plains, 4; ^{2,3} Point of Mountain, 4 (including cotype);¹ San Pedro River, Mexican Boundary Line, 20; ⁴ Sulphur Spring Valley, 2; ⁴ Willcox, 13.

Chihuahua: Colonia Juarez, 5; Juarez, 2; ^{1,3} Sierra en Media, 1.

New Mexico: Animas Valley (Grant County), 14; Cactus Flat (20 miles north of Cliff), 4; Capitan Mountains, 3; Cliff, 1; Cloverdale, 3; Dog Spring (Grant County), 9; Faywood, 2; Gila (Grant County), 1; Hachita, 2; Jornada del Muerto, 1; Lake Valley, 3; Lone Mountain, 1; Manzano Mountains (east foothills), 2; Organ City, 1; Playas Valley, 1; Queen, 3; Roswell, 2; San Luis Springs (=Lang's ranch, Grant County), 26 (including 17 odd skulls); San Pedro, 3; Santa Rosa, 7; Silver City, 5.

Texas: Alpine, 1; Altuda, 3; Belen (El Paso County), 4; El Paso, 4; Fort Davis, 1; Guadalupe Mountains (near), 1; Limpia Mountains (=Davis Mountains), 1; Pecos River, 1; Presidio County, 2; Sheffield, 3; Sierra Blanca, 5

CYNOMYS MEXICANUS MERRIAM.

MEXICAN PRAIRIE-DOG.

(Pl. I, fig. 3; Pl. II, figs. 3, 5; Pl. V, fig. 3; Pl. VII, fig. 2.)

1892. *Cynomys mexicanus* Merriam, Proc. Biol. Soc. Washington, VII, p. 157, July.

Type locality.—La Ventura, Coahuila, Mexico.

Geographic distribution.—Southeastern Coahuila and northern San Luis Potosi, Mexico. North to Saltillo; south to Vanegas.

Characters.—Size of *Cynomys ludovicianus*, but with longer tail; coloration above in summer coat less reddish, more grayish and vinaceous-buff, and much more heavily lined with black; coloration in winter still more hoary; black on terminal portion of tail much more extensive; teeth smaller.

¹ Collection Amer. Mus. Nat. Hist.

² Collection Mus. Comp. Zool.

³ Collection Field Mus. Nat. Hist.

⁴ Dr. Mearns tells me that a few of these specimens were actually collected on the Mexican side of the boundary line, in Sonora.

Color.—*Adult in fresh summer pelage:* Upperparts as in *C. ludovicianus*, but less reddish and much more grayish and vinaceous-buff; entirely black hairs more numerous, giving a much more grizzled general effect. Cinnamon areas less intense, more vinaceous. Tail above like rump for half its length; terminal half chiefly intense black, the black extending forward on sides of tail, leaving a lighter area midway; hairs of sides of pencil tipped with whitish, bases of all the pencil hairs almost pure white. *Adult in fresh winter pelage:* General appearance decidedly hoary or vinaceous-buff, the hairs with broad subterminal bands of whitish, which mix in the general effect with the narrow black tips and cinnamon undercolor. Individual hairs narrowly black at base, then broadly white and narrowly cinnamon, with subterminal band of buff and tip of blackish. The general effect is a glossy marbled vinaceous-buff, making the coat of this species by far the handsomest of all the prairie-dogs. *Juvenile* specimens are much paler than those of the corresponding age in *C. ludovicianus*, and rapidly change into a pelage like the fresh autumnal coat of adults.

Molt.—The molt of *C. mexicanus* is almost continuous and exceedingly complex, and without series of specimens collected in all the summer months it can not be worked out satisfactorily. With only March, April, July, and August skins before me I am inclined to believe that there are three complete renewals of the pelage of the body annually. Specimens collected in March have all renewed below, but are chiefly in the worn winter coat above, except in small areas forward, or even over the greater part of the head, shoulders, and withers, where renewal into a pelage much like the fresh winter coat has commenced. April skins from Saltillo are in a much-worn condition. The real summer pelage is certainly retained only a short time, as specimens collected at La Ventura from July 19 to August 5 exhibit every condition from what appears to be a worn, faded, left-over winter coat; through renewal into a short, stiff summer coat, without underfur; and the progress of the heavy winter pelage with a dense underfur over the posterior half of the back. Several specimens show all three of these pelages in definite areas on the body. Breeding females, as usual, are slow to renew, and the extreme state of wear is common until after the nursing season is over.

Skull and teeth.—Skull broad and angular, with wide-spreading zygomatic arches and sharply defined processes; in general effect more like skulls of *C. l. ludovicianus* from Montana and the Dakotas than like those of *C. l. arizonensis*; upper maxillary root of zygoma narrow along contact with ascending premaxillary bones and along ascending arm of jugal; face of upper incisors bright yellow. Differs from skulls of both *ludovicianus* and *arizonensis* in its much larger,

greatly inflated audital bullæ; teeth smaller; nasals broad and truncate posteriorly; triangular plate of jugal especially well developed and greatly produced at downward point; posterior border of inflected angle of mandible nearly at right angle with axis of jaw (in *ludovicianus* at an angle of about 45° with axis); the indistinct grooves along inner half of face of upper incisors usually more noticeable than in other forms.

Measurements.—Averages of 8 adult males from La Ventura, Coahuila: Total length, 416 (390–430); tail vertebrae, 102 (89–115); hind foot, 63 (59–68.5). *Skull:* Condylobasal length, 59.3 (58.4–60.5); zygomatic breadth, 44.6 (43–45.6); mastoid breadth, 28.6 (27.9–29.5); length of nasals, 23 (22.3–23.8); length of mandible, 43.8 (41.5–45.8); maxillary tooth row, alveoli, 15.9 (15.4–16.3). Females average slightly smaller. For detailed measurements of specimens, see page 35.

Type specimen.—No. ~~244233~~ U. S. National Museum, Biological Survey collection. Adult male, skin and skull (teeth moderately worn). Collected March 24, 1891, by C. P. Streater; original number 625. Except for the underparts, head, nape, and shoulders, which are in process of renewal, the specimen is in the worn, left-over winter pelage.

Remarks.—This is a well-marked species, easily distinguishable externally and by skull characters from the other forms of the genus. It is no more closely related to *Cynomys ludovicianus arizonensis* than to typical *ludovicianus*, and the southern subspecies *arizonensis* can not be considered as intermediate in the true sense between it and *ludovicianus*. In the excessive size of the audital bullæ, *mexicanus* is the extreme of the *arizonensis* type, but in other characteristics it more closely resembles *ludovicianus*, and is separated from both by a number of constant differences. It is completely isolated in its distribution from other forms of *Cynomys* and occupies only a limited range.

Specimens examined.—Total number, 42, as follows:

Coahuila: La Ventura, 37 (including type); Saltillo, 5.¹

Subgenus LEUCOCROSSUROMYS nov.

Characters.—Size slightly smaller than in the subgenus *Cynomys*, general appearance more spermophile-like; tail short, averaging less than one-fifth the total length, and tipped with white; mammae normally 10, rarely 12. *Skull:* General shape of occipital region, viewed from behind, elliptical-oval; jugal bone weak, thin, and flat, the outer surface at angle of ascending branch only very slightly thickened, the margin rounded, not triangular; maxillary root

¹ Collection Mus. Comp. Zool.

of zygoma correspondingly weak, the shelf and suprajugal arm not especially thickened. Teeth smaller than in the subgenus *Cynomys*, not so much expanded laterally.

Type species.—*Cynomys gunnisoni* (Baird).

Remarks.—The mountain-inhabiting group of prairie-dogs commonly known as the "white-tailed" species form a compact group clearly separated from the typical subgenus. It includes three well-

FIG. 2.—Distribution of subgenus *Leucocrossuromys*: 1, *Cynomys leucurus*; 2, *C. parvidens*; 3, *C. gunnisoni*; 4, *C. g. zunienste*.

marked species, *leucurus*, *parvidens*, and *gunnisoni*. In habits these are distinctly spermophile-like and in coloration they are peculiar. All have sharply marked areas of color above the eye and on the cheek, and have the tail tipped or bordered with white.

CYNOMYS LEUCURUS MERRIAM.

WHITE-TAILED PRAIRIE-DOG.

(Pl. III, fig. 1; Pl. IV, fig. 1; Pl. VII, fig. 5.)

1874. *Cynomys columbianus* Allen, Proc. Boston Soc. Nat. Hist., XVI, p. 294 (part; not *Arctomys columbianus* Ord, 1815).

1890. *Cynomys leucurus* Merriam, North Amer. Fauna No. 3, p. 59, September 11; North Amer. Fauna No. 4, p. 33, October 8.

1898. *Cynomys lewisii* Allen, Bull. Amer. Mus. Nat. Hist., X, p. 456, November 10 (not *Arctomys lewisii* Audubon and Bachman, 1854).

1904. *Cynomys lewisi* Trouessart, Cat. Mamm., suppl., p. 342.

Type locality.—Fort Bridger, Sweetwater County, Wyoming.

Geographic distribution.—Irregular areas in the mountainous parts of Montana, Wyoming, Utah, and Colorado. South from the Bighorn Basin, in southern Montana, across central and southwestern Wyoming into western Colorado and northeastern Utah; east to the Laramie Mountains, Wyoming, and into North Park, Colorado; south into the lower Gunnison Valley; west a few miles across the Bear River Divide into extreme northern Utah and, farther south, into the Green River valley. Chiefly Transition Zone.

Characters.—Size, largest of the subgenus, only slightly smaller than in *Cynomys ludovicianus*, but tail much shorter; general coloration less reddish, more grayish buff than in *C. parvidens*; differs from *C. gunnisoni* in having terminal half of tail entirely white; supraorbital spot and cheek dark brown.

Color.—*Adult in fresh summer pelage*: General color of upper parts yellowish buff, streaked with blackish. Nose yellowish buff, unmarked; spot above eye and large area on cheek dark blackish brown; ears pale cinnamon. Top of head to center of tail uniformly mixed pale cinnamon-buff or yellowish buff and blackish; the individual hairs black at bases, then light gray, then pale cinnamon, with subterminal band of buff and, in unworn condition, tip of blackish. Limbs, feet, and underparts clear buffy; nails blackish, tipped with light horn. Tail white, the hairs of proximal half above with bands of blackish, below pale cinnamon; distal half clear white. *Adult in fresh winter pelage*: Decidedly darker than in summer; more blackish above, especially posteriorly; the buff tints richer in tone and the dark areas on head considerably spread out, less sharply defined. There is a heavy underfur of grayish white, but the bases of all the hairs are clear black; sides of nose, chin, and throat white; nape and flanks lighter, more grayish, than back and rump. *Juvenile pelage*: Above grayish brown; below paler grayish; supraorbital spot of brownish black sharply marked. *Postjuvenile pelage*: Specimens in first fresh autumnal coat darker than adults, more reddish, and hairs of upperparts more heavily tipped with blackish.

Adults in the faded, left-over winter coat are often very yellowish above, with little or no black streaking from the hair tips. Many specimens in various stages of molt and renewal present strange combinations of color. Examples deeply stained by color from the soil are frequently noted.

Molt.—The two annual molts are greatly affected by altitude, with a consequent variation of a month or more in near-by localities. In Wyoming the molt is approximately as follows: Specimens taken

before May 10 are still in the old winter coat, with little evidence of molt. Skins collected from May 20 to June 1 have renewed over most of the underparts and somewhat on the head and shoulders. Numerous examples taken from June 1 to 10 are all in fresh coat except on the lower rump and tail. Skins collected July 15 to 30 are in full summer coat. By August 10 there is much evidence of wear over the forward half of body, and by early September the fall renewal has commenced. As in the case of *C. ludovicianus*, this progresses forward, and by September 25 to October 1 is complete.

Skull.—Larger than in *C. parvidens* or *C. gunnisoni*; otherwise much like skull of *parvidens* but with narrower interorbital region. Differs further from skull of *gunnisoni* in the less broadly spreading maxillary arm of zygoma, large and flat mastoids, larger audital bullæ, and less rounded inferior rim of angle of ascending branch of jugal; occiput viewed from behind broader and flatter.

Measurements.—Averages of 13 adult males from Wyoming: Total length, 358 (340–370); tail vertebræ, 57 (44–60); hind foot, 62 (60–65). *Skull*: Condylbasal length, 58.7 (56–61.3); zygomatic breadth, 43.8 (41.7–45.4); mastoid breadth, 29 (27.4–30); length of nasals, 22 (20.7–23.1); length of mandible, 43.1 (41.6–44.9); maxillary tooth row, alveoli, 15.7 (15.1–16). For detailed measurements of specimens see page 35.

Type specimen.—No. 186472, U. S. National Museum. Adult female, skin and skull (teeth moderately worn). Collected September 15, 1888, by Vernon Bailey; original number 224 (Merriam collection, skin 4668, skull 5319). In worn summer coat anteriorly and in fresh winter coat posteriorly.

Remarks.—In 1898, Dr. J. A. Allen¹ proposed that the name *Arctomys lewisii* of Audubon and Bachman be revived for this species. The specimen on which *Arctomys lewisii* was founded was recorded as No. 461 of the Zoological Society of London collection. In reply to my inquiry as to the possible existence of this type specimen in the British Museum, Mr. Oldfield Thomas wrote, under date of January 6, 1915, that the specimen is still preserved, is numbered 55.12.24.144 of the Museum register, but that it is a species of *Marmota*, and not of *Cynomys* as supposed by Dr. Allen.

The ranges of *Cynomys leucurus* and *C. gunnisoni* are not known actually to meet, but the ranges of *C. leucurus* and *C. ludovicianus* do meet, and for a short distance overlap, at several points in Montana and Wyoming. Both species are constantly enlarging their ranges, pushing out into new valleys, and consequently frequently find themselves in close proximity. Individuals of one species sometimes wander into villages of the other. In the Bighorn Basin, in Montana, Bailey found the species living in close proximity but always apart,

¹ Bull. Amer. Mus. Nat. Hist., X, p. 456, 1898.

although there was no natural barrier. Cary found them intermingling in colonies near Ishawooa, Wyoming, and Bailey captured a specimen of *leucurus* in a "town" of *ludovicianus* in Clark's Fork valley, Montana.

Except for what appears to be a slight average increase in size in the extreme southern portions of its range, the specimens of *C. leucurus* that have been assembled present a remarkably uniform appearance, both in coloration and in skull characters. There has been considerable misunderstanding in times past as to the western limit of distribution of this species. Many writers believed that its range extended to the Plains of the Columbia, and this mistake is one of the principal reasons for past confusion in nomenclature. As a matter of fact the animal is entirely unknown in Idaho, and crosses the Bear River Divide to the Wyoming-Utah boundary at only one place, so far as known. Regarding this western limit of distribution, Dr. Merriam has given me an interesting note. He tells of tracing the species, in 1913 and 1914, across the Utah-Wyoming boundary not far from Evanston, westward into Utah for a distance of six or seven miles where it stops abruptly.

Specimens examined.—Total number, 107, as follows:

Colorado: Beaver Creek to bridge over White River (Rio Blanco County), 2;^{1,2} Big Beaver Creek, 2;¹ Buford, 1; Canadian Creek, 2; Coyote Basin, 1;¹ Craig to Kelly's (Moffat County), 4;¹ Crawford, 1;¹ Douglas Spring, 1;¹ Escalante Hills, 1; Grand Junction, 17; Hayden, 1; Hebron, 1; Hell Creek (Jackson County), 1;¹ Meeker, 4; North Park, 1; Sand Creek to Snake River, 2;^{1,2}

Montana: Clark's Fork, 1; Sage Creek, 2.

Utah: Uinta Mountains, 1;³ Uncompahgre Indian Reservation, 3.²

Wyoming: Bear Creek, 1; Bighorn Basin, 1; Big Piney, 1; Big Sandy, 1; Bridger's Pass, 1; Cheyenne (west of), 2; Cumberland, 2; Deer Creek, 2; Dubois, 1; Fontenelle, 1; Fort Bridger, 10 (including type); Fort Steele, 2; Fossil, 1; Garrett, 2; Green River, 2; Independent Rock (25 miles southwest of), 1; Ishawooa, 1; Lander, 3; Laramie Mountains, 2; Lost Cabin, 1; Medicine Bow Mountains, 4; New Fork of Green River, 6; Otto, 1;² Pole Creek, 1; Shirley Mountains, 1; Spring Creek, 1; Sweetwater, 1; Woods Post Office, 5.

CYNOMYS PARVIDENS ALLEN.

UTAH PRAIRIE-DOG.

(Pl. III, fig. 2; Pl. IV, fig. 2; Pl. V, fig. 4; Pl. VII, fig. 4.)

1905. *Cynomys parvidens* Allen, Science Bull., Mus. Brooklyn Inst. Arts and Sci., I, no. 5, p. 119, March 31.

Type locality.—Buckskin Valley, Iron County, Utah.

Geographic distribution.—Mountain valleys of central Utah in the Sevier River region; south from Nephi to Iron and Garfield Counties.

¹ Collection E. R. Warren.

² Collection Amer. Mus. Nat. Hist.

³ Collection Mus. Comp. Zool.

Characters.—In general like *Cynomys leucurus* but smaller and with color of upperparts in summer and winter decidedly reddish or rich cinnamon, less buffy or grayish; tail with terminal half white, as in *leucurus*. Skull as in *leucurus*, but smaller, with greater interorbital breadth.

Color.—*Adult in late summer:* Entire upperparts of head and body cinnamon or dark buffy cinnamon, with very little admixture of buff or blackish hairs; the individual hairs blackish at bases, then narrowly pale buff, broadly cinnamon, and tipped with dark brown. Spot of black above eye very sharply marked; cheek patch of brown distinct; sides of nose pale buff; eye ring, ears, and limbs cinnamon; feet dark buff; lips and chin whitish; underparts buffy or cinnamon. Tail for half its length above concolor with rump; below cinnamon; terminal half all around white, without markings. *Adult in early winter pelage:* In general like summer coat but with dense underfur which is black at base, then light buff; upperparts rich cinnamon, the long hairs with broad bands of black and buff; sides of body yellowish buff, distinctly marked from color of back, and streaked by the bands of black on the longer overlying hairs.

Molt.—Owing to lack of material collected at certain seasons, the molt of *C. parvidens* is not well known. A single skin collected in the Sevier National Forest, May 19, is still entirely in the old winter coat. Specimens collected in late August and early September are mostly in rather worn summer coat, with little indication of molt. The tails are in freshly renewed pelage. Some specimens, taken the first week in September, are well advanced in renewal of winter pelage, with full underfur and long, fresh coat. Evidently the transition from summer to winter coat is gradual and obscure, without a distinct molt, much as in the animals of the northern part of the ranges of *C. ludovicianus* and *C. leucurus*. A series of skins collected in the Sevier National Forest, October 27 to November 3, are in full winter coat.

Skull and teeth.—Skull much like that of *C. leucurus*, but smaller and with greater interorbital breadth; postorbital processes less abruptly projecting. The teeth are not noticeably smaller.

Measurements.—Averages of 8 adult males from Utah: Total length, 338 (305–360); tail vertebrae, 43 (30–57); hind foot, 59 (55–61). *Skull:* Condylbasal length, 55.9 (53–57.9); zygomatic breadth, 42.2 (38.3–44.5); mastoid breadth, 28.6 (26.7–29.8); length of nasals, 21.8 (20.5–22.4); length of mandible, 42.3 (40.3–43.7); maxillary tooth row, alveoli, 15 (14.8–15.4). For detailed measurements of specimens see page 35.

Type specimen.—No. 28738, American Museum of Natural History, New York. Adult not sexed, but probably a male; skin and skull

(teeth moderately worn). Collected August 25, 1904, by George P. Engelhardt, on the Brooklyn Institute of Arts and Sciences expedition of 1904 (Museum of Brooklyn Institute No. 437). Skin in good condition, but not made up into a modern study specimen. It is in worn summer pelage, but with freshly renewed coat on the tail.

Remarks.—The relationship of this distinct species with *Cynomys leucurus* rather than with *C. gunnisoni* is clear. No evidence of intergradation with *leucurus* is found in the material of each form which I have examined, and every specimen of *C. parvidens* can instantly be distinguished by its marked reddish coloration. The superficial resemblance to certain specimens of *C. g. zuniensis* is striking, but the color of the tail and general skull characters are diagnostic. Specimens of this prairie-dog from many parts of its range and collected at all seasons, particularly early summer and late fall, are much needed.

Specimens examined.—Total number, 46, as follows:

Utah: Buckskin Valley, 18 (including the type¹ and paratype¹); Sevier National Forest, 28.

CYNOMYS GUNNISONI (BAIRD).

[Synonymy under subspecies.]

Characters.—Smaller than *Cynomys leucurus*; larger than *C. parvidens*; general coloration darker; tail gray, with white tip and white border on the terminal half (in *leucurus* and *parvidens* the terminal half of tail is entirely white). Skull smaller than in *leucurus*, larger than in *parvidens*; differs from both in more broadly spreading maxillary arm of zygoma; mastoids smaller and more obliquely placed, rather than in general occipital plane; audital bullæ smaller; occiput viewed from behind higher and less broadened; inferior rim of angle of ascending branch of jugal averaging less pointed, more rounded, with little trace of special lateral flattened surface.

Subspecies.—Two subspecies of *Cynomys gunnisoni* are here recognized. The typical race is confined to parts of Colorado and northern New Mexico, while a paler desert form, *C. g. zuniensis*, ranges from central New Mexico and southwestern Colorado to the San Francisco Mountain region and to the Hualpai Indian Reservation, Arizona.

CYNOMYS GUNNISONI GUNNISONI (BAIRD).

GUNNISON PRAIRIE-DOG.

(Pl. III, fig. 3; Pl. IV, fig. 3; Pl. V, fig. 5; Pl. VII, figs. 3, 6.)

1855. *Spermophilus gunnisoni* Baird, Proc. Acad. Nat. Sci. Philadelphia, VII, p. 334, April.

1857. *Cynomys gunnisonii* Baird, Gen. Rep. North Amer. Mamm., pp. xxv, 335.

1877. *Cynomys gunnisoni* Allen, Proc. Boston Soc. Nat. Hist., XVI, p. 294 (syn.)

¹ Collection Amer. Mus. Nat. Hist.

Type locality.—Cochetopa Pass, Saguache County, Colorado.

Geographic distribution.—Rocky Mountain region of central and central-southern Colorado and northern New Mexico. North into South Park, Colorado; east to El Paso, Fremont, and Huerfano Counties, Colorado; south into the Sangre de Cristo and Jemez Mountains, New Mexico; west to western Gunnison and Hinsdale Counties, Colorado, and to western Rio Arriba County, New Mexico. Chiefly Transition Zone, but also in Upper Sonoran and lower parts of Canadian Zone.

Characters.—Slightly smaller than *Cynomys gunnisoni zuniensis*, with smaller hind foot; coloration more buffy and blackish, less pinkish cinnamon and ochraceous. General coloration much as in *C. leucurus*, but averaging darker, and with only tip and border of terminal half of tail white.

Color.—*Adult in fresh summer pelage*: General coloration, except for tail, very much as in *C. leucurus*, but darker; averaging more drab, less yellowish, and the cheeks less sharply marked by dark patch. Tail for proximal half above concolor with back; distal half dark gray, bordered and tipped with white, and with subterminal band of blackish; underside of tail pale cinnamon, blending into white at tip, and edged with white. The fresh spring coat, which is glossy and much intermixed with blackish, rapidly turns a dull brown, the jet black hair tips having worn away or faded. *Winter pelage*, except for the tail, much like that of *leucurus*.

Molt.—There is a variation of about six weeks in the time of molt, according to altitude, but the average dates in Colorado are about as follows: Spring specimens are in the left-over winter coat or in various degrees of molt up to June 10 or July 1, when the pelage, with the exception of the tail, is entirely renewed. A few specimens have completely renewed the pelage on the tail as early as July 15, but numerous examples collected as late as August 10, still have the tail clothed in the old winter hair. The fresh coat rapidly loses its luster, and during the latter half of August the pelage becomes much worn over the anterior half of the body while the posterior half shows considerable influx of new hair. The molt is usually complete and the animal in full fresh coat again by September 15. Mid-October skins are in full long coat, with a dense underfur.

Skull.—Averaging smaller and of less robust build than skull of *C. g. zuniensis*. Readily distinguishable from skulls of *C. leucurus* by its considerably smaller size (see also specific skull characters, page 29).

Measurements.—Averages of 12 adult males from Saguache County and Fort Garland, Colorado: Total length, 340 (309–365); tail vertebrae, 53 (39–65); hind foot, 56 (52–59). *Skull*: Condylbasal length,

54.8 (52.4–56.5); zygomatic breadth, 42.5 (40.7–44.2); mastoid breadth, 27 (25.7–28.2); length of nasals, 20.5 (18.9–22.3); length of mandible, 41.9 (40.9–43.3); maxillary tooth row, alveoli, 14.5 (14–15). Females average slightly smaller. For detailed measurements of specimens see page 35.

Weight.—An adult male collected September 6 in the Jemez Mountains, New Mexico, weighed 1½ pounds.

Type specimen.—No. 1636, U. S. National Museum. Skull of young adult, not sexed (teeth little worn). Collected in September, 1853, by F. Kreutzfeldt; original number 22. The museum catalogue shows that the skin (No. 501) was formerly preserved in the collection, but it has been lost for many years.¹

Remarks.—So far as known the ranges of *Cynomys gunnisoni* and *C. leucurus* do not actually meet at any point, although, as stated by Cary,² they are separated by only a very narrow strip in the Cimarron region. Though so much alike in general characters the two species seem perfectly distinct, with no evidence of intergradation. While chiefly a Transition Zone form, *gunnisoni* is common and at home in the Upper Sonoran valleys within its range, as throughout suitable places in the upper Rio Grande and San Luis Valleys, Colorado. The range of *gunnisoni* nearly if not quite meets that of the black-tailed prairie-dog at several points in the eastern foothill region of Colorado. Prof. Lantz noted a colony of *gunnisoni* in South Park, Colorado, in which black and partly black individuals were common, a dozen or more melanistic specimens being seen.

This dark form of *C. gunnisoni* intergrades directly with the paler race, next described, of the more arid parts of New Mexico and Arizona, but the two subspecies are well marked and the area of intergradation is small.

Specimens examined.—Total number, 111, as follows:

Colorado: Antonito, 2; Cascade, 1; Castrel's Ranch (Park County), 2;³ Cochetopa Pass, 30 (including type skull); Colorado City (northwest of), 3;³ Colorado Springs (west of), 1; Divide (Teller County), 2;⁴ Florissant, 2;⁴ Fort Garland, 20 (including some older skins labeled "Fort Massachusetts"); Fremont County, 2;⁵ Head of Rio Grande, 1;⁶ Pike's Peak, 3; Poncha Pass, 2;⁴ Querida, 2;⁴ Saguache, 4; Salida, 5;⁴ Southfork, 2; Tarryall Creek (Park County), 1;⁴ Twin Creek, 1;³ Twin Lakes, 1; Wagon Wheel Gap, 12.^{3, 4, 6}

New Mexico: Costilla Pass, 3; Coyote Creek, 2; Gallinas Mountains, 1; Jemez Mountains, 1; La Jara Lake, 1; Moreno Valley, 2; Tres Piedras, 2.

¹ See Lyon and Osgood, Bull. 62, U. S. Nat. Mus., pp. 161–162, 1909.

² North Amer. Fauna No. 33, p. 95, 1911.

³ Collection Mus. Comp. Zool.

⁴ Collection E. R. Warren.

⁵ Collection Field Mus. Nat. Hist.

⁶ Collection Amer. Mus. Nat. Hist.

CYNOMYS GUNNISONI ZUNIENSIS SUBSP. NOV.

ZUNI PRAIRIE-DOG.

(Pl. III, fig. 4; Pl. IV, fig. 4; Pl. V, fig. 6.)

Type locality.—Wingate, McKinley County, New Mexico.

Geographic distribution.—Southwestern Colorado, extreme southeastern Utah, northwestern and west-central New Mexico, and north-central Arizona. North in western Colorado to Montrose County; northeast in New Mexico in the Rio Grande Valley to Espanola and east to Pecos and the Manzano Mountains; south on the west side of the Rio Grande Valley to Sierra and Socorro Counties, New Mexico; west in central Arizona to Prescott and the Hualpai Indian Reservation. Chiefly Upper Sonoran, but also in Transition Zone.

Characters.—Slightly larger than *Cynomys gunnisoni gunnisoni*, with larger hind foot and heavier skull. Coloration less buff and blackish, more pinkish cinnamon and ochraceous.

Color.—*Adult in fresh summer pelage*: General color of upperparts pale cinnamon, heavily streaked with lighter cinnamon-buff and blackish; individual hairs blackish at bases, then narrowly buff, then broadly cinnamon, with subterminal band of buff, and tip of blackish. Nose, lips, eye ring, and ears, buff; between eyes, between ears, and over nape darker brown, mixed with blackish; large area of blackish brown on cheek, and a smaller, sharply marked, blackish brown spot above eye; feet, limbs, and underparts pale cinnamon-buff. Basal half of tail above concolor with back; distal half mixed gray and white, bordered and tipped with clear white. The black tips to the hairs of the back rapidly wear away and the pelage becomes a uniform dull cinnamon, mixed with light buff. The distinctive markings of the head become more obscure. *Adult in fresh full winter pelage*: General color more grayish and buff, less cinnamon, than in summer, with greater admixture of blackish hairs on head and more of white and gray on body. General color of upperparts dark cream-buff, heavily mixed with pale buff and blackish, giving a decided grizzled appearance; underfur narrowly black, then broadly whitish; the long hairs with bands of black, pale cinnamon, and white, and narrow tips of black. Top of head and cheeks heavily intermixed with blackish, the spot over eye sometimes intense black; sides of nose, eye ring, ears, limbs, and sides of body rich cream-buff; lips and throat paler; underparts pale cinnamon. Tail above mixed gray and white, with a narrow sub-border of dark gray and border of clear white; below clear pale cinnamon, terminal half with faint sub-border of grayish brown and border and tip of creamy white. *Young* examples in the fresh postjuvenile pelage are more vinaceous or pinkish cinnamon than the corresponding pelage of *C. g. gunnisoni*.

Molt.—The molt of *C. g. zuniensis* is much more conspicuous than in the northern subspecies. May specimens are frequently in a very ragged state, with very little indication of renewal. Specimens in complete summer coat, including the tail, are rarely taken before July 1. The summer coat frequently is so rapidly worn and bleached as to change the entire appearance of the animal before there are any traces of the fall pelage. The new pelage of autumn first appears in adults over the posterior half of the body about September 1. No specimens in full winter coat have been seen which were killed earlier than November 1.

Skull.—As in *C. g. gunnisoni* but averaging larger and more heavily built.

Measurements.—Type specimen: Total length, 363; tail vertebræ, 53; hind foot, 60. *Skull:* Condylbasal length, 57.9; zygomatic breadth, 43.8; mastoid breadth, 29.1; length of nasals, 22.4; length of mandible, 43; maxillary tooth row, alveoli, 15.6. Averages of 9 specimens from Arizona: Total length, 355 (330–373); tail vertebræ, 62 (54–68); hind foot, 60 (57.5–62.5). *Skull:* Condylbasal length, 55.8 (51.9–57.8); zygomatic breadth, 43.5 (39.7–45.5); mastoid breadth, 27.4 (25.7–28.6); length of nasals, 21.9 (20.6–23.5); length of mandible, 42.7 (40.3–44.2); maxillary tooth row, alveoli, 14.5 (14.2–14.8). For detailed measurements of specimens see page 35.

Weight.—An adult male collected at Acoma, New Mexico, September 28, weighed 2 pounds.

Type specimen.—No. 137555, U. S. National Museum, Biological Survey collection. Adult male, skin and skull (teeth considerably worn). Collected at Wingate, New Mexico, June 26, 1905, by N. Hollister; original number 2374. Except on the tail the skin is in fresh summer pelage.

Remarks.—This well-marked-color subspecies of *Cynomys gunnisoni* occupies the arid southwestern part of the range of the species and is the common prairie-dog of large parts of New Mexico and Arizona. Material from southwestern Colorado is not plentiful, but the specimens examined indicate that the range of the pale form extends into that portion of the State. Specimens are wanting from the near-by section of Utah, where this form undoubtedly occurs. Specimens from Flagstaff, Arizona, and the vicinity of San Francisco Mountain in general are slightly darker, more drab, than skins from eastern Arizona and western and central New Mexico, but on the whole the form is very uniform in coloration throughout its range. While in the main an Upper Sonoran form, this prairie-dog is generally distributed in the Transition Zone parks of numerous mountain

ranges. In the Bear Spring Mountains, New Mexico, in 1905, I saw one nearly pure-white animal of this species. Bailey reports finding a mixed colony of individuals of this form and of *C. ludovicianus* near Pecos, New Mexico, and he captured specimens of each form at San Pedro, but the ranges of the two species rarely overlap.

Specimens examined.—Total number, 96, as follows:

Arizona: Agua Fria, 4;¹ Aubrey Valley, 1; Clarks Valley, Mogollon Mountains, 2;¹ Flagstaff, 7; Keams Canyon, 1; Kendrick Park, 4; Little Spring, 6; Mormon Lake, 5; San Francisco Mountain, 7; Spaulding's Ranch, Agua Fria Valley, 1;¹ Springerville, 13, Winslow, 2.

Colorado: Bedrock, 2;² Cortez, 1;¹ Coventry, 1.²

New Mexico: Acoma, 1; Albuquerque, 7; Chusca Mountains, 2; Espanola, 2; Fairview, 2; Fruitland, 1; Liberty, 1; Magdalena, 3; Manzano Mountains, 1; Ojo Caliente, 2; Pecos, 3; Rio Alamosa, 3; San Augustine Plain, 2; San Mateo Mountains (Socorro County), 1; San Pedro, 1; San Rafael, 1; Thoreau, 2; Wingate, 3; Zuni Mountains, 1.

TABLES OF MEASUREMENTS.

Adult male specimens of Cynomys.

Species and locality.	Museum number.	Skin.			Skull.				Condition of molar teeth.
		Total length.	Tail vertebrae.	Hind foot.	Condylolbasal length.	Zygomatic breadth.	Mandible.	Maxillary tooth row.	
<i>C. ludovicianus ludovicianus.</i>									
Montana:									
Shelby Junction.....	66690	375	72	55	59.1	44.7	45.5	16.2	Moderately worn.
Do.....	66691	374	85	60	59.0	44.4	45.3	15.9	Do.
Darnall's Ranch.....	169447	410	95	65	62.5	46.6	47.7	16.9	Do.
North Dakota: Medora.....	161314	405	96	64	61.4	45.5	45.9	16.9	Much worn.
South Dakota:									
Fort Pierre.....	191426	373	76	62	61.0	45.2	45.8	16.8	Considerably worn.
Buffalo Gap.....	191428	384	90	63	60.8	43.8	46.4	16.8	Moderately worn.
Do.....	191429	360	84	61	59.5	42.9	45.0	16.6	Do.
Wyoming:									
Ishawooa.....	169493	396	93	64	60.6	45.2	45.8	17.0	Do.
Newcastle.....	65894	390	79	62	60.9	44.2	46.7	16.8	Do.
Nebraska:									
Kennedy.....	191427	392	78	57	61.4	44.8	46.1	16.8	Do.
Do.....	18678	390	92	63	59.2	45.7	44.8	16.5	Do.
Alma.....	110770	409	89	65	62.1	47.0	48.1	17.2	Do.
Colorado:									
Loveland.....	69521	370	82	62	60.2	45.5	46.0	17.1	Considerably worn.
Olney.....	69952	379	83	61	59.6	44.1	45.5	17.0	Moderately worn.
Do.....	70020	355	82	61	57.2	43.1	43.9	16.9	Do.
Kansas: Pendennis.....	87627	371	81	62	60.3	47.2	46.2	16.9	Considerably worn.
Oklahoma:									
Mount Scott.....	132440	375	115	63	61.5	44.2	47.2	17.3	Moderately worn.
Do.....	132441	376	104	63	59.6	44.8	45.9	17.0	Do.
Texas:									
Vernon.....	64783	365	82	61	60.6	44.4	46.4	16.8	Considerably worn.
Do.....	64784	413	93	60	63.6	48.1	47.3	16.6	Do.
Henrietta.....	64780	386	87	66	62.0	45.3	48.4	17.0	Moderately worn.

¹ Collection Amer. Mus. Nat. Hist.

² Collection E. R. Warren.

Adult male specimens of *Cynomys*—Continued.

Species and locality.	Museum number.	Skin.			Skull.				Condition of molar teeth.
		Total length.	Tail vertebrae.	Hind foot.	Condylolbasal length.	Zygomatic breadth.	Mandible.	Maxillary tooth row.	
<i>C. ludovicianus arizonensis.</i>									
Texas:									
Altuda.....	23183	398	96	64	61.5	45.0	46.0	16.7	Moderately worn.
Do.....	23184	400	92	62	60.8	46.2	47.5	16.7	Do.
Do.....	23396	404	89	67	61.7	46.4	47.4	16.8	Much worn.
New Mexico:									
Silver City.....	51279	380	79	61	60.9	47.0	45.0	16.1	Do.
Dog Spring.....	20380	412	94	66	62.2	44.3	45.7	16.9	Do.
Animas Valley.....	58920	395	83	64	59.9	44.5	44.2	16.0	Do.
Chihuahua: Sierra en Media.....	99362	400	80	65	62.9	45.0	46.0	16.6	Do.
Arizona:									
Fort Huachuca.....	34029	412	97	60	61.8	45.2	46.8	16.6	Considerably worn
Do.....	34030	410	100	64	62.8	45.0	44.9	16.1	Much worn.
Do.....	34031	400	93	62	62.3	44.1	45.9	16.5	Do.
<i>C. mericanus.</i>									
Coahuila:									
La Ventura.....	126423	419	107	63	59.2	45.6	43.9	16.3	Moderately worn.
Do.....	26426	430	106	64	59.9	45.0	43.9	15.5	Do.
Do.....	26428	415	103	61	53.5	44.7	44.0	15.9	Do.
Do.....	26429	415	102	59	58.5	43.0	42.8	15.8	Do.
Do.....	79546	415	115	64	58.7	44.4	45.8	15.4	Do.
<i>C. leucurus.</i>									
Wyoming:									
Ishawa.....	169336	370	60	60	60.3	45.4	44.3	15.6	Much worn.
Spring Creek.....	56002	363	60	60	58.7	43.6	43.0	15.4	Moderately worn.
Fontenelle.....	147187	370	48	62	61.3	45.0	44.9	16.0	Much worn.
Cumberland.....	179515	368	60	63	59.9	44.4	44.6	15.9	Do.
Fort Steele.....	171457	367	52	61	59.2	44.9	44.1	15.3	Do.
Colorado:									
Escalante Hills.....	148145	382	65	67	59.4	44.8	45.8	16.1	Moderately worn.
Grand Junction.....	54111	361	55	64	59.9	44.7	44.0	15.6	Considerably worn.
<i>C. parvidens.</i>									
Utah:									
Buckskin Valley.....	158985	337	57	60	54.5	40.7	42.2	14.9	Moderately worn.
Do.....	158992	326	57	59	54.1	40.7	41.8	14.8	Do.
Do.....	158993	305	52	57	53.0	38.3	40.3	14.8	Little worn.
Sevier National Forest.....	206323	335	31	55	57.9	43.9	42.2	15.0	Moderately worn.
Do.....	206337	354	49	60	57.6	43.2	42.9	15.2	Do.
<i>C. gunnisoni gunnisoni.</i>									
Colorado:									
Cochetopa Pass.....	35845	343	52	53	53.8	40.7	41.1	14.7	Moderately worn.
Do.....	35849	323	41	52	52.4	41.5	40.9	14.0	Considerably worn.
Do.....	35854	330	45	56	54.9	42.6	42.5	14.7	Moderately worn.
Do.....	35855	332	45	56	54.9	42.5	42.5	14.6	Do.
Do.....	35856	331	52	55	54.4	42.7	41.4	15.0	Considerably worn.
Mew Mexico: La Jara Lake.....	134908	328	68	54	53.4	41.3	40.0	14.8	Do.
<i>C. gunnisoni zunienensis.</i>									
New Mexico:									
Thoreau.....	160752	340	60	57	53.8	41.1	41.6	14.5	Considerably worn.
Wingate.....	1137555	303	53	60	57.9	43.8	43.0	15.6	Much worn.
Acoma.....	145290	300	60	62	55.9	43.5	44.5	15.4	Moderately worn.
Magdalena.....	167574	350	60	61	54.7	43.7	42.0	15.0	Much worn.
Ojo Caliente.....	167021	350	49	60	57.6	43.0	42.2	15.1	Considerably worn.
Arizona:									
Springerville.....	24653	355	63	60	55.2	43.4	42.8	14.7	Moderately worn.
Do.....	24654	357	70	60	55.0	43.2	41.7	14.6	Do.
Flagstaff.....	201638	356	64	59	56.4	44.0	42.7	14.3	Much worn.
Kendrick Park.....	202942	373	68	60	57.8	44.5	44.2	14.8	Do.
Little Spring.....	202556	363	54	58	55.9	43.0	42.9	14.4	Considerably worn.

¹ Type.

Averages of adult male specimens of Cynomys.

Species and locality.	Number of specimens averaged.	Skin.			Skull.					
		Total length.	Tail vertebrae.	Hind foot.	Condylolbasal length.	Zygomatic breadth.	Maxilla breadth.	Nasals.	Mandible.	Maxillary tooth row.
<i>C. ludovicianus ludovicianus.</i>										
Montana.....	6	383	84	61	60.4	45.1	28.0	22.8	43.8	16.4
North Dakota.....	1	405	96	64	61.4	45.5	28.1	23.1	45.9	16.9
South Dakota.....	13	388	86	62	59.8	45.0	28.5	23.8	45.9	16.6
Wyoming.....	4	393	86	63	60.7	45.3	28.3	24.0	46.2	16.8
Nebraska.....	3	397	86	62	60.9	45.8	28.3	23.4	46.3	16.8
Colorado.....	4	364	82	62	58.9	44.1	27.8	23.1	45.1	16.9
Kansas.....	10	380	88	62	59.7	44.7	27.8	23.1	45.5	16.5
Oklahoma.....	2	376	110	63	60.6	44.5	28.3	23.5	46.6	17.2
Texas.....	7	392	88	62	61.5	45.5	29.0	24.5	46.9	16.7
<i>C. ludovicianus arizonensis.</i>										
Texas.....	7	395	88	64	60.3	44.7	27.7	24.3	46.5	16.6
New Mexico.....	18	381	84	62	60.1	44.3	28.0	23.8	45.0	16.2
Arizona.....	19	388	89	62	60.0	44.0	27.3	24.0	45.2	16.2
Chihuahua.....	1	400	80	65	62.9	45.0	29.1	23.5	46.0	16.6
<i>C. mexicanus.</i>										
Coahuila.....	8	416	102	63	59.3	44.6	28.6	23.0	43.8	15.9
<i>C. leucurus.</i>										
Wyoming.....	13	358	57	62	58.7	43.8	24.0	22.0	43.1	15.7
Colorado.....	6	368	56	63	60.0	44.6	29.8	22.6	45.0	15.6
<i>C. parvidens.</i>										
Utah.....	8	338	43	59	55.9	42.2	28.6	21.8	42.3	15.0
<i>C. gunnisoni gunnisoni.</i>										
Colorado.....	12	340	53	56	54.8	42.5	27.0	23.5	41.9	14.5
New Mexico.....	1	328	68	54	53.4	41.3	25.8	21.5	40.0	14.8
<i>C. gunnisoni zuniensis.</i>										
New Mexico and eastern Arizona.....	17	344	60	58	55.0	41.9	27.4	21.5	42.3	14.8
Arizona: San Francisco Mountain.....	9	355	62	60	55.8	43.5	27.4	21.9	42.7	14.5

PLATE I.

(About natural size.)

Figs. 1 and 4. *Cynomys ludovicianus ludovicianus* (Ord). ♂ ad. Glendive, Montana. (No. 191411, U. S. Nat. Mus.)

Figs. 2 and 5. *Cynomys ludovicianus arizonensis* Mearns. ♂ ad. San Pedro River, Arizona. (No. 35873, U. S. Nat. Mus.)

Fig. 3. *Cynomys mexicanus* Merriam. ♂ ad. La Ventura, Coahuila, Mexico. (No. 79550, U. S. Nat. Mus., Biological Survey collection.)

SKULLS OF CYNOMYS.

- 1, 4. *C. l. ludovicianus*.
- 2, 5. *C. l. arizonensis*.
- 3. *C. mexicanus*.

PLATE II.

(About natural size.)

- Fig. 1. *Cynomys ludovicianus ludovicianus* (Ord). ♂ ad. Glendive, Montana. (No. 191411, U. S. Nat. Mus.)
- Fig. 2. *Cynomys ludovicianus arizonensis* Mearns. ♂ ad. San Pedro River, Arizona. (No. 35873, U. S. Nat. Mus.)
- Fig. 3. *Cynomys mexicanus* Merriam. ♂ ad. La Ventura, Coahuila, Mexico. (No. 79550, U. S. Nat. Mus., Biological Survey collection.)
- Fig. 4. *Cynomys ludovicianus ludovicianus* (Ord). ♀ ad. Glendive, Montana. (No. 191407, U. S. Nat. Mus.)
- Fig. 5. *Cynomys mexicanus* Merriam. ♀ ad. La Ventura, Coahuila, Mexico. (No. 79554, U. S. Nat. Mus., Biological Survey collection.)

SKULLS OF CYNOMYS.

- 1, 4. *C. l. ludovicianus*.
2. *C. l. arizonensis*.
3, 5. *C. mexicanus*.

PLATE III.

(About natural size.)

- Fig. 1. *Cynomys leucurus* Merriam. ♂ ad. Cumberland, Wyoming. (No. 179515, U. S. Nat. Mus., Biological Survey collection.)
- Fig. 2. *Cynomys parvidens* Allen. ♀ ad. Buckskin Valley, Utah. (No. 158994, U. S. Nat. Mus., Biological Survey collection.)
- Fig. 3. *Cynomys gunnisoni gunnisoni* (Baird). ♂ ad. Saguache, Colorado. (No. 176695, U. S. Nat. Mus., Biological Survey collection.)
- Fig. 4. *Cynomys gunnisoni zuniensis* Hollister. ♂ ad. Wingate, New Mexico. (Type, No. 137555, U. S. Nat. Mus., Biological Survey collection.)

SKULLS OF CYNOMYS.

B2114-129

1. *C. leucurus*.
2. *C. parvidens*.

3. *C. g. gunnisoni*.
4. *C. g. zuniensis*.

PLATE IV.

(About natural size.)

- Fig. 1. *Cynomys leucurus* Merriam. ♂ ad. Cumberland, Wyoming. (No. 179515, U. S. Nat. Mus., Biological Survey collection.)
- Fig. 2. *Cynomys parvidens* Allen. ♀ ad. Buckskin Valley, Utah. (No. 158994, U. S. Nat. Mus., Biological Survey collection.)
- Fig. 3. *Cynomys gunnisoni gunnisoni* (Baird). ♂ ad. Saguache, Colorado. (No. 176695, U. S. Nat. Mus., Biological Survey collection.)
- Fig. 4. *Cynomys gunnisoni zuniensis* Hollister. ♂ ad. Wingate, New Mexico. (Type, No. 137555, U. S. Nat. Mus., Biological Survey collection.)

SKULLS OF CYNOMYS.

B2115-129

1. *C. leucurus*.
2. *C. parvidens*.

3. *C. g. gunnisoni*.
4. *C. g. zuniensis*.

PLATE V.

(About natural size.)

- Fig 1. *Cynomys ludovicianus ludovicianus* (Ord). ♂ ad. Glendive, Montana. (No. 191411, U. S. Nat. Mus., Merriam collection, original number, 4454.)
- Fig. 2. *Cynomys ludovicianus arizonensis* Mearns. ♂ ad. San Pedro River, Arizona. (No. 35873, U. S. Nat. Mus.)
- Fig. 3. *Cynomys mexicanus* Merriam. ♂ ad. La Ventura, Coahuila, Mexico. No. 79550, U. S. Nat. Mus., Biological Survey collection.)
- Fig. 4. *Cynomys parvidens* Allen. ♀ ad. Buckskin Valley, Utah. (No. 158994, U. S. Nat. Mus., Biological Survey collection.)
- Fig. 5. *Cynomys gunnisoni gunnisoni* (Baird). ♂ ad. Saguache, Colorado. (No. 176695, U. S. Nat. Mus., Biological Survey collection.)
- Fig. 6. *Cynomys gunnisoni zuniensis* Hollister. ♂ ad. Wingate, New Mexico. (Type, No. 137555, U. S. Nat. Mus., Biological Suvery collection.)

82116-123

SKULLS OF CYNOMYS.

1. *C. l. ludovicianus*, 2. *C. l. arizonensis*, 3. *C. mexicanus*, 4. *C. parvidens*, 5. *C. g. gunnisoni*, 6. *C. g. zuniensis*.

PLATE VI.

(About natural size.)

Figs. 1 and 2. *Cynomys ludovicianus ludovicianus* (Ord). ♂ ad. Mason, Texas.
(No. 191388, U. S. Nat. Mus.)

Figs. 3 and 4. *Cynomys ludovicianus ludovicianus* (Ord). ♂ ad. Mason, Texas.
(No. 191389, U. S. Nat. Mus.)

Selected skulls of same sex and age from one locality; to show the great individual variation frequently noted in skulls of *Cynomys*.

SKULLS OF *CYNOMYS LUDOVICIANUS LUDOVICIANUS*.

PLATE VII.

(About natural size.)

- Fig. 1. *Cynomys ludovicianus ludovicianus* (Ord), left mandibular ramus. ♀ ad. Glendive, Montana. (No. 191407, U. S. Nat. Mus.)
- Fig. 2. *Cynomys mexicanus* Merriam, left mandibular ramus. ♀ ad. La Ventura, Coahuila, Mexico. (No. 79554, U. S. Nat. Mus., Biological Survey collection.)
- Fig. 3. *Cynomys gunnisoni gunnisoni* (Baird), left mandibular ramus. ♂ ad. Saguache, Colorado. (No. 176695, U. S. Nat. Mus., Biological Survey collection.)
- Fig. 4. *Cynomys parvidens* Allen. ♀ ad. Buckskin Valley, Utah. (No. 158994, U. S. Nat. Mus., Biological Survey collection.)
- Fig. 5. *Cynomys leucurus* Merriam. ♂ ad. Cumberland, Wyoming. (No. 179515, U. S. Nat. Mus., Biological Survey collection.)
- Fig. 6. *Cynomys gunnisoni gunnisoni* (Baird). ♂ ad. Saguache, Colorado. (No. 176695, U. S. Nat. Mus., Biological Survey collection.)
- Figs. 7 and 8. *Cynomys ludovicianus ludovicianus* (Ord). ♀ juv., showing milk premolars and unworn crowns of molars. Ishawooa, Wyoming. (No. 169674, U. S. Nat. Mus., Biological Survey collection.)

SKULLS OF CYNOMYS.

B2118-120

- 1, 7, 8. *C. l. ludovicianus*.
 2. *C. mexicanus*.
 3, 6. *C. g. gunnisoni*.

4. *C. parvidens*.
 5. *C. leucurus*.

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[New names in **bold-face type**; synonyms in *italics*.]

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