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Distribution and Taxonomy of the Pocket Gopher *Thomomys Bottae* in Bernalillo County, New Mexico

James Lester Sands

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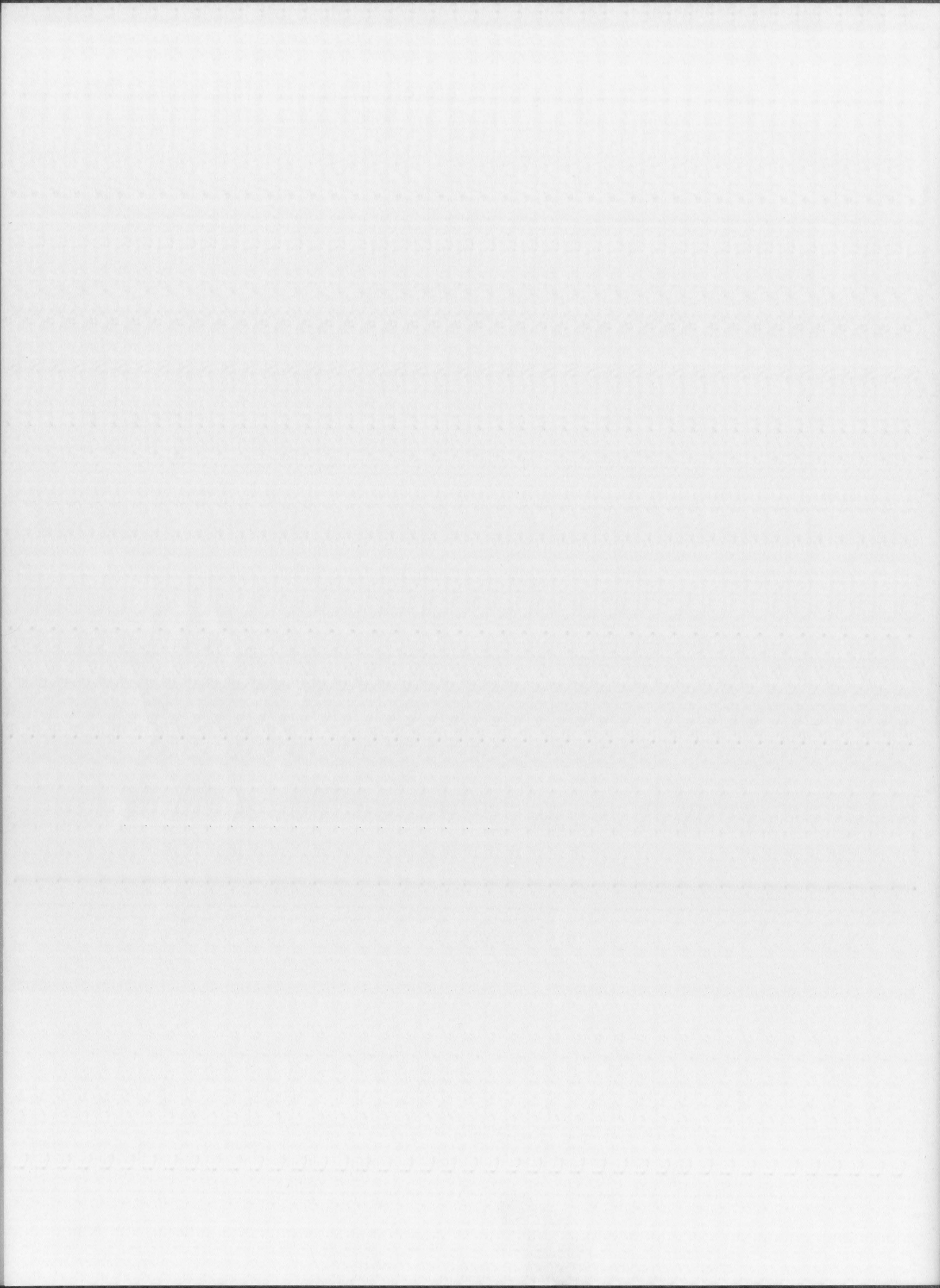
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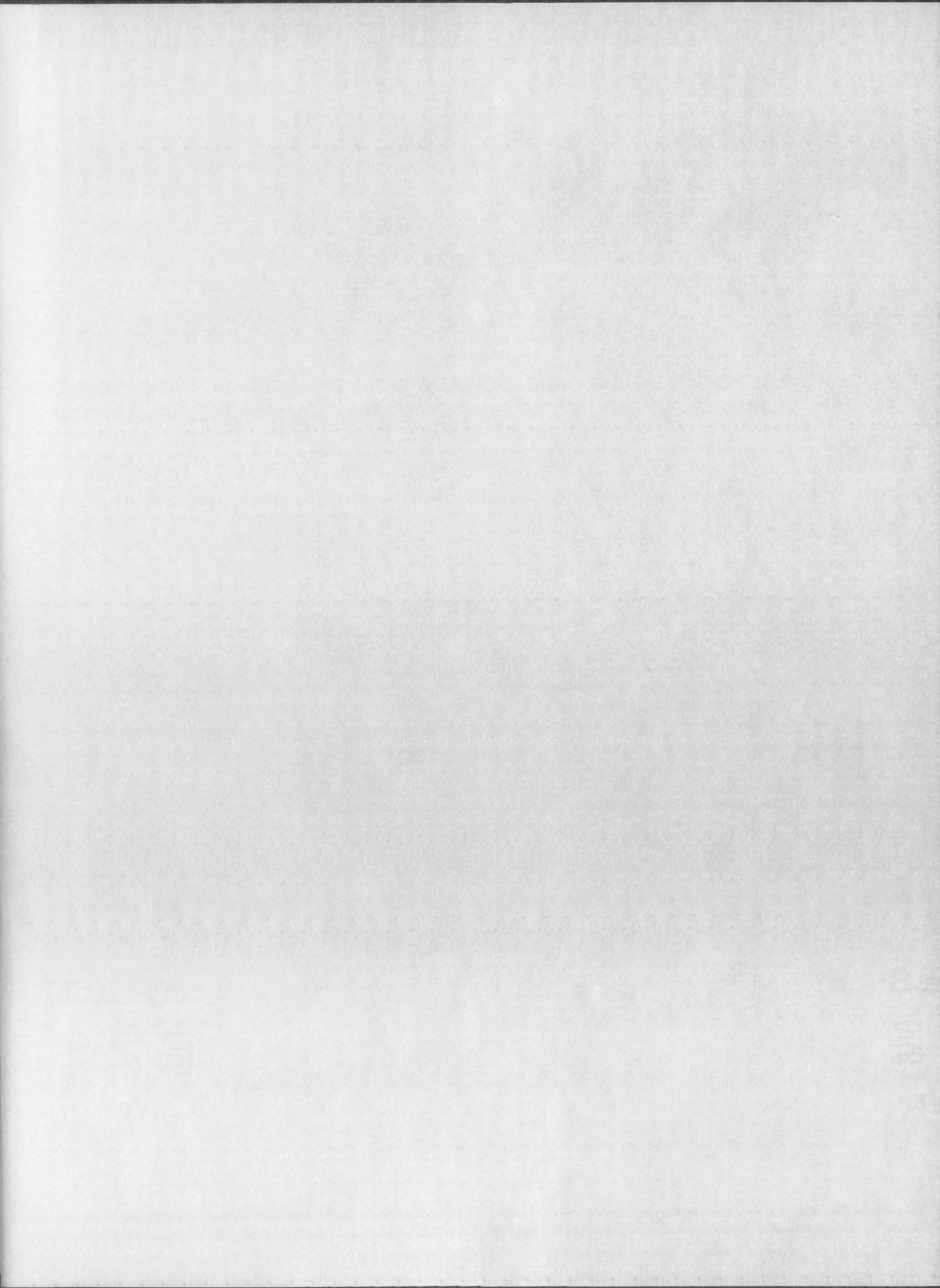
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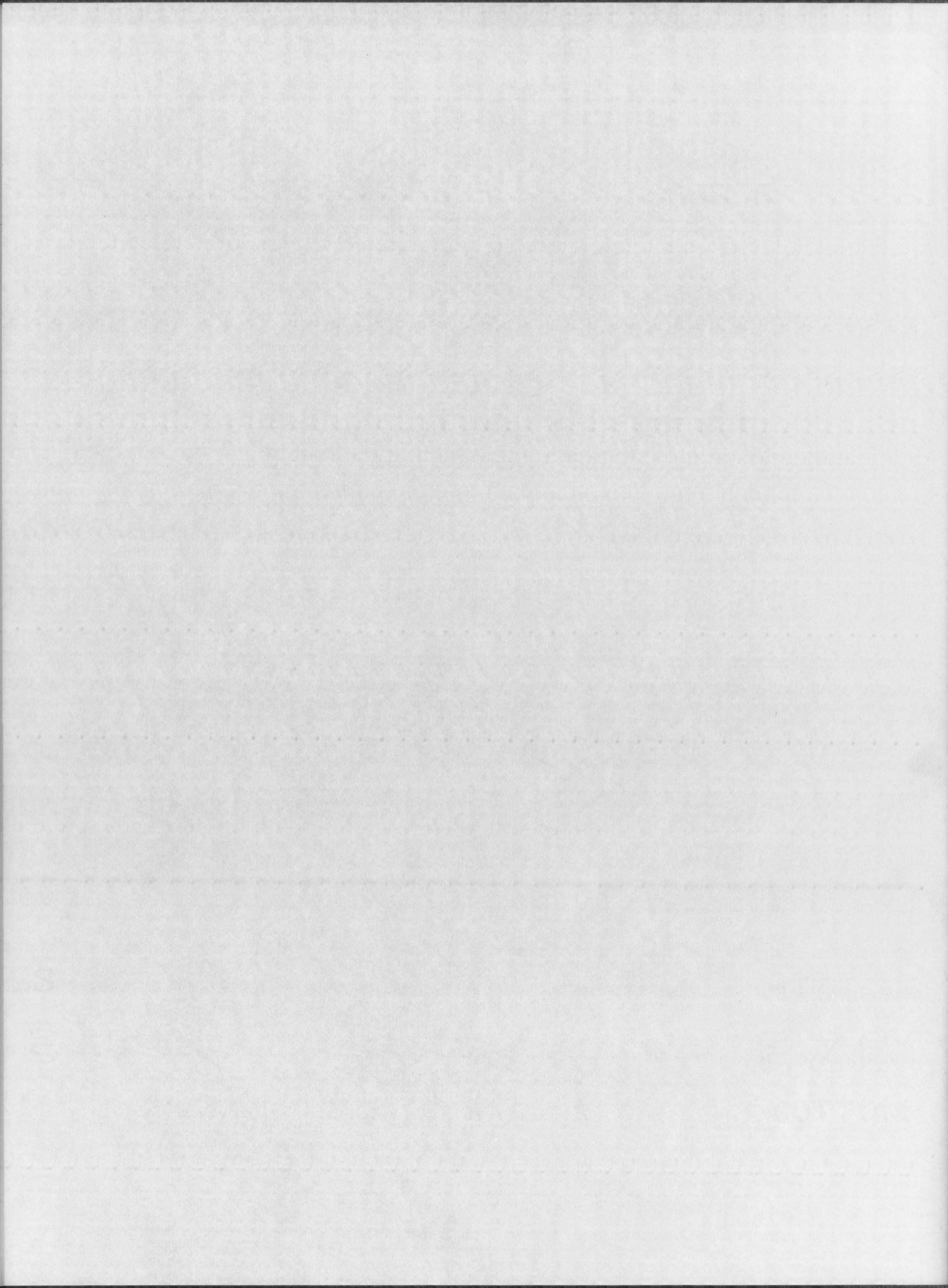
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DISTRIBUTION AND TAXONOMY OF THE POCKET GOPHER
THOMOMYS BOTTAE IN BERNALILLO COUNTY, NEW MEXICO

By

James Lester Sands

A Thesis

Submitted in Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Biology

The University of New Mexico

1956



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Requirements for the system of

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The National Bureau of Standards

This thesis, directed and approved by the candidate's committee, has been accepted by the Graduate Committee of the University of New Mexico in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

E. H. Casteller
DEAN

October 15, 1956
DATE

Thesis committee

James Findley
CHAIRMAN
William V. Koster
W. C. Ervold

This thesis declared and approved by the
university has been accepted by the Graduate
University of New Mexico in partial fulfillment
toward the degree of

MASTER OF SCIENCE

Elizabeth A. ...

October 5, 1950

This committee

James H. ...
William H. ...
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ACKNOWLEDGMENTS

This study was conducted under the guidance of Dr. James S. Findley, to whom the writer is grateful for his many helpful suggestions. I am also grateful to Robert J. Russell, Museum of National History, University of Kansas, for suggesting cranial measurements used in this work. The writer is also indebted to Viola Schantz, United States National Museum, Washington, D. C., and Professor Emmet T. Hooper, University of Michigan, Museum of Zoology, for examination of specimens.

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CHAPTER I

INTRODUCTION

STATEMENT OF THE PROBLEM

The purposes of this study are to determine what kinds of pocket gophers of the genus Thomomys occur in Bernalillo County, New Mexico, and to reveal the relationship between the pocket gophers occupying the Sandia Mountains and those occurring in the valley of the Rio Grande.

HISTORY OF KNOWLEDGE OF THOMOMYS BOTTAE IN BERNALILLO COUNTY

Few comparative studies have been made of the pocket gophers of Bernalillo County. Indeed, little work, with the exception of the descriptions of new kinds has been done on pocket gophers in the state of New Mexico. Many of the early workers who came to New Mexico passed through Bernalillo County. Collections of Thomomys were made by J. A. Loring in 1894, at Bernalillo, Albuquerque, and Belen, by James H. Gaut in 1892-93, in the Manzano Mountains, and by Vernon Bailey in 1889, at Albuquerque.

Bailey (1915, p.82) referred pocket gophers from the Manzano Mountains to Thomomys fulvus fulvus Woodhouse. Since Goldman (1931, p.416) showed that T. fulvus and T. perpallidus were conspecific, and Hall (1932, p.325) demonstrated intergradation between T. perpallidus and T. bottae,

all pocket gophers assigned to the T. fulvus and T. perpallidus groups have usually been known as T. bottae.

Kelson, (1951, p.64) in an examination of the relationships of the subspecies of Thomomys bottae in New Mexico, concluded that pocket gophers formerly assigned to T. b. fulvus from east of the Rio Grande were sufficiently distinct to warrant recognition as two new subspecies, Thomomys bottae actuosus and Thomomys bottae cultellus. The pocket gophers of the Sandia and Manzano Mountains, according to Kelson (op. cit.), fall within the geographic range of T. b. actuosus. Kelson's map showing the geographic distribution of the subspecies of Thomomys bottae in New Mexico, indicates a wide hiatus between T. b. actuosus and T. b. connectens. This hiatus is non-existent as will be pointed out later.

Pocket gophers inhabiting the valley of the Rio Grande near Albuquerque, were referred by Bailey (op. cit.) to Thomomys perpallidus aureus Allen. Hall (1936, p.296) described specimens from the Albuquerque area as a new subspecies Thomomys bottae connectens. Hooper (1940, p.4) described Thomomys bottae paguatae from Cebolleta, Valencia County, New Mexico. He states that T. b. paguatae is known only from the vicinity of Cebolleta, but probably ranges southeastwardly toward the Rio Puerco. This form might thus be expected to occur in Bernalillo County.

EXHIBIT
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MATERIALS AND METHODS

Approximately 145 museum study skins and skulls were used. Most of these were obtained by the author and are preserved in the University of New Mexico Collection of Vertebrates, but some specimens were borrowed from the U. S. National Museum, and the University of Michigan Museum of Zoology.

Specimens were grouped according to locality, age, and sex. Because sex plays a primary role in variation among pocket gophers, and because female gophers are more often obtained than males, only mature female gophers were used in comparisons to reveal geographic variation.

External measurements used were total length, tail length, and length of hindfoot. Cranial measurements chosen to show the differences in size and proportions are as follows:

Condylbasal length -- From anteriormost projection of the premaxillae to posteriormost projection of the occipital condyles.

Basilar length -- From the anteroventral lip of the foramen magnum to the posterior margin of the alveolus of the incisor.

Breadth across zygomata -- The distance between the most lateral points of the zygomatic arches.

Breadth of rostrum -- The greatest breadth, usually taken at the level of the two ridges serving as attachments for the masseter muscles.

Alveolar length of maxillary tooth-row -- The length from the posterior margin of the alveolus of the third molar to the anterior margin of the alveolus of the premolar.

Palato-frontal depth -- From the palate between the molariform teeth to the frontal directly above.

Palatal length -- From the posterior margin of the palatal bone at the emargination lateral to the palatal spine to the anteriormost extension of the premaxilla just anterior to the incisors.

Length of nasals -- The greatest external length.

Breadth of braincase -- The breadth across the braincase at the squamosal notches just above the external auditory meatae.

Mastoid breadth -- The greatest breadth of the skull across the mastoid processes.

Length of rostrum -- The length from the lateral margin of the lacrimal (in dorsal aspect) to the tip of the nasal that is on the same side of the skull.

Least interorbital constriction -- The least distance across the top of the skull between the eye sockets.

Length of skull exclusive of rostrum and occiput -- Measured along the mid dorsal line of the skull from the anteriormost point of frontals to the posterior border of the interparietal.

Breadth of nasals anteriorly -- The greatest combined breadth of both nasals.

Breadth of nasals posteriorly -- The breadth of both nasals taken at the point of their farthest posterior extensions.

In descriptions of color, capitalized terms, refer to those in Maerz and Paul (1930); those capitalized and in parentheses refer to those in Ridgway (1912). Those included in quotations are also from Ridgway. Color terms not capitalized do not refer to any definite standard of color nomenclature.

Unless otherwise indicated, specimens are in the University of New Mexico Collection of Vertebrates. Those in the United States Biological Surveys Collection are identified by the initials BS, while those in the University of Michigan Museum of Zoology by the initials UM.

A hybrid index, taken from Hubbs, Hubbs, and Johnson (1943, p.6), was used as a size index in figure 2. Condylobasal length was arbitrarily used in figures 3 and 4 as a cranial size index and is comparable to other cranial measurements.

In lists of specimens examined, localities are arranged first by state. These are listed from north to south. If two states are at the same latitude, the westernmost is listed first. Within each state, localities are grouped by counties, which are listed in the same geographic sequence

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as the states. Within each county, localities are arranged from north to south. If two counties are at the same latitude, the westernmost is listed first. Localities underlined are not represented in figure 1 to avoid crowding.

The synonymy of each subspecies includes names applied to Thomomys from Bernalillo County. Names of plants follow Kearney and Peebles (1951), except those of the grasses which follow Rominger (1955).

Data on the relationship of life zones and vegetation to climate and elevation follows Baker (1944, pp.223-254).

as the station at 11:15 a.m. on Monday, January 1, 1951.

From 11:15 a.m. to 1:00 p.m. the weather was clear and sunny.

At 1:00 p.m. the temperature was 65°F. and the wind was light.

At 2:00 p.m. the temperature was 68°F. and the wind was light.

The sky was clear and blue with a few wispy clouds.

At 3:00 p.m. the temperature was 70°F. and the wind was light.

At 4:00 p.m. the temperature was 72°F. and the wind was light.

At 5:00 p.m. the temperature was 74°F. and the wind was light.

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At 1:00 a.m. the temperature was 90°F. and the wind was light.

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At 10:00 a.m. the temperature was 108°F. and the wind was light.

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At 12:00 p.m. the temperature was 112°F. and the wind was light.

At 1:00 p.m. the temperature was 114°F. and the wind was light.

At 2:00 p.m. the temperature was 116°F. and the wind was light.

CHAPTER II

ECOLOGICAL DESCRIPTION OF BERNALILLO COUNTY

Bernalillo County occupies a north-central position in the State of New Mexico. The dominant physical features of the county are the Sandia and Manzano Mountains in the eastern part of the county, the valley of the Rio Grande in the central portion, and the valley of the Rio Puerco to the west.

The Sandia Mountains consist of a fault block that rises over 5,000 feet above the valley of the Rio Grande and presents a formidable escarpment to the west. The highest point is Sandia Crest with an elevation of 10,678 feet. The east side of the mountains slope more gradually. The long axis of the mountains runs north and south and effectively divides the county. The Sandia Mountains are composed of a lower layer of granite, schist and quartzite, covered by an upper layer of sandstone, limestone, and shale.

The vegetation of the Sandia and Manzano Mountains is representative of three life-zones: Upper Sonoran, Transition and Canadian-Hudsonian. The dominant vegetation of the Upper Sonoran zone of the Sandias and Manzanos is pinyon pine (Pinus edulis) and junipers (Juniperus monosperma and J. scopulorum), apache plume (Fallugia paradoxa), oak (Quercus turbinella and Q. grisea), and a variety of grasses. The pinyon-juniper community is best developed at altitudes

between 6,000 and 7,000 feet. Annual precipitation averages 12 to 15 inches and the snowfall from 20 to 50 inches. The mean annual temperature is 50° F, with a mean of 30° F in winter and of 70° F in summer (see p.5).

The Transition zone is largely vegetated with yellow pine (Pinus ponderosa), gambel oak (Quercus gambelii) and grasses. Scrub oak (Quercus turbinella) and aspen (Populus tremuloides), are present as subclimax. There is considerable variability in plant communities due to slope and exposure. The Transition zone occurs from 7,000 to 9,000 feet. Annual precipitation averages 15 to 20 inches, and the snowfall from 50 to 100 inches. The mean annual temperature is 40° F, with a mean of 20° F in winter and 60° F in summer.

The Canadian-Hudsonian zone is chiefly vegetated by: Engelmann spruce (Picea engelmanni), Blue spruce (Picea pungens), Douglas-fir (Pseudotsuga taxifolia), White fir (Abies concolor), and Alpine fir (Abies lasiocarpa). Gambel oak appears to be disclimax. The Canadian-Hudsonian zone ranges from 9,000 to 10,678 feet. Annual precipitation averages 20 to 30 inches and the snowfall from 100 to 150 inches. The mean annual temperature is 35° F, with a mean of 15° F in winter and 55° F in summer.

The piedmont alluvial plain between the Sandia and Manzano Mountains and the valley of the Rio Grande is composed of erosion products from the mountains and in

part is covered by alluvium of the same type found in the valley. The plain slopes from 6,200 feet at the base of the mountains to 5,000 feet in the valley with an average slope of approximately 200 feet per mile.

This plain falls entirely within the Upper Sonoran zone. Grasses present are predominantly blue grama (Bouteloua gracilis), sixweeks grama (Bouteloua barbata), sideoats grama (Bouteloua curtipendula), ringgrass (Muhlenbergia torreyi), the dropseed (Sporobolus cryptandrus), and the three-awn (Aristida adscensionis). At present the grasses in many areas are in a state of disclimax. Cane cactus (Opuntia imbricata) and yucca (Yucca baccata and Yucca glauca) are also present. Other areas support only snake weed (Gutierrezia spp.), Russian-thistle (Salsola pestifer), apache plume (Fallugia paradoxa), and some scattered junipers.

In the Albuquerque area the Upper Sonoran grasslands range from 5,000 to 6,200 feet. Annual precipitation averages between 8 and 12 inches and the snowfall less than 20 inches. The mean annual temperature is 60° F, with a mean of 34° F in winter and 75° F in summer.

The valley of the Rio Grande transects the central portion of Bernalillo County, and the river falls from north to south approximately five feet per mile.

The soils in the valley contain relatively more clay and silt than those of the alluvial piedmont, and are potentially more fertile. Management of irrigation and agricul-

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tural practices generally reflect the productivity of these soils. They are generally deep soils and are underlain with very permeable, sterile river sand.

Vegetation other than a variety of agricultural crops is largely cottonwood (Populus deltoides), Russian-olive (Elaeagnus angustifolia), and willows (Salix spp.).

Mean annual precipitation and temperature fall within the range of the Upper Sonoran zone.

The area to the west of the Rio Grande slopes upward towards Mount Taylor. It is broken by a series of mesas and buttes and falls largely within the drainage of the Rio Puerco.

This area falls within the Upper Sonoran zone and is composed mostly of grassland, with junipers (Juniperus spp.) and pinyons (Pinus edulis) occupying the higher mesas. Considerable overgrazing and subsequent wind erosion have created large areas completely denuded of grass. This, in some instances, has led to the development of sand dune seres. In these seres the natural vegetation has been replaced with rabbit brush (Chrysothamnus parryi), and cane cactus (Opuntia imbricata). Large blow-out areas are also common.

Mean annual precipitation and temperature falls within the range of the Upper Sonoran zone.

A series of volcanic cones occupy the area immediately west of Albuquerque. Their flows created a line of basalt

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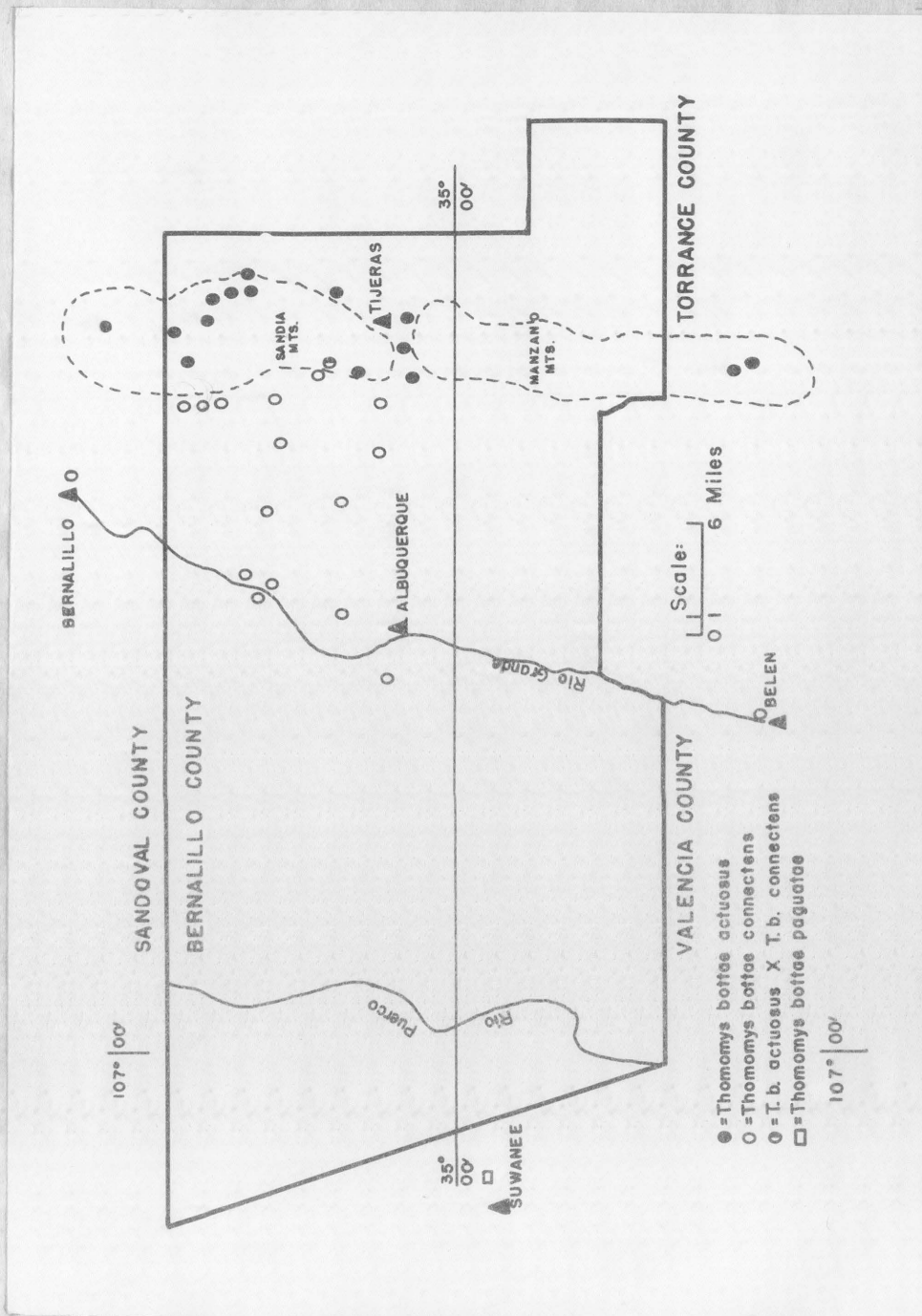
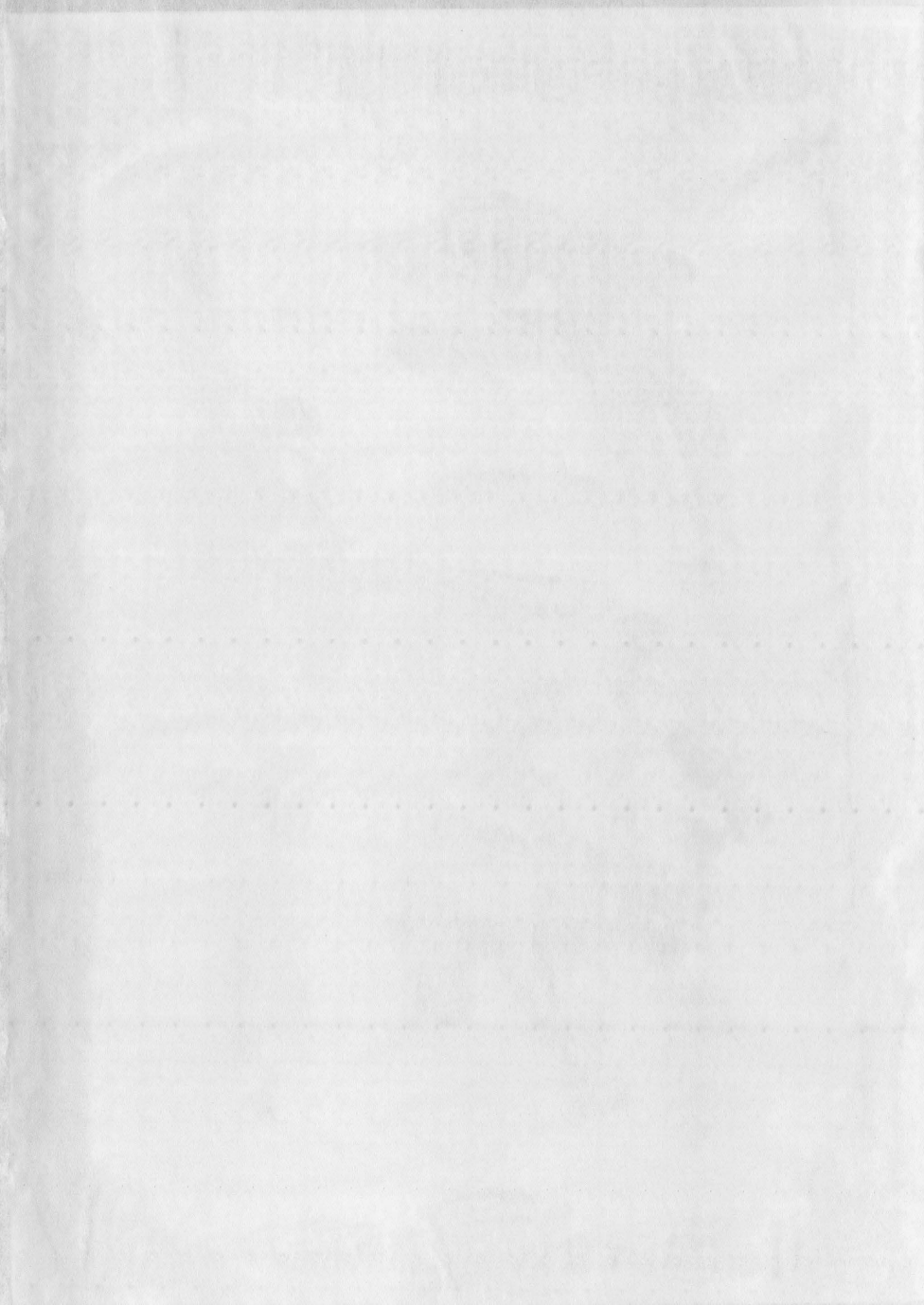


Fig. 1 Distribution of *Thomomys bottae* in Bernalillo County, New Mexico.



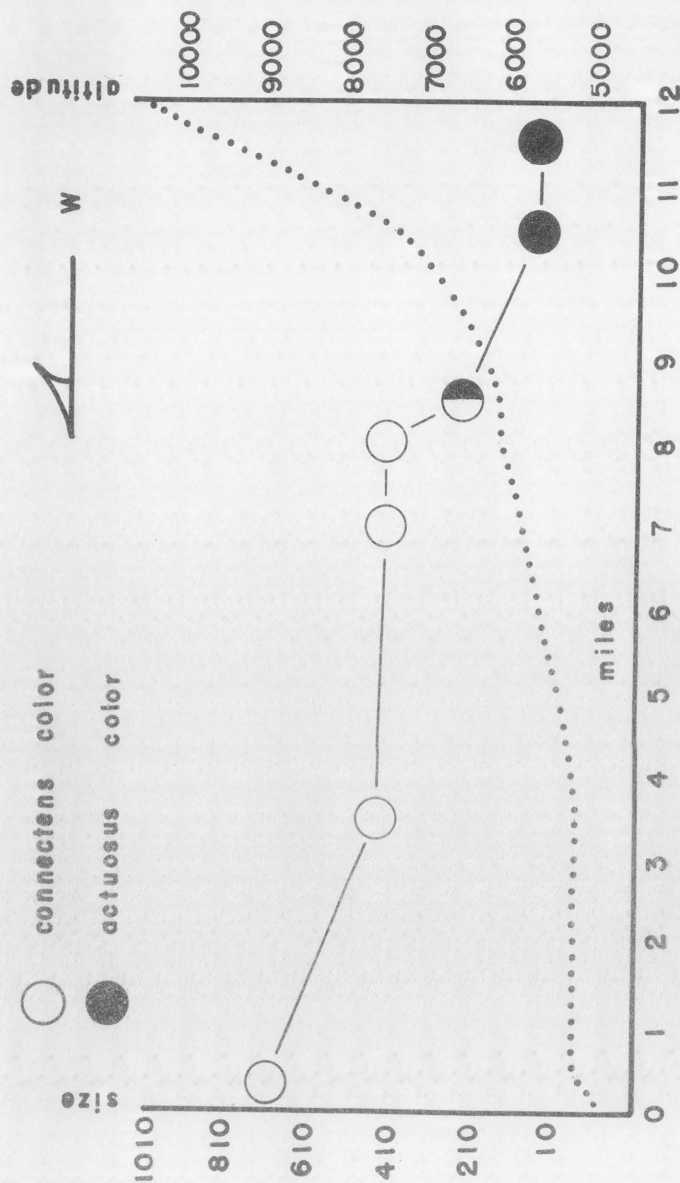
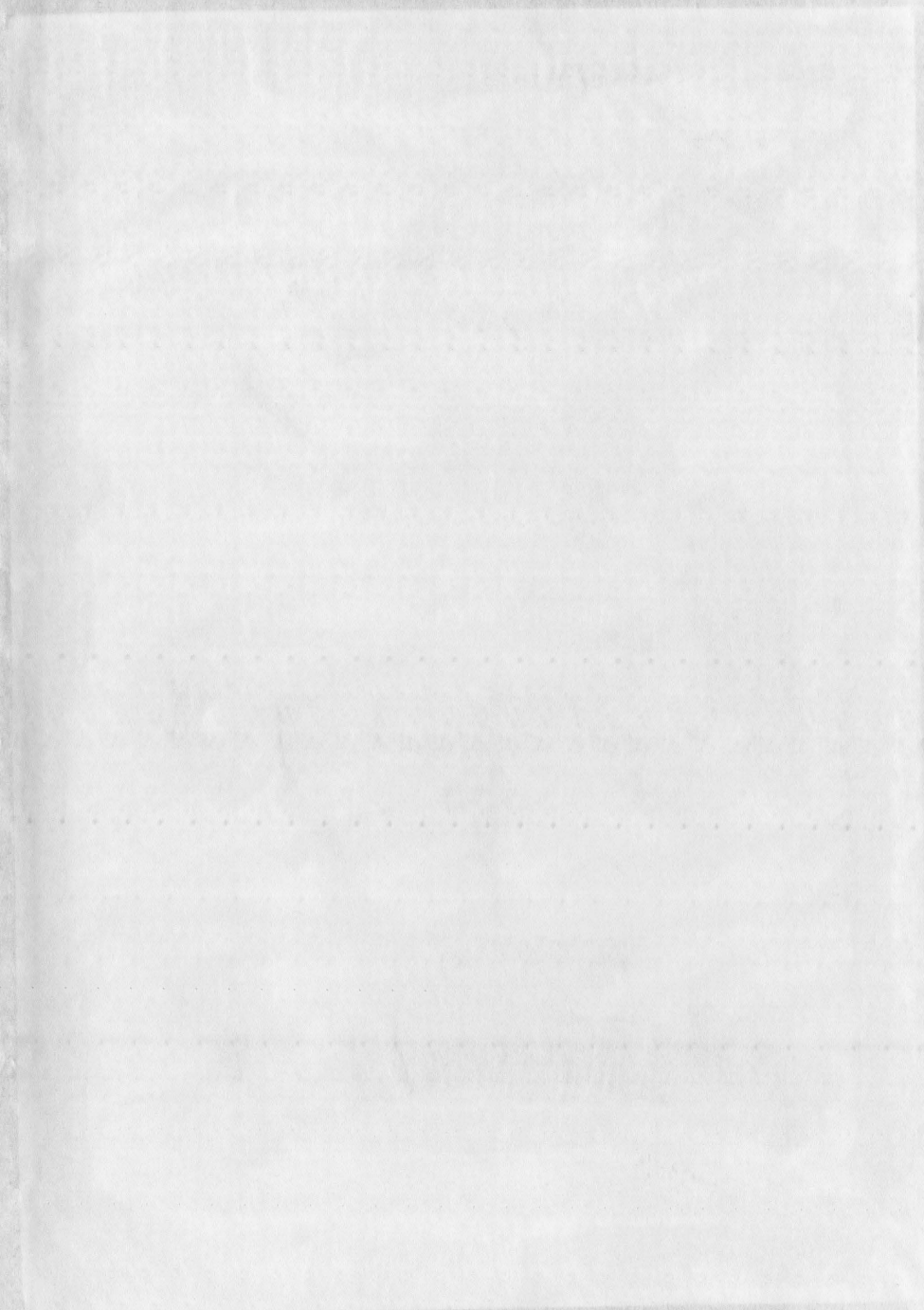


Fig. 2 Relationship of size and color in Thomomys bottae to altitude and geographic position. Broken line represents altitude profile. Solid line indicates size (larger numbers indicate larger gophers).



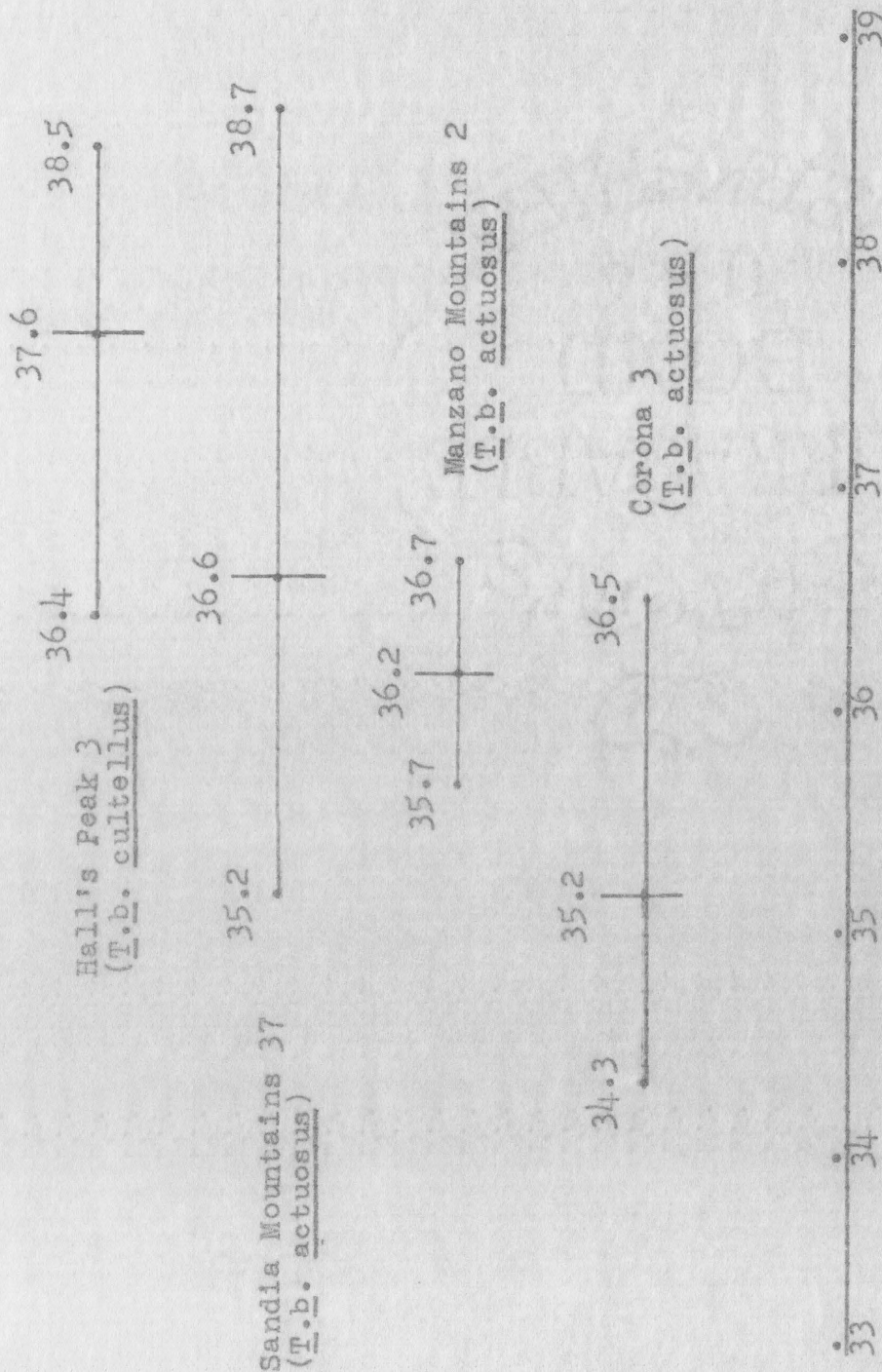


Fig. 3 Relationship of several populations of T.b. actuosus with T.b. cultellus, using condylobasal length as a cranial size index (see p.5).

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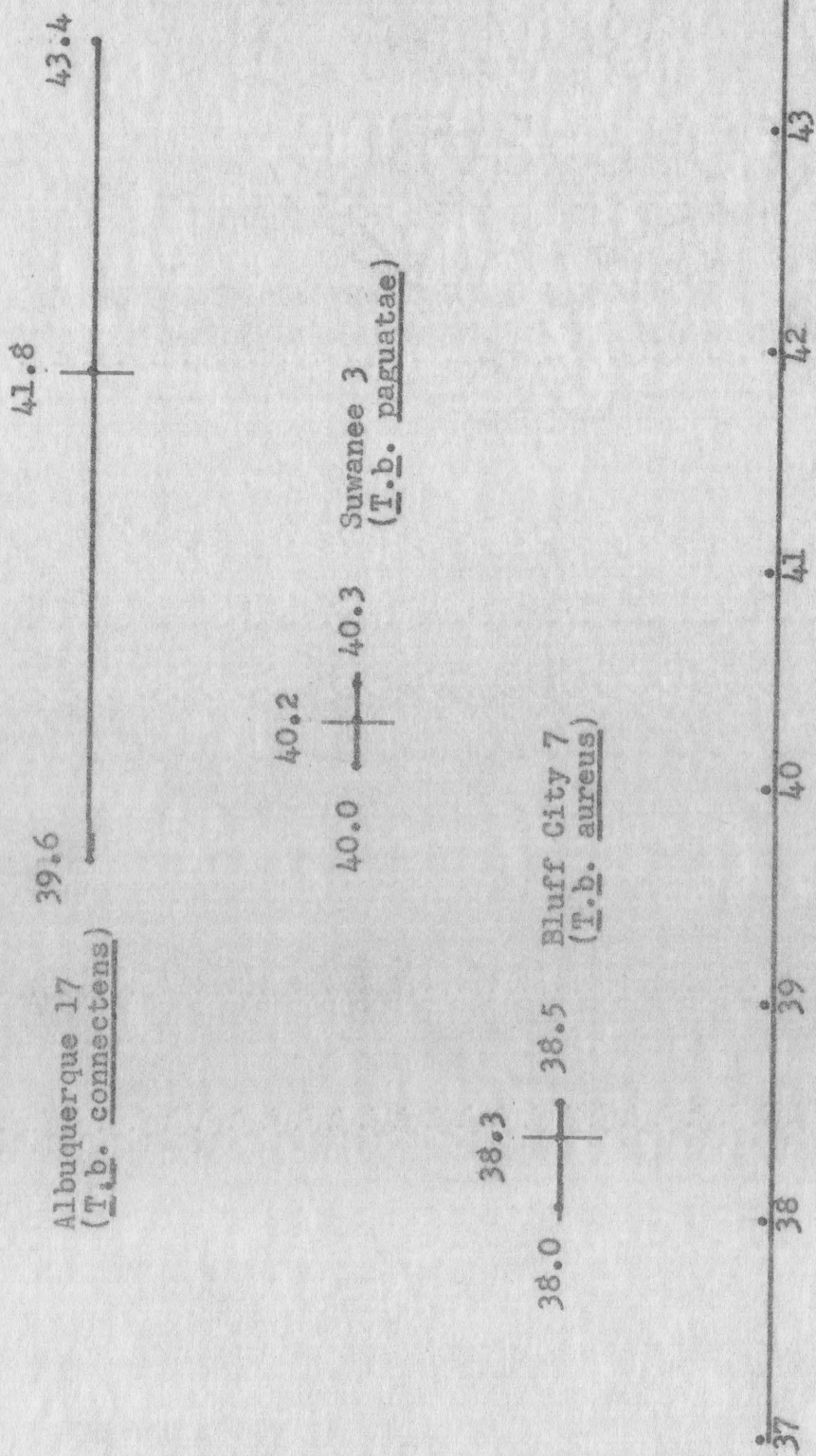
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Condylobasal length in millimeters

Fig. 4 Relationship of *T.b. aureus*, *T.b. paguatae*, and *T.b. connectens* in northwestern New Mexico, using condylobasal length as a cranial size index (see p.5).

CHAPTER III

ACCOUNTS OF SUBSPECIES

THOMOMYS BOTTAE ACTUOSUS KELSON

Thomomys bottae actuosus Kelson, Univ. Kansas Publs.,
Mus. Nat. Hist., vol. 5, p. 67, October 1, 1951.

Type -- Male, adult, skin and skull, no. 119053, U. S. National Museum (Biological Surveys Collection), obtained at Corona, Lincoln County, New Mexico, on October 13, 1902, by James H. Gaut; original number 591.

Range -- Occurs in the mountain ranges of central New Mexico from the eastern slopes of the Sangre de Cristo range at Mora southward to the Sandia, Manzano, San Andres, and Capitan mountains (Kelson, 1951).

Diagnosis -- Size: medium for species (see table 1). Color: upper parts from a Saddle or (Sayal Brown), to a Grouse or (Ochraceous-Tawny) with an over-lay of darker hairs on the back; sides Adobe grading into Butterscotch; underparts from Oakbuff or (Clay Color) to a Yellow Beige or (Cinnamon); postauricular patches well marked with black; hind feet and forefeet whitish with color of forefeet grading into that of upper parts more than does color of hind feet; dorsal surface of tail same color or darker than upper parts, lighter below, tip all white. Skull: according to Kelson (1951, p.67) "size medium; comparatively

100

General Description

From the above description, it is evident that the

specimen is a male, and is of the same species as

the one described in the preceding paper.

It is a small, slender, and very active animal,

and is found in the same localities as the

one described in the preceding paper.

It is a very common animal, and is found in

the same localities as the one described in the

preceding paper.

It is a very common animal, and is found in

the same localities as the one described in the

preceding paper.

It is a very common animal, and is found in

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It is a very common animal, and is found in

the same localities as the one described in the

preceding paper.

It is a very common animal, and is found in

smooth; rostrum moderately depressed distally; nasals moderately inflated distally, usually extending posteriorly not quite to level of dorsolateral spine of frontal, and together usually forming broad V posteriorly, but sometimes truncated or rounded; zygomatic arches with nearly straight and parallel sides; interparietal longer than wide." My own observations on specimens from the Sandia Mountains compare favorably in most respects with Kelson's diagnosis. The exceptions are that the interparietal is more or less trapezoidal rather than rectangular, and the nasals extend posteriorly to or beyond the level of the dorsolateral spine of frontal. In addition the zygomatic plate of the squamosal extends to or over the auditory tube.

Comparisons -- From topotypes of T. b. actuosus from Corona, New Mexico, specimens from the Sandia Mountains differ as follows: darker, more blackish, less Ochraceous; feet whiter, grading less gradually into dorsal pelage; size somewhat larger.

According to Kelson (op. cit.) T. b. actuosus differs from T. b. cultellus from Hall's Peak, New Mexico as follows: "lighter, more Ochraceous and less blackish; size larger; skull slightly smaller; rostrum more depressed; tympanic bullae slightly smaller; zygomatic arches less angular, especially pronounced anterolaterally; and incisors longer." My own observations on specimens of T. b. actuosus from the Sandia

Mountains with those on specimens of T. b. cultellus from Hall's Peak, compare favorably with Kelson's observations (see figure 3).

From specimens of T. b. connectens from Albuquerque, T. b. actuosus differs as follows: darker, more Ochraceous than yellowish; tail more distinctly bicolor; belly (Cinnamon) as opposed to white; size smaller; skull markedly smaller, less robust and angular, crests less pronounced; zygomatic plate of squamosal extending over auditory tube; incisors shorter; audital bullae rounder, less truncate.

Remarks -- There is some evidence of intergradation between T. b. actuosus and T. b. connectens. Five specimens obtained from the west foot of the Sandia Mountains (9 mi. E. and $3\frac{1}{2}$ mi. N. Albuquerque) are intermediate between the two subspecies in all linear measurements taken as well as in color (see figure 2). As a group, these intermediates appear to be closer to T. b. actuosus than to T. b. connectens. One of these animals is closer to T. b. connectens in possessing a nearly white belly, larger size, dorsal pelage more yellow than Ochraceous, and tail distinctly not bicolored. Two other examples are definitely intermediate in size and color in possessing bellies more Tawny than white, lighter than in T. b. actuosus, dorsal pelage darker than in T. b. connectens and less yellowish, but not as Ochraceous as in T. b. actuosus, tails only faintly bicolored with distinct white tip lacking, and hair on feet

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(see figure 3)
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more nearly the color of that on belly. Two other specimens tend more towards T. b. actuosus in: dorsal pelage Tawny with spots of Ochraceous in one to a Diffuse Ochraceous in the other; tail more distinctly bicolor, white tip on tail more discernable. In size, the skulls of all the above mentioned individuals tend more towards T. b. actuosus than T. b. connectens. Most cranial characters seem to be intermediate. The rostrum is broader than in T. b. actuosus, not so broad as in T. b. connectens, and the skull is flatter than that of T. b. actuosus, approaching the condition found in T. b. connectens. Specimens of connectens and actuosus were found in close proximity to one another in the area of intergradation (see figure 1).

Pocket gophers of this subspecies occur in Tijeras Canyon between the Manzano and Sandia Mountains. Those collected at Tijeras and Los Alamos in this canyon are typical of T. b. actuosus, but those at the mouth of the canyon (8½ mi. E. and 2 mi. S. Albuquerque), while still referable to T. b. actuosus, are somewhat larger and distinctly paler and possibly indicate some gene flow from T. b. connectens or an environmental influence such as deeper, sandier, or lighter textured soil.

Pocket gophers from the Sandia Mountains show some evidence of variation within the population. Some gophers from the northern end of the mountains are somewhat darker than average. However, as a whole they are no darker than

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the darkest ones from the summit or from other areas within the mountains. As previously mentioned those from the mouth of Tijeras Canyon are lighter. Other single individuals from within the mountains are highly rufescent. In external measurements and cranial characters, all the gophers from the Sandia Mountains are similar.

Within its range, T. b. actuosus varies in size and color. From the Sandia Mountains southeastwardly, in specimens from the Manzano Mountains and Corona, the skulls become smaller, especially those from Corona (see figure 3). The pelage of those from Corona is definitely paler and more rufescent, than those from the Sandia Mountains.

When specimens of T. b. actuosus from the Sandia Mountains are compared with specimens of T. b. cultellus from Hall's Peak, New Mexico, those from the Sandia Mountains are paler, somewhat larger in external measurements, and with smaller skulls. When specimens of T. b. actuosus from Corona are compared with specimens of T. b. cultellus from Hall's Peak, those from Corona are also lighter, similar in external measurements, but with somewhat smaller skulls (see figure 3).

Sexual dimorphism, while present in T. b. actuosus, is not as well marked as in T. b. connectens. In males the crests of the skull are more pronounced than in females and as a whole the skull is more rugged and angular. There are no differences in color.

Ecological Distribution -- Pocket gophers of this subspecies in Bernalillo County occupy the Sandia and Manzano Mountains and the pinyon-juniper area to the east of the mountains. By far the greatest numbers occur in the spruce-fir zone in the mountains. Lesser numbers are found in the yellow pine zone. The sparsest populations occur in the pinyon-juniper areas. This distribution could possibly be related to the type of soil or vegetation in each area.

Pelage and Molt -- Specimens from the Sandia Mountains show a definite seasonal molt. Those trapped during the winter months of February and March, show a definite darkening through an increase of black hairs on the dorsal surface, while those taken in April show a general tendency towards a more Ochraceous coloration.

Reproduction -- In this study no special effort was made to obtain extensive reproductive data, however, the following observations were made. On April 14 and 15, 1956, a large series (29) of gophers was obtained in the Sandia Mountains. This series contained specimens from elevations of 6,700 feet at San Antonio to 10,678 feet at Sandia Crest. Two gophers from 6,700 and 7,500 feet elevations contained three embryos each. Four other gophers from approximately 7,500 feet had greatly enlarged uteri. Only one gopher from Sandia Crest area contained embryos (3) and the remainder did not have enlarged uteri. It is possible that elevation plays some role in the reproductive pattern of T. b. actuosus.

Geological Description - Plateau

agencies in Pennsylvania. The plateau is a broad, flat area of land, and it is the highest part of the Allegheny Mountains. The plateau is composed of sandstone and shale, and it is covered by a thin layer of soil. The plateau is a very important part of the Allegheny Mountains, and it is a very beautiful area of land. The plateau is a very important part of the Allegheny Mountains, and it is a very beautiful area of land.

show a distinct change in the surface. The plateau is a very important part of the Allegheny Mountains, and it is a very beautiful area of land. The plateau is a very important part of the Allegheny Mountains, and it is a very beautiful area of land.

Geological Description - Plateau

made by the Allegheny River. The plateau is a very important part of the Allegheny Mountains, and it is a very beautiful area of land. The plateau is a very important part of the Allegheny Mountains, and it is a very beautiful area of land.

of 5,000 feet. The plateau is a very important part of the Allegheny Mountains, and it is a very beautiful area of land. The plateau is a very important part of the Allegheny Mountains, and it is a very beautiful area of land.

Specimens examined -- Total, 78, all from New Mexico.

Thomomys bottae actuosus

Sandoval County: $3/4$ mi. W. and $10-3/4$ mi. N. Tijeras, 12.
Bernalillo County: $1-1/2$ mi. W. and $9-1/2$ mi. N. Tijeras, 1;
 $2-1/4$ mi. W. and 2 mi. N. Tijeras, 2; $3-1/4$ mi. W. and 9 mi.
 N. Tijeras, 8; $1/4$ mi. W. and $7-3/4$ mi. N. Tijeras, 15; 1 mi.
 E. and $6-1/2$ mi. N. Tijeras, 10; 1 mi. E. and $1-1/2$ mi. N.
 Tijeras, 1; Tijeras, 2; $12-1/2$ mi. E. and $5-3/4$ mi. N. Albu-
 querque, 1; 9 mi. E. and $3-1/2$ mi. N. Albuquerque, 5; $8-3/4$
mi. E. and $3-1/4$ mi. N. Albuquerque, 1; $8-3/4$ mi. E. and 1
mi. N. Albuquerque, 1; $9-1/2$ mi. E. and 1 mi. N. Albuquerque,
 1; $8-1/2$ mi. E. and 2 mi. S. Albuquerque, 4; $11-1/2$ mi. E.
 and 2 mi. S. Albuquerque, 1.

Torrance County: New Canyon, Manzano Mountains, 9,000 feet,
 2; Capillo Peak, Manzano Mountains, 9,200 feet, 1; Corona,
 5 BS.

Thomomys bottae cultellus

Mora County: Hall's Peak, 5 BS.

THOMOMYS BOTTAE CONNECTENS HALL

Thomomys perpallidus aureus Bailey, N. Amer. Fauna,
no. 39, p.74, November 15, 1915.

Thomomys bottae connectens Hall, Jour. Washington Acad.
Sci., vol. 29, p.296, July 15, 1936.

Type -- Male, adult, skull and skin; no. 66627, Mus.
Vert. Zool., Univ. of California; obtained at Clawson Dairy,
5 miles north of Albuquerque, 4,943 feet elevation, Bernalillo
County, New Mexico, on May 6, 1935, by Annie M. Alexander;
original no. 2981.

Range -- Valley of the Rio Grande probably from northern
Socorro County northward to Bernalillo, including the
alluvial piedmonts bordering the Rio Grande near Albuquerque
(Hall, 1936).

Diagnosis -- Size: large for species (see table 1).
Color: In winter, upper parts from Desert to Cinnamon
Brown, with darker hairs predominating on mid-dorsal line;
belly coloration whitish or whitish with a slight infusion
of Buff in some individuals; sides Raffia to Chamois; post-
auricular patches small and black; feet whitish above, more
or less blending with coloration of belly; upper surface of
tail blending with dorsal coloration, under surface slightly
lighter. Skull: large (see table 1); rostrum broad, from
48 to 55 percent of the length of the skull; nasals truncate
posteriorly; hamulus of lacrimal relatively large; interptery-
goid space V-shaped and provided with a median spine; zygo-

matic plate of squamosal not extending over auditory tube.

Comparisons -- According to Hall (1936, p.297) "compared with Thomomys bottae aureus, connectens is larger in external measurements, darker colored above, and below has the pectoral region strongly marked with Cinnamon Buff rather than white, and is larger in every cranial measurement taken. In connectens the length of the rostrum amounts to more, rather than less, than 67 per cent of the zygomatic breadth."

While T. b. connectens is generally larger than T. b. aureus, it is not larger in every cranial measurement, and only in about 50 per cent of the cases does the length of the rostrum amount to more than 67 per cent of the zygomatic breadth. In T. b. connectens the interpterygoid space is V-shaped rather than U-shaped as in T. b. aureus, and the exoccipital extends farther laterally in T. b. connectens, revealing less of the mastoid face of the auditory bulla. Hooper (1940, p.4) compared T. b. paguatae with T. b. connectens and found that T. b. paguatae was similar "except for its darker dorsal and more Cinnamon ventral coloration, relatively broader brain case, greater spread of zygomata, narrower nasals, actually and relatively longer premaxillary arms, relatively narrower rostrum, and larger and more rounded bullae."

Remarks -- Among named subspecies of T. bottae, the ranges of which approach nearest to that of T. b. connectens, the greatest similarity seems to be with T. b. paguatae. Specimens from Laguna and Juan Tafoya, New Mexico, were

ratio plate of sediment, not exceeding 100 ft. in thickness.

Geological -- According to the U. S. Geological Survey

with Stratigraphic divisions, the following is given as a

statement, based on the work of the U. S. Geological Survey

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Remarks -- Among the U. S. Geological Survey

ranges of which approach nearest to that of the U. S. Geological Survey

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specimens from Laguna and from Laguna

assigned by Kelson (op. cit., p.65) to T. b. connectens. These specimens have been examined by me and appear to be closer to T. b. paguatae than to T. b. connectens. A fuller discussion of these specimens will be found under the account of T. b. paguatae. There appears to be no perceptible difference in color between gophers trapped in the flood plain of the Rio Grande and those from the east and west piedmonts of the river; neither was any difference noted between specimens from Belen, Albuquerque, or Bernalillo.

Ecological Distribution -- By far the largest populations of T. b. connectens occur in the irrigated bottomlands of the Rio Grande at Albuquerque, Belen, and Bernalillo, New Mexico. Smaller, scattered populations occur along both the west and east piedmonts of the river and are found most often in the bottoms of small arroyos on the sloping piedmonts. The relative scarcity of gophers on these piedmonts and the west slope of the Sandia Mountains might be another reason why so few intermediates between T. b. actuosus and T. b. connectens were found. The relatively smaller size of gophers from the alluvial piedmont as compared to those from the valley is graphically illustrated in figure 1. The fact that pelage color of the valley and piedmont forms is not perceptibly different might lead one to assume that the size differences result from ecological factors rather than from gene flow from T. b. actuosus.

Pelage and Molt -- Gophers taken in January and March

show a well developed darkening of the dorsal surface, while those taken in October show less of a dorsal stripe. One specimen from west of the Rio grande at Albuquerque, collected in October, is quite dark but shows some evidence of an older, lighter pelage. Gophers taken in April are all in some stage of molt from the darker winter pelage to the lighter, more yellowish summer pelage. Those collected in April possess a richer yellow pelage than those from October, possibly illustrating a change due to wear.

Reproduction -- Among 20 female gophers collected in valley and east of the river, the following contained embryos; February 15, 1956, 3 with embryos, 2 with 3 embryos, 1 with 5 embryos; March 30, 1956, 1 with 4 embryos, 2 with uteri enlarged indicating probable reproductive activity.

Specimens examined -- Total, 50, all from New Mexico.
Sandoval County: Bernalillo, 4 BS; Valencia County: Belen, 6 BS; Bernalillo County: 8-1/2 mi. N. Albuquerque, 7; 9-1/4 mi. E. and 8-1/2 mi. N. Albuquerque, 2; 9-1/4 mi. E. and 7-1/2 mi. N. Albuquerque, 3; 1/2 mi. W. and 7 mi. N. Albuquerque, 1; 4 mi. E. and 7 mi. N. Albuquerque, 1; 7 mi. N. Albuquerque, 4; 8-1/4 mi. E. and 5-1/2 mi. N. Albuquerque, 1; 9-3/4 mi. E. and 5-1/2 mi. N. Albuquerque, 1; 9-1/2 mi. E. and 4 mi. N. Albuquerque, 2; 3-1/4 mi. N. Albuquerque, 9; 4-1/2 mi. E. and 3 mi. N. Albuquerque, 3; 5 mi. W. and 2-1/2 mi. N. Albuquerque, 1; 7-1/2 mi. E. and 2 mi. N. Albuquerque, 1; Albuquerque, 4 BS.

THOMOMYS BOTTAE PAGUATAE HOOPER

Thomomys bottae paguatae Hooper, Occas. Pap. Mus. Zool.

Univ. Michigan, no. 422, November 14, 1940.

Type -- Mature female, skin and skull, Univ. of Michigan Mus. of Zool., no. 82158; obtained one-half mile north of Cebolleta (Seboyeta Post Office), Valencia County, New Mexico, on June 22, 1939, by Emmet T. Hooper; collector's number, 1332.

Range -- Known originally only from Cebolleta, but here recorded also from Juan Tafoya, Laguna, and Suwanee, New Mexico.

Diagnosis -- "Size: large (hind foot of mature female, 31 mm.). Color: hairs of dorsal surface near Ochraceous-Buff terminally and Dark Plumbeous basally; hairs of ventral surface with bases Dark Plumbeous and terminal parts Light Pinkish Cinnamon; hairs of distal third of tail, white, of proximal two-thirds, dusky. Skull: moderately long and rounded dorsally, not markedly flattened; nasals short (premaxillae extending at least 3 mm. posteriorly beyond them), narrow and conspicuously broader anteriorly than posteriorly (the posterior breadth averages 66 per cent of the anterior breadth in the specimens examined); bullae rounded and moderately large." Diagnosis from Hooper (1940, p.4).

Comparisons -- For comparisons between T. b. paguatae

ENTOMOLOGICAL MONOGRAPH

COLEOPTERA: DOLYCHOPRINAE

Genus: *Dolichoprinus*

Species: *Dolichoprinus*

Number of species: 1

Geographical distribution: (See Plate I)

Plate I. *Dolichoprinus*

1332

Figure -- *Dolichoprinus*

referred and from other sources, and from the

Mexico.

Plate II. *Dolichoprinus*

Plate III. *Dolichoprinus*

Plate IV. *Dolichoprinus*

Plate V. *Dolichoprinus*

Plate VI. *Dolichoprinus*

Plate VII. *Dolichoprinus*

Plate VIII. *Dolichoprinus*

Plate IX. *Dolichoprinus*

Plate X. *Dolichoprinus*

Plate XI. *Dolichoprinus*

Plate XII. *Dolichoprinus*

Plate XIII. *Dolichoprinus*

1333

Plate XIV. *Dolichoprinus*

and Thomomys bottae connectens, see the account of T. b. connectens. The following observations are based solely upon the description by Hooper (op. cit.).

Thomomys bottae paguatae differs from T. b. aureus as follows: "size larger, color lighter; skull broader and more angular; brain case actually and relatively broader anteriorly; zygomata more angular; rostrum actually and relatively longer and relatively narrower (its breadth about 47 per cent of its length, about 52 per cent in aureus) and not rounded anteriorly; nasals actually and relatively narrower anteriorly; premaxillae prolonged posteriorly beyond nasals actually and relatively farther; upper incisors more procumbent; exoccipital actually and relatively larger; auditory bullae nearer oval in shape; zygomatic plate of squamosal extending over auditory tube interpterygoid space V-shaped."

Remarks -- Specimens from Laguna, Juan Tafoya, and Suwanee, New Mexico, were compared with topotypic material of T. b. connectens from Albuquerque, of T. b. aureus from Bluff City, Utah, of T. b. paguatae from Cebolleta, New Mexico, and of T. b. collis from thirty miles south of Grants, New Mexico, Township 6 north, Range 10 west, Section 30.

Specimens from Juan Tafoya examined by me are like T. b. paguatae in cranial characteristics but are intermediate in color between paguatae and T. b. connectens. Kelson (1951), as previously mentioned, assigned specimens from

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Juan Tafoya and Laguna to T. b. connectens. The gophers from Juan Tafoya, Laguna, and Suwanee do not fit connectens in most of the measurable characters (see figure 4). Furthermore, the presently known northwestern limit of T. b. connectens is 5 mi. W. and $2\frac{1}{2}$ mi. N. Albuquerque, New Mexico. The type locality of T. b. paguatae is at Cebolleta, New Mexico, some 36 miles to the northwest of Albuquerque. Juan Tafoya is approximately 7 mi. N. of Cebolleta and Laguna is about the same distance to the South. Between Cebolleta and Albuquerque is a stretch of country in which gophers are extremely rare. Investigations in this area have so far failed to reveal the presence of gophers. The possibility of pocket gophers occurring in isolated, yet undiscovered places, cannot be discounted.

Of the Laguna and Suwanee specimens, the Laguna specimens tend toward T. b. collis in color and cranial characters. Those from Suwanee, Valencia County, New Mexico, tend toward T. b. paguatae in cranial characteristics and in color, more than towards T. b. connectens or T. b. collis. However, until further work can be conducted in the Mount Taylor area, all the gophers from Juan Tafoya, Laguna and Suwanee are tentatively referred to T. b. paguatae. Pocket gophers of the species Thomomys bottae in the vicinity of Mount Taylor to west of Bernalillo County are extremely variable. As pointed out by Hooper (op. cit., p.2) the morphology of these pocket gophers possibly reflects the isolation imposed upon them by the lava flows and the irregular terrain.

Somewhat of a trend may be noted, however, in size. T. b. connectens is the largest of the pocket gophers of the species Thomomys bottae which occur in the northwestern New Mexico. T. b. aureus generally averages the smallest, while T. b. paguatae is intermediate between aureus and connectens (see figure 4). Thus we have the development of a cline with the largest gophers at Albuquerque in the south to the smallest at Fruitland in the north.

Much work still needs to be done in the western and northwestern part of New Mexico before any real understanding of the relationships between the closely related subspecies of Thomomys bottae in this area can be forthcoming.

Specimens examined -- Total, 47.

Thomomys bottae aureus

Utah: San Juan County: Bluff City, 14, BS.

New Mexico: San Juan County: Fruitland, 4, BS.

Thomomys bottae paguatae

New Mexico: Valencia County: Juan Tafoya, 2, BS; Laguna, 3, BS; 1 mi. E. Suwanee Rio San Jose, 5; Cebolleta, 12, UM.

Thomomys bottae collis

New Mexico: Valencia County: 30 mi. S. Grants, Township 6 north, Range 10 west, Section 30, 7, UM.

Somewhat of a trend may be noted, however, in size. *T. b. connectans* is the largest of the pocket gophers of the species *Thomomys bottae* which occur in the northwestern New Mexico. *T. b. arizonae* generally averages the smallest, while *T. b. nevadensis* is intermediate between *arizonae* and *connectans* (see Figure 4). Thus we have the development of a cline with the largest gophers at Albuquerque in the south to the smallest at Trinidad in the north.

Much work still needs to be done in the western and northwestern part of New Mexico before any real understanding of the relationships between the closely related subspecies of *Thomomys bottae* in this area can be forthcoming.

Specimens examined -- Total, 57.

Thomomys bottae arizonae

Utah: San Juan County: Bluff City, 14, 22.

New Mexico: San Juan County: Trinidad, 4, 22.

Thomomys bottae nevadensis

New Mexico: Valencia County: Juan Tabo, 2, 22; Laguna,

3, 22; 1 m. E. Roswell 115 San Jose, 5; Goshute, 12, 22.

Thomomys bottae collis

New Mexico: Valencia County: 36 m. S. Grants, 10.

6 more, range 10 west, Section 30, 7, 22.

CHAPTER IV

GEOGRAPHIC VARIATION

Pocket gophers of the species Thomomys bottae inhabiting Bernalillo County vary geographically. Variations manifest themselves chiefly in color and size.

Gophers may be separated into two main categories: small, dark forms that occupy the Sandia and Manzano Mountains and large, pale forms that occur in the valley of the Rio Grande at Albuquerque and its associated alluvial piedmonts. Both types are considered subspecies of the same species although there is a marked difference between them. It is not surprising that early workers considered the two kinds as separate species.

I have found that the gophers from the Sandia Mountains intergrade with those occupying the alluvial piedmont at the western base of the mountains. Relatively few cases of intergradation between subspecies of the former Thomomys perpallidus and T. fulvus groups have been described. This evidence of intergradation strengthens the classification of the mountain and valley forms as subspecies of the same species, rather than as distinct species.

Possibly sometime in the past history of the species Thomomys bottae, a single population of gophers became separated by a barrier producing two populations. Their isolation was of sufficient duration to allow them to dif-

ferentiate into distinct forms, possibly through the operation of random fixation of genes or differential natural selection pressures. The separation of these two populations, however, was not of sufficient duration to result in reproductive isolation between them. The presence of so few intermediates seems to indicate that secondary and not primary intergradation has taken place. Secondary intergradation is thought to occur after two kinds have become separated (Mayr, 1942, fig. 16). Today, the west face of the Sandia Mountains acts as a partial barrier to reduce gene flow between the two populations of gophers.

The large, pale gophers from near Albuquerque, New Mexico, vary in size from the valley of the Rio Grande eastward towards the foot of the Sandia Mountains (see figure 1). Those occupying the valley are the largest, and the size of the gophers gradually diminishes as the foot of the mountains is approached.

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CHAPTER V

SUMMARY

Two subspecies of Thomomys bottae occur in Bernalillo County, New Mexico. They are Thomomys bottae actuosus Kelson, which occupies the Sandia and Manzano Mountains, and Thomomys bottae connectens Hall, which occupies the valley of the Rio Grande and the associated alluvial piedmonts from Bernalillo south to northern Socorro County. A third subspecies, Thomomys bottae paguatae Hooper, occurs near the western edge of the county and possibly extends into the county.

Thomomys bottae actuosus is characterized as medium size for subspecies of Thomomys bottae. Color of upper parts range from Saddle to Grouse, and underparts from Oak Buff to Yellow Beige. Specimens from the Sandia Mountains differ from topotypes from Corona, New Mexico, by being generally larger and darker.

Pocket gophers from the Sandia Mountains show some evidence of variation within the population, especially in the darkness and rufescent coloration on the dorsal surface.

Within its range, T. b. actuosus seems to vary considerably in size and color. A progressive variation in color is noted from south to north, with the darker forms being found in the northern parts of the range. The same progressive

CHAPTER V

SUMMARY

Two subspecies of *Thomomys talpae* occur in Central America, New Mexico. They are *Thomomys talpae talpae* Nelson, which occupies the Pacific and Atlantic Mountains, and *Thomomys talpae talpae* (Nelson), which occupies the valley of the Rio Grande and the associated adjacent piedmonts from Central to northern Mexico. Nelson's subspecies, *Thomomys talpae talpae* (Nelson), occurs near the western edge of the country and possibly extends into the country.

Thomomys talpae talpae is characterized as follows: also for expansion of *Thomomys talpae*. Color of upper parts varies from white to brown. The subspecies from Central to Mexico is larger and darker. The subspecies from Central to Mexico is larger and darker.

Robert Rogers from the Pacific Mountains shows some evidence of variation within the subspecies, especially in the darkness and the extent of coloration on the dorsal surface. Within the range, *T. t. talpae* seems to vary considerably in size and color. A progressive variation in color is noted from south to north, with the darker forms being found in the northern part of the range. The same progressive

variation exists in the size of the skull and external measurements.

Specimens of T. b. actuosus from the Sandia Mountains show a definite seasonal molt. Those trapped during the winter being darker on the dorsal surface than those in the summer through an increase of black hairs in the pelage.

According to reproductive material obtained (p.21), it is possible that elevation plays some role in the reproductive pattern of T. b. actuosus.

Thomomys bottae connectens is characterized as large in size for subspecies of Thomomys bottae. Color of upper parts ranges from Desert to Cinnamon and underparts from whitish to whitish with a suffusion of Buff.

Gophers from the valley of the Rio Grande at Albuquerque are generally larger than gophers from the alluvial piedmont of the Sandia Mountains. There is no indication, however, of a difference in coloration between gophers of these two populations.

T. b. connectens shows very little variation within its range from south to north. Seasonal molt is fairly well marked in specimens from Albuquerque. Gophers taken in winter show a darkening of the dorsal surface. Summer pelage is usually much lighter, being yellowish in color.

From specimens of T. b. connectens collected on February 15 and March 30, 1956, 3 were found to contain embryos. The

variation exists in the size of the skull and external measurements.

Specimens of *T. p. connectens* from the Santa Mountains show a definite seasonal molt. Those trapped during the winter being darker on the dorsal surface than those in the summer through an increase of black hairs in the pelage. According to reproductive material obtained (p. 21), it is possible that elevation plays some role in the reproductive pattern of *T. p. connectens*.

Thomomys bottae connectens is characterized as large in size for subspecies of *Thomomys bottae*. Color of upper parts ranges from Desert to cinnamon and underparts from whitish to whitish with a suffusion of buff. Gophers from the valley of the Rio Grande at Albuquerque are generally larger than gophers from the alluvial plainland of the Santa Mountains. There is no indication, however, of a difference in coloration between gophers of these two populations.

T. p. connectens shows very little variation within its range from south to north. Seasonal molt is fairly well marked in specimens from Albuquerque. Gophers taken in winter show a darkening of the dorsal surface. Summer pelage is usually much lighter, being yellowish in color. From specimens of *T. p. connectens* collected on February 15 and March 30, 1932, 3 were found to contain embryos.

maximum number being 5 and the minimum number, 3.

There is some evidence of intergradation between T. b. actuosus and T. b. connectens. Five specimens obtained from the west foot of the Sandia Mountains are intermediate between the two subspecies in all linear measurements taken as well as color.

Thomomys bottae paguatae, heretofore known only from its type locality at Cebolleta, Valencia County, New Mexico, is here recorded from Suwanee, Laguna, and Juan Tafoya, all in Valencia County, New Mexico.

Pocket gophers of the species Thomomys bottae inhabiting Bernalillo County and northwestern New Mexico, vary geographically throughout their range. T. b. actuosus exhibits throughout its range a continuous type of variation in color from south to north, the darker forms occurring in the north. This same type of variation in overall size from south to north is also noted among gophers occupying the valley of the Rio Grande and the arid plateau region in northwestern New Mexico. T. b. connectens in the valley of the Rio Grande is larger than T. b. aureus from Bluff City, Utah, while T. b. paguatae from Laguna, Suwanee and Juan Tafoya is intermediate.

eastern number being 9 and the western number being 10.

There is also evidence of a small number of specimens.

Between the two specimens, the western number being 10 and the eastern number being 9.

the west foot of the mountain, the eastern number being 9 and the western number being 10.

Between the two specimens, the western number being 10 and the eastern number being 9.

well as color.

There are other specimens, the western number being 10 and the eastern number being 9.

type locality at Santa Fe, New Mexico, the western number being 10 and the eastern number being 9.

have been recorded from Santa Fe, New Mexico, the western number being 10 and the eastern number being 9.

Valencia County, New Mexico, the western number being 10 and the eastern number being 9.

Further evidence of the western number being 10 and the eastern number being 9.

Benaville County, New Mexico, the western number being 10 and the eastern number being 9.

locally throughout the western number being 10 and the eastern number being 9.

out its range, the western number being 10 and the eastern number being 9.

south to north, the western number being 10 and the eastern number being 9.

same type of variation, the western number being 10 and the eastern number being 9.

also noted among specimens, the western number being 10 and the eastern number being 9.

Granite and the western number being 10 and the eastern number being 9.

I. p. associated with the western number being 10 and the eastern number being 9.

than I. p. usually from the western number being 10 and the eastern number being 9.

from Laguna, the western number being 10 and the eastern number being 9.

from Laguna, the western number being 10 and the eastern number being 9.

from Laguna, the western number being 10 and the eastern number being 9.

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from Laguna, the western number being 10 and the eastern number being 9.

from Laguna, the western number being 10 and the eastern number being 9.

from Laguna, the western number being 10 and the eastern number being 9.

TABLE 1

Cranial and External Measurements of Thomomys bottae

Sex	Catalog number or number of individuals averaged	Condylobasal length	Basilar length	Zygomatic breadth	Palato-frontal depth	Palatal length	Length of nasals	Breadth of braincase	Mastoid breadth	Breadth of rostrum	Length of rostrum	Alveolar length of maxillary tooth-row	Interorbital breadth	Length of skull exclusive of rostrum and occiput	Breadth of nasals anteriorly	Breadth of nasals posteriorly	Length of head and body	Total length	Length of tail	Length of hindfoot
<u>Thomomys bottae actuosus</u> , topotypes (Kelson, 1951:67)																				
♂	119052 BS.	35.8	31.3	22.2	13.7	18.7	14.4	17.5	7.3	---	---	7.9	6.5	---	---	---	136	211	75	29
♂	119173 BS.	38.1	33.1	23.6	14.5	20.0	13.6	15.6	19.0	7.9	15.7	7.8	6.9	---	---	---	135	214	79	27
♀	119054 BS.	34.3	29.9	20.6	13.8	18.0	12.8	14.7	17.8	7.1	14.4	7.6	6.8	---	---	---	137	207	70	27
♀	119055 BS.	34.7	30.3	20.9	13.5	18.3	12.1	14.3	17.4	7.0	14.1	7.2	6.4	---	---	---	138	211	73	26
♀	119172 BS.	36.5	31.5	21.7	13.8	19.2	14.9	18.6	7.5	---	---	7.8	6.8	---	---	---	130	207	77	27
<u>Thomomys bottae actuosus</u> , Manzano Mountains																				
♂	605 UNM.	38.5	32.8	22.9	14.3	20.2	13.9	14.9	19.2	7.3	15.8	7.6	6.1	21.5	4.3	2.8	127	189	62	29
♀	603 UNM.	35.7	30.8	20.8	13.3	18.7	12.0	14.7	17.8	7.0	14.4	6.9	6.4	21.1	4.0	2.8	127	175	48	27
♀	604 UNM.	36.7	31.9	22.2	14.5	19.7	12.9	15.0	18.6	7.2	15.3	7.3	6.9	21.1	4.1	2.1	129	196	67	29
<u>Thomomys bottae actuosus</u> , Sandia Mountains																				
♂	16 av.	39.0	33.7	24.3	15.2	21.1	14.3	15.9	19.9	7.8	16.3	7.9	6.8	22.0*	4.8*	2.6*	153	217	65	28
♂	Max.	41.1	35.6	26.9	16.6	22.4	16.0	16.6	21.7	9.1	17.9	8.7	7.3	23.7	5.3	3.1	170	236	73	31
♂	Min.	37.0	32.3	22.9	14.4	20.0	13.0	15.0	19.2	7.4	15.1	7.3	6.0	21.1	4.2	2.2	143	205	58	27

* average of 14

TABLE 1 -- Continued

Sex	Catalog number or number of individuals averaged	Condylabasal length	Basilar length	Zygomatic breadth	Palato-frontal depth	Palatal length	Length of nasals	Breadth of braincase	Mastoid breadth	Breadth of rostrum	Length of rostrum	Alveolar length of maxillary tooth row	Interorbital breadth	Length of skull exclusive of rostrum and occiput	Breadth of nasals anteriorly	Breadth of nasals posteriorly	Length of head and body	Total length	Length of tail	Length of hindfoot
<i>Thomomys bottae actuosus</i> , Sandia Mountains (continued)																				
♂	37 av.	36.6	31.7	22.4	14.3	19.6	13.1	15.4	18.9	7.2	15.1	7.6	6.7	21.5	4.3	2.5	146	209	63	28
♀	Max.	38.7	33.5	24.2	15.1	20.9	14.6	16.2	20.0	8.3	16.2	8.3	7.1	22.8	4.8	3.1	157	228	71	31
♀	Min.	35.2	30.4	21.3	13.6	18.3	11.6	14.6	17.8	6.7	13.9	7.0	6.2	20.2	3.8	2.1	133	195	53	27
<i>Thomomys bottae connectens</i> , topotypes, Albuquerque																				
♂	7 av.	44.3	38.6	26.7	16.0	23.7	15.6	16.3	22.0	9.3	19.1	8.8	6.9	25.7	5.0	2.7	172	242	71	32
♀	Max.	48.1	41.4	38.9	17.1	25.6	17.5	17.1	24.0	10.2	20.5	9.2	7.1	28.1	5.5	3.2	200	263	80	35
♀	Min.	40.5	35.0	25.7	14.7	21.5	13.1	15.7	20.6	8.5	17.3	8.4	6.5	24.0	4.7	2.6	153	228	61	29
♂	17 av.	41.8	36.1	25.3	15.8	21.6	14.1	16.3	21.2	8.8	17.2	8.7	7.0	25.3	4.6	2.8	166	233	67	32
♀	Max.	43.4	37.5	26.8	16.7	23.0	15.7	17.1	22.8	9.7	18.6	9.4	7.5	26.2	5.1	3.2	179	261	82	35
♀	Min.	39.6	34.2	24.1	14.5	20.5	12.7	15.6	20.2	8.1	16.1	8.2	6.4	23.0	4.4	2.3	153	205	50	31
<i>Thomomys bottae connectens</i> , piedmont east of Rio Grande at Albuquerque																				
♂	6 av.	43.5	37.8	27.5	16.3	23.8	16.0	16.5	22.0	9.4	19.0	8.8	6.6	24.8	5.0	2.8	168	236	69	32
♀	Max.	45.4	39.2	28.1	17.2	24.7	16.8	17.1	22.8	9.6	20.0	9.3	6.9	25.8	5.4	3.0	178	251	80	34
♀	Min.	42.4	36.9	27.2	15.6	22.8	14.9	15.4	21.3	8.9	18.4	8.0	6.2	23.6	4.8	2.5	161	228	65	32

TABLE 1 -- Continued

Sex	Catalog number or number of individuals averaged	Condylobasal length	Basilar length	Zygomatic breadth	Palato frontal depth	Palatal length	Length of nasale	Breadth of braincase	Mastoid breadth	Breadth of rostrum	Length of rostrum	Alveolar length of maxillary tooth row	Interorbital breadth	Length of skull exclusive of rostrum and occiput	Breadth of nasals anteriorly	Breadth of nasals posteriorly	Length of head and body	Total length	Length of tail	Length of hindfoot
Thomomys bottae connectens, piedmont east of Rio Grande at Albuquerque (continued)																				
♂	10 av.	39.6	34.0	24.5	14.8	20.7	13.7	16.2	20.2	8.5	16.6	8.6	7.0	23.6	4.6	2.4	158	221	63	31
♂	Max.	41.1	35.7	26.3	15.1	22.2	15.2	17.1	21.2	8.9	17.9	9.3	7.4	25.6	5.0	2.8	165	227	68	34
♂	Min.	38.0	33.1	23.5	14.3	20.1	12.9	15.3	19.2	8.0	15.7	7.9	6.8	22.0	4.0	2.0	147	212	55	27
Thomomys bottae connectens, Belen, Valencia County																				
♂	58306 BS....	42.1	36.8	25.5	15.7	22.6	14.2	15.6	20.9	8.9	17.5	8.7	7.1	24.7	4.4	3.1	171	251	80	35
♂	58301 BS....	42.1	36.7	25.9	15.9	22.3	14.3	16.4	21.0	8.4	17.5	9.0	7.0	25.3	4.6	2.5	166	236	70	31
♂	58302 BS....	44.0	38.4	27.0	16.8	23.9	14.0	16.1	21.8	9.4	17.5	8.9	6.8	26.0	4.8	3.0	173	247	74	30
♂	58304 BS....	43.8	36.0	27.2	16.7	24.2	14.8	16.3	21.8	8.7	18.0	9.4	6.8	25.3	4.6	2.6	179	250	71	33
Thomomys bottae connectens, Bernalillo, Sandoval County																				
♂	58297 BS....	38.9	33.4	23.5	14.8	19.8	12.2	16.5	20.0	8.2	15.1	7.6	7.1	24.1	4.4	2.7	168	235	67	33
♂	58298 BS....	43.6	36.5	27.3	16.7	23.4	14.7	16.5	22.3	9.2	18.6	9.0	6.6	26.4	5.2	2.7	177	243	66	33
♂	58299 BS....	42.6	37.1	25.8	16.4	22.1	14.2	16.6	21.3	8.8	17.8	8.2	7.0	25.0	4.5	2.7	176	239	63	32
♂	58300 BS....	41.9	36.0	25.8	16.1	22.2	15.0	16.7	21.3	8.7	17.9	8.2	6.8	24.9	4.5	3.0	167	225	58	32

TABLE 1 -- Continued

Sex	Catalog number or number of individuals averaged	Condylobasal length	Basilar length	Zygomatic length	Palato frontal depth	Palatal length	Length of nasals	Breadth of braincase	Mastoid breadth	Breadth of rostrum	Length of rostrum	Alveolar length of maxillary tooth row	Interorbital breadth	Length of skull exclu sive of rostrum and occiput	Breadth of nasals anteriorly	Breadth of nasals posteriorly	Length of head and body	Total length	Length of tail	Length of hindfoot
Thomomys bottae connectens X Thomomys bottae actuosus, 9 ml E. and 3½ ml N. Albuquerque																				
♂	958 UNM.	39.2	33.6	24.2	15.0	21.0	14.4	15.5	19.6	8.8	17.2	8.5	6.7	22.3	4.9	3.1	156	218	62	29
♀	4 av.	36.5	32.5	23.7	14.1	19.8	13.2	15.6	19.3	8.2	15.4	8.1	6.9	21.6	4.5	2.6	152	216	64	30
	Max.	39.9	33.5	24.4	14.9	20.8	13.7	16.5	20.3	8.5	16.0	8.3	7.2	22.9	4.9	2.7	155	220	69	31
	Min.	36.3	30.9	22.8	13.6	18.8	12.8	14.8	18.6	7.9	14.8	7.9	6.5	20.6	4.3	2.2	148	211	60	29
Thomomys bottae paguatae, Suwanee, N.M.																				
♂	711 UNM.	42.1	36.2	26.7	15.7	22.1	14.9	16.9	21.3	9.6	17.9	9.0	6.9	24.1	4.4	2.7	166	230	64	31
♀	4 av.	39.3	34.3	24.3	14.8	20.5	13.0	15.8	20.5	8.1	16.0	8.6	6.9	23.8	4.5	2.7	157	221	64	31
	Max.	40.3	35.6	25.1	15.4	21.5	14.2	16.3	20.6	8.4	17.0	9.2	7.2	24.7	4.8	2.8	161	226	68	32
	Min.	37.0	31.3	22.9	13.8	18.8	11.5	15.3	19.4	7.5	14.8	8.1	6.7	22.4	4.0	2.5	152	217	61	30
Thomomys bottae paguatae, Laguna, N.M.																				
♂	136270 BS.	37.2	32.3	21.9	13.8	19.4	12.2	15.6	19.4	8.1	15.7	7.9	7.0	---	---	---	150	222	72	31
♀	148256 BS.	40.9	35.9	24.1	15.0	21.7	---	16.5	20.6	8.9	---	8.3	6.7	---	---	---	166	240	74	32
♀	148544 BS.	41.0	36.6	25.5	15.4	21.9	14.6	16.6	20.7	8.8	17.0	7.9	7.0	---	---	---	---	---	---	---

TABLE 1.-- Continued

Sex	Catalog number or number of individuals averaged	Condylobasal length	Basilar length	Zygomatic breadth	Palato frontal depth	Palatal length	Length of nasale	Breadth of braincase	Mastoid breadth	Breadth of rostrum	Length of rostrum	Alveolar length of maxillary tooth row	Interorbital breadth	Length of skull exclu- sive of rostrum and occiput	Breadth of nasale anteriorly	Breadth of nasale posteriorly	Length of head and body	Total length	Length of tail	Length of hindfoot
<u>Thomomys bottae paguatae, Laguna, N.M. (continued)</u>																				
♀	148257 BS..	39.2	34.5	24.1	14.8	20.9	13.4	16.3	20.2	8.2	16.3	8.6	6.8	---	---	---	164	230	66	30
<u>Thomomys bottae paguatae, Juan Tafoya, N.M.</u>																				
♂	148254 BS..	41.2	35.5	24.6	15.2	21.8	---	16.1	20.2	8.5	---	8.3	6.7	---	---	---	162	240	78	34
♀	146255 BS..	39.9	35.0	24.6	14.8	21.2	---	16.3	20.7	8.2	---	8.0	7.1	---	---	---	162	240	78	33
<u>Thomomys bottae paguatae, topotypes (Hooper, 1940:4)</u>																				
2 av. ♂	.....	---	38.5	27.7	---	---	15.2	---	20.2	8.9	19.0	---	6.8	26.0	4.8	3.25	---	255	76	30.5
Max. ♂	.....	---	38.8	28.0	---	---	15.4	---	20.3	9.1	19.4	---	6.9	26.3	4.8	3.3	---	259	78	31
Min. ♂	.....	---	38.1	27.3	---	---	14.9	---	20.0	8.7	18.7	---	6.7	25.4	4.8	3.2	---	251	74	30
3 av. ♀	.....	---	36.2	25.6	---	---	13.8	---	19.8	8.2	17.6	---	6.8	25.7	4.2	3.1	---	240	67	30
Max. ♀	.....	---	36.3	25.9	---	---	14.1	---	20.0	8.5	17.9	---	6.9	26.1	4.4	3.3	---	248	70	32
Min. ♀	.....	---	36.0	25.3	---	---	13.5	---	19.6	8.1	17.4	---	6.6	25.4	4.0	2.8	---	234	65	29

TABLE 1 -- Continued

Sex	Catalog number or number of individuals averaged	Condylabasal length	Basilar length	Zygomatic breadth	Palato frontal depth	Palatal length	Length of nasals	Breadth of braincase	Mastoid breadth	Breadth of rostrum	Length of rostrum	Alveolar length of maxillary tooth row	Interorbital breadth	Length of skull exclu- sive of rostrum and occiput	Breadth of nasals anteriorly	Breadth of nasals posteriorly	Length of head and body	Total length	Length of tail	Length of hindfoot
Thomomys bottae collis, topotypes (Hooper, 1940:7)																				
♂	7 av.	33.9	23.9	13.1	18.6	8.4	16.2	6.7	23.5	4.2	3.5	220	65	30	4.2	3.5	149	220	65	30
♂	Max.	35.4	24.7	13.7	19.0	8.7	16.8	6.9	24.3	4.4	3.8	230	73	32	4.4	3.8	135	230	73	32
♂	Min.	33.0	23.2	12.2	18.2	7.9	15.6	6.3	23.0	3.9	3.3	207	56	29	3.9	3.3	135	207	56	29
Thomomys bottae cultellus, topotypes (Kelson, 1951:64)																				
♂	70920 BS...	35.8	24.9	15.0	22.1	15.5	15.6	19.3	8.0	16.8	8.2	6.3	22.2	4.8	2.8	2.8	149	209	60	30
♂	71274 BS...	34.3	24.0	14.7	21.2	14.2	16.1	19.5	7.6	16.5	7.6	6.2	22.3	4.7	2.5	2.5	135	209	74	30
♀	69578 BS...	31.4	22.2	14.2	19.7	12.2	15.5	18.7	7.1	14.7	7.7	6.3	22.3	3.9	3.0	3.0	144	202	58	28
♀	70921 BS...	33.4	22.7	14.5	20.9	13.9	15.3	19.2	7.3	16.3	7.9	6.4	22.2	4.0	2.4	2.4	144	202	58	28
♀	70922 BS...	32.9	23.7	14.8	20.6	12.2	16.0	19.6	7.4	16.3	7.6	6.4	21.0	3.9	3.0	3.0	165	219	54	30
Thomomys bottae aureus, topotypes																				
♂	7 av.	35.4	24.8	15.5	21.4	14.1	16.0	20.5	8.6	16.8	8.4	6.7	22.2	4.0	2.4	2.4	165	235	69	30
♂	Max.	38.6	26.8	17.5	24.5	15.9	17.0	22.6	8.9	18.4	8.9	6.8	22.2	4.0	2.4	2.4	174	252	80	32
♂	Min.	33.6	23.6	14.1	19.3	13.0	14.9	19.3	8.3	15.8	7.9	6.5	22.2	4.0	2.4	2.4	154	220	62	27

TABLE 1 -- Concluded

Sex	Catalog number or number of individuals averaged	Condylobasal length	Basilar length	Zygomatic breadth	Palato frontal depth	Palatal length	Length of nasale	Breadth of braincase	Mastoid breadth	Breadth of rostrum	Length of rostrum	Alveolar length of maxillary tooth row	Interorbital breadth	Length of skull exclu- sive of rostrum and occiput	Breadth of nasals anteriorly	Breadth of nasals posteriorly	Length of head and body	Total length	Length of tail	Length of hindfoot
<u>Thomomys bottae aureus, topotypes (continued)</u>																				
7 av. +0+0+	.....38.3	33.3	23.6	14.9	20.2	12.9	15.5	19.8	8.1	15.6	8.2	6.8	---	---	---	---	158	228	70	30
Max. +0+0+	.....38.5	33.7	24.8	15.2	20.3	13.4	16.1	20.6	8.3	16.4	8.5	7.1	---	---	---	---	164	234	74	31
Min. +0+0+	.....38.0	32.8	22.7	14.4	20.0	12.7	14.8	19.3	7.9	15.0	7.8	6.5	---	---	---	---	153	222	65	29
<u>Thomomys bottae aureus, Fruitland, N.M.</u>																				
158852 BS. +0+0+	41.1	35.7	25.1	15.9	22.2	14.0	15.2	20.5	8.8	17.2	8.7	6.6	---	---	---	---	159	235	76	33
158849 BS. +0+0+	37.0	32.3	23.3	14.6	19.6	12.3	15.3	18.9	8.0	15.8	8.0	6.7	---	---	---	---	153	230	77	30
158850 BS. +0+0+	39.3	33.9	24.2	15.1	20.8	13.9	15.4	20.6	9.1	17.0	8.1	7.0	---	---	---	---	147	225	78	31
158851 BS. +0+0+	37.8	33.3	23.6	14.8	20.4	13.0	14.4	20.1	8.2	16.3	8.5	6.9	---	---	---	---	160	228	68	30

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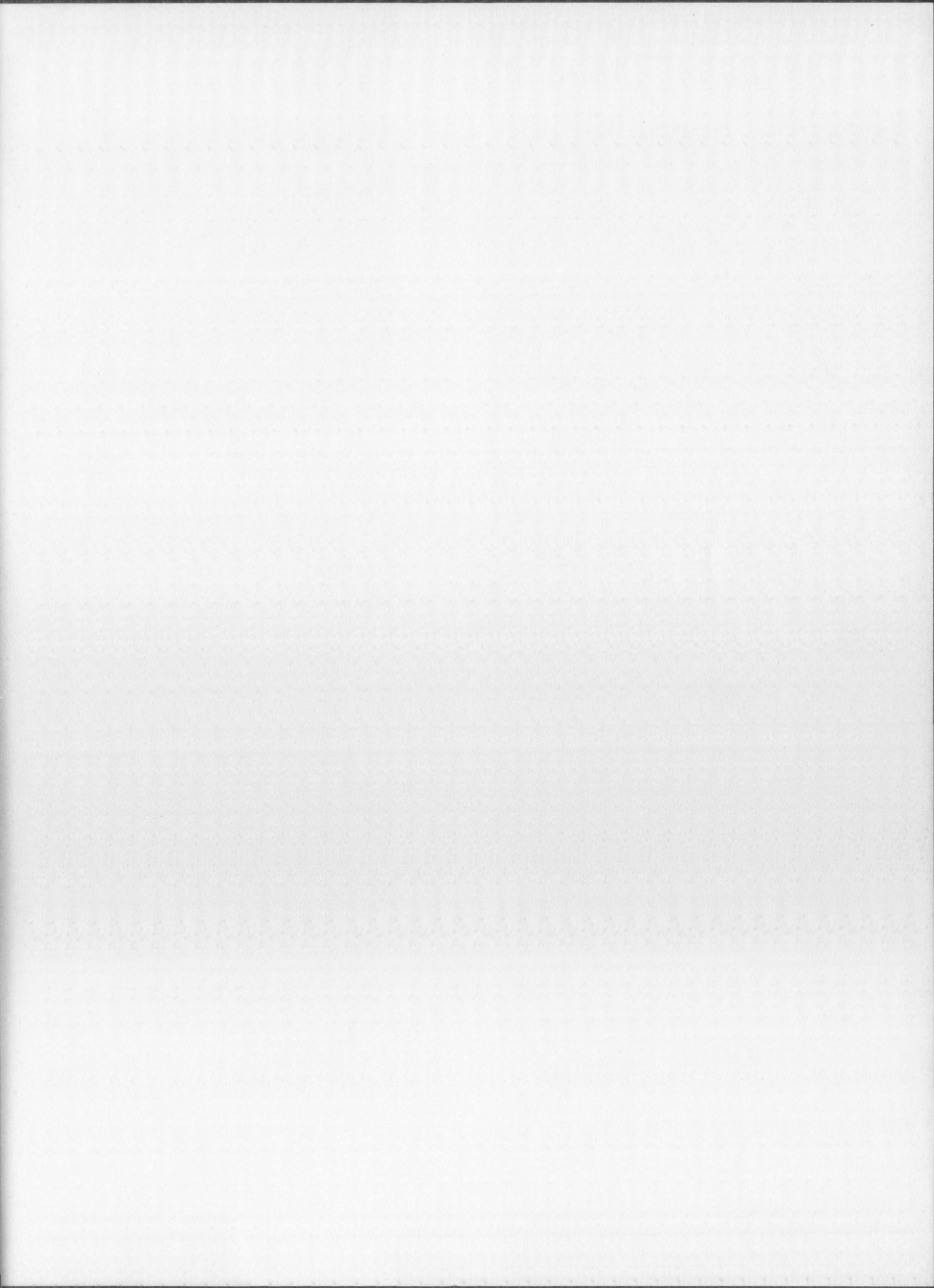
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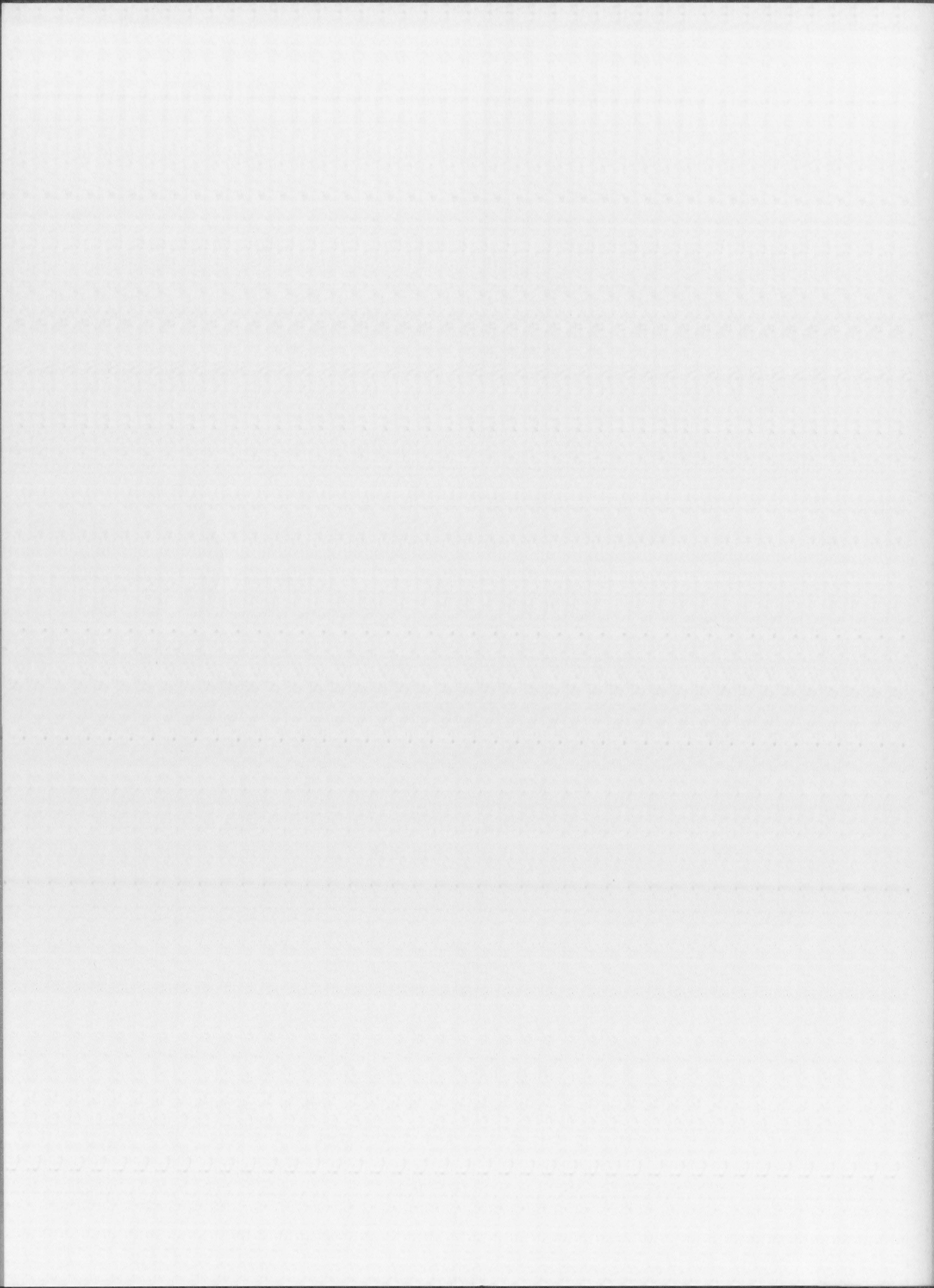
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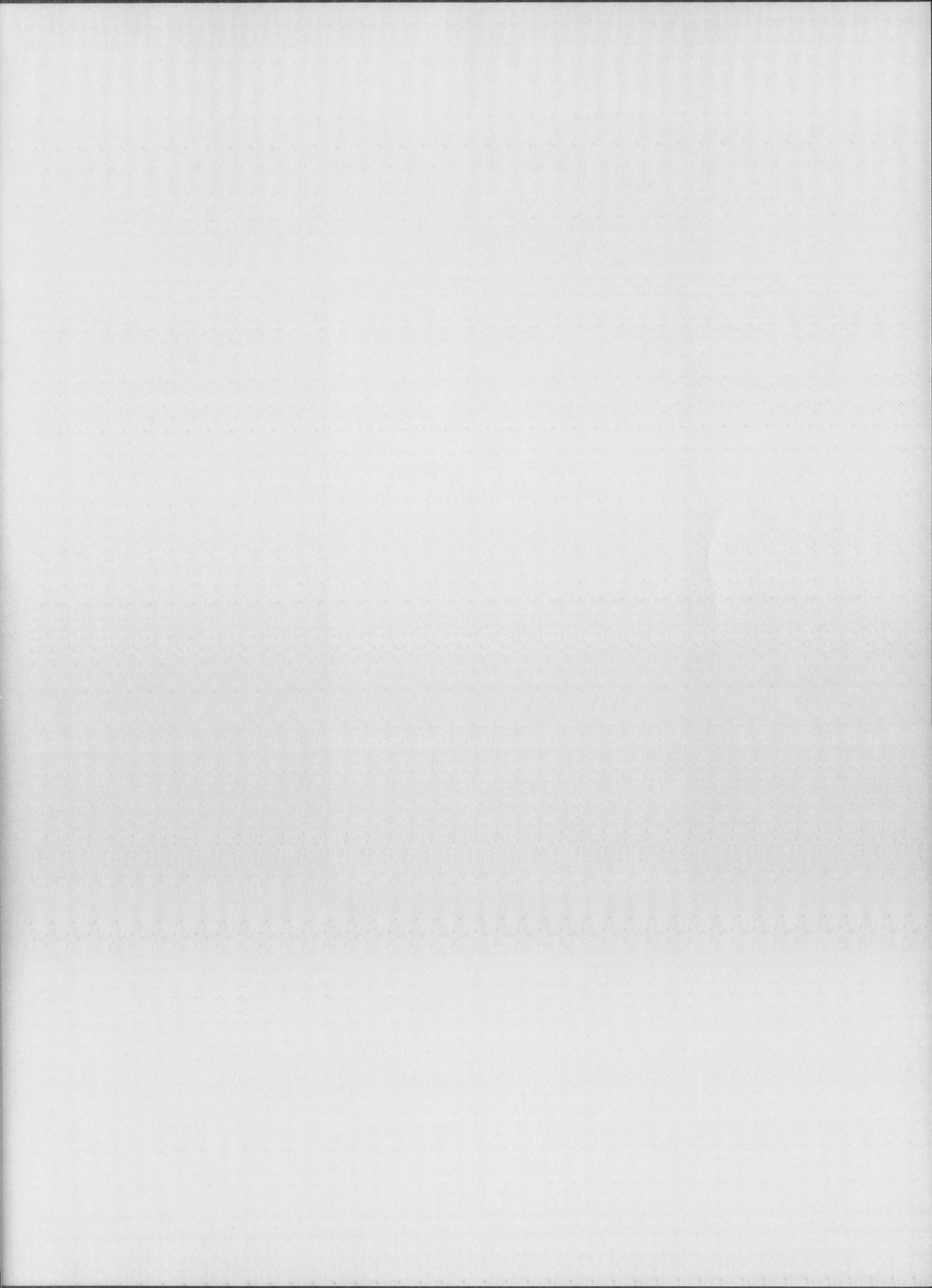
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