

Article XXIII.—A COLLECTION OF REPTILES AND AMPHIBIANS FROM SOUTHERN NEW MEXICO AND ARIZONA.

BY ALEXANDER G. RUTHVEN.

During the summer of 1906 the writer made a trip to southwestern United States for the purpose of obtaining a collection of the terrestrial cold-blooded vertebrates of that region for the American Museum of Natural History. The work was carried on during July and August, and at two points — Alamogordo, New Mexico, and Tucson, Arizona.

In all about 1,000 specimens were obtained, besides many notes on the habitat relations of the different forms. Special effort was made to secure the latter as the writer holds the point of view so ably stated by Gulick:¹ "Inquiries leading to the discovery of bionomic laws have usually been first suggested by observing the relations under which the organisms present themselves as distributed in nature; but after we have once recognized the fact that these relations are the result of the constant interaction between organism and organism, and between the organism and the physical environment, it becomes necessary to make a full classification of the different forms of interaction that tend to modify the species. A systematic and thorough use of this method will, I am convinced, throw light on many problems, correcting many partial and incomplete theories. We may also hope that a careful examination of the different forms of interaction will, in some degree, lessen the danger of attributing exclusively to one form of interaction results that are due to several forms of action. And having discovered that similar results are produced by different forms of action, we are next led to seek for the underlying principle in which they agree." It will be noted that two forms of interrelations are recognized in the above quotation ("the interaction between organism and organism and between the organism and the environment"), both of which may give rise to isolation and racial divergence. The following paper is the result of an endeavor to gather data bearing upon the interrelations between the reptiles and amphibians of the Southwest and their environment.

There is no reason to believe that reptiles and amphibians are less influenced by environmental conditions than are other groups. Indeed, with their limited powers of migration they must be more so than many other forms, and besides the geographic isolation that necessarily attends a

¹ Gulick, *Evolution Racial and Habitudinal*, p. 10-11.

close interrelation of organism and environment we may expect to find nearly related species associated with different environmental complexes, or in the same habitat when the habits are sufficiently different, for both



Fig. 1. Bottom of Box Cañon, Sacramento Mountains (altitude 6,000 feet). The Vegetation consists of *Pinus ponderosa*, *Abies concolor*, Ash, Willow, etc.

of these phases of environmental isolation are like the geographic in that they are favorable factors in the production of divergent racial groups. By determining, therefore, the interrelations between the different forms

and the environmental conditions with which they are found associated, clues may be obtained to the centers of origin, routes of migration, genetic relationships, and possibly some of the causes of divergence.

In carrying out this investigation, however, it must be borne in mind that the problem is a dynamic one. As has been elsewhere stated¹ "the environmental factors are the same as the geological factors in the belt of weathering. Each of these factors is the resultant of various processes (composed in turn of physical forces, heat, light, etc.) which when not in equilibrium tend to become so. The adjustment of these processes to each other brings about changes in the conditions which can only approximately cease when they approach an equilibrium, as, for example, when the topography has been reduced to a base-leveled plain covered by a layer of residual soil. The conditions in habitats where the processes are not in equilibrium are thus being constantly changed in the direction of other habitats in which they have more nearly reached an adjustment, and a succession of societies occurs that only ceases when the processes have become approximately adjusted to each other. The forms that are adapted to the adjusted conditions will constitute the climax society. It is necessary to here emphasize the importance of the organic factor; this must also become adjusted to the others for the entrance of new forms into a region may greatly disturb the equilibrium of its societies." Thus, owing to the fact that the conditions are not stable, in order to interpret the present conditions it is necessary to determine the history of the environment. With these points in mind the work upon which this paper is based was carried on as follows:

1. Two separate regions were explored in order to furnish grounds for comparison.
2. Each region was first covered by a brief reconnaissance in which the different habitats were noted.
3. Typical and accessible points in these habitats were then designated as stations, and the physical conditions and characteristic plants of each were listed.
4. The reptile and amphibian life of each habitat was determined by careful and persistent collecting, and each specimen was numbered and catalogued with the station number and such data as could be secured on habits, including an examination of the stomach contents in as many cases as possible.

The writer fully realizes that the results of the present work are very incomplete. They are necessarily so, however. In the first place it is

¹ Ruthven, An Ecological Survey in the Porcupine Mountains and Isle Royale, Michigan. Ann. Rept. Geol. Surv. Mich., 1905, 43.

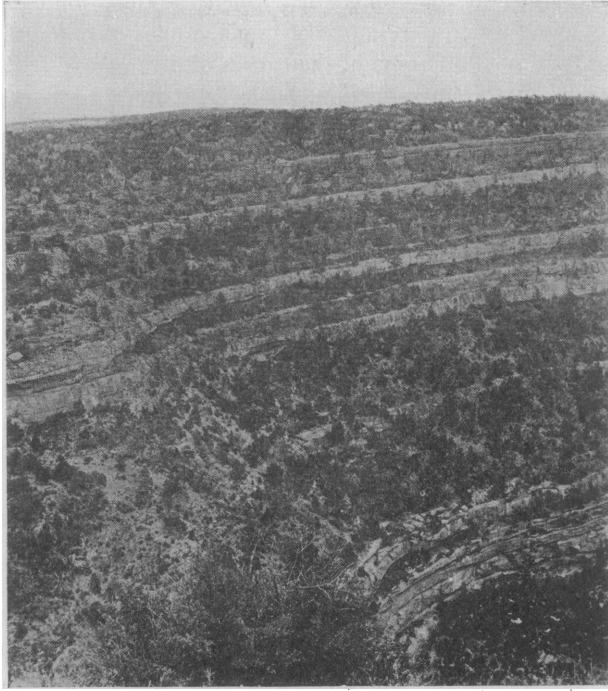


Fig. 2. South side of Box Cañon, Sacramento Mountains (altitude 6,000 feet). Piñon-Cedar association. The conspicuous plants are *Pinus edulis*, *Juniperus monosperma* and *J. pachyphlæa*. *Sceloporus consobrinus* occurs commonly in this habitat.



Fig. 3. Characteristic Piñon tree (*Pinus edulis*), in the Piñon-Cedar association.



Fig. 4. Typical growth of cedar (*Juniperus monosperma*) in the Piñon-Cedar association.

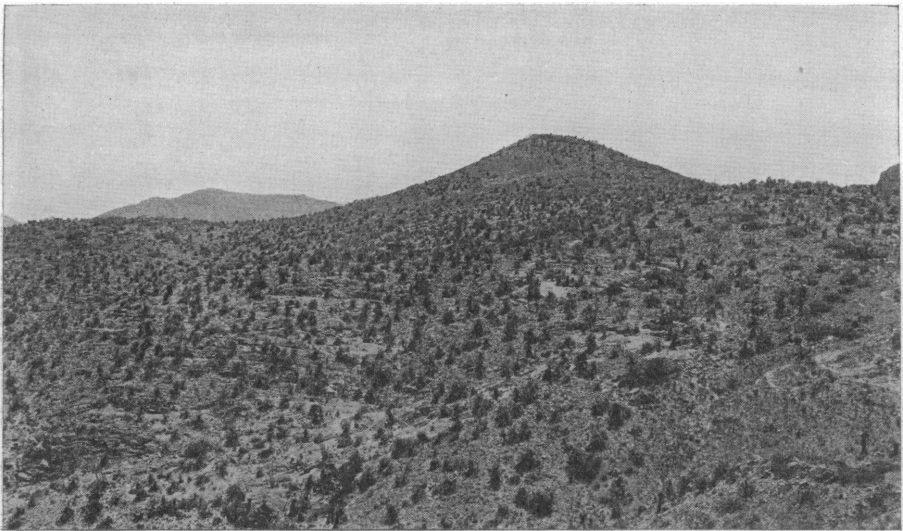


Fig. 5. Foothills of the Sacramento Mountains east of Alamogordo, N. M. Sotol-Ocotillo association. *Crotaphytus collaris baileyi* was found here.

often difficult in the case of reptiles to determine the characteristic forms of a habitat for, owing to their secretiveness, many common forms are often quite as apt to be overlooked as are the rarer ones. Then again while a number of systematists have applied these methods in a general way to other groups, with good results, the literature on the reptiles and amphibians still consists principally of annotated lists which ignore for the most part all environmental factors with the exception of the geographic.¹ Little data for comparison is therefore at hand, and in many instances one can only state the facts observed in the hope that they may serve as a basis for future work.

I desire, first of all, to acknowledge my indebtedness to the American Museum through Dr. H. C. Bumpus and Dr. W. M. Wheeler for the opportunity of carrying on this work, and to these gentlemen in particular, whose interest and coöperation made the trip a very pleasurable one. I am also under great obligations to Prof. Volney M. Spalding of the Desert Botanical Laboratory of the Carnegie Institution, who spent the early part of the summer at Alamogordo, and who very generously placed at my disposal the general results of his work on the local distribution of the flora of that region. I wish also to express my indebtedness to my assistant Mr. Gneomar von Krockow, of the American Museum, for his efficient service; to Mr. A. F. Zimmer of Chicago, who accompanied the party throughout the season entirely at his own expense, contributing many specimens to the collections, and to Prof. F. E. Lloyd, of the Desert Botanical Laboratory, and Prof. J. J. Thorner, of the University of Arizona, for many specimens, and much valuable information relative to the distribution of the flora and fauna about Tucson.

In the identification of several species I gratefully acknowledge the assistance of Dr. Leonhard Stejneger and Miss Mary C. Dickerson.

GENERAL ENVIRONMENTAL CONDITIONS.

Physiographic Features.—The topography of Arizona and New Mexico is dominated by the same feature — the high plateau with its two parietal series of broken mountain chains, that here replaces the lofty ranges of the Rocky Mountains. This plateau, which is bounded approximately by the contour line of 5,000 feet, is continuous with the high plateaus that abut against the eastern and western flanks of the Rocky Mountains, and forms

¹ Instances are numerous where the specimens in a collection from a given locality are labeled merely with the name of the principal neighboring town, fort, etc., when they may have been taken miles from the actual locality given and in many habitats.

with them a general plateau region. This feature is bordered on the south and west by a lower plateau between 3,000 and 5,000 feet, made up of short ranges and intermontane basins, and may be known as the Proplateau.¹ Extending northward from the Mexican Plateau with which it is continuous, the Proplateau pushes into southern Arizona, New Mexico and western Texas to the High Plateau, and follows along the margin of the latter as a narrow bench through Arizona into southern and western Nevada. In several places (the valleys of the Pecos and Colorado, and the bolson plains of the Trans-Pecos region) it penetrates the High Plateau region in long, narrow indentations.

As before stated the Proplateau is bounded by the 3,000 foot contour. In the United States its eastern margin is the Pecos valley, where it overlooks the Prairie region of central Texas, which falls away in elevation to 500 feet near the ninety-eighth meridian. Its western margin in the United States lies between the one hundred and tenth and one hundred and eleventh meridians, where it adjoins the desert plains about the lower parts of the Gila and Colorado rivers (Sonoran Desert) which also descend to a low elevation.

Climatology.—The climate of the different topographic divisions outlined above is distinctive. The Prairie region of Texas is semi-arid. The precipitation varies from about 15 inches on the western border to 40 inches at the ninety-eighth meridian. According to Hill² the seasonal distribution of rainfall in this region is determined by the overlapping of the Gulf and Sonoran types, "so that in these provinces there are usually two epochs of maximum rainfall, in May and September, respectively, and sometimes a third in June."

The desert plains of southwestern Arizona are, on the other hand, exceedingly arid. The mean annual temperature is above 65°, and as the humid air from the vapor zone in the Gulf of California is carried eastward by the prevailing westerly winds, so little moisture is precipitated that "upon this low plain the rain records approximate the absolute minimum of the world."³ As it ascends to the Proplateau, High Plateau, and mountain summits, however, where the temperature is progressively lower, the moisture is condensed and precipitated, and the conditions become less arid. Thus the Proplateau has an annual precipitation of 10–15 inches, the High Plateau 15–20 inches, and the mountain summits (above 7,000 feet) over 20 inches.

The same type of rainfall — the Sonoran — prevails throughout the

¹ Greeley, House Ex. Doc., 2d Sess., 51st Cong., XXXVIII, 303.

² Physical Geography of the Texas Region. Topog. Atlas U. S., 11.

³ Greeley, Climate of Arizona. House Ex. Doc. XXXVIII, 304.

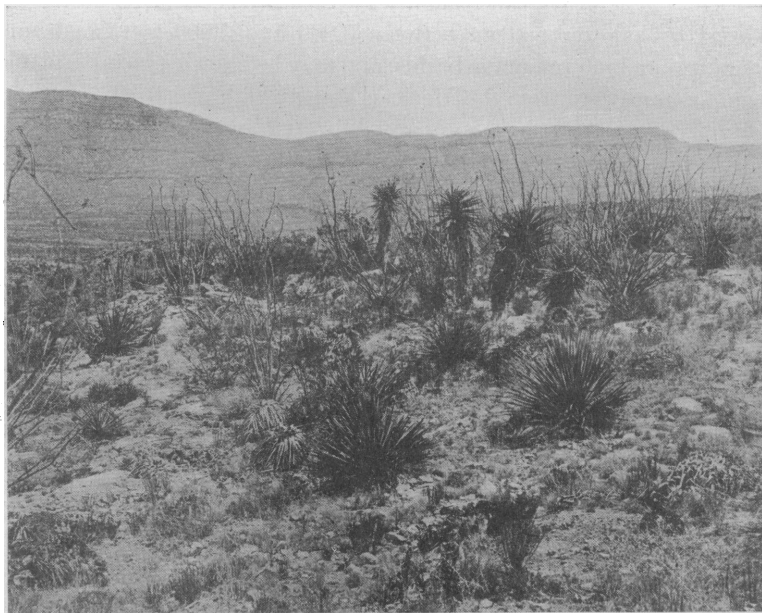


Fig. 6. Details of the Sotol-Ocotillo association. The Sotol, Ocotillo and various other Yuccas and Cacti may be distinguished.

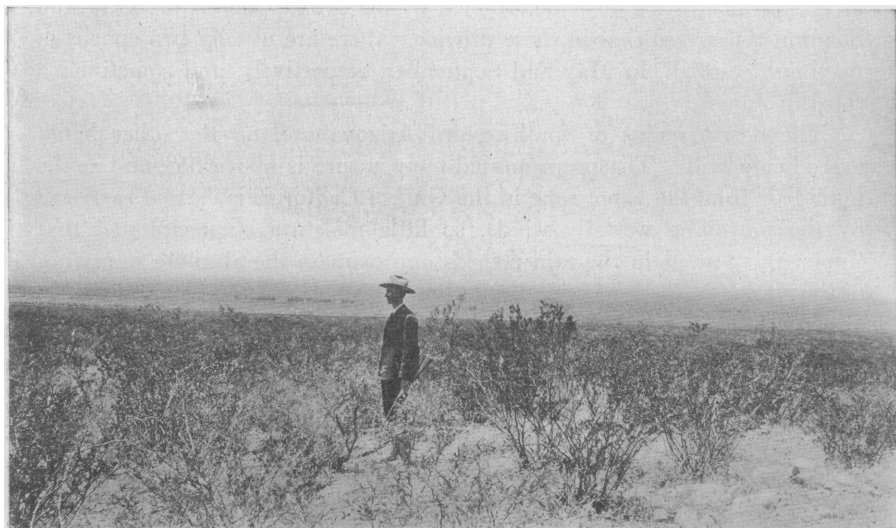


Fig. 7. Alluvial slope east of Alamogordo, N. M. Creosote bush association. The only shrub in the foreground is the Creosote bush. *Cnemidophorus melanostethus* is practically confined in this habitat.



Fig. 8. Arroyo on the alluvial slope east of Alamogordo, N. M. Note the Ocotillo and Sotol along the banks and the Creosote bush in the background, showing that the flora of the foothills is carried well down into the Creosote bush association along the arroyos. *Cnemidophorus gularis* was found in this habitat.

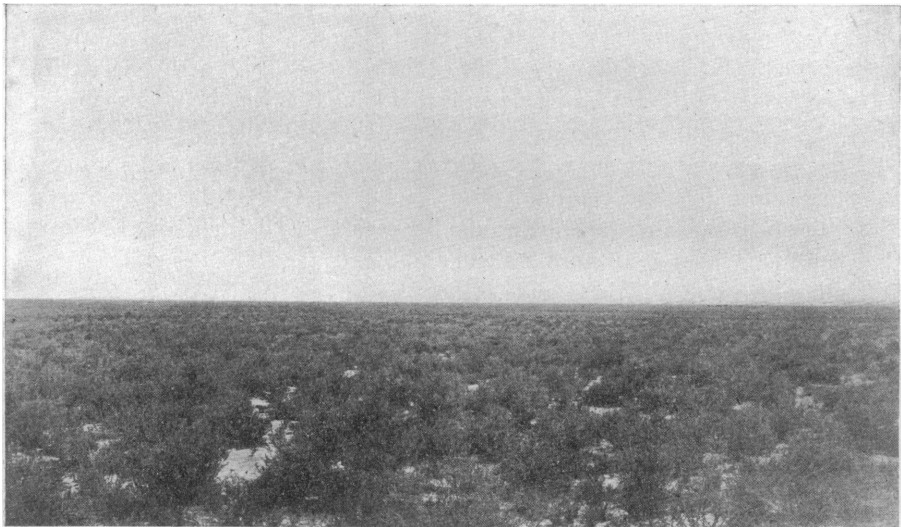


Fig. 9. Central depression west of Alamogordo, N. M. Atriplex association. The principal bush in this habitat is *Atriplex canescens*. The eastern margin of the White Sands may be seen in the distance. The characteristic lizard is *Crotaphytus collaris baileyi*, although *Cnemidophorus sexlineatus* is also common.

Proplateau region in Arizona and New Mexico. There are two rainy seasons, the general rains of winter, and the violent showers of the summer months. Generally speaking, the former begin in Arizona in December and cease in February; the latter beginning in July and ending in September. In New Mexico the winter rains last from January to April, the summer rains from the middle of June or the first of July to October.

In this general region, therefore, there may be distinguished five general sets of environmental conditions, differing in respect to their topography and climate and grading into each other at the margins. They are: 1st, the Prairie region of Texas; 2d, the Desert plains of southern California, Arizona, and Nevada (Sonoran Desert); 3d, the Arid plains (including the mountain slopes below 5,000 feet) of the Proplateau; 4th, the High Plateau, including the mountain slopes of the Proplateau region between 5,000 and 7,000 feet; 5th, the higher summits between 7,000 and 10,000 feet.¹

ALAMOGORDO, NEW MEXICO.

General Geography.—The region about Alamogordo was explored first. This locality is situated about half way up the Hueco bolson, one of the series of four parallel bolsons that carry the conditions of the arid plains of the Proplateau region well into the High Plateau. This feature is briefly described by Hill² as follows: "One of the most extensive and characteristic bolsons of the Trans-Pecos region is that lying between the Oscuro group on the west and the Hueco and Sacramento chains on the east, in southern New Mexico and extreme western Texas. This vast expanse of level plain extends through two degrees of latitude, from just south of the thirty-fourth parallel southward to the Rio Grande between Fort Hancock and El Paso. It is 40 miles wide at its northern end and broadens to 90 miles at its southern border along the Rio Grande.

"On all sides this bolson is inclosed by high mountain blocks or mesas. The mountainous perimeter includes the Sierra Blanca, Hueco, and Sacramento ranges on the east, the Franklin, Organ, and San Andreas blocks on the west, and unnamed Mexican Mountains on the south. At its north end is the Mesa Jumanes, dividing it from the Sandoval Bolson. A bench-like mesa projecting from the Sacramento Mountains is also shown on its eastern border.

¹ In the Sacramento range and on the plateau, there are a number of summits which attain a greater elevation than 10,000 feet and support a boreal biota similar to that of the Rocky Mountains and northern North America. As these peaks could not be examined the habitats will not be discussed in this paper.

² Physical Geography of the Texas Region. Topog. Atlas U. S., 9.

"Although apparently level, this plain slopes southward, according to the profile of the El Paso and Northern Railroad, from 4,500 feet at its northern end to 3,500 feet at its southern end, having an approximate gradient of 7 feet per mile."

At Alamogordo the plain itself has an elevation of about 4,000 feet in the middle and rises gently toward the margins. The rim of the basin is formed by the Sacramento mountains on the east, and the San Andreas range on the west, both of which rise abruptly from the plain. The former have here an altitude of 9,000 feet, but the latter do not attain a much greater height than 7,000 feet.¹

*Description of Habitats.*²—Undoubtedly one of the most potent factors in differentiating the environmental conditions in this region is the physiographic, as it profoundly affects both the climatic and edaphic conditions.

A comparison of the available records of Alamogordo and Cloudcroft shows that a marked decrease in precipitation and increase in temperature takes place between the mountain summits and the plain, which is accompanied by an increase in aridity. Owing to an abundant rainfall, the higher elevations (above 7,000 feet) are clothed with a dense forest growth, that has formed a layer of humus and holds a layer of residual soil. The vegetation of this habitat consists of such coniferous types as *Abies concolor*, *Pinus ponderosa* and *Pseudotsuga douglassi*, with scattered groves of oak and maple.

Below the contour line of 7,000 feet (approximately) the vegetation becomes more and more open, and the slopes exposed to the forces of denudation have become deeply dissected into steep-sided cañons and devoid of all but a thin covering of stony soil. The flora of this habitat is composed principally of low trees, such as *Pinus edulis*, *Juniperus pachyphloea* and *Juniperus monosperma*, associated with a few cacti and yuccas (Figs. 2-4). On the floor of the larger cañons, however, where there is less exposure and more soil, the flora consists of forms of the coniferous forest of the summit (*Pinus ponderosa*, *Pinus concolor*, Poison Ivy, Virginia Creeper, etc.) which push down into the Piñon-Cedar zone in long tongues (Fig. 1).

Below 5,500 feet the slopes and cañons possess only a meager flora of low xerophytic forms, the slopes are swept bare except for a thin veneer of stony waste, the streams are small or transient, and the cañons strewn with large boulders or floored by exposures of the bed rock. The characteristic vegetation consists of the Sotol, Ocotillo, and a number of yuccas and cacti (Figs. 5-6).

¹ The San Andreas Mountains could not be explored on this trip, but Mr. Edwin Walters of Alamogordo, who has been over the region, informed us that the conditions on this range are the same as those of the Sacramentos below 7,000 feet.

² See also MacBride, Science, N. S., XXI, 90-97.

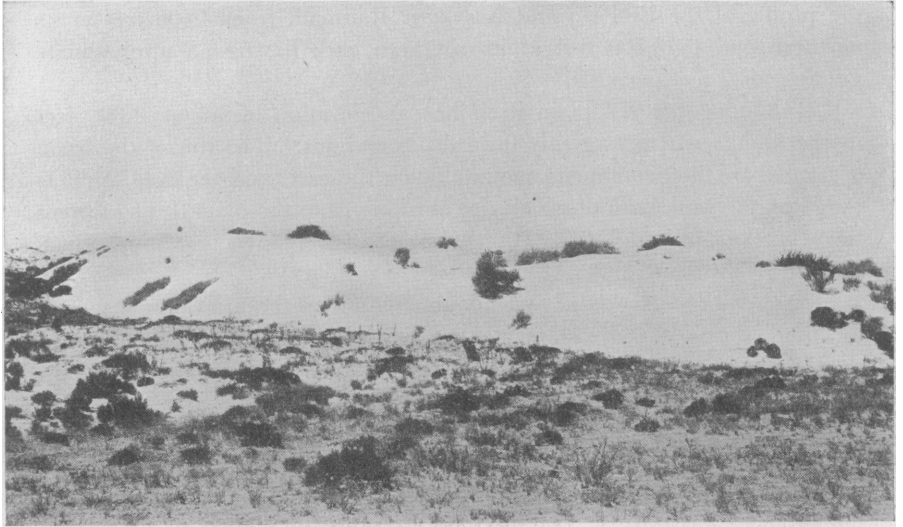


Fig. 10. Easternmost dunes of the White Sands west of Alamogordo, N. M. The steep slope (which is the lee slope) of the dunes indicates that they are advancing on the *Atriplex* association which is shown in the foreground. *Sceloporus consobrinus*, *Cnemidophorus sexlineatus* and *Holbrookia maculata flavilenta* were found on the face of this dune.



Fig. 11. General view of the White Sands west of Alamogordo, N. M. Sumac-Yucca association. The vegetation consists of *Rhus trilobata*, *Yucca radiosa*, Lavender and *Atriplex canescens*. The characteristic reptile of this habitat is *Holbrookia maculata flavilenta*.

During heavy rains the cañons are filled with torrential streams that rush out onto the desert floor and through the dry arroyos to form ephemeral lakes in the central depression. As they leave the cañons the coarser part of the material constituting their load is deposited as alluvial fans of stony material, that coalesce, forming a graded slope along the margin of the plain. The flora of this slope is very characteristic, as the dominant and one might almost say the only plant is the Creosote bush, which covers it from top to bottom with a dense growth (Fig. 7). On the stony soil near the top this flora becomes much diluted with the forms of the slopes, which push still

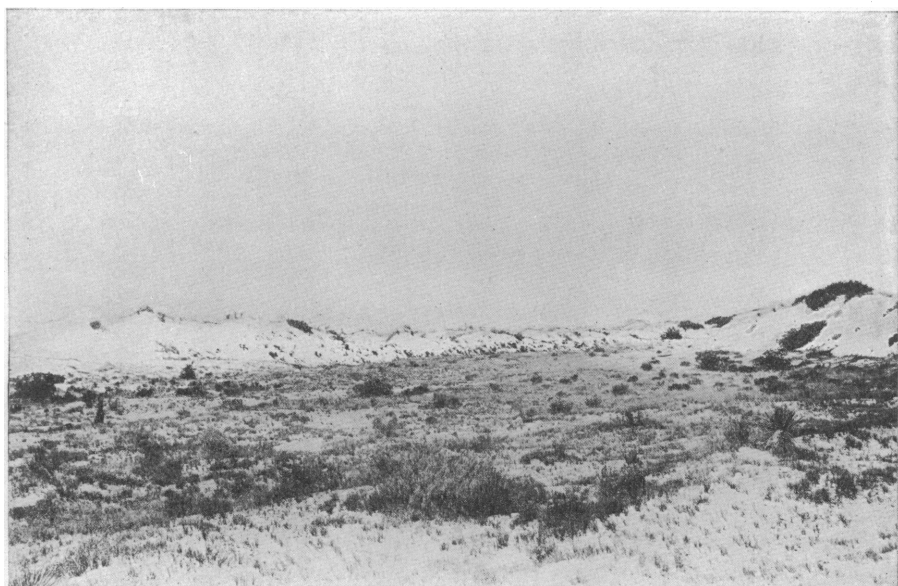


Fig. 12. Characteristic sink in the White Sands. The flora is composed principally of grasses and other low forms, *Atriplex canescens* also being present. The only reptile found in these bottoms was *Cnemidophorus sexlineatus*.

farther down in the arroyos (Fig. 8), and toward the bottom with those of the adjacent plains association, but these intermediate zones are so narrow that at a little distance the association appears sharply defined.

The finer material is carried out on the plain, and the salts largely to the central part of the basin. When the rains cease the streams on the desert floor and the lakes in the central depression rapidly disappear, and the soil dries out into a light pulverulent loam that increases in salinity toward the center of the basin. At the foot of the alluvial slopes the flora consists principally of the Mesquite (with considerable Crucifixion thorn), except.

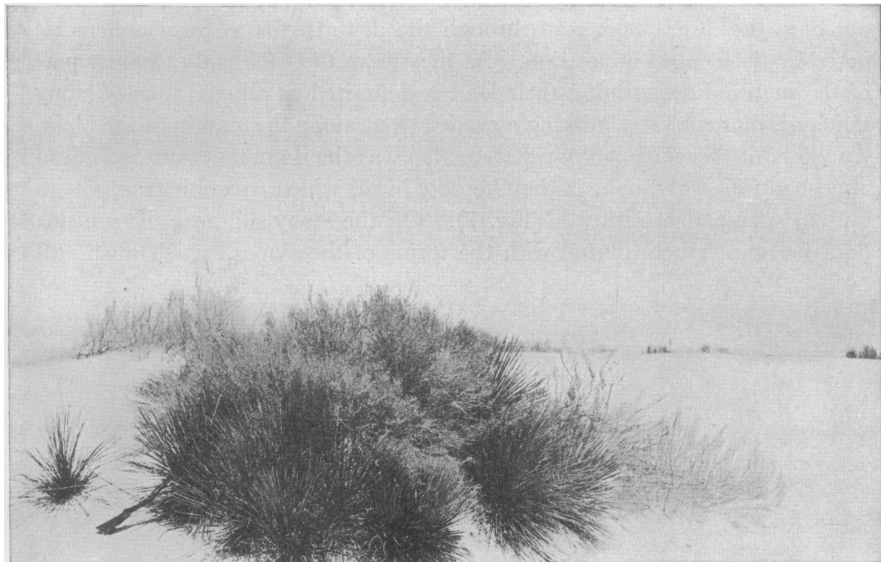


Fig. 13.

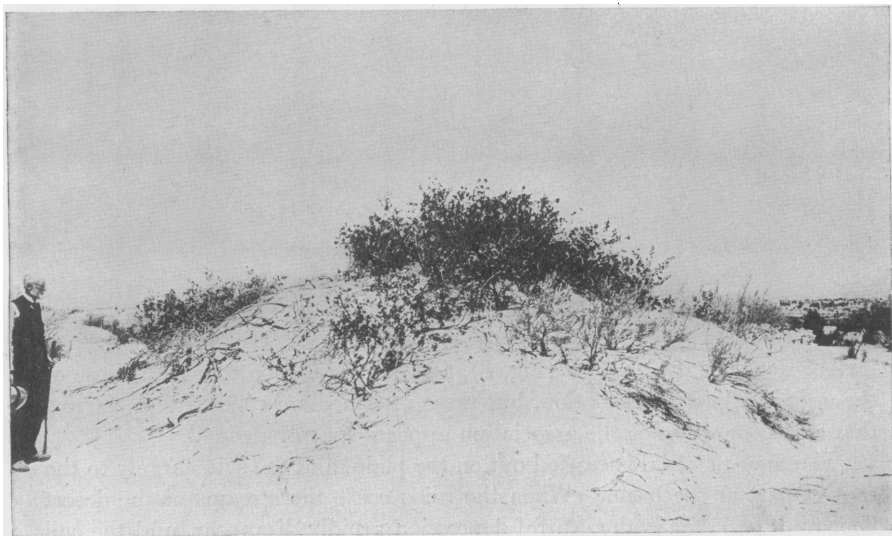


Fig. 14.

Figs. 13 and 14. *Yucca radiosa* and Lavender, above, *Rhus trilobata*, below, acting as dune holders on the White Sands. *Holbrookia maculata flavilenta* is found most commonly about such clumps of vegetation.

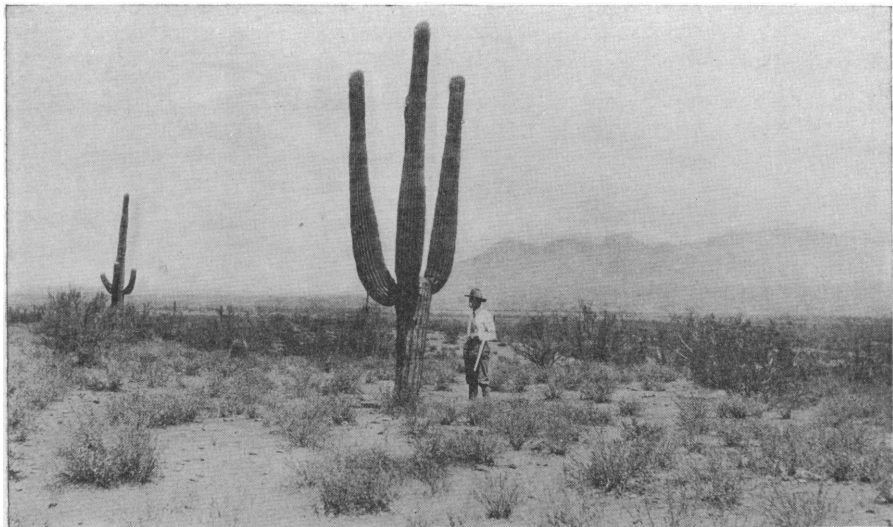


Fig. 15. Mesa west of the Santa Cruz River at Tucson, Ariz. Suaharo-Ocotillo association. Showing the characteristic plant of this habitat, the Suaharo. The small trees in the background are Palo verde.



Fig. 16. Plains east of Tucson, Ariz. Creosote bush association. The dominant shrub is the Creosote bush. The characteristic lizards of this habitat are *Cnemidophorus melanostethus* and *Sceloporus magister*.

about the salt spots, where the principal forms are *Allenrolfia* and *Atriplex*. This vegetation prevails from the foot of the marginal slope, to a point about five miles to the westward, where it is replaced, owing probably to the increased salinity of the soil, by a flora consisting of the forms which margin the salt spots in the mesquite zone. This habitat occupies the central and lowest part of the basin. The soil is fine and strongly impregnated with salts. The vegetation consists of low forms, principally *Atriplex canescens*, associated with *Suaeda*, *Sporobolus*, and other low halophytic forms (Fig. 9).

In the central depression are situated the famous White Sands which cover an area of several hundred square miles on the western side of the plain, their eastern limit being marked by the steep faces of a long line of dunes in the central depression, about 12 miles west of Alamogordo (Fig. 10). They consist of shifting dunes of fine white gypsum sand, with intervening depressions (Figs. 10-14). They are said to owe their origin to the disintegration of exposed gypsum beds on the floor of the plain,¹ and are moving eastward on the desert floor under the influence of the prevailing westerly winds. The sand itself is composed principally of calcium sulphate,² and being soft and fine packs well, forming compact surfaces except on the lee slope of the dunes. In color it is a dull white that in the intense light of the desert takes on a buff or even pinkish tint.

Obtaining the minimum precipitation and possessing a porous, saline, and very unstable substratum, the White Sands form by far the most severe habitat in this region. Nevertheless they support a meager flora, that struggles to maintain a foothold, giving rise to the usual forms of wandering, captive and rejuvenated dunes.

Directly west of Alamogordo, and on the eastern margin of the White Sands is a large salina (Lake Walters) which is apparently perennial. It covers a roughly estimated area of two or three square miles, about one-fourth of which lies within the area of the White Sands. It is shallow and very strongly saline, and has a bottom composed of fine silt; the shores are covered with a layer of encrusted salts. During the summer months the rainfall is not sufficient to counteract the evaporation, and wide areas of mud are exposed about the shores.

The depressions within the White Sands appear to have the same level as the floor of the desert. They are usually dry, but those that extend inward from the end of Lake Walters contain occasional water holes in which the water is very alkaline. The vegetation of these bottoms consists of a low and comparatively dense growth of grasses and other low forms (Fig. 12), while on the dunes the flora consists almost entirely of a very scat-

¹ Herrick, The Geology of the White Sands of New Mexico, Jour. Geol., VIII, 123.

² Coville and MacDougal, Desert Botanical Laboratory of the Carnegie Institution, 9.

tered growth of *Rhus trilobata*, *Yucca radiosa*, *Atriplex* and Lavender, species that, with the exception of *Rhus trilobata*, are also found in the *Atriplex* association. These plants act as dune holders, *Rhus trilobata* probably being the most successful¹ (Figs. 13-14).

List of Stations.

- Station I. Clouderoft, N. M. Altitude 8,650 feet. Pine-Spruce association.
Station II. Between Pinto and Highrolls, N. M. Altitude 6,500 feet. Piñon-Cedar association. (Figs. 2-4.)
Station III. Foothills east of Alamogordo, N. M. Altitude 4,500 feet. Sotol-Ocotillo association. (Figs. 5-6.)
Station IV. Alluvial slope east of Alamogordo, N. M. Creosote bush association. (Fig. 7.)
Station V. Floor of Hueco bolson from Alamogordo to the White Sands inclusive.
 Substation 1. Margin of plain, about Alamogordo. Mesquite association.
 Substation 2. Central depression. *Atriplex* association. (Fig. 9.)
 Substation 3. White Sands, Sumac-Yucca association. (Figs. 10-14.)

TUCSON, ARIZONA.

General Geography.—This locality is situated in southeastern Arizona, a little to the north of the junction of the 32d parallel with the 111th meridian. It marks approximately the western limit of the Proplateau region, and the eastern margin of the Sonoran Desert in this latitude. The same broad topographic features prevail in this region as at Alamogordo and elsewhere in the Proplateau region — a low plain between parallel mountain chains.

Description of Habitats.—Here as elsewhere in the Proplateau region the mountains receive most of the rainfall. The summits, where high enough, are clothed with coniferous forests with a subjacent zone of Piñon and Cedar. These habitats could not be explored.

Below the Piñon-Cedar zone, owing to the increased aridity, the slopes are covered by a sparse flora of such xerophytic forms as the Sotol, Ocotillo, and various yuccas and cacti, the *Suaharo* being a conspicuous form. Dry cañons were not investigated but probably support a flora similar to that of the slopes. Sabino Cañon, in which there is a perennial stream, contains, below the Piñon-Cedar zone, a flora of shrubs and trees.²

¹ Lake Walters would be considered as a separate habitat, were it not for the fact that this paper concerns itself primarily with reptiles. The flora about its shores is distinctive, as is also its aquatic biota.

² Prof. Thornber has very kindly furnished me with the following list of the more characteristic trees and shrubs that occur in the lower part of Sabino Cañon: *Populus fremontii wislizeni*, *Platanus racemosa*, *Quercus oblongifolia*, *Quercus arizonica*, *Fraxinus velutina*, *Salix nigra*, *Salix bonplandiana*, *Celtis reticulata*, *Juglans rupestris*, *Rhamnus californica tomentella*, *Vitis arizonica*, *Dodonaea viscosa*, *Coursetia microphylla*.

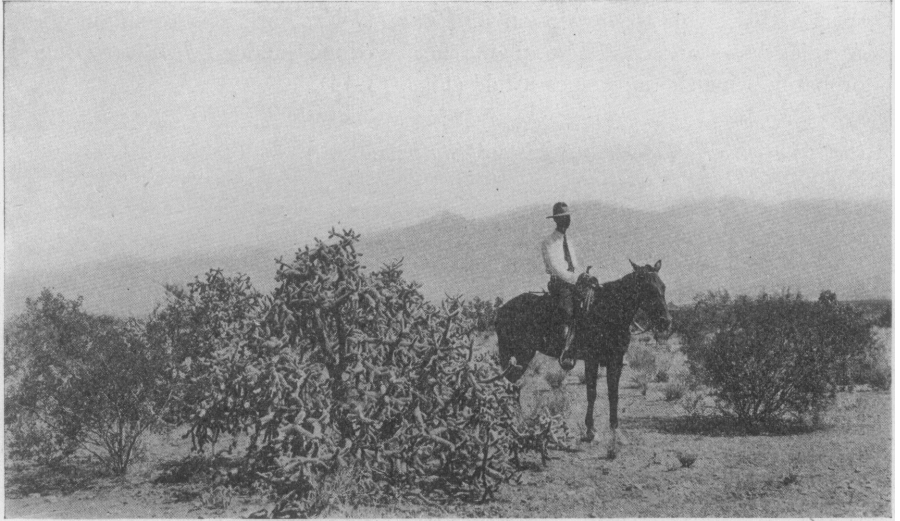


Fig. 17. Characteristic growth of the Cholla in the Creosote bush association on the plains about Tucson, Ariz. These Cacti are frequented by *Sceloporus magister*.

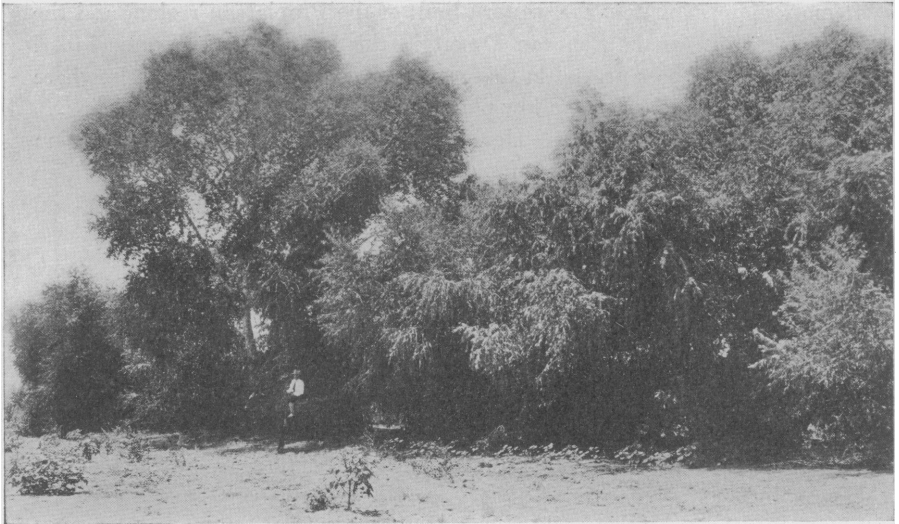


Fig. 18. Riparian vegetation along the Santa Cruz River at Tucson, Ariz. Willow-Poplar association. The trees are willows and poplars. This is the habitat of *Cnemidophorus gularis*, *Sceloporus clarkii* and *Uta ornata* on the plains.

Below an elevation of 3,000 feet a broad inclined bench of stony waste leads down from each range to the plain.¹ These slopes are elaborately dissected by branching arroyos, and are covered by a flora consisting principally of the Ocotillo, Sotol, Palo verde and various cacti and yuccas, with a slight infusion of plains forms (Creosote bush and Chollas, Fig. 15.) The larger arroyos are U-shaped, and contain a flora dominated by the Mesquite flanked by the Creosote bush on the slopes. In the smaller ones the vegetation is composed principally of the forms of the hills, with a narrow fringe of Cat's-claw tree, Palo verde and Mesquite on the immediate margin of the stream bed.



Fig. 19. Bed of Santa Cruz River at Tucson, Ariz. (The trees have been mostly removed from the banks at this place.) *Rana pipiens* is found commonly along the margin of this stream.

The plain which lies at the foot of the mesas has an altitude of about 2,500 feet. It is covered by a loose coarse soil, and supports a flora dominated by the Creosote bush and several arborescent *Opuntias* (Figs. 16-17). The former is so abundant and characteristic of the plains in this region as to have given to them the name of Greasewood plains. The feature differs from the plains at Alamogordo in being drained, so that there is no central depression or salinas.

The plain is traversed by numerous shallow sandy washes which are margined by Cat's-claw tree and Mesquite, but there are but three larger

¹ While similar in structure these detrital formations differ from the alluvial slopes at Alamogordo in that they have not been formed in the present geographic cycle. Their origin has been discussed by Ransome (U. S. Geol. Surv., Professional Paper, No. 12.).

streams in the vicinity of Tucson, the Santa Cruz River, Rillito Creek, and Pantano Wash, the last two being tributary to the former. The Santa Cruz River at this point is mostly perennial and is attended by three distinct floras, (1) an aquatic, (2) a marginal association composed of trees and bushes (Willows, Poplars and various shrubs), Fig. 18, (3) a flood-plain flora largely dominated by the Mesquite.¹ Nearly the same floras exist along Rillito Creek as along the Santa Cruz River, although modified by the greater aridity. The stream is not perennial so that an aquatic flora is wanting, and the trees found along the banks are few and scattered. The Mesquite zone is present, however, extending from the margin of the stream bed well onto the plains on the one hand, and on the other into the larger arroyos on the mesa that flanks the Santa Catalinas.

Pantano Wash is a wide arroyo, dry during the summer except after heavy showers. Both the aquatic and marginal floras are wanting, but there is a narrow Mesquite zone along its banks. The reptile fauna in this habitat was found to be identical with that of the surrounding plains, with which it may be considered.

List of Stations.

Station I. Plain north, east and south of Tucson.

Substation 1. Plain proper. Creosote bush association. (Figs. 16-17.)

Substation 2. Sandy washes. Acacia association.

Station II. Santa Cruz River from Tucson to a point about five miles to the southward.

Substation 1. The stream. Association of aquatics. (Fig. 19.)

" 2. Banks. Willow-Poplar association. (Fig. 18.)

" 3. Flood plain. Mesquite association.

Station III. Rillito Creek, north of Tucson.

Substation 1. Stream bed.

" 2. Banks. Willow-Poplar association.

" 3. Flood-plain. Mesquite association.

Station IV. Mesa and foothills northeast of Tucson Mountains, west of Tucson.

Substation 1. Hills. Suaharo-Ocotillo association. (Fig. 15.)

" 2. Slopes. Creosote bush association.

" 3. Bottom of arroyos. Acacia association.

Station V. Alluvial slopes southwest of Santa Catalina Mts., northeast of Tucson.

Substation 1. Hills. Suaharo-Ocotillo association.

" 2. Slopes. Creosote bush association.

" 3. Bottom of arroyos. Acacia association.

Station VI. Lower part of Sabino Cañon.

Substation 1. Stream. Association of aquatics.

" 2. Bottom of Cañon. Willow-Poplar association.

¹ Most of the arable land in this region along the Santa Cruz River, and about Tucson, the original plants have been mostly removed so that this zone may now very appropriately be called the zone of cultivated weeds, as suggested to me by Prof. Spalding. In our collecting, however, we confined our attention to localities where original conditions still prevail.

ANNOTATED LIST.

SALIENTIA.

***Scaphiopus couchii* Baird.**

Scaphiopus couchii BAIRD, Proc. Acad. Nat. Sci. Phila., 1854, 62.—BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 28.—COPE, Proc. Acad. Nat. Sci. Phila., 1863, 52.—COPE, Bull. U. S. Nat. Mus., I, 1875, 32.—“BROCCHI, Miss. Sci. Mex., Batr., 1881, 26.”—BOULENGER, Cat. Batr. Salient. Brit. Mus., 1882, 434–435.—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 25, 177.—“BELDING, West Am. Sci., III, No. 24, 1887, 99.”—COPE, Bull. U. S. Nat. Mus., XXXIV, 1889, 301–302.—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, V, 1895, 558–559.—DICKERSON, The Frog Book, 1906, 57–59.

Scaphiopus varius COPE, Proc. Acad. Nat. Sci. Phila., 1863, 52–53.—COPE, Bull. U. S. Nat. Mus., XVII, 1880, 29, 44, 46.—“BROCCHI, Miss. Sci. Mex., Batr., XXIV, 1881, 27.”

Scaphiopus varius varius COPE, Bull. U. S. Nat. Mus., I, 1875, 31.—YARROW, *ibid.*, XXIV, 1883, 25, 177.

Scaphiopus couchii varius COPE, Proc. Acad. Nat. Sci. Phila., 1866, 313.—“GARMAN, Bull. Essex Inst., XVI, 1884, 1, 46.”—COPE, Bull. U. S. Nat. Mus., XXXII, 1887, 12.

Locality.—A number of specimens of this Spadefoot were taken at Tucson, where it is apparently a common form.

Description of Specimens.—These specimens have the coarsely tuberculate skin, obscure parotids and rather distinct tympanum characteristic of *S. couchii*. Color above dull brownish yellow to bright greenish yellow, with an irregular network of brown bars. These may be broad and fewer with broad interspaces, or narrow and numerous with smaller light interspaces. Tubercles on the back (except between the hind limbs) black, those on the sides, and on the back between the hind limbs bright greenish yellow. Color of limbs above, as the dorsal surface except that the dark markings are roughly arranged as cross bars. Under surfaces white. Outer sole tubercle and occasionally the tips of the fingers and toes brownish black. Throat of the males not black.

Habitat Relations.—Six individuals (three males and three females) of this toad were found in a small pool on the flood-plain of the Santa Cruz River (Mesquite association), on August 1. They were breeding, and during the fertilization of the eggs the female was clasped firmly about the inguinal region by the male who kept up a constant singing. The pool was small and shallow, owing its origin to a few showers that had occurred previous to this date, one the night before. Five days later the pool had become entirely dry and hundreds of tadpoles were dying in the mud.

The transient nature of the water bodies on the plains makes it necessary that the immature stages of the amphibians of this habitat be brief. Prof. Thornber has mentioned the fact that the larval period of *Bufo alvarius* is short (p. 506). In the case of an unidentified species of toad found at Tucson I noted that the transition from tadpoles with a complete tail and the hind limbs but partially developed, to small toads which had acquired a terrestrial life, took place in 10 days.

Range.—*Scaphiopus couchii* has been taken in central Texas, in the Proplateau region of Arizona, and in Lower California.

Scaphiopus couchii Baird.

| Habitat | Field No. | Locality | When Collected | Collector | Remarks |
|----------------|-----------|--|----------------|----------------|---------|
| Mesquite Assn. | 621 | Tucson, Ariz. Flood plain of Santa Cruz river at Tucson | Aug. 1-06 | A. G. Ruthven | Adult |
| " | 622 | " | " | " | " |
| " | 623 | " | " | " | " |
| " | 624 | " | " | " | " |
| " | 625 | " | " | G. von Krockow | " |
| " | 626 | " | " | A. G. Ruthven | " |
| " | 640 | " | " | " | Eggs |
| | 641 | Deposited by toad No. 625 in captivity | " | " | " |
| | 1046 | Tucson, Arizona | Aug. 25-06 | J. J. Thornber | Adult |

Bufo cognatus Say.

Bufo cognatus "SAY, Long's Exped. Rocky Mts., II, 1823, 190."—"HOLBROOK, North Am. Herp., V, 1842, 12."—BAIRD & GIRARD, Marcy's Explor. Red River, 1853, 213-214.—BAIRD, Rept. Pac. R. R. Surv., X (Whipple-Ives Route), 1859, 44.—BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 26.—COPE, Bull. U. S. Nat. Mus., XXXIV, 1889, 275-277.—COPE, Proc. Acad. Nat. Sci. Phila., 1892, 332.—COPE, Am. Nat., XXX, 1896, 1016.—DICKERSON, The Frog Book, 1906, 99-102.

Bufo lentiginosus cognatus COPE, Bull. U. S. Nat. Mus., I, 1875, 29.—YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 521.—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 23, 165.

Locality.—This species is a common form about the irrigating ditches at Tucson.

Description of Specimens.—The three specimens obtained are typical of the species. The head is short, the muzzle very blunt and high, and the cranial crests diverge posteriorly from a bony protuberance situated between

the anterior part of the orbits. Back of the eyes each of these ridges is met by another which extends between the parotid gland and the eye to the tympanum. Inner and outer sole tubercles present, the outer much the larger, both with free cutting edges. The ground color in two specimens is pale yellowish gray, that of the third, dark brown anteriorly, becoming yellowish gray on the hind quarters. Muzzle variously barred with vertically elongated spots. An elongated spot over each eye. Two to four small spots between the anterior end of the parotid glands, followed by two pairs of larger and one pair of smaller, oblique spots on either side of the pale vertebral line. Limbs with similar dark spots, those on the posterior face of the leg forming two or three well defined cross bars. Under surfaces yellow, unspotted. Digits of the fore and hind limbs tipped with very dark brown.

Habitat Relations.—This toad was commonly found at dusk about the irrigating ditches, but not elsewhere.

Range.—*Bufo cognatus* is found on the Proplateau in southern Arizona and occurs on the Great Plains as far north as Nebraska, and eastward to eastern Kansas. It has also been recorded within the Rocky Mountains (Fort Garland, Colorado).

Bufo cognatus Say.

| Habitat | Field No. | Locality | When Collected | Collector |
|---------------------------------------|-----------|-----------------|----------------|----------------|
| Irrigating ditch, Creosote bush Assn. | 604 | Tucson, Arizona | July 29-06. | A. G. Ruthven |
| “ | 1047 | “ | Aug. 25-06 | J. J. Thornber |
| “ | 1048 | “ | “ | “ |

Bufo alvarius Girard.

Bufo alvarius GIRARD apud Baird, U. S. and Mex. Bound. Surv., II, 1859, 26.—COPE, Bull. U. S. Nat. Mus., XXXIV, 1889, 265-267.—COPE, Am. Nat., XXX, 1896, 1014.—DICKERSON, The Frog Book, 1906, 106-108.

Locality.—One adult specimen (No. 1037) and three tadpoles of this toad, taken in Sabino Cañon, were presented to the party by Prof. Thornber.

Description of Specimen.—The adult specimen conforms closely to the descriptions given by Girard, Cope and Dickerson. The size is large (total length 147 mm.). Skin smooth, with a few, rather small, rounded warts scattered over the dorsal surface. The nostrils are large, oval and lateral. A bony crest extends backward from the nostrils and bifurcates in front of

the eye; one branch extends downward in front of the eye, the other, encircling the orbit above, reaches the ear and again divides to embrace the upper part of the tympanum.

The tympanum is a large vertical oval. The parotid glands are large, oblong in form and very divergent. They begin a short distance behind the eye and extend to a point above the axillary pit. There is a single large elevated gland on the outer aspect of the thigh, a longer one (that is partially constricted into two) on the posterior face of the leg, and a long but less elevated one on the outer side of the forearm. Posterior to the angle of the mouth is a large wart preceded by two or three smaller ones.

Two large palm tubercles. Palm covered with small tubercles, a larger one at the base of the second phalange of each digit. Upper surface of fore foot covered by minute tubercles. Both inner and outer sole tubercles present, the inner much the larger.

Habitat Relations.—Professor Thornber has kindly furnished me the following account of the habits of this toad: "It is abundant in Tucson and on the University campus. One usually sees the toads a few days before the beginning of the summer showers, and their presence is taken as a sign of rain. Seldom does one see them during dry periods. They may, however, be observed about irrigation ditches and in irrigated land any time during the growing season.

"With the first heavy summer showers, as a result of which water will stand in pools, these frogs appear in abundance and lay eggs which hatch very soon; the young pass in a remarkably short time through the tadpole stage. I do not think it is more than a month's time from the egg stage to the time when the young toad hops away with his tail nearly absorbed.

"The particular specimen which I gave you was collected in Sabino Cañon, St. Catalina Mts., in June (about the 15th), 1903. A small stream of water came down from the mountains as the result of rain above, and these toads appeared in abundance pairing almost immediately. On that day every female was laying eggs. The eggs were laid in the clear stream of water, which was perhaps a foot to eighteen inches deep. I assure you there was no lack of noise that day nor night, the croaking being incessant. I have also seen it at Oracle, Ariz., where it gets into the sheep troughs and causes more or less trouble."

Range.—This seems to be the third locality recorded for this toad. The locality of the type is given as "Valley of Gila and Colorado" by Baird, and as "Fort Yuma, Calif.," by Cope. Miss Dickerson has recently recorded it from Phoenix, Arizona.

***Bufo punctatus* Baird & Girard.**

Bufo punctatus BAIRD, Proc. Acad. Nat. Sci. Phila., 1852, 173.—HALLOWELL, Sitgreaves' Exped. Zuni and Colo. Riv., 1853, 143, 147.—GIRARD, Proc. Acad. Nat. Sci. Phila., 1854, 87.—BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 25.—HEERMANN apud Hallowell, Rept. Pac. R. R. Surv., X (Williamson's Route), 1859, 25.—COPE, Proc. Acad. Nat. Sci. Phila., 1866, 313.—COPE, Bull. U. S. Nat. Mus., I, 1875, 29.—YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 523.—COPE, Bull. U. S. Nat. Mus., XVII, 1880, 4, 29, 46, 47.—YARROW, *ibid.*, XXIV, 1883, 22 and 162.—COPE, *ibid.*, XXXII, 1887, 10.—“BELDING, West Am. Scientist, III, No. 24, 1887, 99.”—COPE, Proc. U. S. Nat. Mus., XI, 1888, 395.—COPE, Bull. U. S. Nat. Mus., XXXIV, 1889, 262–264.—STEJNEGER, North Am. Fauna, No. 3, 1890, 117.; *ibid.*, No. 7, 1893, 219.—VAN DENBURGH, Proc. Cal. Acad. Sci., Ser. 2, V, 1895, 559–560.—COPE, Am. Nat., XXX, 1896, 1012.—STONE & REHN, Proc. Acad. Nat. Sci. Phila., 1903, 34.—DICKERSON, The Frog Book, 1906, 19, 110–112.

Bufo beldingii YARROW, Proc. U. S. Nat. Mus., IV, 1882, 441.—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 23, 163.—“BELDING, West Am. Scientist, III, No. 24, 1887, 99.”

Locality.—A single specimen (No. 87) of this toad was found on the streets of Alamogordo, N. M.

Description of Specimen.—The structural characters of the single specimen obtained are entirely typical of this well defined species. The color of the dorsal surface is grayish ash with small scattered black spots, mostly grouped about the bases of the warts. Warts yellow, tipped with red. Ventral surface yellowish, the breast and submaxillary region spotted with black.

Habitat Relations.—This specimen was found after dark on the bank of an irrigation ditch. Rehn and Viereck¹ took two specimens at a spring in Dry Cañon. It is possibly a cañon form which has extended its range onto the desert floor by way of the irrigating ditches.

Range.—*Bufo punctatus* occurs in the Proplateau and Mexican Plateau regions, having been recorded from New Mexico, Arizona and northern Mexico. On the eastward it extends into central Texas, and on the westward to southern California and throughout the length of the peninsula of Lower California. So far as I know it has not thus far been taken in the Sonoran Desert.

***Bufo lentiginosus woodhousii* Girard.**

Bufo dorsalis HALLOWELL, Proc. Acad. Nat. Sci. Phila., 1852, 181.—HALLOWELL, Sitgreaves' Exped. Zuni and Colorado Rivers, 1853, 142.

Bufo woodhousii GIRARD, Proc. Acad. Nat. Sci. Phila., 1854, 86.—BAIRD, U. S. and Mex. Bound. Survey, II, 1859, 27.

Bufo frontosus COPE, Proc. Acad. Nat. Sci. Phila., 1866, 301.

Bufo lentiginosus frontosus COPE, Bull. U. S. Nat. Mus., I, 1875, 29.—YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 520.—COUES, *ibid.*, 627-628.—COPE, Proc. Acad. Nat. Sci. Phila., 1883, 14, 15.—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 23, 165.

Bufo lentiginosus woodhousii STEJNEGER, North Amer. Fauna, No. 3, 1890, 116-117; *ibid.*, No. 7, 1893, 221.—DICKERSON, The Frog Book, 1906, 91-93.

Locality.—Twelve specimens of this toad were taken in the village of Alamogordo in July. Like its eastern representatives, *B. lentiginosus* and *americanus*, it was the common toad in the localities in which it was found.

Description of Specimens.—As has been stated by various writers it is difficult to point out characters that will distinguish the western form known as variety *woodhousii* from the eastern *B. americanus*. In general it may be said that the cranial crests are more nearly parallel in *woodhousii*, but they are little divergent in *americanus* and occasionally slightly divergent in *woodhousii*, so that this character alone cannot be relied upon. Probably the best character is the shortness of head but in the Alamogordo specimens this is not as great as given by Dickerson (one-fifth of length), but may be as low as one-fourth, a proportion often shown in *americanus*.

Colors light. Ground color grayish or yellowish brown often spotted with black. These spots may be either rather large and confluent or restricted to the bases of the warts. A whitish, grayish, or dark yellow vertebral line more or less irregular in some specimens. Ventral surface light yellow, immaculate, except for a few small black spots between the front limbs. Throat of male black.

Habitat Relations.—All of the specimens of this toad were taken in the evening along the irrigating ditches in the Mesquite association on the plains. As in the case of *B. punctatus*, the natural habitat of var. *woodhousii* is probably the cañons in the mountains, where moisture is more abundant, and it can be considered to have extended its range out onto the plain with the advent of the irrigating ditches. Nothing seems to have been recorded as to the habits of this toad. As in the case of *B. americanus* beetles make up the bulk of the food, as is shown by an examination of stomach contents. Another important article of food is the grasshopper. Doubtless spiders and caterpillars also form a part of the food as in the case of the eastern form.

During the intense heat of the day these toads were not seen, but about dusk they came out in numbers along the shallow ditches, especially near street lamps.

Range.— This is the common toad of the Great Plains and Great Basin region. It is recorded from Montana, Nebraska, Kansas, Wyoming, Colorado, Utah, New Mexico, Arizona and Texas. It is very evidently the western representative of the *B. lentiginosus* and *americanus* group, but until the relationships of these forms have been worked out, the boundary of their respective ranges cannot be established.

Bufo lentiginosus woodhousii Girard.

| Habitat | Field No. | Locality | When Collected | Collector |
|---------------------------------------|-----------|------------------------|----------------|---------------|
| Near irrigating ditch. Mesquite Assn. | 145 | Alamogordo, New Mexico | July 9-06 | V. Spalding |
| " | 249 | " | July 13-06 | A. G. Ruthven |
| " | 250 | " | " | " |
| " | 251 | " | " | " |
| " | 252 | " | " | " |
| " | 253 | " | " | " |
| " | 254 | " | " | " |
| " | 255 | " | " | " |
| " | 256 | " | " | " |
| " | 257 | " | " | " |
| " | 258 | " | " | " |
| " | 286 | " | July 14-06 | " |
| " | 287 | " | " | " |

Hyla arenicolor Cope.

Hyla arenicolor COPE, Jour. Acad. Nat. Sci. Phila., 1866, 84.— COPE, Proc. Acad. Nat. Sci. Phila., 1866, 301.— COPE, Bull. U. S. Nat. Mus., XVII, 1880, 47.— BOULENGER, Cat. Batrach. Salient., 1882, 373.— YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 524.— COUES, *ibid.*, 630.— COPE, Bull. U. S. Nat. Mus., XXXII, 1887, 14.— COPE, Bull. U. S. Nat. Mus., XXXIV, 1889, 369-370.— STEJNEGER, North Amer. Fauna, No. 3, 1890, 117-118.— COPE, Am. Nat., XXX, 1896, 1014, 1021, 1022.— STONE, Proc. Acad. Nat. Sci. Phila., 1903, 539.— DICKERSON, The Frog Book, 1906, 122-123.

Hyla affinis BAIRD, Proc. Acad. Nat. Sci. Phila., 1854, 61.— BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 29.

Hyla copei BOULENGER, Ann. and Mag. Nat. Hist., (5), XX, 1887, 53.; *ibid.* (6), I, 1888, 189.

Locality.— Professor Thornber presented the party with two specimens of this species, which he secured in the lower part of Sabino Cañon, Santa Catalina Mountains, Ariz., May 23, 1903.

Description of Specimens.— These specimens are typical in having a rough skin, prominent disks on anterior and posterior digits, broad flat head, and no webs on the anterior digits. Hind limbs long. Eye small.

The color cannot now be determined. Several rows of dark blotches are discernible on the back, and the hind limbs are crossed by short, broad bands of darker.

Habitat Relations.—These specimens were found among the bushes on the floor of the cañon, Willow-Poplar association. No other observations have apparently been recorded on the habitat of this species.

Range.—*Hyla arenicolor* is apparently principally confined to the Mexican Plateau and Proplateau regions. Cope states that it is found as far south as Guanajuato, Mexico; the accurate northern records are White River Cañon, Tucson, Ariz., and Fort Wingate and Sante Fé, N. M. The latter records seem to indicate that it reaches the summit of the High Plateau.

***Rana pipiens* Schreber.¹**

Locality.—Taken in the lower part of Sabino Cañon and along the Santa Cruz River near Tucson.

Description of Specimens.—Size of specimens small, mostly below 45 mm. Only two obtained which reached a length of 55 mm., and none seen that were noticeably larger.

Most of the specimens in the collection are light greenish gray above, with two irregular rows of light brown spots above and about two below the dorso-lateral fold. A few are dark brown above with black spots. In the lighter individuals the limbs are light grayish ash, in the darker ones brownish ash to light brown. The markings on the hind limbs consist of cross bars on the thigh, leg and foot, and irregular markings on the posterior face of the thigh. On the fore limbs there is a short longitudinal bar on the anterior face of the forearm near the shoulder, a patch just above the point of the elbow, and three or four short cross bars on the anterior face of the forearm. Under surfaces white or yellowish white, immaculate.

Habitat Relations.—Owing to its aquatic habits it is to be expected that the habitat of this species would be very limited and sharply defined in an arid region. Specimens were only found about the margins of pools and irrigating ditches in the valley of the Santa Cruz River, and along the

¹ Miss Dickerson finds it impossible at present to recognize any subspecies in this wide-ranging and variable species. She sums up the situation as follows: "The variation of the frogs is remarkable, but no fundamental characteristic (such as proportionate length of head and body, leg measurement, etc.) remains stable when large series of frogs from adjoining districts are examined. Eastern specimens are likely to be green or brown, southern and western specimens are more often gray. Eastern frogs, especially those that frequent the salt marshes of the coast, are more smooth-skinned and slender, and on the whole more delicately moulded, while southern and western specimens are much more robust in build, have a rougher skin, and attain a large size. The material is very confusing. With a smaller series, the subspecies might have been granted. With a still more complete series, it is possible that two or three intergrading varieties of the species *pipiens* could be recognized. Much systematic study of such a series of frogs combined with knowledge of their habits and life histories, could alone produce any definite conclusion in the matter." (The Frog Book, p. 171.)

stream in Sabino Cañon. It is quite common in these habitats, but closely confined to the vicinity of the water, a fact which limits the migration routes of the species in this region to the water courses.¹

Range.— This species, as defined at present, ranges in general from the Sierra Nevada Mountains to the Atlantic Coast.

Rana pipiens Schreber.

| Habitat | Field No. | Locality | When Collected | Collector |
|----------------------------|-----------|--|----------------|----------------|
| Immediate margin of stream | 678 | Bed of Santa Cruz River at Tucson | Aug. 5-06 | A. G. Ruthven |
| " | 679 | " | " | " |
| " | 680 | " | " | " |
| " | 681 | " | " | " |
| " | 682 | " | " | G. von Krockow |
| " | 683 | " | " | " |
| " | 874 | Bed of Santa Cruz River south of Tucson | Aug. 14-06 | A. G. Ruthven |
| " | 875 | " | " | " |
| " | 929 | Creek in flood plain of Santa Cruz River south of Tucson | Aug. 16-06 | " |
| " | 930 | " | " | " |
| " | 931 | " | " | " |
| " | 932 | " | " | " |
| " | 933 | " | " | " |
| " | 934 | " | " | " |
| " | 935 | " | " | " |
| " | 936 | " | " | " |
| " | 937 | " | " | " |
| " | 938 | " | " | G. von Krockow |
| " | 939 | " | " | " |
| " | 940 | " | " | " |
| " | 941 | " | " | " |
| " | 969 | In lower part of Sabino Cañon | Aug. 18-06 | A. G. Ruthven |
| " | 970 | " | " | " |
| " | 971 | " | " | " |
| " | 972 | " | " | " |
| " | 973 | " | " | " |
| " | 985 | " | " | A. F. Zimmer |
| " | 986 | " | " | " |
| " | 989 | " | " | G. von Krockow |
| " | 990 | " | " | " |
| " | 991 | " | " | " |
| " | 992 | " | " | " |

¹ In the timbered and prairie regions of eastern United States this frog is often found a mile or more from water, having traveled this distance through damp underbrush or long grass. Its migration routes in this region are not, therefore, confined to particular streams.

SAURIA.

***Crotaphytus collaris baileyi* Stejneger.**

Crotaphytus collaris AUCT. part, nec Say.

Crotaphytus collaris var. "BOCOURT, Miss. Sci. Mex., Rept., 1874, 3 livr., 155."

Crotaphytus baileyi STEJNEGER, North Amer. Fauna, No. 3, 1890, 103-105; *ibid.*, No. 7, 1893, 165-166.—VAN DENBURGH, Occ. Papers, Calif. Acad. Sci., V, 1897, 53-54.—STEJNEGER, Proc. U. S. Nat. Mus., XXV, 1902, 149-150.

Crotaphytus collaris baileyi STONE & REHN, Proc. Acad. Nat. Sci. Phila., 1903, 30.—BAILEY, North Amer. Fauna, No. 25, 1905, 40.—MEEK, Field Mus. of Nat. Hist., Zool. Ser., VII, 1905, 8.

Locality.—Eleven specimens collected near Alamogordo are referred to this variety as they all have two rows of interocular scutes.

Description of Specimens.—In seven of the twelve specimens collected the interoculars are in two distinct rows between the orbital regions; in four, however (Nos. 124, 125, 415, 416), one pair is fused into a single scute (Fig. 20). In the single specimen collected in the foothills, a very large individual (No. 295), the scales of the head are so rough that it is impossible to determine the arrangement of the interoculars with certainty, but they are apparently in two rows.

The colors of most of the specimens taken on the desert floor are strikingly pallid. The ground color above is light ash, light yellow, bluish gray, or brown relieved by numerous small, round or oblong spots of very light yellow. In some specimens these spots tend to arrange themselves in reticulations and break up the ground color into large spots. On the tail the lighter color increases to equal or exceed the darker which is broken up into a row of spots on either side of a median dorsal line. The characteristic collars consist of a pair of black bands on either side of the neck, interrupted on the throat and also on the median dorsal line. These bands are usually margined narrowly with light yellow. Belly, under surface of tail, and throat, light yellow, the anterior part of the latter occasionally marked with dark slate colored spots. In one specimen (No. 125) there is a narrow line of bright crimson before, between and behind the collars, and numerous small spots of the same color on the neck and anterior part of the body. In life there were similar neck lines on No. 109, but their color was light pink, and there were no spots on the body.

In the single specimen (No. 295) collected in the Sotol-Ocotillo association on the slopes the colors are much darker than in the desert forms. The ground color in this specimen is light olive, becoming brown toward middle of back, and on the limbs and base of tail. The light spots on the body and distal end of tail are light yellow, on the leg and proximal half of tail greenish. Fore limbs light green. Head dark brown spotted with black.

Belly and ventral surface of tail pale greenish yellow. Throat with a central, triangular patch of light blue. Sides densely and finely spotted with black.

In the younger specimens the tendency of the light dorsal spots to unite into reticulations and break up the ground color into large spots, and also to form transverse lines is more pronounced. This coloration is strikingly similar to that of the young of *C. wislizenii*, and is retained more perfectly in adults of the latter species than in *C. collaris baileyi*.

Habitat Relations.—Merriam states that in the western part of its range (southern California, Nevada and southwestern Utah) *C. collaris baileyi* is an Upper Sonoran form (Piñon-Cedar belt) and only enters the upper edge of the Lower Sonoran zone. At Alamogordo the conditions are exactly reversed, as it was found here only in the Atriplex association on the plains, and in the Sotol-Ocotillo association in the foothills of the Sacramentos. It is apparently rare in the latter habitat, while not a single specimen was taken or observed in either the Creosote bush or Mesquite associations. They doubtless occur to some extent, however, in both of the latter habitats.

In the Atriplex association, on the other hand, they are not uncommon. Here they may be seen on sunny days running about on the ground between the bushes or occasionally climbing among their branches. When approached carefully they will occasionally lie very quietly until one is within a couple of yards, their colors harmonizing so perfectly with the light soil that, unless one is aware of their exact whereabouts, it is difficult to detect them. They can seldom be approached in this way, however, as they are very shy, and usually the first intimation that one has of their proximity is a fleeting glimpse of a light colored body dashing off across the desert. When frightened they run with great swiftness from bush to bush, often for several rods, which is in contrast with the habits of the smaller lizards in the same habitat, which usually stop beneath the first clump of vegetation. They are very pugnacious, fighting furiously when wounded, but their food does not indicate as fierce a nature as that of *C. wislizenii*. As far as observed their diet consists exclusively of insects — grasshoppers, beetles and locusts being found in the stomachs of those examined. A large grasshopper forms the bulk of the contents of these stomachs.

Range.—Stejneger defines the range of *Crotaphytus collaris baileyi* as "western New Mexico, Arizona, Utah, Nevada, and northern Mexico," and that of *C. collaris* as "Kansas, Indian Territory, Arkansas, Texas and eastern New Mexico." The specimens from Alamogordo come, therefore, from a region which is supposed to be intermediate between the ranges of these two forms. We have seen, however, that specimens from Alamogordo

are undoubtedly to be referred to *C. collaris baileyi*, and as most of the Texas localities recorded for this variety are to the west of the Pecos Valley, it seems that the East Front Ranges mark approximately the eastern margin of the range of variety *baileyi*. East of this line of uplift, in the Pecos Valley, specimens showing the characters of both varieties have been recorded as well as numerous individuals in which the traits are apparently blended in various degrees. It seems, therefore, that it is in a general way in the region immediately east of the East Front Ranges in Texas that these two varieties of *Crotaphytus* grade into each other. Since in the Rio Grande Valley *C. collaris baileyi* is apparently not found on the plain but in "the lower part of the cañons and the mesas adjoining"¹ it would seem further that this variety pushes down the mountains in western New Mexico, and becomes a plains form in the Hueco bolson and Trans-Pecos region. It is thus able to intergrade with the eastern variety which is a plains form.

Range.—*C. collaris baileyi* is a typical form of the Proplateau region. It apparently does not occur as far west as Tucson in this latitude nor on the High Plateau, but follows the narrow strip of mountainous country that margins the latter region, through Arizona and southern Nevada to California.

Crotaphytus collaris baileyi Stejneger.

| Habitat | Field No. | Locality | When Collected | Collector | Interocular Scutes |
|----------------------|-----------|---|----------------|----------------|--------------------------------|
| Atriplex Assn. | 107 | Alamogordo, N.M. Plains between Alamogordo and White Sands | July 9-06 | A. G. Ruthven | Two rows |
| " | 108 | " | July 9-06 | " | " |
| " | 109 | " | " | " | " |
| " | 124 | " | " | G. von Krockow | Two rows, one pair fused |
| " | 125 | " | " | " | " |
| Sotol-Ocotillo Assn. | 295 | Foot hills of Sacramento Mts. | July 15-06 | A. G. Ruthven | Two rows (apparently) |
| " | 414 | Plains west of Alamogordo | July 19-06 | A. F. Zimmer | Two rows |
| " | 415 | " | " | A. G. Ruthven | Two rows, one pair fused |
| " | 416 | " | " | " | " |
| " | 417 | " | " | " | Two rows |
| " | 448 | " | " | " | " |
| " | 507 | " | July 21-06 | " | " |

¹ Herrick, Bull. Sci. Lab. Denison Univ., XI, 142.

***Crotaphytus wislizenii* Baird & Girard.**

Crotaphytus gambelii BAIRD & GIRARD, Proc. Acad. Nat. Sci. Phila., 1852, 126.—BAIRD & GIRARD, Marcy's Explor. of Red River, 1854, 205.

Crotaphytus fasciatus HALLOWELL, Proc. Acad. Nat. Sci. Phila., 1852, 207-208.—HALLOWELL, Sitgreaves' Exped. Zuni and Colo. Riv., 1853, 115-116, 145.—HEERMANN apud Hallowell, Rept. Pac. R. R. Surv., X (Williamson's Route), 1859, 24.

Leiosaurus hallowellii "DUMÉRIL, Arch. Mus., VIII, 1856, 533."

Crotaphytus copei YARROW, Proc. U. S. Nat. Mus., V, 1882, 441.—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 953.

Crotaphytus wislizenii BAIRD & GIRARD, Proc. Acad. Nat. Sci. Phila., 1852, 69.—BAIRD & GIRARD, Stansbury's Exped. Great Salt Lake, 1852, 340.—HALLOWELL, Sitgreaves' Exped. Zuni and Colo. Riv., 1853, 145.—BAIRD & GIRARD, Marcy's Explor. Red River, 1854, 205.—BAIRD, Rept. Pac. R. R. Surv., X (Beckwith-Gunnison Route), 1857, 17.—BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 7.—BAIRD, Rept. Pac. R. R. Surv., X (Whipple-Ives Route), 1859, 37.—COOPER, Rept. Pac. R. R. Surv., XII, Book II, Part III, 1860, 294.—"COOPER & SUCKLEY, Natural History of Washington Territory, 1860."—COPE, Proc. Acad. Nat. Sci. Phila., 1866, 303.—"BOCOURT, Miss. Sci. Mex., Rept., 1874, 155."—COPE, Bull. U. S. Nat. Mus., I, 1875, 48.—YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 566-567.—COUES, *ibid.*, 599.—COPE, Proc. Acad. Nat. Sci. Phila., 1883, 14, 15, 18.—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 9, 53.—BOULENGER, Catalogue of Lizards in British Museum, II, 1885, 204.—STEJNEGER, North Amer. Fauna, No. 3, 1890, 105; *ibid.*, No. 7, 1893, 167-169.—COPE, Am. Nat., XXX, 1896, 1013, 1015, 1018.—VAN DENBURGH, Proc. Cal. Acad. Sci., Ser. 2, V, 1896, 1004; *ibid.*, Ser. 2, VI, 1896, 339.—VAN DENBURGH, Occ. Papers Calif. Acad. Sci., V, 1897, 56-59.—HERRICK, TERRY & HERRICK, Bull. Sci. Lab. Denison Univ., XI, 1899, 140-141.—COPE, Rept. U. S. Nat. Mus., 1898, (1900), 255-261.—STONE & REHN, Proc. Acad. Nat. Sci. Phila., 1903, 31.—BROWN, Proc. Acad. Nat. Sci. Phila., 1903, 545, 552.—BAILEY, North Amer. Fauna, No. 25, 1905, 40.—MEEK, Field Mus. of Nat. Hist., Zool. Series, VII, 1906, 8-9.

Locality.—Four specimens of the Leopard Lizard were taken near Alamo-gordo, N. M., during July, and ten near Tucson, Ariz., in the following month. In the former locality it appears to be rare, for the four specimens secured were all that were observed. About Tucson, however, it is not an uncommon form. These notes would indicate that *C. wislizenii* is much more abundant in the western than in the eastern parts of its range, which seems to be the true state of affairs, for several writers have noted its abundance in western Arizona, Nevada, southern Utah, and eastern California,¹ while but few specimens have been recorded from eastern New Mexico and western Texas.

Description of Specimens.—In general the coloration of our specimens

¹ Baird, Rept. Pac. R. R. Surv., X (Beckwith-Gunnison Route), 17.
Yarrow, Wheeler's Surv. West of 100th Merid., V, 566.
Merriam apud Stejneger, North Amer. Fauna, No. 7, 167-169.

of *C. wislizenii* may be described as follows: Above four longitudinal rows of dark spots (the median two the larger) on a lighter ground. These rows of spots extend from the head to the tip of the tail, and are divided into cross rows by light yellow transverse bars. On the distal end of the tail the spots fuse to form dark bands that entirely surround the tail and are separated from each other by narrow bands of light yellow. Each individual spot is surrounded by a circular mesh of very small light yellow spots that join together to form a network over the dorsal surface, the common side of the meshes that surround the two larger median rows uniting to form a single, narrow, dorsal line. The hind limbs are spotted like the body and are also crossed transversely by light yellow bands. The fore limbs have the ground color of the body and tend to have a similar coloration but the markings are usually not distinct. Belly white, usually marbled with dark slate on the sides. Throat also white, and marked with distinct longitudinal bands of dark slate.

Although the pattern is seldom as regular as this the individual variation is not as great as might be expected. The modifications are usually in the form of interruptions of the transverse bars, which generally occur between the two lateral rows of small spots on either side, and on the dorsal line between the two rows of larger spots. When the cross bands are thus interrupted the sections are usually displaced, and alternate with each other.

The differences in color due to age are much greater than the individual variations. In young specimens the coloration is of the general type described above, subject to individual modifications. The ground color of the body is grayish slate, becoming light brown toward the middle of the back and on the head. The dorsal spots are dark red, usually partly surrounded, chiefly on the posterior margin, with very dark brown. The cross bands, which are orange yellow, are broad and very distinct, and the spots that compose the finer reticulations are so close together as often to form narrow lines. The grayish color of the head is relieved by small dark brown spots, and irregular bands of yellow that tend to connect over the lips with the light spaces between the dark longitudinal bands on the anterior part of the throat.

As the individuals become older the ground color becomes light brown, the sides remaining the lighter, the individual spots of the finer reticulations become more distinct, and the light bands on the head disappear. Later the cross bands break up into small spots and lose their distinctness from the finer reticulations. In specimens of this type the large dark spots have usually increased in number (apparently by division), and have lost their serial arrangement.

In very old specimens the ground color is brownish gray, and the back

is covered with many, relatively small, dark brown spots between which are very numerous small white spots without definite arrangement. Each scale of the head has a dark brown center and is margined with white. During all of the changes in color during life the pattern on the tail is but little modified.

Habitat Relations.—Alamogordo. It is impossible to define the habitat of the Leopard Lizard at Alamogordo with certainty on account of its rareness in that locality. It was only found in the Creosote bush association on the alluvial slopes. The stomach contents of the specimens examined from this locality consist largely of insects; a large grasshopper constituting the bulk of the food.

At Tucson *C. wislizenii* is quite common although not as abundant as *Cnemidophorus melanostethus* or *Sceloporus magister*. Like these forms it occurs everywhere in the Creosote bush association on the plains, and is thus widely distributed. It is also found (although apparently in less abundance) on the flood-plain of the smaller streams (Rillito Creek and Pantano Wash) where the Mesquite, which is the dominant plant in this habitat, does not attain a great development, and the vegetation is only a little denser than that of the adjoining plain. On the flood-plain of the Santa Cruz River, it only ranges into the margin of the Mesquite association which here forms dense thickets and forests. It was nowhere found in the Suaharo-Ocotillo association on the slopes, although Merriam¹ states that it ranges to some extent upward into the Upper Sonoran zone, in southern California. The extent to which it occurs on the desert ranges in this region is as yet a question, but its principal habitat is unquestionably the Creosote bush association of the plains.

Contrary to the statements of Merriam and in accordance with the notes on the Alamogordo specimens the principal food found in the stomachs of the Leopard Lizards taken about Tucson indicate that they are chiefly carnivorous and insectivorous. A small piece of vegetable matter was found in the stomach of one young specimen, but the contents of all of the other stomachs examined consist for the most part of insects, such as grasshoppers, robber-flies and beetles. In several instances other lizards had been eaten, and the remains of *Cnemidophorus melanostethus*, *Sceloporus magister*, and young specimens of *C. wislizenii* were found in the stomachs of the larger specimens. Stejneger² states that he removed two full grown individuals of *Uta stansburiana* from one specimen, and a full grown horned toad and a young *C. wislizenii* from another; while Mr. Fisher³ also discovered one in the act of swallowing a *Sceloporus*. The

¹ North Amer. Fauna, No. 7, 168.

² North Amer. Fauna, No. 7, 167.

³ North Amer. Fauna, No. 7, 168.

ferocity of this lizard is indicated by the fact that adult individuals of *Cnemidophorus melanostethus* are eaten.

Range.—The distribution of *C. wislizenii* corresponds closely to that of *C. collaris baileyi*, as it is found in the Proplateau region from the East Front Ranges in Texas through southern New Mexico and Arizona to southern California (occurring to some extent on the western slope of the Sierra Nevadas),¹ and northward through southern and western Nevada to southern Oregon and Idaho.

Crotaphytus wislizenii Baird & Girard.

| Habitat | Field No. | Locality | When Collected | Collector |
|------------------------|-----------|--|----------------|----------------|
| Creosote bush Assn. | 497 | Alamogordo, N. M. Alluvial slope east of Alamogordo | July 21-06 | G. von Krockow |
| " | 552 | " | July 23-06 | A. G. Ruthven |
| " | 587 | " | July 24-06 | G. von Krockow |
| " | 600 | " | July 26-06 | " |
| " | 642 | Tucson, Ariz. Plains southeast of Tucson | Aug. 2-06 | A. G. Ruthven |
| Suaharo-Ocotillo Assn. | 676 | Hill north of Rillito Creek | Aug. 4-06 | " |
| Creosote bush Assn. | 714 | Plains east of Tucson | Aug. 6-06 | G. von Krockow |
| " | 747 | " | Aug. 7-06 | " |
| " | 785 | Plains south of Ft. Lowell | Aug. 10-06 | A. G. Ruthven |
| " | 786 | " | " | " |
| Mesquite Assn. | 792 | Bank of Pantano Wash near Fort Lowell | " | " |
| Creosote bush Assn. | 804 | Plains east of Tucson | Aug. 11-06 | A. F. Zimmer |
| " | 809 | " | Aug. " | G. von Krockow |
| Mesquite Assn. | 835 | Rillito Creek | Aug. 13-06 | A. G. Ruthven |
| Creosote bush Assn. | 897 | Plains east of Tucson | Aug. 15-06 | A. F. Zimmer |
| " | 944 | Plains south of Tucson | Aug. 17-06 | G. von Krockow |
| Suaharo-Ocotillo Assn. | 1018 | Mesa west of Santa Cruz River | Aug. 21-06 | A. F. Zimmer |
| Creosote bush Assn. | 1027 | Plains east of Tucson | Aug. 22-06 | A. G. Ruthven |

Callisaurus ventralis Hallowell.

Homalosaurus ventralis HALLOWELL, Proc. Acad. Nat. Sci. Phila., 1852, 179-180.—HALLOWELL, Sitgreaves' Exped. Zúñi and Colo. Riv., 1853, 117-118.—HEERMANN apud Hallowell, Rept. Pac. R. R. Surv., X (Williamsons Route), 1859, 24.

¹ Merriam apud Stejneger, North Amer. Fauna, No. 7, 168.

Callisaurus draconoides LOCKINGTON, Am. Nat., XIV, 1880, 295.—BOULENGER, Catalogue of the Lizards in British Museum, II, 1885, 206.—COPE, Proc. U. S. Nat. Mus., XII, 1889, 147.—TOWNSEND, *ibid.*, XIII, 1890, 144.

Callisaurus draconoides gabbi COPE, Bull. U. S. Nat. Mus., I, 1875, 47.—YARROW, *ibid.*, XXIV, 1883, 9, 189.—COPE, Rept. U. S. Nat. Mus., 1898 (1900), 272.

Callisaurus draconoides ventralis COPE, Bull. U. S. Nat. Mus., I, 1875, 47.—YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 565.—COUES, *ibid.*, 600.—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 5, 51.

Callisaurus ventralis BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 8.—BAIRD, Rept. Pac. R. R. Surv., X (Beckwith-Gunnison Route), 1859, 17.—COPE, Proc. Acad. Nat. Sci. Phila., 1866, 310.—STEJNEGER, North Amer. Fauna, No. 7, 1893, 170-173.—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, V, 1895, 97-99; *ibid.*, VI, 1896, 339.—VAN DENBURGH, Occ. Papers Calif. Acad. Sci., V, 1897, 48-51.—MEEK, Field Museum of Nat. Hist., Zool. Ser., VII, 1906, 7.

Locality.—The Gridiron-tailed Lizard was found only at Tucson, and it is not surprising that a fine series of specimens was secured, as it is a common and conspicuous form in that region.

Description of Specimens.—There are some differences in color but not much variation in color pattern among the Tucson specimens of *Callisaurus ventralis*. In the darker specimens the ground color above is brownish ash relieved by small spots of light yellow or white. These light spots may be rather distinct or nearly obscured. The head is yellowish brown. There is nearly always a row of rounded dark spots on either side of the vertebral line, and often a series of indistinct, partially confluent blotches on the sides, that are quite distinct in the young. The lateral blotches are continued on the base of the tail as a dark horizontal shading, that may be broken up into spots which fuse with those of the dorsal series. The latter series are continued onto the tail, the adjacent spots of each row becoming confluent and intensified in color distally, to form about six broad, dark brown or black cross bars. The fore limbs and thighs are generally indistinctly spotted, and the legs and hind feet cross-banded, with darker. On the posterior side of the thigh there is a light yellowish line which is bordered below by a distinct dark band, and above by a narrow dark line formed by the confluence of the dusky markings on the dorsal aspect of the limb.

In the lighter colored specimens the pattern on the tail is the same as in the darker ones. The markings on the dorsal surface of the limbs may also be the same, but are frequently obscure or entirely obsolete. The ground color of the back is gray relieved by numerous minute spots of white. The head is dark yellow or light brown. In the most pallid individuals there are no dark markings above, except the usual ones on the tail, and very faint indications of dark mottlings on the limbs. The head is cream colored, the limbs white faintly tinged with yellow. The ground color of

the neck is light brownish ash in the form of reticulations enclosing areas of pure white. The ground color of the body is the same, but increased in amount, so as to constrict the lighter markings to rounded areas which are lemon yellow on the back, changing to orange yellow on the sides. On the base of the tail the cross bars are rather obscure, and separated by lemon yellow areas; distally the bars are black separated by reddish brown interspaces.

The coloration of the ventral surfaces is the same in both light and dark specimens. The inferior surface of the tail and limbs is pure white. Throat white or whitish in the females, but in males often suffused with light bluish or reddish purple, although occasionally but faintly. It is also usually crossed by several oblique, more or less distinct, lines of dusky. In nearly all females and in some males there is a gular patch of brilliant pink, and another on the lateral region of the breast. On the sides of the belly in all of the males there are two extensive patches of bright blue, broadly separated mesially by white, and containing two long triangular spots of jet black. The broadest side of these black spots lies close to the inner margin of the blue areas, and from here the blotches run forwards and upwards to the sides, the apices becoming lighter in color and blending with the dark lateral markings, when these are present. In females the blue patches are wanting, and the spots are represented by a pair of dusky markings which may be rather distinct but in most specimens are not well defined. Between the bluish patches and the hind limbs in the males, and in the corresponding region in the females the color although occasionally white is usually bright yellow, as are also the sides of the base of the tail, especially in the females. The ventral surface of the tail is white with five to eight broad, jet black markings. These markings are the continuation on the ventral surface of the cross bands of the upper surface, and each of the four or five distal ones are fused with a corresponding one on the dorsal surface to form continuous rings; there are usually one to four proximal ones, however, which do not extend to the sides of the tail but form blotches on the median ventral line. Femoral pores 13 to 24, usual number 17 or 18.

Habitat Relations.—The Gridiron-tailed Lizard is very common in the region about Tucson, but it is not, like *Cnemidophorus melanostethus*, of general distribution. It evidently prefers an open habitat, for on the mesa west of the Santa Cruz River it is found only in the ravines and on the salt spots, while on the plains east of the river it occurs in the shallow sandy washes. It is so characteristic of the ravines and washes that we could almost always depend on seeing it whenever these conditions were encountered, while we never observed it elsewhere.

Owing to their light color, individuals so closely resemble the sand that

they are rarely seen until they run. The method of running is grotesque but highly effective in covering ground. With the knees and elbows well elevated, the body about on a plane with them, and the tail curled over its back as if, says Dr. Merriam, "afraid to let it touch the hot surface of the earth," it dashes off across the sand so rapidly that it can scarcely be followed with the eye, and stops in plain view with a suddenness and apparent ease that is astonishing in view of the speed with which it is moving. When at rest its colors again blend with those of the sand, making it exceedingly difficult to discern, although one may have in view the exact spot where it stopped. In such instances, however, it often betrays itself by waving its tail above its back like a plume, which then becomes a conspicuous object owing to the contrast between the alternating black and white bands.

Merriam¹ states that "this species feeds on insects and the blossoms and leaves of plants in about equal proportions; at least such was the case in the large number whose stomachs were examined." I am unable to find any vegetable matter in the stomachs of Tucson specimens. The contents of those examined apparently consist entirely of insects — beetles, grasshoppers, robber flies, and ants (a few) being distinguishable. From the stomach of one specimen, No. 618, a mass of partially digested food was removed that may be vegetable in its nature, but it is doubtful.

Several adult females taken in August contain large eggs.

Range.—As indicated by its habits at Tucson, *C. ventralis* is an arid type, and this fact is further indicated by the nature of the region which it inhabits. Its range as defined by Stejneger² comprises, so far as known, "the northern portion of Lower California; the coast of Sonora, Mexico, at least as far south as Guaymas; the desert regions of southern California; southern Arizona as far east as Camp Apache and Fort Buchanan, at least; southern and western Nevada as far north as Pyramid Lake; southern Utah, where it is restricted to the Santa Clara Valley." In the central part of this region — about the lower part of the Colorado — the conditions are very arid, and the desert habitat a more open one. Here the Gridiron-tailed Lizard is probably of general distribution on the desert. To the eastward, however, the altitude increases gradually, and with this rise in elevation the vegetation also increases, and the open sandy areas become restricted to the ravines, washes and salt spots. These are the conditions that prevail about Tucson, and the fact that *C. ventralis* was only found in open habitats in this locality seems to indicate quite clearly that it is a form of the Sonoran Desert which to the eastward becomes confined to the ravines, salt spots and washes, as these alone furnish environmental conditions similar to those that prevail in the principal part of its range.

¹ North Amer. Fauna, No. 7, 172.

² North Amer. Fauna, No. 7, 171.

Callisaurus ventralis Hallowell.

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|----------------|-----------|---|----------------|----------------|---------------|
| Acacia Assn. | 605 | Tucson, Ariz. Mesa west of Santa Cruz River | July 31-06 | G. von Krockow | 17-18 |
| " | 606 | " | " | " | " |
| " | 616 | " | Aug. 1-06 | A. G. Ruthven | 14-17 |
| " | 617 | " | " | " | 17-18 |
| " | 618 | " | " | " | 15-15 |
| " | 619 | " | " | " | 18-18 |
| " | 620 | " | " | " | 17-18 |
| " | 627 | " | " | G. von Krockow | 18-19 |
| " | 628 | " | " | " | 18-19 |
| " | 643 | Plains southeast of Tucson | Aug. 2-06 | A. G. Ruthven | 14-18 |
| " | 644 | " | " | " | 20-? |
| " | 645 | " | " | " | 16-18 |
| " | 646 | " | " | " | 17-18 |
| " | 647 | " | " | " | 21-21 |
| " | 667 | Mesa west of Santa Cruz River | Aug. 3-06 | A. F. Zimmer | 24-21 |
| " | 674 | Plains north of Tucson | Aug. 4-06 | G. von Krockow | 16-16 |
| " | 675 | " | " | " | 16-15 |
| " | 686 | Bed of Santa Cruz River at Tucson | Aug. 5-06 | G. von Krockow | 17-17 |
| " | 736 | Plains east of Tucson | Aug. 7-06 | A. G. Ruthven | 16-18 |
| " | 737 | " | Aug. 7-06 | " | 17-17 |
| " | 756 | Flood plains of Santa Cruz River south of Tucson | Aug. 8-06 | A. F. Zimmer | 17-20 |
| " | 758 | " | " | G. von Krockow | 18-19 |
| Atriplex Assn. | 763 | Salt spot, about 4 miles north of Laboratory Hill | Aug. 9-06 | A. G. Ruthven | 16-16 |
| " | 764 | " | " | " | 17-18 |
| " | 765 | " | " | " | 18-18 |
| " | 766 | " | " | " | 13-14 |
| " | 767 | " | " | " | 16-18 |
| " | 768 | " | " | " | 19-20 |
| Acacia Assn. | 773 | Mesa west of Santa Cruz River | " | " | 15-16 |
| " | 774 | " | " | " | 18-19 |
| " | 776 | " | " | " | 19-21 |
| Atriplex Assn. | 781 | Salt spot about 4 miles north of Laboratory Hill | " | G. von Krockow | " |
| " | 783 | " | " | A. F. Zimmer | 21-18 |
| " | 823 | Bed of Santa Cruz River | Aug. 12-06 | G. von Krockow | 20-22 |
| Acacia Assn. | 834 | Plains north of Tucson | Aug. 13-06 | A. G. Ruthven | 16-17 |
| " | 843 | Mesa west of Santa Cruz River | Aug. 14-06 | G. von Krockow | 16-16 |
| " | 844 | " | " | " | 18-16 |
| " | 852 | " | " | A. F. Zimmer | 16-19 |

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|--------------|-----------|-------------------------------|----------------|----------------|---------------|
| Acacia Assn. | 853 | Mesa west of Santa Cruz River | Aug. 14-06 | A. F. Zimmer | 17-18 |
| " | 854 | " | " | " | 16-17 |
| " | 855 | " | " | " | 15-16 |
| " | 857 | " | " | " | 18-20 |
| " | 864 | " | " | A. G. Ruthven | 17-? |
| " | 865 | " | " | " | 18-18 |
| " | 866 | " | " | " | 19-19 |
| " | 867 | " | " | " | 18-? |
| " | 868 | " | " | " | 18-17 |
| " | 873 | " | " | " | 17-18 |
| " | 892 | Plains east of Tucson | Aug. 15-06 | | |
| " | 900 | " | " | G. von Krockow | 18-19 |
| " | 924 | Mesa west of Santa Cruz River | Aug. 16-06 | A. F. Zimmer | |
| " | 925 | " | " | G. von Krockow | 14-16 |
| " | 961 | Plains south of Tucson | Aug. 17-06 | A. G. Ruthven | 16-17 |
| " | 962 | " | " | " | 16-17 |
| " | 963 | " | " | " | 24-24 |
| " | 964 | " | " | A. F. Zimmer | 19-20 |
| " | 965 | " | " | " | 17-18 |
| Shallow wash | 1003 | Plains east of Tucson | Aug. 20-06 | " | 15-16 |
| Ravine | 1011 | Mesa west of Santa Cruz River | Aug. 21-06 | A. G. Ruthven | 18-18 |
| " | 1012 | " | " | " | 18-? |
| " | 1013 | " | " | " | 17-18 |
| " | 1016 | " | " | A. F. Zimmer | 17-17 |
| " | 1017 | " | " | " | 16-? |

Holbrookia maculata flavilenta Cope.

Holbrookia propinqua COPE, Proc. Acad. Nat. Sci. Phila., 1866, 303.

Holbrookia maculata propinqua COUES, Wheeler's Surv. West of 100th Merid., V, 1875, 601.

Holbrookia maculata flavilenta COPE, Proc. Acad. Nat. Sci. Phila., 1883, 10.—STEJNEGER, North Amer. Fauna, No. 3, 1890, 109-110.

Locality.—Six specimens of this lizard were secured on the White Sands. It was quite abundant in this habitat, but was not found elsewhere.

Description of Specimens.—Like the other lizards taken on the White Sands, these *Holbrookias* are remarkably light colored, there being no dorsal blotches as in *H. m. approximans*. The specimens obtained are nearly pure white with two jet black, crescentric, lateral spots which are placed slightly farther forward than in *approximans*, the foremost lying under the point of the elbow in the former, generally behind it in the latter. These slight differences serve to ally the White Sands specimens with *H. m. flavilenta* and to distinguish them from *H. m. approximans*.

In one specimen (No. 113) the color of the dorsal surface is uniformly grayish white, except for faint traces of dusky on the hind limbs, sides of head, and base of tail, and numerous faint spots of orange yellow that at a distance give a slightly pinkish appearance to the body. The head is light golden yellow above. There is a faint pinkish line extending from the outer canthus along the sides of the body and base of the tail, and another from the angle of the mouth to the groin, which is continued along the inner and outer sides of the thigh and base of tail. Belly creamy white, immaculate.

Two other specimens (Nos. 473-474) are almost identical in color with the last, except that the dusky markings on the back are slightly increased in amount, making the orange spots somewhat more distinct. In No. 474 the upper surface of the head is also marked with darker.

Three others, while also very pallid, are a little darker than those described above. In the darkest individual (No. 472) the ground color is light gray, with numerous small dark spots interspersed with orange colored ones; the dark spots distinct or obscure but without definite arrangement. The amount of dark pigment is greatest on the upper surface of the limbs and tail. The color of the head is light golden yellow, that of the under surfaces the same as in the other two specimens. The pinkish lateral line is not discernible.

Scutellation apparently as in *H. m. approximans*. Tail not longer than head and body. Femoral pores 7-14.

Habitat Relations.—This *Holbrookia* was only found on the White Sands, although it probably occurs also in the *Atriplex* association. In this habitat it is quite common on the dunes, but very difficult to observe owing to its shyness and protective coloring. Usually the first glimpse that one gets of an individual is a flurry of sand up the side of some distant dune. When the lizard stops the orange tint of the pale ground color harmonizes so perfectly with the delicate buff or pinkish hue which the sands take on in intense sunlight, that even when looking directly at it from a distance of a few feet it is difficult to differentiate the form from the background.

It runs about on the sides of the dunes, picking up its food which consists of ants, small beetles and spiders. When surprised it dashes up the dune, taking refuge in the bushes or ground squirrel holes on the summit. Females taken in July contain large eggs.

Range.—The range of this lizard is not as yet known, as it has only been recorded from three localities. These are Lake Valley, N. M.; the Painted Desert, Ariz.; and the present locality, which is the most eastern one.

Holbrookia maculata flavilenta Cope.

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|-------------------|-----------|--|----------------|----------------|---------------|
| Sumac-Yucca Assn. | 112 | Alamogordo, N. M. White Sands west of Alamogordo | July 9-06 | A. F. Zimmer | 12-12 |
| " | 113 | " | " | A. G. Ruthven | 7-9 |
| " | 437 | " | July 19-06 | " | 13-14 |
| " | 472 | " | " | " | 8-9 |
| " | 473 | " | " | G. von Krockow | 9-9 |
| " | 474 | " | " | " | 10-11 |

Holbrookia maculata approximans Baird.

Holbrookia approximans BAIRD, Proc. Acad. Nat. Sci. Phila., 1858, 253-254.—“BOCOURT, Miss. Sci. Mex., Rept., 1874, 163.”

Holbrookia maculata approximans COPE, Bull. U. S. Nat. Mus., XXXII, 1887, 38.—STEJNEGER, North Amer. Fauna, No. 3, 1890, 109-110.—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, VI, 1896, 339-340.—VAN DENBURGH, Occ. Papers, Calif. Acad. Sci., V, 1897, 51-53.—COPE, Rept. U. S. Nat. Mus., 1898 (1900), 297-298.—STEJNEGER, Proc. U. S. Nat. Mus., XXV, 1902, 150.

Locality.—Six specimens from the vicinity of Tucson, Arizona.

Description of Specimens.—These specimens differ from those of the White Sands (*H. m. flavilenta*) in having large distinct dorsal spots. These consist of two median series of distinct and paired spots, flanked on either side by a row of similar but more obscure ones. All four of these series are continued onto the base of the tail, where the two median rows fuse, and are thus represented on the distal portion of the tail by but three rows. The dorsal spots vary in the different specimens from yellow to light or dark brown. They have generally darker edges, and each is surrounded by a pale areola. The body spots have roughly the form of an ellipse broadly truncate anteriorly, and the posterior margin is nearly always crenate. The caudal spots are V-shaped proximally, but become rapidly compressed into narrow elongated bars toward the end of the tail.

Ground color above light grayish ash to dark bluish ash, with few or many small, white, or pale yellow spots. Hind feet and legs distinctly cross-banded, fore limbs and thighs less regularly so. Head above dark yellow or light brown. Belly white, unspotted. In the males there are two jet black lateral spots in a blue patch, the foremost lying behind the elbow when adpressed to the side. The throat is light bluish ash relieved by light markings on the anterior part. In the females the lateral black spots are represented by faint bluish markings, and the surrounding patch

of blue is wanting. In some specimens the throat is white, in others the posterior part is light bluish ash, the anterior part white with bluish cross bars running obliquely backward from the lips. In every female, however, there is a central patch of bright pink on the throat, that may be faint but is usually intense and well defined, and the sides of the neck, and the lateral region of the breast are also suffused with pink.

Femoral pores 12-15.

Habitat Relations.—We found this lizard in company with *Callisaurus ventralis* in the arroyos on the slopes. It resembles the Gridiron-tailed Lizard so closely in appearance and habits that it is often difficult to distinguish between these species in the field, unless one can come to close quarters.

The food in the stomachs examined consists principally of grasshoppers, although ants are present in a small amount.

Females taken during the first part of August contain large eggs.

Range.—The general range of this species is given by Stejneger¹ as "Southern Arizona, parts of Sonora, Chihuahua and Coahuila."

Holbrookia maculata approximans Baird.

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|--------------|------------------|---|----------------|----------------|---------------|
| Acacia Assn. | 607 | Tucson, Arizona. Mesa west of Santa Cruz River | July 31-06 | G. von Krockow | 12-13 |
| " | 638 | " | Aug. 1-06 | A. G. Ruthven | 14-15 |
| " | 775 | " | Aug. 9-06 | " | 14-14 |
| " | 777 | " | Aug. " | " | 15-15 |
| " | 856 | " | Aug. 14-06 | A. F. Zimmer | 13-? |
| " | 987 ² | Sabino Cañon, near mouth | Aug. 18-06 | A. G. Ruthven | 14-13 |

Uta stansburiana Baird & Girard.

Uta stansburiana BAIRD & GIRARD, Proc. Acad. Nat. Sci. Phila., 1852, 69.—BAIRD & GIRARD, Stansbury's Exped. to Gt. Salt Lake, 1853, 343-346.—BAIRD, Rept. Pac. R. R. Surv., X (Whipple-Ives Route), 1859, 37.—BAIRD, Proc. Acad. Nat. Sci., Phila., 1859, 299.—BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 7.—COPE, Proc. Acad. Nat. Sci. Phila., 1864, 177; *ibid.*, 1866, 312.—COPE, Bull. U.

¹ North Amer. Fauna, No. 3, 109.

² This specimen is probably not *H. m. approximans*. It differs from the Tucson specimens of that species in having the tail flattened, the dorsal spots small and in two rows only, and the tail ringed with broad bands which are jet black below. The ground color above is light gray with numerous pale yellow spots. It is a female and lacks the blue and black spots on the sides, but has the pink throat patch and the lateral suffusion of pink. The chin is obliquely banded with light slate. It will be noted also that the habitat of this specimen is different from the other *Holbrookias* obtained.

S. Nat. Mus., I, 1875, 48.—YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 568-569.—COUES, Wheeler's Surv. West of 100th Merid., V, 1875, 596-597.—STREETS, Bull. U. S. Nat. Mus., VII, 1877, 37.—LOCKINGTON, Am. Nat., XIV, 1880, 295.—COPE, Proc. Acad. Nat. Sci. Phila., 1883, 12, 15, 18, 21, 28.—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 10, 56-57.—BOULENGER, Cat. of Lizards in Brit. Museum, II, 1885, 211.—COPE, Bull. U. S. Nat. Mus., XXXII, 1887, 35.—"BELDING, West Am. Sci., III, No. 24, 1887, 98."—COPE, Proc. U. S. Nat. Mus., XII, 1889, 147.—TOWNSEND, Proc. U. S. Nat. Mus., XIII, 1890, 144.—STEJNEGER, North Amer. Fauna, No. 3, 1890, 106-107; *ibid.*, No. 7, 1893, 175-177.—COPE, Amer. Natur., XXX, 1896, 1013, 1015, 1018.—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, V, 1895, 104-105; *ibid.*, 1896, 1004; *ibid.*, VI, 1896, 340.—VAN DENBURGH, Occ. Papers Calif. Acad. Sci., V, 1897, 66-68.—HERRICK, TERRY & HERRICK, Bull. Sci., Lab. Denison Univ., XI, 1899, 138-139.—COPE, Rept. U. S. Nat. Mus., 1898 (1900), 306-312.—STONE & REHN, Proc. Acad. Nat. Sci. Phila., 1903, 31.—BROWN, Proc. Acad. Nat. Sci. Phila., 1903, 546, 552.—BAILEY, North Amer. Fauna, No. 25, 1905, 41.—MEEK, Field Museum of Nat. Hist., Zool. Series, VII, 1906, 10.

Uta elegans YARROW, Proc. U. S. Nat. Mus., 1882, 442.—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 10, 55.—BOULENGER, Cat. of Lizards in Brit. Museum, II, 1885, 211-212.—"BELDING, West Amer. Scientist, III, No. 24, 1887, 98,"—TOWNSEND, Proc. U. S. Nat. Mus., XIII, 1890, 144.

Uta schottii YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 10, 55.—"BELDING, West Amer. Scientist, III, No. 24, 1887, 98."

Locality.—*Uta stansburiana* is very common about Alamogordo, and a good series of specimens was secured. It is not rare at Tucson, but we did not find it nearly so abundant in that locality as at Alamogordo.

Description of Specimens.—Scutellation apparently normal. The femoral pores vary in number from 12 to 17, the normal number being apparently 14 or 15.

The ground color above is variable and may be light or dark, brown or olive brown. There is a broad light stripe that extends from the snout across the eye, and along either side of the back onto the tail, and another from the angle of the mouth to the hind limb, occasionally also indicated on the base of the tail. On the sides below the lower lateral stripe the color is bluish with numerous short vertical light lines corresponding in color to the stripes, and a prominent indigo blue spot which is broadly margined with lighter in the lateral region of the breast. The light markings just described (lateral stripes and bars) may be bright yellow, bluish white, gray or blue. The stripes are rarely complete except in front of the shoulder. Very often the lower one is represented on the body by a row of short vertical light bars situated just above the series that usually lies below the stripe. The upper stripe is nearly always complete but may be broken up into small spots. There is no definite series of markings between the stripes, but above each of the upper ones there is a single row of rather large U-

shaped spots, each one surrounded on the inner and posterior sides by a series of small, yellow, light or dark blue spots. These spots usually form a single series on the base of the tail, and are occasionally flanked by a row of smaller spots. The limbs are usually barred and spotted with the prevailing light color. In some individuals the color is dark brown, obscuring the dark spots, and the only markings consist of the stripes in front of the shoulder, the lateral spot, and very numerous small bright blue spots disposed irregularly over the dorsal surface of the neck, body, limbs and tail.

The color of the under surfaces may be white with dusky markings on the throat, or light bluish, or dark bluish slate, the throat being a darker blue with lateral markings of orange or yellow that cross the lips as vertical bars.

Habitat Relations.—Alamogordo. As illustrated by our collections, the home of *Uta stansburiana* in this region is on the desert floor. We found it to be common from the upper margin of the alluvial slope to the White Sands, but we did not find it above the alluvial slope. One specimen was taken on one of the easternmost dunes of the White Sands, but it was not observed within the Sands.

In habits this *Uta* is strictly a ground form. On the alluvial slope, where the vegetation is denser, it may be found almost anywhere on the ground, but on the desert floor, where the shrubs are much more widely scattered, it is seldom observed far from the shelter of a bush. In the Mesquite association, a favorite haunt is the small hillocks that have been built up by wind and erosion about the base of the bushes.

The food in the stomachs of the specimens examined consists of small beetles, ants, and cicadas, indicating that it is insectivorous in its food habits.

Several females taken during the latter half of July contained large eggs.

Tucson. At Tucson this lizard is distributed generally throughout the Creosote bush association on the plains. We only secured one specimen in the Suaharo-Ocotillo association on the slopes, and it probably occurs in that habitat to a more limited extent than in the Creosote bush association.

The habits of the individuals observed at Tucson are similar to those observed about Alamogordo. They were found on the ground, generally near or under a bush. These observations confirm the statement of Van Denburgh that *Uta stansburiana* is a ground-loving species.

Range.—Although Cope¹ gives the range of this species as lying "between the Rocky Mountains and the Sierra Nevada," it somewhat transcends these limits. To the east Bailey has found it in western Texas, beyond

¹ Rept. U. S. Nat. Mus., 1898, 309.

the East Front Ranges, in the Pecos Valley, while to the west it has been recorded from the west slope of the Sierra Nevadas, and in southern California reaches the coast and off shore islands, San Clemente and Santa Cruz (Townsend).¹ Apparently the most northern record is that of Summer Lake, Oregon, given by Cope² and Van Denburgh.³ To the southward it is known to exist throughout the entire length of the peninsula of Lower California and on the adjacent islands (Van Denburgh),⁴ but the extent of its occurrence on the mainland of Mexico is unknown.

Uta stansburiana Baird & Girard.

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|---------------------|-----------|--|----------------|----------------|---------------|
| Creosote bush Assn. | 44 | Alamogordo, N. M. | | | |
| " | 55 | Alluvial slope east of Alamogordo | July 5-06 | G. von Krockow | |
| Atriplex Assn. | 129 | Plains west of Alamogordo | July 9-06 | " | 15-? |
| Creosote bush Assn. | 148 | Alluvial slope east of Alamogordo | July 10-06 | A. F. Zimmer | |
| Mesquite Assn. | 149 | Plains near Alamogordo | " | " | |
| Creosote bush Assn. | 292 | Alluvial slope north of Alamogordo | July 15-06 | A. G. Ruthven | 13-13 |
| " | 293 | " | " | " | 15-16 |
| Atriplex Assn. | 329 | Plains west of Alamogordo | July 16-06 | A. F. Zimmer | 15-15 |
| Creosote bush Assn. | 389 | Alluvial slope east of Alamogordo | July 18-06 | G. von Krockow | 12-13 |
| " | 390 | Alluvial slope north of Alamogordo | " | " | 12-? |
| " | 410 | " | " | A. F. Zimmer | 15-15 |
| Atriplex Assn. | 418 | Plains west of Alamogordo | July 19-06 | A. G. Ruthven | 17-16 |
| " | 419 | " | " | " | 16-? |
| " | 420 | " | " | " | |
| " | 426 | " | " | " | 15-15 |
| " | 427 | " | " | " | 12-14 |
| " | 435 | $\frac{1}{2}$ mile east of White Sands | " | " | |
| " | 436 | $\frac{1}{2}$ mile east of White Sands | " | " | 15-15 |
| Sumac-Yucca Assn. | 440 | Easternmost dunes of White Sands | " | " | 14-14 |
| Atriplex Assn. | 451 | Three miles east of White Sands | " | " | 15-15 |
| " | 457 | " | " | " | 15-14 |

¹ Proc. U. S. Nat. Mus., XIII, 144.

² Rept. U. S. Nat. Mus., 1898, 309.

³ Occ. Papers Calif. Acad. Sci., V, 68.

⁴ Proc. Calif. Acad. Sci., Ser. 2, V, 105, 1004.

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|---------------------------------------|-----------|---|----------------|----------------|---------------|
| Atriplex Assn. | 459 | Three miles east of White Sands | July 19-06 | A. G. Ruthven | 15-14 |
| " | 463 | " | " | " | 14-14 |
| " | 465 | " | " | " | 15-16 |
| " | 466 | " | " | " | 13-14 |
| " | 478 | Plains west of Alamogordo | " | G. von Krockow | |
| " | 479 | Three miles east of White Sands | " | " | 14-14 |
| " | 481 | " | " | " | 15-15 |
| " | 484 | " | " | " | 12-13 |
| " | 485 | " | " | " | 14-14 |
| " | 490 | Plains west of Alamogordo | " | " | |
| Mesquite Assn. | 502 | Plains east of Alamogordo | July 21-06 | " | |
| " | 503 | " | " | A. G. Ruthven | 15-16 |
| Sotol-Ocotillo Assn. | 556 | Mouth of Dry Cañon | July 23-06 | " | 13-16 |
| Creosote bush & Sotol-Ocotillo Assns. | 559 | Upper part of Alluvial slope east of Alamogordo | " | A. F. Zimmer | |
| Creosote bush Assns. | 563 | Alluvial slope north of Alamogordo | " | G. von Krockow | |
| " | 599 | " | July 26-06 | A. G. Ruthven | |
| Suaharo-Ocotillo Assn. | 637 | Tucson, Ariz. Mesa west of Santa Cruz River | Aug. 1-06 | G. von Krockow | 13-14 |
| Creosote bush Assn. | 657 | Plains S. E. of Tucson | Aug. 2-06 | A. G. Ruthven | |
| " | 658 | " | " | " | 14-15 |
| " | 734 | " | Aug. 7-06 | " | |
| " | 735 | " | " | " | 15-15 |
| " | 748 | " | " | G. von Krockow | 15-16 |
| " | 749 | " | " | " | 13-13 |
| Mesquite Assn. | 754 | Flood-plain of Santa Cruz River | Aug. 8-06 | A. G. Ruthven | |
| Creosote bush Assn. | 805 | Plains east of Tucson | Aug. 11-06 | A. F. Zimmer | 13-15 |
| " | 846 | Mesa west of Santa Cruz River | Aug. 14-06 | G. von Krockow | |
| " | 903 | Plains east of Tucson | Aug. 15-06 | " | 14-14 |
| Creosote bush and Mesquite Assns. | 951 | Near Santa Cruz River | Aug. 17-06 | G. von Krockow | 14-16 |
| " | 952 | " | " | " | 14-14 |
| Creosote bush Assn. | 999 | Plains east of Tucson | Aug. 20-06 | " | 16-17 |
| " | 1000 | " | " | " | 14-14 |
| " | 1021 | Mesa west of Santa Cruz River | Aug. 22-06 | A. F. Zimmer | 14-14 |

***Uta ornata* Baird & Girard.**

Uta ornata BAIRD & GIRARD, Proc. Acad. Nat. Sci. Phila., 1852, 126.—BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 7.—COPE, Bull. U. S. Nat. Mus., I, 1875, 48.—YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 568.—COUES, *ibid.*, 597.—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 56. (At least in part).—BOULENGER, Cat. of Lizards in Brit. Museum, II, 1885, 213.—STEJNEGER, North Amer. Fauna, No. 3, 1890, 107-108.—COPE, Am. Naturalist, XXX, 1896, 1013.—HERRICK, TERRY & HERRICK, Bull. Sci. Lab. Denison Univ., XI, 1899, 138.—COPE, Rept. U. S. Nat. Mus., 1898 (1900), 315-317.—BAILEY, North Amer. Fauna, No. 25, 1905, 41.

Uta ornata linearis BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 7.—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, VI, 1896, 340.

Locality.—Six specimens of *Uta ornata* were taken in the region about Tucson.

Description of Specimens.—Lateral scales small except for two rows of enlarged ones. A median dorsal band of enlarged scales, consisting of two rows of large scales, separated by smaller ones. The four rows of large scales in the dorsal series are not perfect, the larger scales in each row being occasionally separated by quite small ones.

The color of a large male is dark brown with occasional dark yellow scales. On either side of the back is a series of transverse black bars narrowly margined with yellow. These bars fuse on the tail to form dusky rings. Limbs cross-banded above. Lips and submental region dark gray grading backward through yellowish ash into a bluish green patch on the throat. Under surfaces of limbs light grayish mottled with black. Belly bright blue. Ventral surface of tail dusky gray, the dark rings faint and margined with bright blue. A preanal patch of light blue.

Females light gray above, cross bars black. Head covered above with a network of fine black lines. Below light grayish, becoming darker toward the end of the tail. Numerous short, longitudinal and undulating lines of darker on the belly. Throat patch bright orange yellow or reddish orange. Only faint indications of the dusky rings on the ventral surface of the tail. Enlarged dorsal scales often tinged with orange yellow, which in two specimens becomes a well defined patch in the sacral region.

In very young specimens (total length 45 mm.) the ground color above is light grayish. Head marked with fine black lines. Dorsal band of enlarged scales margined on either side with a narrow broken line of black, and another along the upper lateral series of enlarged scales. No lateral cross bars. Limbs cross-banded. Tail ringed with dusky. Upper lip white. Under surfaces white mottled with dark slate.

Habitat Relations.—This *Uta* was found only in the timber zone (Wil-

low-Poplar association) on the banks of the Santa Cruz River and in Sabino Cañon. In the former habitat it occurs with *Sceloporus clarkii* which it resembles in habits, being found on the trunks and limbs of the large willows and cottonwoods. In Sabino Cañon it was observed only among the large boulders that strew the bottom of the gorge.

Range.— This species has been recorded from Texas to western Arizona, but most of the localities given are so general that it is impossible to determine its range with accuracy. It probably does not occur in the desert region of southwestern Arizona, while on the plains (according to our observations) it seems to be confined to the cañons and the timber zones along the larger streams. These facts, together with the observations of Stejneger¹ that on San Francisco Mountain it occurs in the cedar zone, permits the tentative conclusion that *Uta ornata* is primarily a plateau form which is able to extend its range from the major habitat (Piñon-Cedar association) down the cañons, and into the Willow-Poplar association along the streams on the plains. Considerable light might be thrown on this point by observations of its distribution in the Piñon-Cedar association on the mountains of the Proplateau region.

Uta ornata Baird & Girard.

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|---------------------|-----------|---|----------------|---------------|---------------|
| Willow-Poplar Assn. | 752 | Tucson, Ariz. Bank of Santa Cruz River | Aug. 8-06 | A. G. Ruthven | 10-11 |
| " | 841 | Vicinity of Tucson | Aug. 13-06 | Gift | |
| " | 976 | Lower end of Sabino Cañon | Aug. 18-06 | A. G. Ruthven | 11- |
| " | 977 | " | " | " | 11-12 |
| " | 978 | " | " | " | 11-11 |
| | 1042 | Tucson | Aug. 22-06 | Lita Morales | |

Sceloporus magister Hallowell.

Sceloporus magister HALLOWELL, Proc. Acad. Nat. Sci. Phila., 1854, 93.—HALLOWELL, Rept. Pac. R. R. Surv., X (Williamson's Route), 1859, 5.—HEERMANN apud Hallowell, *ibid.*, 24.—STEJNEGER, North Amer. Fauna, No. 7, 1893, 178-183.—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, VI, 1896, 341.—VAN DENBURGH, Occ. Papers Calif. Acad. Sci., V, 1897, 84-86.—HERRICK, TERRY & HERRICK, Bull. Sci. Lab. Denison Univ., XI, 1899, 125-126.—MEEK, Field Mus. of Nat. Hist., Zool. Ser., VII, 1905, 10.

Sceloporus clarkii clarkii COPE, Bull. U. S. Nat. Mus., I, 1875, 40. (Part.)—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 11, 63. (Part.)

¹ North Amer. Fauna, No. 7, 107-108.

Sceloporus clarkii STEJNEGER, North Amer. Fauna, No. 3, 1890, 110-111.—COPE, Am. Nat. XXX, 1896, 1014. (Part.)—COPE, Rept. U. S. Nat. Mus., 1898 (1900), 358-363. (Part.)

Sceloporus spinosus "GÜNTHER, Biol. Centrali-Americana, 1890. (Part.)."

Sceloporus spinosus clarkii BOULENGER, Cat. of Lizards in Brit. Mus., II, 1885. 227. (Part at least.)

Locality.—At Alamogordo this large scaly lizard appears to be very rare, as we obtained but four specimens. At Tucson, however, it is abundant, and thirty-seven specimens were taken.

Description of Specimens.—Dr. Stejneger has shown that the large *Scelopori* in this locality, which were formerly known as *S. clarkii*, are referable to two species, the *S. clarkii* of Baird and *S. magister* Hallowell. In the specimens obtained by the expedition the distinctive traits as pointed out by Stejneger, and the additional characters mentioned by Van Denburgh, although slight, are quite appreciable, so that it is not difficult to separate the specimens belonging to the two forms.

S. magister is the largest, although not the longest, lizard that occurs in this locality with the exception of the Gila Monster. One large specimen in our collection measures 285 mm. total length, 140 mm. body length, 125 mm. girth. About four, long, lanceolate, preauricular scales. Plates convex and head consequently rough. Top of head ovate in outline, but not as broad as in *S. clarkii*. Profile slightly arched, not decidedly flattened above as in *S. clarkii*. Femoral pores 11 to 14 (15 in one specimen).

The color is variable, and the pattern not well defined. The head above is usually mottled with dark brown and yellow or light brown. A narrow brown line extends along the infraorbital scutes from the canthus rostralis, and is continued on the neck to the shoulder. A similar line parallel to this one extends from the supralabials also to the shoulder. On the nape there are usually indications of narrow V-shaped bands. These are rarely distinct with the exception of the posterior one, which forms a narrow black collar that usually terminates on the side of the neck.

On either side of the back, about five rows of scales apart and two rows wide, are two longitudinal light bands that are usually some shade of yellow, and may be either quite distinct or obscure. On either side of each light stripe is a row of indefinite dark brown or black spots, the middle two of which may unite to form transverse bands across the back. The scales not included in the stripes or spots are usually yellow and brown, but there are often on the back and sides many blue scales, and these may be numerous enough to form blotches or a solid, broad, blue band between the stripes, and to give a bluish cast to the sides. This tendency is most conspicuous in male specimens. Again all or most of the scales on the back, sides, and neck

may be margined with orange or red, giving an orange appearance to the body. The tail is usually rather distinctly banded above with light brown, and dark brown or black. The scales on the limbs are mostly yellow with brown lateral margins which connect with those of adjacent scales, giving the appearance of narrow longitudinal stripes.

In old males the pattern above may be nearly obsolete, and the color very dark, the scales being blue black and dark brown. When the skin is being shed the color is uniformly yellowish.

The under surface in females and young specimens is usually light yellow. In the males there is generally a narrow central band of white or yellow but on either side of this are two large blotches of bright metallic blue, occasionally with interspersed scales of bright yellow. The individual scales in the blue areas are generally narrowly margined with black. Tail and ventral surface of limbs bluish white. A bright blue spot on the gular region, that may extend over the entire throat, but usually becomes lighter on the anterior part. In nearly all of the specimens the black collar is continued across the throat by black edgings to the scales.

Habitat Relations.—Alamogordo. The few specimens found at Alamogordo were all taken in the Creosote bush association on the alluvial slope. They climb about in these bushes much as they do in the large *Opuntias* about Tucson. In the stomach contents of these specimens, ants greatly predominate, but a few beetles are also present.

Tucson. The habitat of *S. magister* is well defined in this region. It is quite common on the Greasewood plains, but seems to be excluded from the flood-plains of the larger streams (Mesquite and Willow-Poplar associations). Mr. Jouy appears to have been the first to observe that its habitat thus differs from that of *S. clarkii*. Although it occurs in the Suaharo-Ocotillo association at the foot of the Santa Catalina and Tucson Mountains, it is much less common in these places. Its principal habitat in this region is thus preëminently the Creosote bush association of the plains.

It is very wary and rather difficult to secure as it does not run about on the desert as do the *Crotaphyti* and *Cnemidophori* but resides in the bushes. Individuals were occasionally observed in Mesquite or Creosote bushes, and more often beneath the Crucifixion thorn, but it evidently prefers the tall branching *Opuntias*, especially the larger ones. Here it may be seen very commonly on the trunks, upon the highest branches or in the nests of the wood rats which are constructed of the detached branches of these shrubs on the ground beneath. If the bushes are approached at a good pace the chances are that no lizards will be seen, for when frightened they scramble swiftly down the stems and into a hole, if there is time, or if not flatten themselves out against the trunk of the shrub or among the

dead branches on the ground. In such cases they do not give themselves away by the teetering movement so characteristic of many lizards, and their extraordinary resemblance to the trunk or a lobe of an *Opuntia* makes them very difficult to discern. Many times I have seen an individual scuttle down the trunk of one of these cacti but on carefully approaching the bush would be unable to distinguish it, although it would be in full view. Only the great development of the scales in these lizards would protect them from the needlelike spines of the *Opuntias*, and permit of their moving about upon them with such facility.

In regard to its food habits Dr. Merriam remarks that in the Great Basin region "*Sceloporus magister* is a mixed feeder, both insects and flowers being found in the stomachs examined. At the Great Bend of the Colorado, Nevada, and St. George, Utah, stomachs were opened that contained insects only."¹ The stomach contents of the Tucson specimens consist almost entirely of insects. A small amount of vegetable matter is present in some of them, but this is in the form of small, dried fragments that were probably taken up with the animal food. Ants make up the great bulk of the contents of these stomachs, and every one examined contained great numbers of these insects. A few beetles are also present, but they make up a very small proportion of the total contents. The stomach of one lizard that was taken under a Crucifixion thorn bush was distended with scores of winged ants.

These lizards are preyed upon by *Crotaphytus wislizenii* as shown by an examination of the stomach contents of the latter. They are doubtless also eaten by the Road Runner which is often observed in the *Opuntias*. The old individuals in our collection are nearly all maimed, having lost a part of their tail, a varying number of toes, or both.

Range.—Too little is known of the range and relationships of this *Sceloporus* to make it possible to determine its habitat at present. It has been recorded from southern California, Nevada, Utah, and Arizona. The Alamogordo specimens listed above thus apparently constitute the most eastern record for the species.² It is very probably a Proplateau form that will not be found to the eastward of the East Front Ranges in Texas, nor in the desert region of southwestern Arizona.

¹ North Amer. Fauna, No. 7, 182.

² It is quite possible that the specimen of *S. clarkii* recorded by Stone (Proc. Acad. Nat. Sci. Phila., 1903, 31) from Alamogordo, may be referable to this species.

Sceloporus magister Hallowell.

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|--------------------------------------|-----------|--|----------------|----------------|---------------|
| Between Creosote and Mesquite Assns. | 150 | Alamogordo, N. M. Foot of alluvial slope east of Alamogordo | July 10-06 | G. von Krockow | 13-13 |
| Creosote bush Assn. | 182 | Alluvial slope east of Alamogordo | July 12-06 | A. G. Ruthven | 13-14 |
| " | 495 | " | July 20-06 | G. von Krockow | 12-13 |
| " | 496 | " | " | " | 13-? |
| | | <i>Tucson, Ariz.</i> | | | |
| " | 725 | Plains east of Tucson | Aug. 7-06 | A. G. Ruthven | 11-11 |
| " | 726 | " | " | " | 12-13 |
| " | 727 | " | " | " | 11-12 |
| " | 728 | " | " | " | 12-14 |
| " | 729 | " | " | " | 12-13 |
| " | 745 | " | " | G. von Krockow | 11-11 |
| " | 746 | " | " | " | |
| " | 782 | Mesa west of Santa Cruz River | Aug. 9-06 | A. F. Zimmer | 12-13 |
| Creosote bush Assn. | 795 | Plains east of Tucson | Aug. 11-06 | A. G. Ruthven | 10-11 |
| " | 796 | " | " | " | 12-14 |
| " | 797 | " | " | " | 11-13 |
| " | 798 | " | " | " | 14-14 |
| " | 799 | " | " | " | 12-12 |
| Mesquite Assn. | 839 | Near Rillito Creek | Aug. 13-06 | G. von Krockow | 12-13 |
| " | 860 | Near Santa Cruz River | Aug. 14-06 | A. F. Zimmer | 12-13 |
| Creosote bush Assn. | 876 | Plains east of Tucson | Aug. 15-06 | A. G. Ruthven | 12-13 |
| " | 877 | " | " | " | 13-13 |
| " | 878 | " | " | " | 12-12 |
| " | 879 | " | " | " | 12-12 |
| " | 880 | " | " | " | 12-14 |
| " | 881 | " | " | " | 11-12 |
| " | 882 | " | " | " | 14-15 |
| " | 895 | " | " | A. F. Zimmer | ?-14 |
| " | 896 | " | " | " | 12-13 |
| " | 901 | " | " | G. von Krockow | 11-13 |
| " | 902 | " | " | " | 11-13 |
| Mesquite Assn. | 943 | Near Santa Cruz River | Aug. 16-06 | " | 13-14 |
| " | 955 | " | Aug. 17-06 | A. G. Ruthven | 13-13 |
| " | 956 | " | " | " | 14-14 |
| " | 957 | " | " | " | 12-14 |
| " | 967 | Alluvial slope of Santa Catalina Mts. | Aug. 18-06 | A. G. Ruthven | 12-14 |
| Creosote bush Assn. | 1001 | Plains east of Tucson | Aug. 20-06 | G. von Krockow | 13-14 |
| " | 1005 | " | " | A. G. Ruthven | |
| " | 1006 | " | " | " | 11-12 |
| " | 1007 | " | " | " | 13-13 |
| " | 1008 | " | " | " | 11-11 |
| " | 1014 | Mesa west of Santa Cruz River | Aug. 21-06 | " | 12-12 |

***Sceloporus clarkii* Baird & Girard.**

Sceloporus clarkii BAIRD & GIRARD, Proc. Acad. Nat. Sci. Phila., 1852, 127.—BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 5. (Part.)—STEJNEGER, North Amer. Fauna, No. 7, 1893, 178-183.—COPE, Amer. Natur., XXX, 1896, 1014, (Part.)—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, VI, 1896, 340-341.—HERRICK, TERRY & HERRICK, Bull. Sci. Lab. Denison Univ., XI, 1899, 126.—COPE, Rept. U. S. Nat. Mus., 1898 (1900), 358-363. (Part.)—STEJNEGER, Proc. U. S. Nat. Mus., XXV, 1902, 150.—STONE, Proc. Acad. Nat. Sci. Phila., 1903, 31 (?).—BAILEY, North Amer. Fauna, No. 25, 1905, 42.

Sceloporus clarkii clarkii COPE, Bull. U. S. Nat. Mus., I, 1875, 49. (Part.)—YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 575-576. (Part.)—COUES, *ibid.*, 594. (Part.)—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 11, 63, (Part.)

Sceloporus spinosus "GÜNTHER, Biol. Centrali-Americana, 1890. (Part.)"

Sceloporus spinosus clarkii BOULENGER, Cat. of Lizards in Brit. Mus., II, 1885, 227. (Part ?)

Locality.—The specimens of *Sceloporus clarkii* obtained by the expedition consist of two specimens from the Santa Cruz valley south of Tucson, Arizona, and one from Sabino Cañon in the Santa Catalina Mountains. In the former locality it was not rare, and several specimens were seen during the one day spent in Sabino Cañon. It was not found at Alamogordo, although Stone and Rehn record a single specimen from that locality. As before stated (p. 535) this may be a specimen of *S. magister*.

Description of Specimens.—As shown by Stejneger and Van Denburgh, although closely similar, this *Sceloporus* is easily distinguishable from *S. magister*. The body is less stout, the head flatter above and more broadly ovate, and the snout more depressed than in *S. magister*, while the pre-auricular scales (about three in number) are triangular in form instead of lanceolate as in the latter species.

Femoral pores 12-13.

The coloration of *S. clarkii* is distinctive. There are no light dorsal lines, and the collar, is not, as a rule, well defined. The limbs are definitely cross-banded above (cf. *S. magister*, p. 533), even to the ends of the digits. The tail is only indistinctly cross-barred. The head is uniformly light brown, very minutely speckled with black. In females the color of the dorsal surface is light brown relieved by spots of yellow and blue, and a fairly distinct row of black cross bars on either side. In males the color is more uniform as the dark bands are wanting; the general color is dark brown with so many spots of bright blue that the entire dorsal surface has a bluish green cast.

The ventral surface of the females is light yellow often tinged with bluish on the throat, sides of belly, and tail. In the males the inferior

surface of the limbs and breast, and a narrow band along the middle of the belly, are yellow; the sides of the belly are bright blue, and there is on the throat a spot of very intense blue that fades out to a white or gray anteriorly.

Habitat Relations.—In contrast to *S. magister*, which occurs on the plains, the habitat of *S. clarkii* is limited to the timber zone along the streams (Willow-Poplar association), and in harmony with the different conditions under which it lives its habits also differ from those of the desert form. It is found only on or near trees, and when surprised does not dash down a hole as would *S. magister* under the same circumstances, but up and around the trunk, keeping on the far side of the tree like a squirrel. It is thus more arboreal in its habits than *S. magister*, a fact that determines its local distribution, for trees on the desert are confined to the larger water courses, the higher elevations on the mountains, and the bottoms of the cañons. Near Tucson *Sceloporus clarkii* occurs along the Santa Cruz River and Rillito Creek, following the tributaries of the latter into the cañons which they have carved out of the south slope of the Santa Catalina Mountains. In the lower part of Sabino Cañon I observed several individuals among the trees and bushes with *Cnemidophorus gularis*, and they seemed quite as willing when frightened to take refuge beneath the stones that strew the bottom of the gorge as to run up the trees.

The stomach contents of but one specimen was examined. It consisted entirely of insects (one caterpillar and the remains of several beetles).

Range.—Concerning the distribution of this lizard Dr. Stejneger¹ wrote in 1893 that *S. clarkii* “within the United States, seems confined to southeastern Arizona, whence it is found southward into Mexico for an unknown distance, probably confined to the western slope of the Sierra Madre, for it is pretty certain that *S. clarkii* and all its allied forms, or species, are confined to the western slope of the continent.” Since that time it has been recorded from Alamogordo, N. M.,² and Boquillas and Langtry,³ in western Texas.

Sceloporus clarkii Hallowell.

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|---------------------|-----------|---|----------------|---------------|---------------|
| Willow-Poplar Assn. | 684 | Tucson, Ariz. Bank of Santa Cruz River | Aug. 5-06 | A. G. Ruthven | 13-13 |
| “ | 751 | “ | Aug. 8-06 | “ | 12-13 |
| “ | 974 | Lower part of Sabino Cañon | Aug. 18-06 | “ | 12-13 |

¹ North Amer. Fauna, No. 7, 180.

² Stone and Rehn, Proc. Acad. Nat. Sci. Phila., 1902, 31 (cf. p. 535).

³ Bailey, North Amer. Fauna, No. 25, 42.

Sceloporus consobrinus Baird & Girard.

Sceloporus consobrinus BAIRD & GIRARD, Marcy's Explor. Red River, 1853, 208-210.—BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 5.—BAIRD, Rept. Pac. R. R. Surv., X (Whipple-Ives Route), 1859, 37.—COPE, Proc. Acad. Nat. Sci. Phila., 1866, 303.—COPE, Bull. U. S. Nat. Mus., I, 1875, 49.—YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 574.—COUES, *ibid.*, 594.—COPE, Bull. U. S. Nat. Mus., XVII, 1880, 17, 44.—COPE, Proc. Acad. Nat. Sci. Phila., 1883, 15, 16.—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 10, 61.—BOULENGER, Cat. of Lizards in Brit. Museum, II, 1885, 229-230.—COPE, Proc. Amer. Phil. Soc., XXII, 1885, 395, 397-398.—STEJNEGER, North Amer. Fauna, No. 3, 1890, 111.—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, 1896, VI, 341.—COPE, Amer. Natur., XXX, 1896, 1015.—HERRICK, TERRY & HERRICK, Bull. Sci. Lab. Denison Univ., XI, 1899, 128-129.—STONE & REHN, Proc. Acad. Nat. Sci. Phila., 1903, 31-32.—BROWN, *ibid.*, 546, 552.—BAILEY, North Amer. Fauna, No. 25, 1905, 42.

Sceloporus garmani "BOULENGER, Proc. Zool. Soc. Lond., 1882, 761."

Sceloporus tristichus COPE apud Yarrow, Wheeler's Surv. West of 100th Merid., V, 1875, 571-572.

Sceloporus undulatus tristichus COPE, Rept. U. S. Nat. Mus., 1898 (1900), 376-377.

Sceloporus undulatus consobrinus COPE, Rept. U. S. Nat. Mus., 1898 (1900), 377-381.—STONE, Proc. Acad. Nat. Sci. Phila., 1903, 540.

Locality. Ten specimens of *S. consobrinus* were taken near Alamogordo, where it is a common form.

Description of Specimens.—The specimens secured are approximately normal and little variable in scutellation. There is, however, some variation in size and color, which appears to be correlated with the habitat. On the basis of these characters our specimens may be divided into three groups: (1) Those taken in the Piñon-Cedar association on the mountains; (2) Those from the Creosote bush and Mesquite associations on the plains, and (3) Those from the Atriplex association and White Sands. The specimens from the desert floor (second and third groups) are all of comparatively small size,¹ and vary only in color, those from the Atriplex association and White Sands being the more pallid. Those from the Piñon-Cedar association are, however, strikingly different from the plains forms both in being more robust and in their darker color. These differences are brought out in the following descriptions.

Creosote bush and Mesquite Associations.—Head brown, spotted with black. A well defined greenish, bright or light yellow stripe extends from the outer canthus, along either side of the back and onto the base of the tail.

¹ The difference in size between the specimens from the plains and Piñon-Cedar association is not expressed so much in total length as in the proportions. In specimens of the same size from the two habitats those from the plains have a proportionately shorter body and longer tail, the tail being about 1.54-1.6 times the length of the body, as against 1.2-1.32 in those from the Piñon-Cedar association.

Above this light stripe there is a dark or reddish brown band about two rows of scales wide, which is more or less marked with black, but not in the form of definite spots. A median dorsal band of dark olive or olive brown, unspotted. Limbs above brown and spotted irregularly with black. About three rows of scales below the superior lateral stripe, there is a second or inferior light band extending from below the orbit to the hind limb. Between these light stripes is a second band of the ground color (brown or reddish brown with small irregular black spots) which also covers the upper surface of the limbs. The ventral surface of the limbs and tail are white or yellowish. The belly possesses on either side a large patch of blue (distinct in males, faint or wanting in females) separated by a wide median band of white. There is also a pair of blue spots on the throat, which are large and confluent mesially in males but small and mostly separated in females.

Atriplex and *Sumac-Yucca* Association.— Head light clay colored above. Median dorsal band light grayish slate. Sides of head and lateral stripes light gray or white. Stripes of ground color very light yellowish brown, reddish brown, or white, irregularly spotted with black. Under surfaces white except for the throat and belly spots. Both belly and throat spots are well defined in the males, but the former are mostly lacking in the females, the latter usually present although small.

Piñon-Cedar Association.— Head dark brown marked with black cross bars. Lateral stripes light or dark greenish yellow. Bands of ground color dark brown or olive brown crossed by numerous distinct narrow, black bars, that encroach upon and nearly interrupt the superior lateral stripe. Median dorsal band dark greenish olive. Under surface of female iridescent, throat patches small and light blue in color, throat elsewhere delicately suffused with blue. Belly white. In the male the belly is yellowish white with two lateral patches of very dark purple separated by bluish; throat patches dark metallic blue, both throat and belly patches margined with black.

Habitat Relations.— Considering the specimens obtained as belonging to a single form, the range of habitats is very large. Stone and Rehn¹ record it from Highrolls (altitude 6540), which is in the *Piñon-Cedar* association. We obtained it above Pinto (6000 ft.), which is also in the *Piñon-Cedar* association, in the *Creosote bush* association on the alluvial slopes, in the *Mesquite* and *Atriplex* associations on the plains and on the easternmost dunes of the White Sands. It was not found within the White Sands, not even in the bottoms, where the conditions are more like the *Atriplex* association than those of the surrounding dunes.

¹ Proc. Acad. Nat. Sci. Phila., 1903, 31.

It is primarily a ground form,¹ in the mountains being found among the rocks, on the plains about the foot of the bushes. On the dunes it occurs with *Holbrookia maculata flavilenta* and *Cnemidophorus sexlineatus* about the clumps of Lavender, Sumac and Yuccas.

The stomach of the only White Sand specimen examined contains a robber fly, the remains of a small beetle and a few ants. A specimen taken on the plains had eaten a grasshopper, a few small beetles, ants and one or two fragments of vegetable matter.

Range.—*S. consobrinus* has been recorded in central Texas and on the Mexican Plateau, High Plateau and Proplateau. On the High Plateau Stejneger² states that it "is confined to the Cedar belt," and this would seem to be the case also in the Proplateau region of Arizona since we failed to find it on the alluvial slopes or plains, although it is known to occur in this general region.³ On the other hand in eastern New Mexico and western and central Texas it occurs commonly both in the Piñon-Cedar association and on the plains. It may be found that, like *Crotaphytus collaris baileyi*, this species pushes down the mountains in the eastern part of its range.

Sceloporus consobrinus Baird & Girard.

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|---------------------|-----------|--|----------------|----------------|---------------|
| Piñon-Cedar Assn. | 77 | Alamogordo, N. M. Box Cañon, near Pinto, N. M. | July 6-06 | G. von Krockow | 14-15 |
| Atriplex Assn. | 114 | Plains west of Alamogordo | July 9-06 | A. G. Ruthven | |
| " | 115 | " | " | " | 14-15 |
| " | 128 | " | " | G. von Krockow | 13-14 |
| Mesquite Assn. | 158 | Plains south of Alamogordo | July 11-06 | A. G. Ruthven | 16-16 |
| " | 159 | " | " | " | 14-14 |
| Piñon-Cedar Assn. | 358 | Between Pinto and Highrolls, N. M. | July 17-06 | " | 15-15 |
| Creosote bush Assn. | 411 | Alluvial slope east of Alamogordo | July 18-06 | " | |
| Sumac-Yucca Assn. | 438 | White Sands west of Alamogordo | July 19-06 | " | 16-16 |
| " | 439 | " | " | " | 15-16 |
| " | 444 | " | " | " | 17-15 |
| " | 471 | " | " | G. von Krockow | 15-17 |
| " | 475 | " | " | " | 16-17 |

¹ Cope (Bull. U. S. Nat. Museum, XVII, 17) states that in central Texas "It is found on the ground, but always takes refuge in trees, running on and around the limbs with great agility." At Alamogordo we never observed it to climb about in the bushes.

² North Amer. Fauna, No. 3, 111.

³ Van Denburgh, Proc. Cal. Acad. Nat. Sci., Ser. 2, VI, 341.

Cope, Rept. U. S. Nat. Museum, 1898, 380-381.

***Phrynosoma hernandesi* Girard.**

Phrynosoma douglassii COPE, Proc. Acad. Nat. Sci. Phila., 1866, 302.—ALLEN, Proc. Bost. Soc. Nat. Hist., XVIII, 1874, 69.—COPE, Proc. Acad. Nat. Sci. Phila., 1883, 12.—BOULENGER, Cat. of Lizards in Brit. Museum, II, 1885, 240–241. (Part.) — HERRICK, TERRY & HERRICK, Bull. Sci. Lab. Denison Univ., XI, 1899, 134–135.

Tapaya douglassii BAIRD, Rept. Pac. R. R. Surv., X (Beckwith-Gunnison Route), 1859, 18. (Part.)

Phrynosoma douglassii douglassii COPE, Bull. U. S. Nat. Mus., I, 1875, 49. (Part.) — YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 580–581.—COUES, *ibid.*, 591–593. (Part.)—YARROW, Bull. U. S. Nat. Museum, XXIV, 1883, 11, 68–69.

Tapaya hernandezii "GIRARD, U. S. Explor. Exped., 1858, 395."—GIRARD apud Baird, U. S. and Mex. Bound. Surv., II, 1859, 8–9.—BAIRD, Rept. Pac. R. R. Surv., X (Whipple-Ives Route), 1859, 38.—"BOCOURT, Miss. Sci. Mex., Rept., 1874, 228."

Phrynosoma hernandesi COPE, Bull. U. S. Nat. Mus., I, 1875, 49.—YARROW, *ibid.*, XXIV, 1883, 11, 68. (Part.)—STEJNEGER, North Amer. Fauna, No. 3, 1890, 112–115.—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, VI, 1896, 342.—STEJNEGER, Proc. U. S. Nat. Mus., XXV, 1902, 151.—BAILEY, North Amer. Fauna, No. 25, 1905, 43.

Phrynosoma douglassii hernandesi COPE, Rept. U. S. Nat. Mus., 1898 (1900), 413–415.—STONE & REHN, Proc. Acad. Nat. Sci. Phila., 1903, 32.

Locality. We obtained a specimen (No. 585) of this horned toad at Cloudcroft, New Mexico, where it is a common form on both slopes of the mountains. None were taken at Tucson.

Description of Specimens. One series of marginal spines. No enlarged gular scales. Horns reduced, consisting of three temporals and one occipital on either side. Occipital horns directed posteriorly but not produced as far as the adjacent temporals. Femoral pores 15–16.

In a living specimen there are four pairs of elongated rectangular black spots on the dorsal surface of the body, and a large pair of nuchal blotches. The members of each pair of spots are separated by a median dorsal band, that extends from the head to the posterior end of the triangular expansion of the base of the tail. This dorsal band is bluish white on the nape, becoming dark slate on the body, and is confluent with the spaces between the spots. The color of these interspaces varies from dark slate toward the dorsal band, to dark olive brown on the sides, thus somewhat obscuring the margins of the spots. Posteriorly the first three spots on each side are margined near the vertebral band with a narrow light yellow line. Tail, fore and hind limbs light olive, rather indistinctly barred with black above, the black bars on the tail being apparently continuations of the dorsal series that is interrupted along the vertebral line to form the dorsal spots. There

is a patch of bluish white behind the angle of the jaw, and a dark orange red line extends posteriorly from the axillary pit, just above the marginal row of spines on either side. Head dark olive brown, sides of muzzle light orange yellow. Lower lip bright red. Horns pinkish.

Ventral surface white, tinged with yellow and obscurely spotted with dark slate. Throat bright orange yellow.

Habitat Relations.—Dr. Stejneger¹ in extending the name *hernandesi* to include the Rocky Mountain horned toads previously known as *P. douglassii* or *P. douglassii douglassii* (not *Agama douglassii* Bell) gives the habitat in the San Francisco Mountain region as being “chiefly confined to the cedar belt and lower pine belt.” In the Sacramento Mountains we only found it in the Pine-Spruce association on the summits, where it occurs

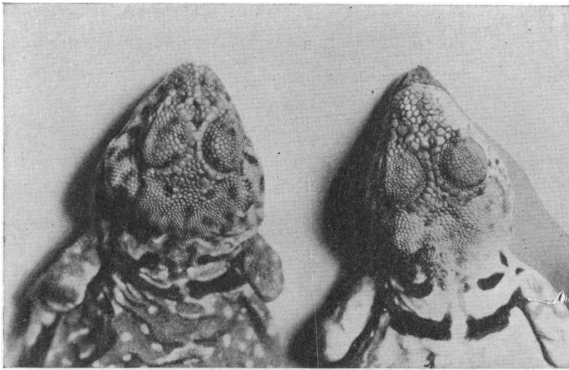


Fig. 20. Specimens of *Crotaphytus collaris baileyi* from Alamogordo, N. M., showing the arrangement of the interocular scales in the specimens from this region.

abundantly. We did not have the opportunity of determining the extent to which it descends the slopes, but Stone² states that it was “obtained abundantly by Mr. Viereck in the Transition and Canadian belts,” evidently meaning by the Transition belt, the Piñon-Cedar association, although, as will be pointed out later (p. 601), the Piñon-Cedar zone is classed as Upper Sonoran by Merriam and Bailey. It is certain that it does not occur below the Piñon-Cedar association.

Range.—*Phrynosoma hernandesi* has a very extensive range, the limits of which have not as yet been definitely determined. As known at present it may be defined in general as the higher plateaus of the Rocky Mountain region in Colorado, Utah, Nevada, New Mexico and Arizona, and the mountain ranges of the Proplateau in southwestern Texas, southern New

¹ North Amer. Fauna, No. 3, 112-115.

² Proc. Acad. Nat. Sci. Phila., 1903, 32.

Mexico and Arizona. As it occurs in the Piñon-Cedar association its distribution along the East Front Ranges in eastern New Mexico and southwestern Texas is very probably continuous with the major part of its range to the northward. In the western part of its range the Colorado Plateau affords a continuous highway as far south as the middle of Arizona. South of the escarpment that marks the southern margin of this plateau, however, the Piñon-Cedar association only occurs on the higher isolated peaks and short ranges that rise island-like from the surrounding desert. In this region of open basins and short ranges the distribution of *Phrynosoma hernandesi* is discontinuous. It has been recorded from the Huachuca Mountains, and there is little doubt but that it occurs on most, if not all, of the ranges of this region, that rise high enough to support the Piñon-Cedar and Pine-Spruce associations.

It is not as difficult to explain the occurrence of this horned toad on the mountains of the Proplateau region in southern Arizona, as it is to account for the presence of forms of the Pine-Spruce forests on the higher summits, for it is evident that it would not have required a great decrease in temperature in this region during the glacial period to cause the Piñon-Cedar association to descend onto the higher mesas, and thus connect up isolated parts of this habitat.

***Phrynosoma solare* Gray.**

Phrynosoma solare "GRAY, Cat. of Lizards in Brit. Museum, 1845, 229."—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, IV, 1894, 456; *ibid.*, V, Ser. 2, 1895, 115.—COPE, Amer. Natur., XXX, 1896, 1014.—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, VI, 1896, 342.—COPE, Rept. U. S. Nat. Mus., 1898 (1900), 420-423.

Phrynosoma regale "GIRARD, U. S. Explor. Exped., 1858, 406."—GIRARD apud Baird, U. S. and Mex. Bound. Surv., II, 1859, 9.—COPE, Proc. Acad. Nat. Sci. Phila., 1866, 302.—"BOCOURT, Miss. Sci. Mex., Rept., 1874, 235."—YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 578.—COUES, *ibid.*, 593.—COPE, Bull. U. S. Nat. Mus., I, 1875, 49.—LOCKINGTON, Am. Natur., XIV, 1880, 295.—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 11, 66.—BOULENGER, Cat. of Lizards in Brit. Museum, II, 1885, 245.

Locality.—A single specimen of *Phrynosoma solare* was taken about a quarter of a mile south of old Fort Lowell, Arizona. Prof. Thornber also presented the expedition with five specimens taken in the vicinity of Tucson.

Description of Specimens. (Fig. 21.)—This is one of the most spinous species of the genus, as one usually becomes aware when he endeavors to capture one alive. The horns are large, flattened in the dorso-ventral plane, slightly upcurved, and consist of four occipitals and six temporals, three on either side. The temporals are on a slightly lower plane than the occipitals,

but the difference in elevation is so slight that the appearance is that of a continuous ruff of horns about the back of the head. There are two rows of marginal spines, the inferior consisting of small acuminate scales, the superior of elongated, pyramidal spikes set very closely together. The two rows are separated by several series of small flat scales.

On either side of the dorsal line are one or two series of rather large, keeled and slightly elevated scales, and lateral to these four spaced rows of much larger, strongly keeled, mucronate and elevated ones. The spines of the two upper rows on either side are the larger, much broader than wide, their posterior faces are convex and their anterior concave. The spines of

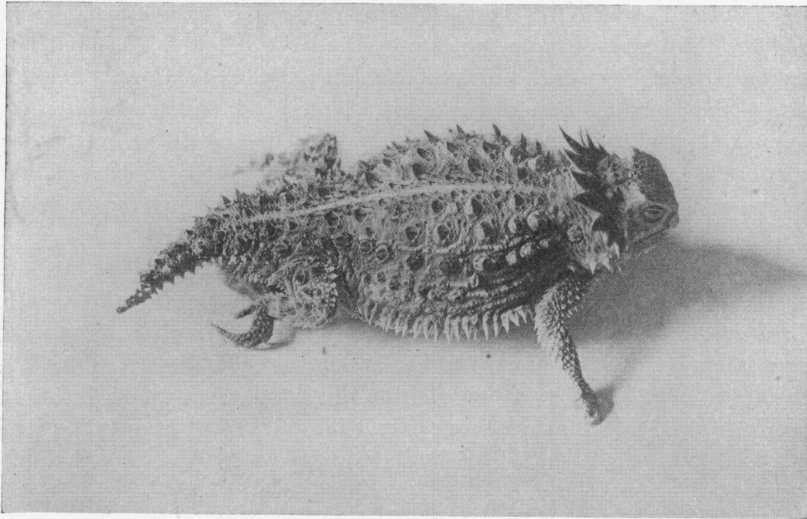


Fig. 21. *Phrynosoma solare* from Tucson, Ariz.

the two lower rows are more erect and narrower, and of a pyramidal form. Posteriorly the first and third rows end in the lumbar region, the third in the lateral abdominal region, the second on the triangular base of the tail, but the spines of the fourth row, becoming more erect, continue nearly to the end of the tail. Below this series on the tail is a row of slender pyramidal spines that seems to be a continuation of the upper marginal row on the body, although the connection between the two series is not definite. Ventral to this marginal series of spines on the tail there is a short row of points on the expanded base.

The forelimb and leg are covered above with large, keeled and mucronate

scales. On the thigh there are small, keeled scales interspersed with large scattered spines, and a row of keeled and pointed scales on the inner margin.

The general color is pale. There is a vertebral line of light yellow extending from the head to the end of the expanded base of the tail, and a similar narrower line on either side between the second and third rows of enlarged scales, extending from the neck to the lumbar region. The nuchal blotches are very dark brown. The ground color on the sides is bright yellow, somewhat variegated with dark brown which replaces the yellow near the light longitudinal line, and connects along these lines with the nuchal spots. The flattened scales adjacent to the light vertebral band and the fourth row of spines are also brown, and have black keels. The small scales between the flattened vertebral scales, the lateral light lines, and the third row of large spines are very light yellow. The hind limbs are barred with very dark brown above, but not very definitely. On either side of the expanded base of the tail is a large black blotch separated from its neighbor by the light vertebral line. This line is absent on the distal part of the tail, however, and the pattern consists of alternate bars of bright yellow and black. The head is light gray, becoming dark brown toward the tip of the occipital horns.

Habitat Relations.— Apparently nothing has been recorded on the habits of *Phrynosoma solare*. The single specimen taken was found beneath a Creosote bush on the plains just south of old Fort Lowell (Creosote bush association). Without doubt the five specimens taken by Mr. Price¹ "on the desert near Fort Lowell" were from this habitat, and probably also the specimens in the National Museum (Nos. 8437 and 17179) recorded by Cope.²

The stomachs of the two specimens examined were both gorged with the remains of scores of ants.

Range.— Unfortunately but few specimens of this horned toad have been recorded, so that it is impossible, as yet, to accurately define its range. Most of the literature that has accumulated has been based on specimens from the following localities: "California"; "Gila and Colorado Desert"; Fort Lowell and Tucson, Arizona; Hermosilla, Mexico; Las Animas Bay, Lower California. Few as these records are they indicate that the home of *P. solare* is the same as that of *Callisaurus ventralis*—the Sonoran Desert in the extreme southwestern United States, and western Mexico—and like the latter species it probably pushes little farther into the Proplateau region than Tucson, Arizona.

¹ Proc. Calif. Acad. Sci., Ser. 2, VI, 342.

² Rept. U. S. Nat. Mus., 1898, 423.

Phrynosoma solare Gray.

| Habitat | Field No. | Locality | When Collected | Collector |
|---------------------|-----------|---|----------------|----------------|
| Creosote bush Assn. | 793 | <i>Tucson, Ariz.</i> Plains south of Fort Lowell | Aug. 10-06 | A. G. Ruthven |
| | 1094 | Tucson, Arizona | ? | J. J. Thornber |
| | 1095 | " | ? | " |
| | 1096 | " | ? | " |
| | 1097 | " | ? | " |
| | 1098 | " | ? | " |

Phrynosoma cornutum Harlan.

Agama cornuta HARLAN, Jour. Acad. Nat. Sci. Phila., IV, 1825, 299; *ibid.*, VI, 1829, 14.—"GRIFFITH, Cuvier's Anim. King., IX, 1831, 216."—HARLAN, Med. and Phys. Res., 1835, 141.

Tapaya cornuta "CUVIER, Règ. Anim., II, 1829, 37."

Phrynosoma bufonium "WIEGMANN, Isis, 1828, 367."—"GRAY, Syn. Rept. Griff. Cuvier's Anim. King., IX, 1831, 45."

Tropidogaster cornutus "FITZINGER, System. Rept., I, 1843, 79."

Tropidogaster bufonium "FITZINGER, System. Rept. I, 1843, 79."

Phrynosoma harlanii "WIEGMANN, Herpt. Mex., I, 1834, 54."—DUMÉRIL & BIBRON, Erpétologie Générale, IV, 1837, 314-318.—"SPRING & LACORDIERE, Anat., Pt. 2, 192, Bull. Acad. Roy. Bruxelles, 1842."—"DUMÉRIL, Cat. Meth. Coll. Rept. Mus., 1851, 28."

Phrynosoma orbiculare "HOLBROOK, North Amer. Herp., II, 1842, 93."

Phrynosoma planiceps HALLOWELL, Proc. Acad. Nat. Sci. Phila., 1852, 178.—HALLOWELL, Sitgreaves' Exped. Zúñi and Colo. Riv., 1853, 124-125.—COPE, Bull. U. S. Nat. Mus., I, 1875, 49.—COUES, Wheeler's Surv. West of 100th Merid., V, 1875, 593.—YARROW, *ibid.*, 579.

Phrynosoma cornutum planiceps BOULENGER, Cat. of Lizards in Brit. Museum, II, 1885, 246.

Phrynosoma cornutum "GRAY, Syn. Rept. Griff. Cuvier's Anim. King., IX, 1831, 45."—"HOLBROOK, North American Herpetology, II, 1842, 87."—"GRAY, Cat. Liz. Brit. Mus., 1845, 229."—GIRARD, Stansbury's Exped. Gt. Salt Lake, 1852, 360.—"BLANCHARD, Organ. Reg. Anim., 1852, Pt. 5."—HALLOWELL, Sitgreaves' Exped. Zúñi and Colo. Rivers, 1853, 119-122, 145.—BAIRD & GIRARD, Marcy's Explor. of the Red Riv., 1854, 204-205.—"GIRARD, U. S. Explor. Exped., 1858, 403."—BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 9.—BAIRD, Rept. Pac. R. R. Surv., X (Whipple-Ives Route), 1859, 37.—"BOCOURT, Miss. Sci. Mex., Rept., 1874, 236."—COPE, Bull. U. S. Nat. Mus., I, 1875, 49.—YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 579.—COPE, Bull. U. S. Nat. Mus., XVII, 1880, 17-18, 44, 46.—YARROW, *ibid.*, XXIV, 1882, 11, 66-67.—COPE, Proc. Acad. Nat. Sci. Phila., 1883, 10, 12.—BOULENGER, Cat. of Lizards in Brit. Museum, II, 1885, 245-246.—COPE, Proc. Am. Phil. Soc., XXII, 1885, 169; *ibid.*, XXIII, 1886, 282.—COPE, Bull. U. S. Nat. Mus., XXXII, 1887, 39.—COPE, Proc. U. S. Nat. Mus.,

XI, 1888, 398.—COPE, Proc. Acad. Nat. Sci. Phila., 1892, 335.—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, VI, 1896, 342.—HERRICK, TERRY, & HERRICK, Bull. Sci. Lab. Denison Univ., XI, 1899, 135-136.—COPE, Rept. U. S. Nat. Mus., 1898 (1900), 432-436.—COPE, Proc. U. S. Nat. Mus., XXV, 1902, 151.—STONE & REHN, Proc. Acad. Nat. Sci. Phila., 1903, 32.—STONE, *ibid.*, 540.—BROWN, *ibid.*, 546, 552.—BAILEY, North Amer. Fauna, No. 25, 1905, 43.

Locality.—*Phrynosoma cornutum* is the common horned toad on the desert about Alamogordo, N. M., where nine specimens were taken. It has been recorded from southeastern Arizona, and even from the vicinity of Fort Lowell,¹ but we did not find it in this region.

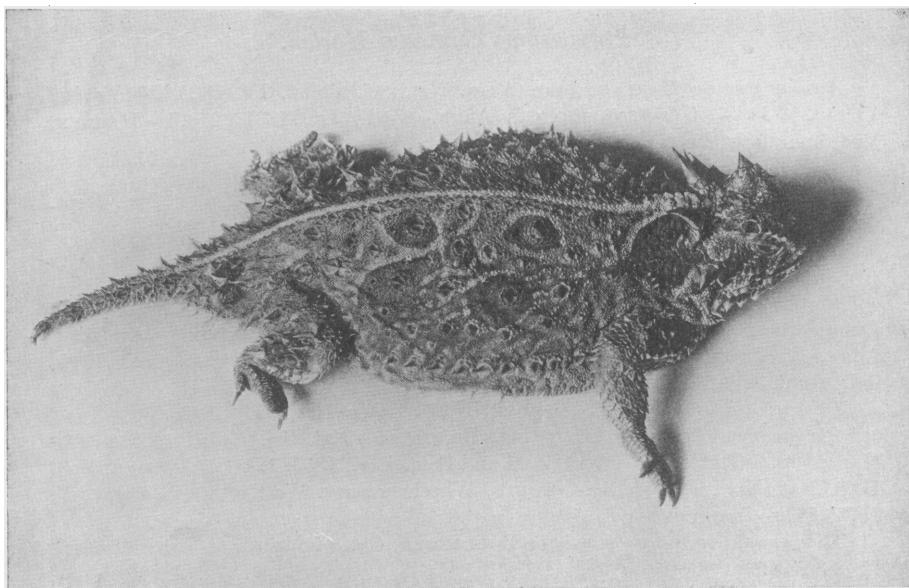


Fig. 22. *Phrynosoma cornutum* from Alamogordo, N. M.

Description of Specimens. (Fig. 22.)—The ground color above varies from dark orange yellow to dark brown. There is a pale vertebral line, and two rows of large, dark brown or black spots on either side. There are four spots in the lower series, three or four in the upper row, and the last spot in each series is usually united with the corresponding spot in the adjacent row to form a deeply notched cross band. There is also a similar pair of large spots on the base of the tail, separated by the vertebral line that extends to the slender portion of the tail. All of these spots are gener-

¹ Cope, Rept. U. S. Nat. Mus., 1898, 436.

ally margined broadly with bright yellow. Distal end of tail cross-barred with black or dark brown; upper surface of limbs irregularly barred with the same color.

Head and face distinctly barred with black. The pattern on the head usually consists of a transverse bar between the superciliary horns, and similar bars across the middle and anterior portions of the interorbital region. On the sides of the head a dark bar extends from the anterior bar on the top of the head across the mouth, another also across the mouth from the middle of the orbit, a third extends from the posterior orbital angle to the first temporal horn, and a fourth from the superciliary horns to a point between the occipital and third temporals. The occipitals, first and usually a varying amount of the second temporals, and the posterior halves of the superciliary horns are very dark horn color, the third and part of the second temporal spines light horn color. Ventral surfaces very light yellow or cream colored, with scattered dusky spots.

Habitat Relations.—Like *Anota modesta* the habitat of *P. cornutum* is the plains. It is the common horned lizard of the Mesquite association about Alamogordo, and in the Creosote bush association of the adjacent alluvial slopes. It was not found in the Atriplex association west of Alamogordo, nor on the Sacramento Mountains.

Almost nothing has been recorded on the habitat of this reptile. Rehn and Viereck only record it from the plain about Alamogordo. Herrick states that it is common in the valley of the Rio Grande, and Bailey that it is an arid Lower Sonoran form in Texas.

An examination of several stomachs shows that the principal food is insects; ants greatly predominating. Beetles are present in small numbers, and a few leaves of some weed, which may have been taken in accidentally with the food. Cope¹ records specimens from Lake Valley, N. M., as "full of eggs in June."

Range.—*P. cornutum* occurs chiefly in the Proplateau region of western Texas, southern New Mexico, and southeastern Arizona, and on the northern part of the Mexican Plateau. It has been recorded from Utah.² To the eastward it extends through central Texas into the margin of the forest area of the eastern part of the State.

¹ Proc. Acad. Nat. Sci. Phila., 1883, 10.

² Rept. U. S. Nat. Mus., 1898, 436.

Phrynosoma cornutum Harlan.

| Habitat | Field No. | Locality | When Collected | Collector |
|---------------------|-----------|-----------------------------------|----------------|----------------|
| Mesquite Assn. | 84 | Alamogordo, N. M. | July 7-06 | G. von Krockow |
| " | 86 | Plain near Alamogordo | " " | A. F. Zimmer |
| " | 110 | " | July 9-06 | A. G. Ruthven |
| " | 146 | " | July 10-06 | " |
| " | 151 | " | " | G. von Krockow |
| Creosote bush Assn. | 413 | Alluvial slope east of Alamogordo | July 18-06 | A. G. Ruthven |
| " | 590 | " | July 25-06 | G. von Krockow |
| Mesquite Assn. | 603 | Plain near Alamogordo | July 26-06 | A. G. Ruthven |

Anota modesta Girard.

Phrynosoma modestum GIRARD, Stansbury's Exped. Gt. Salt Lake, 1852, 365.—HALLOWELL, Sitgreaves' Exped. Zúñi and Colo. Rivers, 1853, 145.—COPE, Proc. Acad. Nat. Sci. Phila., 1866, 302.—"BOCOURT, Miss. Sci. Mex., Rept., 1874, 232."—YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 577.—COUES, *ibid.*, 594.—COPE, Bull. U. S. Nat. Mus., I, 1875, 49.—COPE, Proc. Acad. Nat. Sci. Phila., 1883, 10, 12.—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 11, 64.—BOULENGER, Cat. of Lizards in Brit. Museum, II, 1885, 248.—COPE, Proc. Am. Phil. Soc., XXIII, 1886, 282.—COPE, Bull. U. S. Nat. Mus., XXXII, 1887, 38.—COPE, Proc. Acad. Nat. Sci. Phila., 1892, 335.—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, VI, 1896, 342.—BROWN, Proc. Acad. Nat. Sci. Phila., 1903, 546, 552.—BAILEY, North Amer. Fauna, No. 25, 1905, 43-44.

Doliosaurus modestus "GIRARD, U. S. Explor. Exped., 1858, 309."—BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 10.—GIRARD, Rept. Pac. R. R. Surv., X (Whipple-Ives Route), 1859, 38.

Phrynosoma platyrhynus HERRICK, TERRY & HERRICK, Bull. Sci. Lab. Denison Univ., XI, 1899, 136-137.

Anota modesta COPE, Amer. Natur., XXX, 1896, 1014.—COPE, Rept. U. S. Nat. Mus., 1898 (1900), 437-439.—STONE & REHN, Proc. Acad. Nat. Sci. Phila., 1903, 32.

Locality.—Seven specimens of *Anota modesta* were secured on the plains about Alamogordo, where it is quite common but not as abundant as *P. cornutum*. It was not found about Tucson, Arizona.

Description of Specimens.—There is little variation in the coloration of the specimens taken in the Atriplex association. The ground color above is light brownish yellow. The only markings on the head consist of numerous small black spots that are usually, but not always, confined to the points of the rugosities. On the nape there is a pair of large nuchal blotches that extend from the head to a point behind the fore limbs, and a similar

pair in front of the hind limbs. These spots may or may not connect along the sides of the body. On the dorsal surface there are usually numerous small, black or dark brown spots that may occur singly or grouped into larger spots. The limbs are usually indistinctly and irregularly barred above, and there is a series of distinct cross bars on the tail. The proximal band is usually divided on the median line, and the two halves expand to form a large spot on either side of the triangular base of the tail.

In one specimen taken in the Creosote bush association the ground color above is light orange yellow, the head being dark slate. There are no spots on the dorsal surface, the usual large spots on the sides being represented by a dusky shade that extends along either side from the head to the hind limb.

In the other specimen taken in the Creosote bush association the ground color is yellowish gray; that of the head light slate. No dorsal spots, and the usual lateral spots represented only by a dark shading.

The ability that some horned toads have of changing their color has often been remarked upon. That this species has this power was shown in a striking way by specimen No. 122. It was necessary to shoot this specimen, as it was making for an impenetrable Crucifixion thorn bush when discovered. It was not seriously injured, but bled quite freely, and when the bag in which it was placed became stained with the blood, the large black lateral spots, which were previously very distinct, became a bright pink, and remained so for four hours, only becoming black again when the specimen was killed.

Habitat Relations.—This horned toad was found about Alamogordo only on the plains and the adjacent alluvial slope. It is widely distributed there, however, occurring in the Atriplex, Mesquite and Creosote bush associations, being apparently more common in the Atriplex association west of Alamogordo.

Bailey¹ states that "apparently the species belongs to Lower Sonoran zone and extends to its extreme upper limit." According to his interpretation this would mean that *A. modesta* occurs through the Sotol-Ocotillo association to the lower limit of the Piñon-Cedar zone. This it does not seem to do in this part of its range, as no specimens were observed by us above the Creosote bush association on the alluvial slope, and Rehn and Viereck only record it from "the plains about Alamogordo." It is entirely probable, however, that it occurs to some extent in the Sotol-Ocotillo association as there is no sharp line between this zone and the adjacent Creosote bush association, but be this as it may it is quite evident that the principal home of *Anota modesta* in this region is on the plains.

¹ North Amer. Fauna, No. 25, 43.

The stomach contents of several specimens consist very largely of ants; a few beetles are also present, and a small amount of vegetable matter.

Range.— The limits of the range of *Anota modesta* are not as yet definitely known, but as far as our knowledge goes its distribution is in harmony with the arid character of its habitat.

It occurs in the Prairie region of central Texas between the 98th meridian and the eastern edge of the Staked Plains. To the south it skirts the margin of the High Plateau, and is found in the open arid basins of the Mexican Plateau and Proplateau regions as far westward as southeastern Arizona. In western Texas and New Mexico it takes advantage of the three highways that permit the most northern extension of the range of the plains types in this region, and is found in the Pecos, Hueco, and Rio Grande basins, in the latter possibly as far north as Albuquerque. The western boundary of its range in southern Arizona seems to be marked in general by the western margin of the Proplateau, but it may be found to follow this feature through the central part of the State.

Anota modesta Girard.

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|---------------------|-----------|-----------------------------------|----------------|----------------|---------------|
| Atriplex Assn. | 111 | Alamogordo, N. M. | July 9-06 | A. G. Ruthven | 13-13 |
| " | 122 | Plains west of Alamogordo | " | G. von Krockow | 15-15 |
| Creosote bush Assn. | 219 | Alluvial slope east of Alamogordo | July 13-06 | A. G. Ruthven | 10-9 |
| " | 412 | " | July 18-06 | A. G. Ruthven | 12-12 |
| Atriplex Assn. | 467 | Plains west of Alamogordo | July 19-06 | A. F. Zimmer | 14-10 |
| " | 468 | " | " | A. G. Ruthven | 12-12 |
| " | 469 | " | " | A. F. Zimmer | 11-12 |

Coleonyx brevis Stejneger.

Stenodactylus variegatus BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 12. (Part.)

Eublepharis variegatus BOULENGER, Cat. of Lizards in Brit. Museum, I, 1885, 233-234.—COPE, Amer. Natur., XXX, 1896, 1009.—COPE, Rept. U. S. Nat. Mus., 1898 (1900), 466-469. (Part.)

Coleonyx variegatus COPE, Bull. U. S. Nat. Mus., I 1875, 52. (Part.)—*Ibid.*, XVII, 1880, 13-14, 44, 46.—YARROW, *ibid.*, XXIV, 1883, 11, 72. (Part.)—HERRICK, Terry & HERRICK, Bull. Sci. Lab. Denison Univ., XI, 1899, 119.

Coleonyx brevis STEJNEGER, North Amer. Fauna, No. 7, 1893, 162-164.—BAILEY, *ibid.*, No. 25, 1905, 44.

Locality.—A single specimen (No. 55) of this Gecko was taken near Alamogordo, New Mexico. The Geckos obtained at Tucson belong to the following species.

Description of Specimens.—Pupil vertical, eyelids well developed. Head and body above covered with small granular scales except about the mouth and nostrils. Tail cylindrical, covered with whorls of small scales. A small spine on either side of the base of the tail. Toes conical, covered with small scales, and possessing a median ventral series of wide lamellæ; claws short. Seven small supralabial plates extending from a well developed rostral to a point beneath the eye. A similar row of infralabials diverging from a large symphysial plate. A single prenasal scute applied to the sides of the rostral, and separated from its neighbor on the opposite side by a small scale behind the apex of the rostral.

The differences between *C. brevis* and *C. variegatus* are so slight that it is impossible on the basis of most of them to determine the species of the few specimens obtained by the expedition. Thus both in the individuals from Alamogordo and from Tucson the snout is a trifle longer than the distance from the posterior angle of the orbit to the ear, and the number of superior labials in the Alamogordo specimen is the same as in one from Tucson. The size of the internasals, however, separates sharply the Alamogordo specimen from those from Arizona. In the former specimen, as stated above, the prenasal scutes are separated from each other on the median line, while in both of the individuals from Tucson they are broadly in contact. Whether or not the differences between eastern and western individuals are of specific value, however, is another question. It seems quite probable that the two forms may subsequently be found to intergrade.

Habitat Relations.—This Gecko is evidently nocturnal in its habits as is evidenced by its vertical pupil. Cope¹ states that he found it in western Texas "in the rocky hills of the first plateau northwest of San Antonio." The Alamogordo specimen was taken under a large stone, in the upper part of the Creosote bush association on the talus slope. It doubtless does not occur commonly on the plains owing to the absence of rocks and other objects under which it could hide, but it may be expected to occur in the Sotol-Ocotillo zone of the foot hills. (Compare habitat relations of *C. variegatus*, p. 554.)

Range.—Before the species *C. brevis* was established, the range of *C. variegatus* was given as central Texas to California. Since the eastern and western forms were separated, however, there has been a questionable region between Tucson, Arizona, the most eastern record for *C. variegatus*,

¹ Bull. U. S. Nat. Mus., XVII, 14.

and central Texas, the only region from which specimens of *C. brevis* have been recorded. The Alamogordo specimen helps very materially to bridge this gap by carrying the range of *C. brevis* well into the Proplateau region. The western limit of its range must now be sought to the westward of the Hueco bolson.

***Coleonyx variegatus* Baird.**

Stenodactylus variegatus BAIRD, Proc. Acad. Nat. Sci. Phila., 1858, 254.—BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 12. (Part.)

Eublepharis fasciatus BOULENGER, Cat. of Lizards in Brit. Museum, I, 1885, 234.

Coleonyx variegatus COPE, Proc. Acad. Nat. Sci. Phila., 1866, 310; *ibid.*, 1867, 85.—COPE, Bull. U. S. Nat. Mus., I, 1875, 50. (Part.).—COUES, Wheeler's Surv. West of 100th Merid., V, 1875, 590.—YARROW, Bull. U. S. Nat. Museum, XXIV, 1883, 11, 72. (Part.).—STEJNEGER, North Amer. Fauna, No. 7, 1893, 162–164.—VAN DENBURGH, Occ. Papers Calif. Acad. Sci., V, 1897, 40–42.—COPE, Rept. U. S. Nat. Museum, 1898 (1900), 466–469.—MEEK, Field Museum of Nat. Hist., Zool. Series, VII, 1905, 4.

Locality.—Two specimens (Nos. 840 and 1035) of *Coleonyx variegatus*, which had been taken near Tucson, were presented to the party, one by Prof. Thornber.

Description of Specimens.—Similar to *C. brevis*, but with better developed prenasal scutes which meet broadly above. Superior labials 7 in one specimen and 6 in another. Both specimens secured were in alcohol so that the colors of the living animal could not be obtained. The general color pattern is as follows: A broad, transverse, dark band on the neck and four on the body. These bands are continued onto the tail, forming rings on the distal portion. Between these bands the color is white, with a few dark spots, especially on the sides. Ground color of head white with numerous, rather large, dark spots that tend to become elongated longitudinally on the snout.

Habitat Relations.—This form, like its more eastern relative *C. brevis*, is also nocturnal in its habits. Van Denburgh¹ remarks that “An individual kept in confinement for more than a year spent most of his time in a hole provided in the ground of his cage. His food during this time consisted entirely of house flies. His usual time of feeding was after dark, but not infrequently he would snap up a fly which chanced to stray into the mouth of his burrow during the day, and sometimes would come forth in search of prey while the sun was shining brightly on his den.”

Prof. Thornber's specimen (No. 1035) was found under a board on the University grounds, which are in the Creosote bush association, where he

¹ Occ. Papers, Calif. Acad. Sci., V, 42.

says it is occasionally captured under boards or piles of cord wood. The habitat of the other specimen was unknown. Prof. F. E. Lloyd informed us that he had observed it quite frequently under stones on Laboratory Hill. The latter habitat is undoubtedly a natural one, and it is doubtless to be found in the Suaharo-Ocotillo association on most of the higher elevations in this region. We do not believe that it will be found to occur commonly in the Creosote bush association on the plains, owing to the absence of objects under which it may hide, although it may occur here in holes instead of under stones as on the higher elevations.

Range.—In the discussion of the range of *C. brevis* it was stated that the known eastern limit of *C. variegatus* is Tucson, Arizona. It is known to extend from here westward to the Sierra Nevadas in southern California (Inyo, Kern and Riverside counties). Its northern and southern distribution is still unknown, but it has been recorded from Ventanas, Mexico, and San Filipe, Lower California.

***Heloderma suspectum* Cope.**

Heloderma horridum BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 11.—BAIRD, Rept. Pac. R. R. Surv., X (Whipple-Ives Route), 1859, 38.—COPE, Proc. Acad. Nat. Sci. Phila., 1866, 303.

Heloderma suspectum COPE, Proc. Acad. Nat. Sci. Phila., 1869, 5.—COPE, Bull. U. S. Nat. Mus., I, 1875, 47.—YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 562–563.—COUES, *ibid.*, 601–602.—“BOCOURT, Miss. Sci. Mex., Rept., 1878, 297.”—“YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 9, 48.—BOULENGER, Catalogue of Lizards in Brit. Museum, II, 1885, 302.—STEJNEGER, North Amer. Fauna, No. 7, 1893, 194–195.—COPE, Amer. Natur., XXX, 1896, 1014.—VAN DENBURGH, Occ. Papers Calif. Acad. Sci., V, 1897, 120–122.—HERRICK, TERRY & HERRICK, Bull. Sci. Lab. Denison Univ., XI, 1899, 144.—COPE, Rept. U. S. Nat. Mus., 1898 (1900), 476–483.—BROWN, Proc. Acad. Nat. Sci. Phila., 1903, 552.

Locality.—One specimen (No. 968) of the Gila Monster was brought back by the Expedition. It was taken on the mesa near the mouth of Sabino Cañon, Santa Catalina Mountains, Arizona.

Description of Specimen.—The single specimen obtained of this well known form seems to be entirely normal and needs no description.

Habitat Relations.—It seems strange that practically nothing has been recorded on the habitat of such a well known animal as the Gila Monster. About Tucson we found that its principal habitat was the alluvial slope at the foot of the Santa Catalina Mountains (Suaharo-Ocotillo association), where it is quite common. In four weeks collecting none were seen by us on the plains in this region, and Prof. Thornber informed us that specimens were only very rarely secured in this habitat.

In spite of the sluggishness usually attributed to the Gila Monster it can fight fiercely, and when angered displays an unexpected agility in view of its awkward appearance. The specimen captured when seized with long forceps struggled fiercely, snapping and hissing, and throwing its head from side to side with surprising swiftness. When its teeth came in contact with any object, such as the side of the bag into which we were endeavoring to place it, it held on with bulldog tenacity, making it necessary to pry open the jaws to free the bag.

Van Denburgh,¹ writing on the much debated question of the venomous nature of the bite of this reptile, states that "The Gila Monsters are the only lizards whose bite is known to be poisonous. The venom is secreted by large glands situated just under the chin, and flows out, onto the floor of the mouth between the lips and the gums. Being below the teeth and not directly communicated to them, the poison sometimes fails to find its way into a wound although the teeth are grooved to afford it a passage." He further remarks in regard to its food habits that "In spite of its clumsy form it sometimes climbs bushes, probably in search of bird's eggs, which, together with young rabbits, etc., form its food."

Range.—As known at present the range of *H. suspectum* is quite limited. Living specimens seem to have been obtained only in southwestern Arizona, and in the northwestern part of the State of Sonora in Mexico. The southern extent of its range is unknown. That it ranges farther northward in the basins of the Proplateau region, seems to be indicated by the finding of a dead specimen in the valley of the Virgin River in southern Nevada.² However, the extent of its occurrence in this region has not as yet been ascertained. It is thus to be considered as a form of the Sonoran Desert, which, with *Callisaurus ventralis* and *Phrynosoma solare*, only enters the margin of the Proplateau region.

***Cnemidophorus gularis* Baird & Girard.**

Cnemidophorus gularis BAIRD & GIRARD, Proc. Acad. Nat. Sci. Phila., 1852, 128.—BAIRD & GIRARD, Marcy's Explor. Red Riv., 1854, 210–211.—"HALLOWELL, Proc. Acad. Nat. Sci. Phila., 1856, 239."—BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 11.—BAIRD, Rept. Pac. R. R. Surv., X (Whipple-Ives Route), 1859, 38.—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, VI, 1896, 342–343.—STEJNEGER, Proc. U. S. Nat. Mus., XXV, 1902, 151.—STONE & REHN, Proc. Acad. Nat. Sci. Phila., 1903, 32–33.—STONE, *ibid.*, 540–541.—BAILEY, North Amer. Fauna, No. 25, 1905, 44.

Cnemidophorus gularis gularis COPE, Proc. Acad. Nat. Sci. Phila., 1892, 334.—COPE, Rept. U. S. Nat. Mus., 1898 (1900), 602–605.

¹ Occ. Papers Calif. Acad. Sci., V, 122.

² North Amer. Fauna, No. 7, 194–195.

Cnemidophorus sexlineatus gularis COPE, Proc. Acad. Nat. Sci. Phila., 1866, 303-304.—COUES, Wheeler's Surv. West of 100th Merid., V, 1875, 602-603.—COPE, Bull. U. S. Nat. Mus., XXXII, 1887, 44.

Cnemidophorus guttatus HALLOWELL, Proc. Acad. Nat. Sci. Phila., 1854, 192.

Cnemidophorus gularis scalaris COPE, Rept. U. S. Nat. Museum, 1898 (1900), 605-607. (Part.)

Cnemidophorus scalaris VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, VI, 1896, 343-344.

Cnemidophorus sexlineatus YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 557-558.—COPE, Bull. U. S. Nat. Museum, I, 1875, 45. (Part.)—YARROW, *ibid.*, XXIV, 1883, 84, 3-44. (Part.)—BOULENGER, Cat. of Lizards in Brit. Museum, II, 1885; 364-365. (Part.)

Locality.—*Cnemidophorus gularis* was found to be common in suitable habitats both at Alamogordo and Tucson.

Description of Specimens.—In scutellation this species is distinguished with difficulty from *C. sexlineatus*. In *C. gularis* the scales on the gular fold (especially the marginal row) are generally relatively larger than in *C. sexlineatus*, and there is always in *C. gularis* one or two rows of enlarged scales on the posterior face of the forearm (separating the minute dorsal and ventral scales) which are either absent in *C. sexlineatus* or when present much smaller than in the former species. These characters are unsatisfactory, however, the better marked characteristics being in the coloration. These are: (1) In the adults of *C. gularis* the pattern always consists of stripes and spots as described below, while in *C. sexlineatus* it is composed of stripes only. (2) In *C. gularis* the members of the dorsal pair of stripes are closer together than in *C. sexlineatus* (not considering the median dorsal line), the interspace being as narrow or narrower than the adjacent lateral one in the former species, generally wider in the latter.

There is considerable variation in size among Tucson specimens, so much so, in fact, as to have caused their reference to different species. Stejneger after an examination of specimens in this collection, both from Alamogordo and Tucson, still considers the eastern and western individuals as all belonging to a single form (*C. gularis*) as he has always done, but Cope¹ and Van Denburgh² have both referred the larger Tucson specimens to *C. scalaris*, although both record *C. gularis* from the same region.

From our series it is evident that there is but one species at Tucson, and that the specimens referred to typical *C. gularis* by Van Denburgh and Cope are in reality not full grown specimens. Since individuals of this size are generally indistinguishable from Alamogordo specimens I have no hesitancy in referring them to the same species. The difference between

¹ Rept. U. S. Nat. Mus., 1898, 606.

² Proc. Calif. Acad. Sci., Ser. 2, VI, 341.

them lies in the fact that while those from Tucson may grow to a total length of 400 mm. and over, I am convinced that Alamogordo specimens seldom exceed 280 mm. in length. This difference I believe may be attributed to differences in the nature of the habitat, as stated below. Femoral pores 16–21 (usual number 18 or 19).

The color descriptions are as follows:

(a) Young specimens from Tucson (body length 35 mm.). Above black with six longitudinal lines of pale bluish white, but no spots. The median dorsal pair of stripes end at the cephalic plates, the second on either side is continued above the eye, the lowest above the ear to the eye. Head dark brown. Limbs pale brown marbled with darker, a pale line along the posterior face of the thigh. Tail light reddish, the light and dark bands of the dorsal surface plainly indicated on its base. Belly white.

(b) Adult specimens from Alamogordo (body length 85 mm.). Dorsal surface reddish brown with six greenish or light reddish brown stripes, separated by one or more irregular rows of rounded pale orange spots. The ground color of the limbs above is the same as that of the dorsal surface of the body, and is spotted with lighter. Tail light brown. The members of the median pair of stripes are as a rule close together, but may be separated more widely and have a row of spots in the interspace.

(c) Medium sized specimens from Tucson (body length 80–90 mm.). The same as *b* except that the ground color may be black, and the median pair of dorsal stripes are usually wider apart with a row of light spots in the interspace. Stripes in the darker specimens bright greenish yellow.

(d) Large specimens from Tucson (body length 125 mm.). In the largest specimens from this locality the ground color is very dark reddish brown or black, and the stripes (beginning anteriorly) are nearly or entirely broken up into spots. Spots greenish blue. Neck uniformly dark reddish brown, with or without faint indications of the usual longitudinal stripes.

Habitat Relations.—Alamogordo. At Alamogordo this lizard was found only in the lower part of the cañons, and in the stony arroyos on the alluvial slopes (Fig. 8). Its habitat is thus quite distinct from that of *C. scolineatus* which is found only on the plains.

Tucson. At Tucson it occurs likewise in the lower part of the cañons, and follows down the arroyos on the slopes to the Santa Cruz River where it is a characteristic reptile in the Willow-Poplar association on the banks.

While it thus occupies the same topographic features in the two localities, the other environmental conditions are sufficiently dissimilar to make the habitat a very different one in the two regions. This is well illustrated by the plants. At Alamogordo the vegetation consists of the Sotol, Ocotillo, various cacti, yuccas, etc., and the habitat is a very open and arid one, while

at Tucson the vegetation consists of trees and bushes, and the habitat is the most shaded and protected one below the Piñon-Cedar association. It may or may not be significant that the only specimen taken in a dry arroyo at Tucson (vegetation Ocotillo, cacti, etc.) is a "medium sized" individual with both stripes and spots, while the largest specimens were only found in the Willow-Poplar association along the streams. At any rate it is conceivable that the environmental conditions at Tucson may be more favorable for this species than those composing its habitat at Alamogordo, and thus be directly or indirectly the cause of the larger size attained by individuals in this locality. If this is the true explanation of the facts in the case it must be that the Alamogordo specimens are either inhibited from attaining a larger size by the exigencies of their habitat, or represent a dwarfed race.

In both localities *C. gularis* is strictly a ground form. At Alamogordo it is found among the rocks and clumps of yuccas, cacti, etc.; at Tucson about the bushes and weeds that form the underbrush in the Willow-Poplar association, and among the rocks in dry cañons. In the Willow-Poplar association it is difficult to secure owing to its shyness and the rapidity of its movements. The large individuals can often be heard several rods away rustling about in the leaves and brush, but they are almost constantly in motion and stay close to the protection of the bushes.

The food, as shown by the examination of a number of stomachs from both localities, consists entirely of insects; beetles and ants forming the bulk of the stomach contents.

Range.—The principal home of this species is the Proplateau region. It has been found in northern Mexico, southern Arizona, New Mexico, and western Texas. In Texas it has been recorded from as far east as Waco in the Prairie region, but the specimens upon which the central Texas records are based should be carefully reexamined and distinguished from the western form of *C. sexlineatus* which occupies the same region (see p. 557). It has not been recorded from the Sonoran desert.

Cnemidophorus gularis Baird & Girard.

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|---------------------|-----------|--|----------------|----------------|---------------|
| Creosote Bush Assn. | 98 | Alamogordo, N. M. Alluvial slope east of Alamogordo | July 8-06 | G. von Krockow | 18-19 |
| " | 160 | " | July 11-06 | A. G. Ruthven | 18-? |
| " | 161 | " | " | " | 18-19 |
| " | 162 | " | " | A. F. Zimmer | 18-18 |

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|-------------------------------|-----------|-----------------------------------|----------------|----------------|---------------|
| Creosote Bush Assn. | 163 | Alluvial slope east of Alamogordo | July 11-06 | A. F. Zimmer | 18-19 |
| Arroyo in Creosote bush Assn. | 179 | " | July 12-06 | A. G. Ruthven | 19-19 |
| " | 180 | " | " | A. F. Zimmer | 19-19 |
| " | 218 | " | July 13-06 | A. G. Ruthven | 19-19 |
| " | 235 | " | " | G. von Krockow | " |
| " | 236 | " | " | " | 18-19 |
| " | 237 | " | " | " | 18-18 |
| " | 238 | " | " | " | " |
| " | 269 | " | July 14-06 | " | 17-17 |
| Sotol-Ocotillo Assn. | 553 | Dry Cañon east of Alamogordo | July 23-06 | A. G. Ruthven | 18-18 |
| " | 554 | " | " | " | 17-19 |
| " | 557 | " | " | A. F. Zimmer | " |
| " | 558 | " | " | " | 18-19 |
| " | 560 | " | " | G. von Krockow | 18-18 |
| " | 561 | " | " | " | 18-19 |
| " | 586 | " | July 24-06 | " | 18-20 |
| " | 587 | " | " | " | 18-? |
| | | <i>Tucson, Ariz.</i> | | | |
| Willow-Poplar Assn. | 608 | Bank of Santa Cruz River | July 31-06 | A. G. Ruthven | 19-19 |
| Suaharo-Ocotillo Assn. | 663 | Mesa west of Santa Cruz River | Aug. 3-06 | " | 18-19 |
| Willow-Poplar Assn. | 685 | " | Aug. 5-06 | " | 19-20 |
| " | 687 | " | " | G. von Krockow | " |
| " | 688 | " | " | " | " |
| " | 750 | Bank of Santa Cruz River | Aug. 8-06 | A. G. Ruthven | 19-19 |
| " | 824 | " | Aug. 12-06 | G. von Krockow | 18-19 |
| " | 979 | Near mouth of Sabino Cañon | Aug. 18-06 | A. G. Ruthven | 21-20 |
| " | 980 | " | " | " | 19-19 |
| " | 981 | " | " | " | 18-19 |
| " | 982 | " | " | " | 16-17 |
| " | 983 | " | " | " | 18-19 |
| " | 984 | " | " | " | 20-20 |

Cnemidophorus melanostethus Cope.

Cnemidophorus melanostethus COPE, Proc. Acad. Nat. Sci. Phila., 1863, 104; *ibid.*, 1866, 310.

Cnemidophorus tessellatus melanostethus COPE, Bull. U. S. Nat. Mus., I, 1875, 46.—COPE, Rept. U. S. Nat. Mus., 1898, (1900), 581-582.

Cnemidophorus tigris melanostethus COUES, Wheeler's Surv. West of 100th Merid., V, 1875, 603.—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 8, 45.—VAN DEN BURGH, Proc. Calif. Acad. Sci., Ser. 2, VI, 1896, 344.—STEJNEGER, Proc. U. S. Nat. Mus., XXV, 1902, 151.

Locality.—Representatives of a series of 168 specimens from Tucson, Ariz., and 120 from Alamogordo, N. M., have been referred by Dr. Stejneger to this species. In both localities the species is very abundant in suitable habitats.

Description of Specimens.—The specimens of *Cnemidophorus* from Tucson and Alamogordo referred to this species apparently agree in scutellation. In both there are eight rows of ventral plates, and the scales of the gular region become granular on the edge of the fold. The specimens from the two localities differ so much in coloration, however, as to require separate descriptions.

In the Alamogordo specimens the ground color above is light chocolate brown to black, with very numerous, short narrow bands of lighter. These markings are grayish brown to dull orange yellow on the back, light bluish slate on the sides, and, although of varying length and irregularly disposed, are mostly transverse on the sides, becoming more or less confluent toward the middle of the back. The coalescing of the light dorsal markings occasionally give rise to an indistinct series of longitudinal stripes which are, however, much broken up. Head brown, without markings. Limbs above spotted with lighter. Tail without pattern, becoming dark brown toward the tip. Belly white, the two external rows of scales on either side often tinged with pink, the central four with green. Throat and breast white, grayish white or bluish gray, spotted with black and often tinged with pink or yellow, but never entirely black.

Unfortunately no very young specimens were secured so that the development of the pattern cannot be followed as in Tucson specimens. But between individuals with a body length of 55–60 mm. and the largest adults there is little difference in coloration.

In the specimens from Tucson the ground color above is dull reddish brown to blackish brown, divided into longitudinal bands by four narrower and lighter stripes which vary in color from light ash to dull orange yellow. Between each pair of light stripes the ground color is relieved by small rounded spots similar in color to the stripes and arranged more or less irregularly in a single row. On the sides below the stripes the pattern consists of rather large and well defined white or light reddish gray spots on the dark ground which is occasionally broken up into black spots by the confluence of the light markings. On the superior surface of the limbs the light spots are mostly large and abundant enough to constrict the ground color to reticulations. The pattern of the dorsal surface of the body is occasionally continued onto the base of the tail but only indistinctly. The usual color of the tail is dark greenish yellow or light brown, mottled with

darker at the base, and becoming uniformly reddish brown toward the tip. The head is dull greenish yellow above in the paler specimens, light to dark chocolate in the darker ones, and without markings except for the slight difference in the intensity of the color on different parts of the head in the darker specimens. The mottled pattern of the sides of the body is continued onto the sides of the head. The lower labials are light gray, purple or bluish black, the throat, breast and under surface of the fore limbs entirely black, or mottled with black, gray or reddish. Posteriorly the black pigment becomes more and more restricted to the base of the scales, the prevailing color being white or yellowish. The posterior half of the belly and the under surfaces of the hind limbs and tail may be entirely white or yellowish, but are also frequently marked with black.

In very young specimens from Tucson there is another light stripe on either side, extending from below the eye and above the shoulder to the lateral abdominal region. The ground color is jet black, the stripes pale orange yellow, and there is a U-shaped mark of the latter color embracing the parietal plate. There are light spots on either side of the lowest lateral stripes but none between the upper four. Dorsal pattern continued distinctly onto the base of the tail, the extremity of which is uniformly light blue. Limbs black above, spotted with lighter. Ventral surface white, throat faintly mottled with darker.

Changes leading to the adult coloration appear very early. Faint spots make their appearance between the four dorsal stripes, the lowest stripe on either side breaks up into light rounded spots similar to the other light spots adjacent to them, and those on the limbs expand to restrict the ground color to a network. But although even in the very young specimens (body length 30–35 mm.) the throat is slightly mottled with darker, it is not until a considerable size (body length 60–70 mm.) has been attained that it begins to be generally suffused with black.

In the largest specimens from Tucson the four dorsal stripes are faint, and the lower one on either side is occasionally very obscure except for rounded spots of lighter at intervals. In none of the specimens are they entirely wanting, however. The form may thus be easily distinguished from the Alamogordo type by the dorsal pattern of light stripes, and rounded, generally well defined light spots, and the black throat in adults; the Alamogordo specimens, as above described, having the light markings in the form of short bars, which seldom, and then but imperfectly, fuse to form longitudinal stripes, while the throat is only spotted and never suffused with black. In my opinion these differences at least indicate two distinct varieties.

Habitat Relations.—Alamogordo. The habitat of this lizard at Alamogordo is very well defined, as it is found in the Creosote bush association on the alluvial slopes and only slightly exceeds the limits of this habitat. It is very common in this habitat, being as characteristic of these conditions as is the Creosote bush. It is a ground form, and is most frequently seen running about between the bushes picking up grasshoppers, beetles, locusts and ants, which constitute the bulk of its food. The stomach of one individual contains a large number of winged ants. When frightened they do not, as the smaller lizards, seek concealment in the nearest bush, but dash away swiftly for several rods before stopping. They generally stop near a bush, however, and after looking about for a moment or two slip quietly into it, frequently leaving it directly again on the other side for a neighboring one. This may be repeated several times, making it difficult to secure them.

At Tucson *C. melanostethus* is common and of general distribution on the Greasewood plains. It is also found on the mesas, but more abundantly in the Creosote bush association in the arroyos, and much less commonly in the Suaharo-Ocotillo association of the hills. Its food, as shown by an examination of stomach contents, seems to consist of insects exclusively—ants, beetles, grasshoppers and spiders being recognizable. It is in turn, according to our observations, preyed upon by the Arizona Racer (*Bascanian flagellum frenatum*) and the Leopard Lizard (*Crotaphytus wislizenii*).

Range.—It will be impossible to define the range of this species until the status of the different forms has been established. The name has heretofore been restricted to southern Arizona specimens.

Cnemidophorus melanostethus Cope.

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|---|-----------|--|----------------|----------------|---------------|
| Between the Creosote bush and Mesquite Assns. | 82 | Alamogordo, N. M. Lower margin of alluvial slope east of Alamogordo | July 7-06 | A. G. Ruthven | 23-23 |
| " | 94 | " | July 8-06 | G. von Krockow | 24-23 |
| " | 95 | " | " | " | 21-21 |
| " | 96 | " | " | " | 21-24 |
| " | 97 | " | " | " | " |
| " | 99 | " | " | " | 23-23 |
| " | 101 | " | July 11-06 | A. G. Ruthven | 21-23 |
| " | 164 | " | " | G. von Krockow | 23-23 |
| " | 166 | " | " | " | 22-24 |
| " | 168 | " | " | " | 20-21 |
| " | 169 | " | " | " | 20-22 |
| " | 170 | " | " | " | 21-21 |
| " | 172 | " | " | " | 20-23 |

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|---------------------|-----------|-----------------------------------|----------------|----------------|---------------|
| Creosote bush Assn. | 181 | Alluvial slope east of Alamogordo | July 21-06 | A. G. Ruthven | 20-22 |
| " | 183 | " | " | " | 20-22 |
| " | 184 | " | " | " | 23-23 |
| " | 185 | " | " | " | 22-22 |
| " | 186 | " | " | " | |
| " | 187 | " | " | " | 23-24 |
| " | 188 | " | " | " | 22-22 |
| " | 189 | " | " | " | 22-23 |
| " | 190 | " | " | " | 20-20 |
| " | 192 | " | " | G. von Krockow | 25-26 |
| " | 193 | " | " | " | 23-23 |
| " | 194 | " | " | " | |
| " | 195 | " | " | " | 22-25 |
| " | 196 | " | " | " | 22-24 |
| " | 197 | " | July 13-06 | A. G. Ruthven | |
| " | 198 | " | " | " | 23-23 |
| " | 199 | " | " | " | 21-21 |
| " | 200 | " | " | " | 21-24 |
| " | 201 | " | " | " | 22-22 |
| " | 202 | " | " | " | 22-24 |
| " | 203 | " | " | " | 21-22 |
| " | 204 | " | " | " | 22-23 |
| " | 205 | " | " | " | 22-23 |
| " | 206 | " | " | " | 20-21 |
| " | 207 | " | " | " | 21-22 |
| " | 208 | " | " | " | 22-24 |
| " | 209 | " | " | " | 25-26 |
| " | 210 | " | " | " | 20-23 |
| " | 211 | " | " | " | 22-23 |
| " | 212 | " | " | A. F. Zimmer | 22-24 |
| " | 213 | " | " | " | 23-24 |
| " | 214 | " | " | " | 22-23 |
| " | 215 | " | " | " | 23-24 |
| " | 216 | " | " | " | 22-23 |
| " | 217 | " | " | " | |
| " | 220 | " | " | G. von Krockow | 21-21 |
| " | 221 | " | " | " | 24-24 |
| " | 222 | " | " | " | 20-22 |
| " | 223 | " | " | " | 22-23 |
| " | 224 | " | " | " | 21-21 |
| " | 225 | " | " | " | 22-24 |
| " | 226 | " | " | " | 21-23 |
| " | 227 | " | " | " | 21-23 |
| " | 228 | " | " | " | 20-20 |
| " | 229 | " | " | " | 19-19 |
| " | 230 | " | " | " | 21-23 |
| " | 231 | " | " | " | 22-23 |
| " | 232 | " | " | " | |
| " | 233 | " | " | " | 21-21 |
| " | 234 | " | " | " | 24-25 |
| " | 259 | " | July 14-06 | " | 23-24 |
| " | 260 | " | " | " | 22-22 |
| " | 261 | " | " | " | 22-24 |
| " | 262 | " | " | " | 23-23 |
| " | 263 | " | " | " | 23-23 |

| Habitat | Field No. | Locality | When Collected | Collector | Fem-oral Pores |
|---|-----------|---|----------------|----------------|----------------|
| Creosote bush Assn. | 264 | Alluvial slope east of Alamogordo | July 14-06 | G. von Krockow | 20-22 |
| " | 265 | " | " | " | |
| " | 266 | " | " | " | 24-24 |
| Between the Creosote bush and Mesquite Assns. | 267 | Lower margin of alluvial slope east of Alamogordo | " | " | |
| " | 268 | " | " | " | 22-22 |
| " | 270 | " | " | " | 24-24 |
| " | 272 | " | " | A. G. Ruthven | 22-22 |
| " | 273 | " | " | " | 20-21 |
| Creosote bush Assn. | 274 | Alluvial slope east of Alamogordo | " | " | 23-25 |
| " | 275 | " | " | A. F. Zimmer | |
| " | 276 | " | " | " | 22-24 |
| " | 277 | " | " | " | 20-22 |
| " | 288 | " | July 15-06 | A. G. Ruthven | 23-24 |
| " | 289 | " | " | " | 22-23 |
| " | 290 | " | " | " | 22-22 |
| " | 291 | " | " | " | 21-24 |
| " | 296 | " | " | G. von Krockow | |
| " | 297 | " | " | " | |
| " | 298 | " | " | " | 22-22 |
| " | 299 | " | " | " | 21-23 |
| " | 300 | " | " | " | 25-25 |
| " | 301 | " | " | " | |
| " | 379 | " | July 18-06 | " | 21-22 |
| " | 380 | " | " | " | 22-22 |
| " | 381 | " | " | " | 24-25 |
| " | 382 | " | " | " | 23-27 |
| " | 383 | " | " | " | 23-24 |
| " | 384 | " | " | " | 21-24 |
| " | 385 | " | " | " | 22-22 |
| " | 386 | " | " | " | 22-22 |
| " | 387 | " | " | " | 22-24 |
| " | 388 | " | " | " | 24-24 |
| " | 391 | " | " | A. G. Ruthven | 19-20 |
| " | 392 | " | " | " | 22-25 |
| " | 393 | " | " | " | 20-23 |
| " | 394 | " | " | " | 22-22 |
| " | 395 | " | " | " | 21-21 |
| " | 396 | " | " | " | 24-24 |
| " | 397 | " | " | " | 20-23 |
| " | 398 | " | " | " | |
| " | 399 | " | " | " | 20-21 |
| " | 400 | " | " | " | 22-22 |
| " | 401 | " | " | " | 24-26 |
| " | 402 | " | " | " | 22-23 |
| " | 403 | " | " | " | 24-24 |
| " | 404 | " | " | " | 23-24 |
| " | 405 | " | " | " | 22-22 |
| " | 406 | " | " | " | 20-20 |
| " | 407 | " | " | A. F. Zimmer | 22-23 |
| " | 408 | " | " | " | 20-21 |
| " | 409 | " | " | " | |

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|---|-----------|---|----------------|----------------|---------------|
| Between the Creosote bush and Mesquite Assns. | 498 | Lower margin of alluvial slope south-east of Alamogordo | July 21-06 | G. von Krockow | 22-22 |
| " | 499 | " | " | " | 21-22 |
| " | 505 | " | " | A. G. Ruthven | 23-23 |
| " | 508 | " | " | " | " |
| " | 510 | " | " | " | 22-23 |
| Between the Creosote bush and Sotol-Ocotillo Assns. | 555 | Upper part of alluvial slope east of Alamogordo | July 23-06 | " | 24-25 |
| " | 562 | " | " | G. von Krockow | 23-24 |
| " | 588 | " | July 24-06 | " | " |
| " | 591 | " | " | A. G. Ruthven | 21-21 |
| | | <i>Tucson, Ariz.</i> | | | |
| Creosote bush Assn. | 609 | Mesa west of Santa Cruz River | July 31-06 | G. von Krockow | 20-19 |
| " | 610 | " | " | " | 19-20 |
| " | 611 | " | " | " | 19-19 |
| " | 612 | " | " | " | 19-20 |
| " | 613 | " | " | " | 20-21 |
| " | 614 | " | " | " | 21-21 |
| " | 615 | " | " | " | 19-19 |
| " | 629 | " | Aug. 1-06 | A. G. Ruthven | 20-21 |
| " | 630 | " | " | " | 20-21 |
| " | 631 | " | " | " | 17-18 |
| " | 632 | " | " | " | 20-20 |
| " | 633 | " | " | " | 19-20 |
| " | 634 | " | " | " | 20-23 |
| " | 635 | " | " | " | 20-20 |
| " | 636 | " | " | " | 19-20 |
| " | 648 | Plains southeast of Tucson | Aug. 2-06 | " | 19-20 |
| " | 649 | " | " | " | 19-20 |
| " | 650 | " | " | " | 18-19 |
| " | 651 | " | " | " | " |
| " | 652 | " | " | " | 21-21 |
| " | 653 | " | " | " | 19-20 |
| " | 654 | " | " | " | 19-20 |
| " | 655 | " | " | " | 21-22 |
| " | 656 | " | " | " | 18-18 |
| " | 659 | " | " | G. von Krockow | 20-21 |
| " | 660 | " | " | " | 19-19 |
| " | 661 | " | " | A. F. Zimmer | 21-22 |
| Suaharo-Ocotillo Assn. | 662 | Mesa west of Santa Cruz River | Aug. 3-06 | A. G. Ruthven | 20-21 |
| " | 664 | " | " | " | 19-20 |
| " | 665 | " | " | " | 22-21 |
| " | 666 | " | " | A. F. Zimmer | 22-24 |
| " | 668 | Mesa west of Santa Catalina Mts. | Aug. 4-06 | G. von Krockow | 18-19 |
| " | 669 | " | " | " | 19-20 |
| " | 670 | " | " | A. G. Ruthven | 21-21 |
| " | 671 | " | " | " | 19-19 |

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|---|-----------|----------------------------------|----------------|----------------|---------------|
| Suaharo-Ocotillo Assn. | 672 | Mesa west of Santa Catalina Mts. | Aug. 4-06 | A. G. Ruthven | 18-18 |
| " | 673 | " | " | " | |
| Creosote bush Assn. | 690 | Mesa west of Santa Cruz River | Aug. 5-06 | G. von Krockow | 21-21 |
| " | 698 | Plains east of Tucson | Aug. 6-06 | A. G. Ruthven | 19-20 |
| " | 699 | " | " | " | |
| " | 700 | " | " | " | |
| " | 701 | " | " | " | |
| " | 702 | " | " | " | 23-24 |
| " | 703 | " | " | " | 19-19 |
| " | 704 | " | " | " | 19-20 |
| " | 705 | " | " | " | 22-22 |
| " | 706 | " | " | " | 22-22 |
| " | 707 | " | " | " | 20-21 |
| " | 708 | " | " | A. F. Zimmer | 23-24 |
| " | 709 | " | " | G. von Krockow | 23-24 |
| " | 710 | " | " | " | 23-24 |
| " | 711 | " | " | " | 19-20 |
| " | 712 | " | " | " | |
| " | 713 | " | " | " | |
| " | 716 | " | Aug. 7-06 | A. G. Ruthven | 19-20 |
| " | 717 | " | " | " | 20-23 |
| " | 718 | " | " | " | 19-20 |
| " | 719 | " | " | " | 19-20 |
| " | 720 | " | " | " | 19-20 |
| " | 721 | " | " | " | 22-23 |
| " | 722 | " | " | " | 20-20 |
| " | 723 | " | " | " | 22-23 |
| " | 724 | " | " | " | 21-21 |
| " | 730 | " | " | " | |
| " | 731 | " | " | " | |
| " | 732 | " | " | " | |
| " | 733 | " | " | " | |
| " | 738 | " | " | A. F. Zimmer | |
| " | 739 | " | " | G. von Krockow | 18-19 |
| " | 740 | " | " | " | 19-22 |
| " | 741 | " | " | " | 19-19 |
| " | 742 | " | " | " | 21-21 |
| " | 743 | " | " | " | 22-24 |
| " | 744 | " | " | " | 17-20 |
| Between the Creosote bush and Mesquite Assns. | 753 | Near Santa Cruz River | Aug. 8-06 | A. G. Ruthven | |
| " | 755 | " | " | " | 20-21 |
| " | 757 | " | " | A. F. Zimmer | 26-24 |
| " | 759 | " | " | G. von Krockow | 20-22 |
| " | 762 | " | " | " | 21-21 |
| Atriplex Assn. on Salt Spot. | 769 | Mesa west of Santa Cruz River | Aug. 9-06 | A. G. Ruthven | |
| Creosote bush Assn. | 770 | " | " | " | 18-19 |
| " | 771 | " | " | " | 21-21 |
| " | 772 | " | " | " | 20-21 |

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|---|-----------|--|----------------|----------------|---------------|
| Mesquite Assn. | 778 | Near Santa Cruz River | Aug. 9-06 | A. G. Ruthven | 18-19 |
| " | 779 | " | " | " | |
| Atriplex Assn. on Salt Spot | 780 | Mesa west of Santa Cruz River | " | G. von Krockow | 21-21 |
| " | 784 | " | " | A. F. Zimmer | 18-19 |
| Creosote bush Assn. | 787 | Plains southwest of Fort Lowell | Aug. 10-06 | A. G. Ruthven | 19-22 |
| " | 788 | " | " | " | 20-21 |
| " | 789 | " | " | " | 20-20 |
| " | 790 | " | " | " | 23-24 |
| Mesquite Assn. | 791 | Bank of Pantano Wash east of Fort Lowell | " | " | |
| Creosote bush Assn. | 794 | Plains south of Fort Lowell | " | G. von Krockow | 22-22 |
| " | 800 | Plains east of Tucson | Aug. 11-06 | A. G. Ruthven | 20-20 |
| " | 801 | " | " | " | 21-21 |
| " | 802 | " | " | " | 18-19 |
| " | 803 | " | " | " | 19-21 |
| " | 806 | " | " | A. F. Zimmer | 19-19 |
| " | 807 | " | " | " | 19-20 |
| " | 608 | " | " | " | 22-23 |
| " | 810 | " | " | G. von Krockow | 20-20 |
| " | 811 | " | " | " | 21-21 |
| Willow-Poplar Assn. | 825 | Bank of Santa Cruz River | Aug. 12-06 | " | 22-22 |
| " | 826 | " | " | " | |
| Creosote bush Assn. | 827 | Plains northeast of Tucson | Aug. 13-06 | A. G. Ruthven | 19-22 |
| " | 828 | " | " | " | 21-22 |
| " | 829 | " | " | " | |
| " | 830 | " | " | " | 20-20 |
| " | 831 | " | " | " | 20-21 |
| " | 832 | " | " | " | 20-22 |
| " | 833 | " | " | " | 19-19 |
| " | 836 | " | " | A. F. Zimmer | 18-18 |
| " | 837 | " | " | G. von Krockow | 21-21 |
| " | 838 | " | " | " | |
| " | 845 | Mesa west of Santa Cruz River | Aug. 14-06 | " | 19-22 |
| " | 847 | " | " | " | 21-21 |
| " | 848 | " | " | " | 21-21 |
| " | 849 | " | " | " | 19-20 |
| " | 850 | " | " | " | 19-19 |
| " | 851 | " | " | " | 20-21 |
| Between the Creosote bush and Mesquite Assns. | 858 | Near Santa Cruz River | " | A. F. Zimmer | |
| " | 859 | " | " | " | |
| Mesquite Assn. | 861 | " | " | A. G. Ruthven | 19-21 |
| " | 862 | " | " | " | |
| " | 863 | " | " | " | |
| Creosote bush Assn. | 869 | Mesa west of Santa Cruz River | " | " | 17-19 |

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|---|-----------|-------------------------------|----------------|----------------|---------------|
| Creosote bush Assn. | 870 | Mesa west of Santa Cruz River | Aug. 14-06 | A. G. Ruthven | 17-18 |
| " | 871 | " | " | " | 18-19 |
| " | 872 | " | " | " | 19-19 |
| " | 883 | Plains east of Tucson | Aug. 15-06 | " | 19-20 |
| " | 884 | " | " | " | 20-21 |
| " | 885 | " | " | " | 16-17 |
| " | 886 | " | " | " | 20-20 |
| " | 887 | " | " | " | |
| " | 888 | " | " | " | 19-20 |
| " | 889 | " | " | " | |
| " | 890 | " | " | " | |
| " | 891 | " | " | " | |
| " | 893 | " | " | A. F. Zimmer | 20-21 |
| " | 894 | " | " | " | |
| " | 898 | " | " | " | |
| " | 904 | " | " | G. von Krockow | |
| " | 905 | " | " | " | 22-22 |
| " | 906 | " | " | " | 21-22 |
| " | 907 | " | " | " | 23-23 |
| " | 908 | " | " | " | 21-23 |
| Suaharo-Ocotillo Assn. | 911 | Mesa west of Santa Cruz River | Aug. 16-06 | A. G. Ruthven | 20-20 |
| " | 912 | " | " | " | 19-20 |
| " | 913 | " | " | " | 20-21 |
| " | 914 | " | " | " | 20-20 |
| " | 915 | " | " | " | 20-20 |
| Creosote bush Assn. | 916 | " | " | " | 19-20 |
| " | 917 | " | " | " | |
| " | 923 | " | " | A. F. Zimmer | |
| " | 926 | " | " | G. von Krockow | 21-21 |
| " | 927 | " | " | " | 22-23 |
| " | 928 | " | " | " | |
| Between the Creosote bush and Mesquite Assns. | 945 | Near Santa Cruz River | Aug. 17-06 | " | 20-21 |
| " | 946 | " | " | " | 19-19 |
| " | 947 | " | " | " | 20-21 |
| " | 948 | " | " | " | 20-20 |
| " | 949 | " | " | " | 21-21 |
| " | 950 | " | " | " | 20-20 |
| " | 958 | " | " | A. G. Ruthven | 20-21 |
| " | 959 | " | " | " | 21-21 |
| " | 960 | " | " | " | 21-21 |
| Creosote bush Assn. | 1004 | Plains east of Tucson | Aug. 20-06 | " | 20-20 |
| Suaharo-Ocotillo Assn. | 1019 | Mesa west of Santa Cruz River | Aug. 21-06 | A. F. Zimmer | 18-20 |
| " | 1020 | " | " | " | 18-20 |

Cnemidophorus sexlineatus *Linnaeus*.

Locality.—Specimens of *C. sexlineatus* were taken at Alamogordo, N. M., where it is a common reptile.

Description of Specimens.—The structural characters of this species have been considered under *C. gularis*. Size smaller than *C. gularis*, the largest individuals having a body length of 65–70 mm. The color pattern of the dorsal surface consists of 7 light stripes on a darker ground, the median dorsal one distinct or obscure but usually more indistinct posteriorly.

Specimens from the Mesquite Association. Ground color above a deep brown, stripes pale to bright golden yellow. No spots. Limbs above nearly uniformly brown, occasionally with a few lighter markings on the thighs. Tail distally bright blue. Head dark olive. The under surface of the limbs, base of tail, and usually the infralabials are white, the rest of the ventral surface bluish.

Specimens from the White Sands. Above pale brownish gray, stripes light bluish, mostly faint, occasionally entirely wanting. Head pale grayish olive. Tail light blue. Ventral surface of limbs, base of tail, and frequently the throat, white; under parts otherwise pale bluish.

Habitat Relations.—*C. sexlineatus* is a characteristic form of the desert floor habitats. In the Mesquite and Atriplex associations it was found commonly about the clumps of bushes that comprise the vegetation. On the White Sands it was also abundant, but apparently prefers the bottoms and lower parts of the dunes to the more exposed summits of the latter, being unlike *Holbrookia maculata flavilenta* in this respect. Its food consists of insects which it picks up on the ground. Ants, grasshoppers and spiders were found in the stomachs examined.

There has been considerable uncertainty as to the relationship of *C. gularis* and *C. sexlineatus* in New Mexico and central Texas. This has resulted from the fact that west of the 98th meridian *C. sexlineatus* approaches *C. gularis* so closely in appearance as to suggest either an intergrading or at least a close relationship between the two forms. At Alamogordo, which is near the western limit of *C. sexlineatus*, we found both forms perfectly distinct not only in the scutellation and color, as described under *C. gularis*, but by the fact that *C. gularis* is confined to the lower part of the cañons, and the stony arroyos on the alluvial slopes, while *C. sexlineatus* occurs only in the Mesquite, Atriplex and Sumac-Yucca associations on the plains.

If the habitats of the two species in Texas were known, it would probably be found that a similar habitat distribution exists in that region. The ranges of the two forms thus interdigitate for a long distance and intergradation very probably does not occur.

Range.—*Cnemidophorus sexlineatus* is a form of southeastern United States, ranging northward to about the 40th parallel. It is one of the few reptiles which crosses the 98th meridian in Texas, extending at least as far westward as the Rio Grande Valley ¹ in New Mexico. The Arizona records known to me are too indefinite to be relied upon.

Cnemidophorus sexlineatus Linnæus.

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|--|-----------|---|----------------|----------------|---------------|
| Mesquite Assn. | 78 | Alamogordo, N. M. Plains south of Alamogordo | July 7-06 | A. G. Ruthven | 17-17 |
| " | 79 | " | " | " | 16-16 |
| " | 80 | " | " | G. von Krockow | 16-17 |
| " | 85 | " | " | " | 16-16 |
| Between the Creosote bush and Mesquite Assns. | 98 | " | July 8-06 | " | 17-17 |
| Mesquite Assn. | 100 | " | July 9-06 | A. G. Ruthven | 16-17 |
| " | 102 | " | " | " | " |
| " | 103 | " | " | " | 14-14 |
| " | 104 | " | " | " | " |
| " | 105 | " | " | A. F. Zimmer | 15-16 |
| " | 106 | " | " | " | 16-17 |
| " | 107 | " | " | A. G. Ruthven | " |
| Sumac-Yucca Assn. | 116 | White Sands west of Alamogordo | " | " | 15-15 |
| " | 117 | " | " | " | " |
| " | 118 | " | " | A. F. Zimmer | 13-14 |
| " | 119 | " | " | " | " |
| " | 120 | " | " | G. von Krockow | 14-15 |
| " | 121 | " | " | " | 15-16 |
| Mesquite Assn. | 126 | Plains south of Ala- mogordo | " | " | 15-15 |
| " | 127 | " | " | " | 17-17 |
| " | 147 | " | July 10-06 | A. F. Zimmer | " |
| " | 156 | " | July 11-06 | A. G. Ruthven | 14-15 |
| " | 157 | " | " | " | 14-15 |
| " | 165 | " | " | G. von Krockow | " |
| " | 167 | " | " | " | 15-16 |
| " | 171 | " | " | " | " |
| " | 191 | " | July 12-06 | A. F. Zimmer | 17-17 |
| " | 271 | " | July 14-06 | A. G. Ruthven | 15-15 |
| " | 305 | Plains west of Ala- mogordo | July 16-06 | " | 17-18 |
| " | 306 | " | " | " | 14-15 |
| Atriplex Assn. | 307 | " | " | " | 14-14 |
| " | 308 | " | " | " | 17-17 |
| " | 309 | " | " | " | 16-16 |
| " | 310 | " | " | " | 15-15 |
| " | 311 | " | " | " | " |

¹ Herrick, Terry and Herrick, Bull. Sci. Lab. Denison Univ., XI. 145-146.

| Habitat | Field No. | Locality | When Collected | Collector | Fem-oral Pores |
|--|-----------|--------------------------------|----------------|----------------|----------------|
| Atriplex Assn. | 312 | Plains west of Alamogordo | July 16-06 | A. G. Ruthven | 17-18 |
| " | 313 | " | " | " | 16-16 |
| " | 314 | " | " | " | 14-16 |
| " | 315 | " | " | " | 14-16 |
| " | 316 | " | " | " | 16-16 |
| " | 317 | " | " | " | 17-17 |
| " | 318 | " | " | " | 15-15 |
| " | 319 | " | " | " | 15-15 |
| " | 320 | " | " | " | 16-17 |
| Between the Atriplex and Mesquite Assns. | 321 | " | " | A. F. Zimmer | 13-14 |
| " | 322 | " | " | " | 15-16 |
| " | 323 | " | " | A. G. Ruthven | 16-16 |
| " | 324 | " | " | " | " |
| Mesquite Assn. | 325 | " | " | G. von Krockow | 18-18 |
| " | 326 | " | " | " | 14-16 |
| Atriplex Assn. | 421 | " | July 19-06 | A. F. Zimmer | 15-15 |
| " | 422 | " | " | A. G. Ruthven | 14-15 |
| " | 423 | " | " | A. F. Zimmer | 16-16 |
| " | 424 | " | " | " | 15-15 |
| " | 425 | " | " | " | " |
| " | 428 | " | " | " | 15-15 |
| " | 429 | " | " | " | 15-15 |
| " | 430 | " | " | " | 14-14 |
| " | 431 | " | " | A. G. Ruthven | 15-15 |
| " | 432 | " | " | " | 17-17 |
| " | 433 | " | " | " | 13-15 |
| " | 434 | " | " | " | 15-16 |
| Sumac-Yucca Assn. | 441 | White Sands west of Alamogordo | " | " | 16-17 |
| " | 442 | " | " | A. F. Zimmer | 16-16 |
| " | 443 | " | " | " | 15-16 |
| " | 445 | " | " | " | " |
| " | 446 | " | " | " | 12-14 |
| " | 447 | " | " | A. G. Ruthven | 15-15 |
| Atriplex Assn. | 449 | Plains west of Alamogordo | " | " | 15-15 |
| " | 450 | " | " | " | 16-17 |
| " | 452 | " | " | " | 16-16 |
| " | 453 | " | " | A. F. Zimmer | " |
| " | 454 | " | " | " | 14-15 |
| " | 455 | " | " | A. G. Ruthven | 15-16 |
| " | 456 | " | " | A. F. Zimmer | 16-17 |
| " | 458 | " | " | A. G. Ruthven | 15-16 |
| " | 460 | " | " | A. F. Zimmer | 15-15 |
| " | 464 | " | " | " | 17-18 |
| Summac-Yucca Assn. | 470 | White Sands west of Alamogordo | " | G. von Krockow | 17-17 |
| Atriplex Assn. | 476 | Plains west of Alamogordo | " | " | 13-13 |
| " | 477 | " | " | " | 14-14 |
| " | 480 | " | " | " | 16-17 |
| " | 482 | " | " | " | 17-17 |

| Habitat | Field No. | Locality | When Collected | Collector | Femoral Pores |
|-------------------|-----------|--------------------------------|----------------|----------------|---------------|
| Atriplex Assn. | 483 | Plains west of Alamogordo | July 19-06 | G. von Krockow | 15-16 |
| " | 486 | " | " | " | |
| " | 487 | " | " | " | 17-18 |
| " | 488 | " | " | " | 16-17 |
| " | 489 | " | " | " | 17-18 |
| " | 491 | " | " | " | 14-16 |
| " | 492 | " | " | " | 15-17 |
| Sumac-Yucca Assn. | 493 | White Sands west of Alamogordo | " | A. G. Ruthven | 16-17 |
| Mesquite Assn. | 500 | Plains south of Alamogordo | Aug. 21-06 | G. von Krockow | |
| " | 501 | " | " | " | 14-15 |
| " | 504 | " | " | " | 15-15 |
| " | 506 | " | " | " | 14-15 |
| " | 509 | " | " | A. G. Ruthven | 16-18 |
| " | 511 | " | " | " | 16-17 |
| " | 512 | " | " | A. F. Zimmer | 14-14 |

SERPENTES.

*Leptotyphlops*¹ *humilis* Baird & Girard.

Rena humilis BAIRD & GIRARD, Cat. of North Amer. Reptiles, 1853, 143.—COPE, Bull. U. S. Nat. Museum, XXXII, 1887, 64.—STEJNEGER, Proc. U. S. Nat. Museum, XIV, 1891, 501.—COPE, *ibid.*, XIV, 1892, 590.—STEJNEGER, North Amer. Fauna, No. 7, 1893, 203.—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, V, 1895, 136-137.

Stenostoma humile "PETERS, Monatsberichte, 1857, 402."—COPE, Proc. Acad. Nat. Sci. Phila., 1861, 305; *ibid.*, 1866, 312.—COPE, Bull. U. S. Nat. Museum, I, 1875, 44.—YARROW, *ibid.*, XXIV, 1882, 20, 142.—GARMAN, Mem. Mus. Comp. Zool., VIII, No. 3, 1883, 130.—"BELDING, West Amer. Sci., III, No. 24, 1887, 98."

Glauconia humilis "BOULENGER, Cat. of Snakes in Brit. Museum, I, 1893, 70."—COPE, Amer. Nat., XXX, 1897, 1014.—COPE, Rept. U. S. Nat. Museum, 1898 (1900), 719.—BROWN, Proc. Acad. Nat. Sci. Phila., 1901, 14.

Siagonodon dugesii "BOCOURT, Miss. Sci. Mex., Rept., 1882, 507."

Siagonodon humilis VAN DENBURGH, Occ. Papers Calif. Acad. Sci., V, 1897, 150-151.

Locality.—Two specimens (Nos. 1032 and 1033) of this curious little snake were presented to the expedition by Prof. Thornber.

¹ I am not able to find sufficient differences between *Leptotyphlops dulcis* and *Rena humilis* to warrant their generic separation. These forms are evidently closely related and while *L. dulcis* occurs from western Texas to central New Mexico, *L. humilis* ranges from Tucson westward to California. The region where the ranges of the two forms come together is, therefore, extreme southeastern Arizona or southwestern New Mexico. The case thus seems to be analogous to that of *Salvadora grahamiae* and *S. hexalepis* and lends weight to the argument that they are nearly related species of the same genus.

Description of Specimens.—Body slender and vermiform; tail short and blunt; head not differentiated from body. Body covered with smooth, imbricate scales in 14 longitudinal rows, the terminal caudal scale ending in a short spine. Anal plate entire. The snout is protruding, considerably overlapping the mouth. The rostral is large and strongly recurved. Behind it is a single series of scales which is continuous with the median row of dorsal scales, and separates the corresponding lateral head plates of each side. The latter consist of: 1st, a large nasal extending to the mouth, and divided by a suture that extends between the nostril and the adjacent angle of the following plate; 2nd, a small supralabial plate bounded above and anteriorly by the nasal; 3rd, a large ocular that extends from the median cephalic series to the mouth, and beneath which may be seen the eye; 4th, a second and last small supralabial; 5th, a large plate situated above the last supralabial and followed by a 6th which is rather smaller.

Habitat Relations.—That this snake is a burrowing form is very evident from its partly concealed eyes and general vermiform shape. The specimens secured from Prof. Thornber were found with several others in a pile of manure on the Greasewood plains east of Tucson. Van Denburgh¹ states that in the "Cape Region" of Lower California this species "lives both in the mountains, and at the level of the sea."

Range.—This species is known to occur in the Proplateau region by the fact that specimens have been taken at Tucson, Ariz., and in southern California north to Death Valley. To the southward it extends to the southern end of the peninsula of Lower California, and in Mexico to Colima on the coast slope of the Sierra Madres.

Bascanion piceum Cope.

Bascanium flagelliforme piceum COPE, Bull. U. S. Nat. Mus., I, 1875, 40.—COUES, Wheeler's Surv. West of 100th Merid., V, 1875, 617.—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 16, 111.

Zamenis flagellum piceus COPE, Rept. U. S. Nat. Mus., 1898 (1900), 804-805.—BROWN, Proc. Acad. Nat. Sci. Phila., 1901, 61.

Bascanion piceum COPE, Bull. U. S. Nat. Mus., XVII, 1880, 24.—COPE, Proc. U. S. Nat. Mus., XIV, 1892, 625.—STEJNEGER, North Amer. Fauna, No. 7, 1893, 209.—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, VI, 1896, 347.

Locality.—A single specimen (No. 639) of this snake was secured, on the mesa west of Tucson, Ariz. It is apparently the fourth specimen of this species to be recorded, three of these being from Tucson.

Description of Specimen.—Adult, total length 1440 mm., tail length

¹ Proc., Calif. Acad. Sci., Ser. 2, V, 136.

345 mm. Scale formula 19-17-15-13, the 19 only extending to a point 95 mm. from the end of the snout. Scales smooth. Cephalic plates normal. Supralabials 8, infralabials 11. Oculars 1-2. An anterior subocular on either side. Form long and slender; gastrosteges 199, urosteges in 105 pairs. Anal divided.

Body and tail above, broadly including the ends of the ventral scutes, blue black without markings. Head dark brown with a few irregular reddish markings above. The loreals, preoculars and postoculars, and first six supralabials have bright orange yellow centers. Anterior part of throat marbled with bright yellow and black. Throat black with scattered spots of yellowish orange. About the twentieth gastrostegite the light color increases in amount and the black becomes restricted to small blotches that become fewer posteriorly, only a few small, widely scattered spots being present on the posterior three-fourths of the body length and none on the tail. For most of the length the belly is a yellow orange tint, becoming a dark orange tint on the posterior one-fourth of the body and on the tail.

Habitat Relations.—The single specimen obtained was shot in the Suaharo-Ocotillo association on the mesa west of the Santa Cruz River. Nothing is known of the habits of the species.

Range.—The four specimens of *B. piceum* now known were all taken in the Proplateau region of southern Arizona, three of them in the immediate neighborhood of Tucson, the other at Camp Grant, Graham County.

Bascanion flagellum frenatum Stejneger.

Masticophis testaceus COPE, Proc. Acad. Nat. Sci. Phila., 1866, 305, 312.

Bascanion testaceum COPE, Proc. Acad. Nat. Sci. Phila., 1883, 11, 29, 32.

Bascanium flagelliforme testaceum COPE, Bull. U. S. Nat. Mus., I, 1875, 40. (Part at least.) — YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 542.—COUES, *ibid.*, 617.—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 17, 111-112. (Part.)—COPE, Proc. Amer. Phil. Soc., 1885, 284.—“BELDING, West Amer. Sci., III, No. 24, 1887, 89.”—COPE, Bull. U. S. Nat. Mus., XXXII, 1887, 71.

Coluber flagelliformis testaceus GARMAN, Mem. Mus. Comp. Zool., VIII, No. 3, 1883, 148.

Bascanion flagelliforme COPE, Proc. U. S. Nat. Mus., XIV, 1892, 625-626. (Part.)

Herpetodryas flavigularis HALLOWELL, Rept. Pac. R. R. Surv., X (Williamson's Route), 1859, 12-13.—HEERMAN apud Hallowell, *ibid.*, 24.

Zamenis flagellum flagellum COPE, Rept. U. S. Nat. Mus., 1898, 799-803. (Part.)

Bascanion flagellum MEEK, Field Museum of Nat. Hist., Zool. Series, VII, 1906, 15.

Bascanion flagellum frenatum STEJNEGER, North Amer. Fauna, No. 7, 1893, 208-209.—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, V, 1895, 147-148.; *ibid.*, VI, 1896, 347.—VAN DENBURGH, Occ. Papers Calif. Acad. Sci., V, 1897, 186-188.—STEJNEGER, Proc. U. S. Nat. Mus., XXV, 1902, 155.

Zamenis flagellum frenatus BROWN, Proc. Acad. Nat. Sci. Phila., 1901, 60-61.

Locality.—One specimen of this Racer (No. 966) was shot by Mr. Zimmer on the Greasewood plains, one mile south of Tucson. Several others were seen at various times.

Description of Specimen.—Adult. Form slender; total length 1140 mm., tail 300 mm. Dorsal scale formula 17–15–13, scales all smooth. Supralabials 8, infralabials 11. One anterior subocular. Oculars 1–2. Gastrosteges 193, urosteges 104, anal plate divided.

Above, except for a short distance anteriorly, the color is yellowish brown, relieved by small, mostly concealed bars of whitish that margin each scale on either side of the base. On the anterior half of the body, the base of nearly every scale is black, although the light lines are still present, occasionally being of a pinkish tint. On the neck the light marks tend to break up the ground color into cross bands, but only five or six of these are distinct, the anterior four being nearly solid black.

On either side of the belly there is a series of blotches similar in color to the dorsal surface, except anteriorly where they are black. Between this series of gastrostegial spots and the first row of scales, which also has the color of the dorsal surface, is a white line that includes the tips of the gastrosteges and the lower edge of the first row of dorsal scales. Similarly the light marks on the bases of the scales of the first and second rows are somewhat better developed than those above, which also results in the appearance of a narrow light longitudinal line, but this is very indefinite. The top of the head is light brown, the sides considerably variegated with yellow.

The belly is light yellow, with the marginal series of blotches mentioned above. Interior to these blotches there is also, for about the anterior four-fifths of the length, a second row of small spots. The throat is also light yellow, and thickly spotted with black. The ventral surface of the tail is a light orange tint, immaculate.

Habitat Relations.—In this form, as in the other species of the genus, a slender form and long tail accompany a remarkable agility of movement and dexterity in climbing about in bushes. We only observed it on the Greasewood plains (Creosote bush association), where several individuals eluded us by their swiftness.

No observations on food habits were made other than that an individual was seen to capture an adult *Cnemidophorus melanostethus*, but it doubtless lives largely on small birds and mammals. Stejneger records a specimen which had eaten a mouse (North Amer. Fauna, No. 7, 209).

Range.—Stejneger¹ gives the range of *B. f. frenatum* as "Southern

¹ North Amer. Fauna, No. 7, 208.

Arizona, Utah, Nevada, California, and Lower California." To the southward it occurs throughout the length of the peninsula of Lower California, and to an undetermined distance on the plateau and western coastal slope of Mexico.

In southern New Mexico or western Texas it intergrades with typical *Bascanion flagellum* which ranges to the eastward.

***Salvadora hexalepis* Cope.**

Salvadora grahamiae COPE, Bull. U. S. Nat. Mus., XXXII, 1887, 72. (Part at least.)—COPE, Proc. U. S. Nat. Mus., XIV, 1892, 619–620. (Part.)—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, V, 1895, 146–147; *ibid.*, VI, 1896, 347.—*ibid.*, V, 1896, 1006.—VAN DENBURGH, Occ. Papers Calif. Acad. Sci., V, 1897, 181–182.—COPE, Rept. U. S. Nat. Mus., 1898 (1900), 818–820. (Part.)—BROWN, Proc. Acad. Nat. Sci. Phila., 1901, 63–64. (Part.)—MEEK, Field Museum of Nat. Hist., Zool. Series, VII, 1906, 15.

Phimothya grahamiae COPE, Proc. Acad. Nat. Sci. Phila., 1861, 300.—YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 538–539.—COUES, *ibid.*, 620.—COPE, Proc. Acad. Nat. Sci. Phila., 1883, 14.—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 98. (Part.)—"BELDING, West Amer. Sci., III, No. 24, 1887, 98."

Salvadora grahami JAN, "Icon. Gen. Ophid., Pt. 1, 1860, fig. 1."

Phimothya grahamiae COPE, Proc. Acad. Nat. Sci. Phila., 1861, 300.

Phimothya hexalepis COPE, Proc. Acad. Nat. Sci. Phila., 1866, 304.

Phimothya grahamiae hexalepis COUES, Wheeler's Surv. West of 100th Merid., V, 1875, 620.—YARROW, Bull. U. S. Nat. Mus., XXIV, 1883, 15.

Salvadora grahamiae hexalepis COPE, Bull. U. S. Nat. Mus., I, 1875, 38.—GARMAN, Mem. Mus. Comp., Zool., VIII, No. 3, 1883, 145.—STEJNEGER, North Amer. Fauna, No. 7, 1893, 205–206.

Salvadora hexalepis STEJNEGER, Proc. U. S. Nat. Mus., XXV, 1902, 154–155.

Locality.—A specimen (No. 1034) of this snake taken on the plains east of Tucson, was presented to the expedition by Prof. Thornber.

Description of Specimen.—This individual possesses all of the characters of the western as distinguished from the eastern species of the genus.¹ It also exhibits the tendency toward the breaking up of the lateral head plates, shown by Stejneger to be characteristic of western examples of the genus, which was the basis of the original description of *S. hexalepis* (*Phimothya hexalepis*). The cephalic plates are normal. The rostral is very large with free lateral edges and is recurved on the top of the snout. There are two distinct nasal plates, and one loreal, one preocular, two postoculars, two anterior temporals, 9–10 supralabials and 11 infralabials. The symphyseal plate is small, but the first pair of inferior labials are much elongated posteriorly and broadly in contact mesially. The first pair of genials are also in

¹ Stejneger, Proc. U. S. Nat. Museum, XXV, 154–155.

contact, but the scutes of the second pair are separated by two rows of small scales anteriorly and four posteriorly.

The breaking up of the lateral head plates alluded to above is largely confined to the supralabials, as seems generally to be the case. If they were "normal" in this specimen there would be nine on each side (the seventh on the right side is anomalously divided, making ten in this series), and the anterior half of the first, and the second supralabials would be in contact above with the prenasal, the posterior half of the second and the anterior half of the third with the postnasal, the posterior half of the third and the anterior half of the fourth with the loreal, the posterior half of the fourth and the anterior half of the fifth with the preocular, the posterior half of the fifth and the anterior half of the sixth with the orbit, the posterior half of the sixth and the anterior half of the seventh with the lower postocular, and the remainder of the seventh, and the eighth and ninth with the temporals. While, however, the first three superior labials are in contact with the nasals a small plate has been cut off from the upper part of each of the fourth, fifth, and sixth plates, which constitute the small scutes usually designated as lower loreal, lower or subpreocular and anterior subocular. In this specimen the sixth supralabial on each side is fused with the lower postocular leaving but two plates in that series. If this were not the case the sixth labial would, as indicated above, be in contact with the orbit and lower postocular. If the posterior half of the upper part of the sixth was also cut off as a small plate (posterior subocular) the labials would be entirely separated from the orbit as Stejneger¹ has found in specimens from southern California.

The dorsal scales are smooth and in 17 rows for the greater part of the length, decreasing to 15 and 13 posteriorly. The gastrosteges are 206 in number, the urosteges 87. The anal plate is divided.

Habitat Relations.—This specimen of *S. hexalepis* was taken on the Greasewood plains to the east of Tucson (on the University campus). This is all that can be said as to its habitat in this region.

Almost nothing is recorded on the habits of the species. The well developed rostral plate seems to indicate that it is more or less of a burrowing form, and Van Denburgh² records a specimen from northern Lower California, which was found partly buried in sand. Stejneger³ states that this snake "to a great extent lives in holes in the ground," and suggests that as there is an apparent correlation between the breaking up of the labials and the greater width of the rostrals in western specimens that both of these

¹ North Amer. Fauna, No. 7, 205.

² Proc. Calif. Acad. Sci., Series 2, V, 1006.

³ North Amer. Fauna, No. 7, 205.

modifications are due to the more arid conditions (or the nature of the soil) in that region. There is little doubt but that a well developed rostral in snakes is often at least associated with the habit of burrowing in the loose soil of arid regions, for it is present in such widely separated forms as *Pituophis*, *Heterodon*, *Phyllorhynchus* and *Salvadora*, genera that are both arid region forms and of more or less burrowing habits. On the other hand the breaking up of the labial plates does not appear to be a phenomenon restricted to burrowing types, for it also occurs in *Sistrurus*, *Agkistrodon*, and several other genera which have a normal rostral and are not burrowing forms. It is true that the formation of suboculars in the last two named genera may be due to a different cause, but, excluding this line of argument, before it can be proven that the formation of subocular plates in *Salvadora* is correlated with its burrowing habits it must be demonstrated either that the trait is advantageous to the snake or that there is a region of stress along the upper margin of the labial plates, during burrowing. It is difficult to see how this trait, which is probably associated with a greater flexibility of the head, can be of advantage to a burrowing form. The reverse would rather be expected. Neither can we conceive how the labial plates can be particularly subject to a stress during burrowing that would lead to their breaking up. Another explanation of the phenomena presents itself, which in the judgment of the writer is more satisfactory, although, owing to our very incomplete knowledge of the habits of these snakes and the factors which influence scutellation, it can be considered only as a suggestion. This is that since in *Salvadora* and *Pituophis* the formation of suboculars is principally confined to the upper part of the supralabials, and since also in the act of seizing and swallowing large prey the sides of the mouth in snakes are spread outward, the hinge line being along the groove formed by the upper margin of the labial plates, it is conceivable that the breaking up of these plates may be associated with the need of greater mobility of the sides of the mouth in handling prey. If this explanation is a true one for these forms, the tendency toward the formation of a row of small plates from the upper part of the supralabials may be considered as a step in the breaking up of the plates of the head, which becomes more pronounced in *Agkistrodon* and *Sistrurus*, and reaches its greatest development in *Crotalus*.

The only observations on the food of this species that seems to be recorded is the statement of Dr. Coues¹ that a lizard (*Cnemidophorus sexlineatus*) was found in the stomach of a specimen from Fort Whipple.

Range.—The exact range of this species is not as yet accurately determined. It is known to occur in the desert regions of southern California

¹ Wheeler's Surv. West of the 100th Merid., V, 620.

and Lower California, and from here eastward across the Proplateau region of southern Nevada and Arizona, being replaced in the eastern part of the latter State or in southwestern New Mexico by *Salvadora grahamiae*. Whether these forms intergrade in this region or not is still an unsettled question, but it is very probable that they do. It is one of the plains forms of the Proplateau region, which is replaced in the prairie region of central Texas by a nearly related form.

Arizona elegans Kennicott.

Arizona elegans KENNICOTT, U. S. and Mex. Bound. Surv., II, 1859, 18.—BAIRD, Rept. Pac. R. R. Surv., X (Whipple-Ives Route), 1859, 42.—“BOCOURT, Miss. Sci. Mex., Rept., XI, 1888, 676.”—VAN DENBURGH, Occ. Papers Calif. Acad. Sci., V, 1897, 193–195.—BROWN, Proc. Acad. Nat. Sci. Phila., 1903, 549, 553.

Pityophis elegans COPE, Bull. U. S. Nat. Museum, I, 1875, 39.—YARROW, Bull. U. S. Nat. Museum, XXIV, 1883, 16, 108.

Rhinechis elegans COPE, Proc. Amer. Phil. Soc., XXIII, 1866, 284.—COPE, Bull. U. S. Nat. Museum, XXXII, 1887, 72.—COPE, Proc. U. S. Nat. Museum, XIV, 1891, 638.—COPE, Amer. Nat., XXX, 1896, 1014.—COPE, Rept. U. S. Nat. Museum, 1898 (1900), 863–865.—BROWN, Proc. Acad. Nat. Sci. Phila., 1901, 52.

Coluber arizonæ “BOULENGER, Cat. of Snakes in Brit. Museum, II, 1894, 66.”

Locality.—A single specimen (No. 1036) of this snake was presented to the party by Prof. Thornber. It was taken on the plains east of Tucson (near the University of Arizona).

Description of Specimen.—Form rather stout. Head moderately distinct. Tail short. Dorsal scales smooth, formula 27–25–23–21–19. Supralabials 8, infralabials 13–14. Oculars 1–2. Two pairs of genials, the posterior the shorter. Gastrosteges 221. Urosteges 46 pairs. Anal plate entire.

The ground color is faded but the markings are distinct. The dorsal pattern consists of a single median series of transverse blotches with dark edges, which alternate with smaller indistinct lateral spots. Small scattered spots on the first four rows of scales, and a single series of blotches on the tail. On the head there are several dark spots on the parietals and frontal, a cross bar between the eyes along the suture of the frontal and occipitals with the prefrontals, a short bar immediately below the eye, another from the eye to the posterior margin of the last supralabial, and a fourth extending backward from the upper edge of the orbit.

Habitat Relations.—The single specimen obtained was taken in the Creosote bush association on the plains east of Tucson. Professor Thornber informed us that he has taken several specimens in this habitat. Van

Denburgh¹ states that a "captive individual ate a brown-shouldered lizard (*Uta stansburiana*)."

Range.—This species has been taken in southern California, southeastern Arizona, and Mesilla Valley, New Mexico. From our present knowledge of its range it is impossible to determine whether it ranges across the Sonoran Desert, or is a form of the Proplateau which pushes southward in the mountains in southern California.

***Pituophis catenifer sayi* Schlegel.**

Coluber sayi SCHLEGEL, Ess. Phys. des Serpentes, 1837, 157, 158.

Churchillia bellonia BAIRD & GIRARD, Stansbury's Exped. Gt. Salt Lake, 1852, 350-351.

Pityophis bellona BAIRD & GIRARD, Cat. of North Amer. Reptiles, 1853, 66-68. (Part.)—BAIRD, Rept. Pac. R. R. Surv., X (Whipple-Ives Route), 1859, 42.—ALLEN, Proc. Bost. Soc. Nat. Hist., XVII, 1874, 69.

Pituophis sayi COPE, Proc. U. S. Nat. Museum, XI, 1888, 398.—BAIRD & GIRARD, Cat. North Amer. Reptiles, 1853, 151-152.—COPE, Proc. U. S. Nat. Museum, XI, 1888, 398.—HAY, 17th Ann. Rept. Dept. Geol. and Nat. Resources Ind., 1892, 591.—BAILEY, North Amer. Fauna, No. 25, 1905, 47.

Pityophis sayi sayi COPE, Bull. U. S. Nat. Museum, I, 1875, 39.—YARROW, *ibid.*, XXIV, 1883, 16, 105.—DAVIS & RICE, Bull. Chicago Acad. Sci., I, 1883, 30.—COPE, Proc. U. S. Nat. Museum, XIV, 1892, 641.—COPE, Proc. Acad. Nat. Sci. Phila., 1892, 335.—COPE, Amer. Nat., XXX, 1896, 1014.—COPE, Rept. U. S. Nat. Museum, 1898 (1900), 870-872.

Pituophis maclellani BAIRD & GIRARD, Cat. of North Amer. Reptiles, 1853, 68-69.—BAIRD & GIRARD, Marcy's Explor. Red River, 1854, 196-197.

Pityophis catenifer sayi GARMAN, Mem. Mus. Comp. Zool., VIII, No. 3, 1883, 150-151.—GARMAN, Bull. Ill. State Lab. Nat. Hist., III, 1892, 286-289.—TAYLOR, Ann. Rept. Nebr. State Board Agric., 1891, 335-337.—BROWN, Proc. Acad. Nat. Sci. Phila., 1901, 55; *ibid.*, 1903, 549.—BRANSON, Kansas Univ. Sci. Bull., XII, No. 13, 1904, 357-360.

Pituophis mexicanus DUMÉRIL & BIBRON, Erpétol. Gén., VII, 1854, 236-238.

Pituophis sayi mexicanus YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 539-540.

Pituophis sayi bellona COUES & YARROW, Bull. U. S. Geol. Surv. Terr., IV, 1878, 282-283.—YARROW, Bull. U. S. Nat. Museum, XXIV, 1883, 16, 106-107. (Part.)—TAYLOR, Ann. Rept. Nebr. State Board Agric., 1891, 337.—STONE & REHN, Proc. Acad. Nat. Sci. Phila., 1903, 33.

Locality.—The Bull Snakes referred to this variety were only found at Alamogordo, N. M. The Tucson specimens² belong to the following form. It is probably the commonest snake in this region.

¹ Occ. Papers Calif. Acad. Sci., V, 195.

² Although Stone has stated that the Alamogordo specimens collected by Rehn and Viereck, are probably referable to *P. c. bellona (deserticola)*, and Van Denburgh has listed Tucson specimens as *P. sayi*, a comparison of the specimens obtained by us in these two localities reveals at once that the Alamogordo specimens are true *sayi* while the Tucson individuals are variety *deserticola* as defined by Stejneger. This gives weight to the opinion expressed by Stejneger that Baird's type of *bellona* belongs to variety *sayi* (North Amer. Fauna, No. 7, 206).

Description of Specimens.—The dorsal scale formulas in the specimens obtained are as follows: 29-31-33-31-29-27-25-23; 29-31-29-27-25-23; 27-29-31-29-27-25-23-21. The first five scale rows are smooth, the others keeled. The cephalic plates are normal in number and arrangement except that there are four prefrontals in three specimens and six in the fourth. The rostral plate is long, narrow and elevated. The supralabials are 8-8 in two specimens, 9-9 in one, 8-9 in a fourth. The infralabials are 12-12 in two specimens, 13-13 in the third, and 12-13 in the fourth. In two of the specimens the fourth supralabial is bounded above by the posterior half of the preocular and the adjacent half of the orbit. In two specimens, however, it is separated from the preocular and nearly entirely from the orbit by a small scale, being in contact with the eye only at its posterior angle. This small plate is the second preocular of some writers and is often present in the genus. That it is not formed by a division of the preoculars is, however, quite evident, since it lies below the usual line of contact of the preoculars and subjacent labial, while a true lower preocular would be formed by a transverse division of this plate above this line. It quite evidently takes its origin from the labial series. The fifth labial is entirely excluded from the orbit by a small plate which is usually considered as a part of the postocular series, but this plate we believe also to be a subocular formed from the apex of the second labial that would normally enter the orbit. From this view point the arrangement of the lateral head plates in our specimens is as follows: 1 preocular, 1 posterior subocular, 3 postoculars; 1 preocular, 1 posterior subocular, 2 postoculars (in two specimens); 1 preocular, 1 posterior subocular, 1 anterior subocular, 3 postoculars. The gastrosteges in the four specimens are 222, 232, 233, 233; the urosteges 52, 58, 59, the tail being broken in the fourth. Anal plate entire.

In these specimens the ground color is yellow, the keels of the scales between the spots dark brown (light orange in the two smaller individuals). There is a dorsal series of large chocolate or dark reddish brown spots, about four scales long, nine or ten wide, and separated by the length of three scales. On either side of this series of blotches and alternating with them is a row of small spots similar in color to those of the dorsal row. These spots are distinct posteriorly, but anteriorly tend to fuse longitudinally into narrow dark bands. Beneath this row are two others, the spots of which are also arranged alternately. All of the spots tend to be black edged, but the borders are seldom well defined except on the tail. On the posterior part of the body there is but one row of spots on either side, while on the tail the dorsal spots are in the form of dark red cross bars which are occasionally bifurcated. The head is dark yellow with a dusky band across the line of contact of the supraoculars and frontals with the preoculars and

prefrontals, and numerous spots behind this bar, that are either black or brown edged with black. The supralabials are margined with black with the exception of the last, the fifth, sixth and seventh with but a small spot. Belly white, or yellowish white with a prominent or indistinct black, dusky or reddish blotch on the ends of every third or fourth scute. On the ventral surface of the tail these blotches are fused transversely and longitudinally along the median line and may be continuous or alternating with the dorsal blotches. Distally the lateral blotches are wanting for a greater or lesser distance leaving only the irregular median band.

Habitat Relations.—This Bull Snake has a very wide range of habitat. At Alamogordo it was found in the Mesquite association on the plains, in the Creosote bush association on the alluvial slope, and in the Piñon-Cedar zone on the mountain slope at an elevation of 6,000 ft. It undoubtedly ranges higher than this, as Mr. Edwin Walters of Alamogordo informed us that he had observed it in the Pine-Spruce forest of the higher elevations. The wide range of habitat of the species, in this locality, is in harmony with its extensive geographic range.

In spite of their large size these snakes are very docile, and while said to be able "to defend themselves against the attacks of an ordinary sized dog,"¹ seldom attempt to bite. Those secured made little resistance when picked up with the hands, although several were of large size.

The food consists for the most part of small mammals, although a considerable number of birds are probably also taken. The specimen secured in the Piñon-Cedar association had recently swallowed a young rabbit. This was the only stomach examined, but Taylor² states that the stomach contents of Nebraska specimens "show that their food is almost wholly made up of rodents, most notably ground mice, but also including rats, gophers, squirrels, moles and similar animals." Bailey³ observed one in Texas "in the act of swallowing a freshly killed squirrel (*Citellus m. parvidens*)," and Branson⁴ records a specimen in captivity that ate several sparrows and a pigeon's egg. A specimen kept by myself for several months was fed entirely on freshly killed sparrows.

It is rather remarkable that so little is known of the breeding habits of such a conspicuous form as this snake, but I know of but one contribution to our knowledge of the subject. Branson⁵ states that he received twelve eggs ("2 $\frac{4}{5}$ inches in length by 4 $\frac{4}{5}$ inches in circumference") on the 15th of August. He describes the embryos as follows: "I opened one of them

¹ Taylor, Ann. Rept. Nebr. State Board of Agric., 1891, 336.

² Ann. Rept. Nebr. State Board Agric., 1891, 336.

³ North Amer. Fauna, No. 25, 47.

⁴ Kansas Univ. Sci. Bull., XII, No. 13, 360.

⁵ Kansas Univ. Sci. Bull., XII, No. 13, 359.

[the eggs] immediately and found it contained a Bull Snake eight inches long. The snake was surrounded by a gelatinous mass. Its color was olive-buff, with spots faintly outlined in a darker shade. The cephalic plates were well developed. It was able to raise its head about one-third of an inch, but it could not open its mouth. It could see large moving objects. The hemipenis was protruded, and small calcifications were already present on it.

"I placed the other eggs in damp sand where the direct rays of the sun could not reach them. The weather was cool and damp most of the time to the period of their hatching. September 28 two snakes were hatched and during the next three days eight more came out of the eggs. They were fifteen to fifteen and one-half inches long." These snakes are stated to have been very fat when born, and hibernated and emerged the next spring before taking food.

Range.—*Pituophis catenifer sayi* is a plains and prairie form, being found in the United States from the Rocky Mountains to the western margin of the eastern forest. It is more abundant in Texas, Kansas and Nebraska, but it occurs also in the prairie regions of Iowa and Illinois. To the northward it probably occurs about to the boundary although definite localities are not given in the literature. To the southward it enters the Proplateau region in western Texas and eastern New Mexico and is replaced to the westward by *P. catenifer deserticola*.

Pituophis catenifer sayi Schlegel.

| Habitat | Field No. | Locality | When Collected | Collector |
|---------------------|-----------|--|----------------|----------------|
| Creosote bush Assn. | 294 | Alamogordo, N. M. Alluvial slope east of Alamogordo | July 15-06 | A. G. Ruthven |
| Piñon-Cedar Assn. | 356 | West slope of Sacramento Mts. (Alt. 6,000 ft.) | July 17-06 | " |
| Atriplex Assn. | 461 | Plains three miles east of White Sands | July 19-06 | G. von Krockow |
| Mesquite Assn. | 494 | Plains southwest of Alamogordo | July 20-06 | " |

Pituophis catenifer deserticola Stejneger.

Pituophis bellona BAIRD & GIRARD, Cat. of North Amer. Rept., 1853, 66-68. (Part.)—KENNICOTT apud Baird, Rept. Pac. R. R. Surv., X (Beckwith-Gunnison Route), 1859, 19.—KENNICOTT apud Baird, U. S. and Mex. Bound. Surv., II, 1859, 18.—COPE, Proc. Acad. Nat. Sci. Phila., 1866, 305.

Pituophis sayi bellona COPE, Bull. U. S. Nat. Museum, I, 1875, 39.—YARROW, Wheeler's Surv. West of 100th Merid., V, 1875, 540-541.—COUES, *ibid.*, 617-618.—STREETS, Bull. U. S. Nat. Museum, VII, 1877, 40-41.—YARROW, *ibid.*, XXIV, 1883, 106-107. (Part.)—COPE, Proc. U. S. Nat. Museum, XIV, 1892, 641.—COPE, Amer. Natur., XXX, 1896, 1015.—COPE, Rept. U. S. Nat. Museum, 1898 (1900), 872-876.

Pituophis sayi VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, VI, 1896, 348.

Pituophis catenifer COPE, Proc. Acad. Nat. Sci. Phila., 1883, 18.—STEJNEGER, North Amer. Fauna, No. 5, 1891, 110.—MEEK, Field Museum of Nat. Hist., Zool. Series, VII, 1906, 15-16.

Pituophis catenifer bellona GARMAN, Mem. Mus. Comp. Zool., VIII, No. 3, 1883, 151.—BROWN, Proc. Acad. Nat. Sci. Phila., 1901, 54.

Pituophis catenifer deserticola STEJNEGER, North Amer. Fauna, No. 7, 1893, 206-208.—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, V, 1895, 149.—VAN DENBURGH, Occ. Papers Calif. Acad. Sci., V, 1897, 198-199.—STEJNEGER, Proc. U. S. Nat. Museum, XXV, 1902, 153.

Locality.—Two specimens of this snake were secured at Tucson, Ariz. Van Denburgh has recorded a number of individuals collected in this region (Fort Lowell) as *P. sayi*, but his specimens are undoubtedly to be referred to this variety instead.

Description of Specimens.—Our specimens are very evidently *P. catenifer deserticola* for in both of them the rostral is decidedly wider and flatter than in the eastern form. The scale formula in both specimens is 29-31-33-31-29-27-25; the lateral eight in one and five in the other being smooth. The supralabials are 8-8 and 8-9, the infralabials 12-12 and 13-14, the oculars 1-2 in both. In one specimen there is an anterior and posterior subocular on each side, but in the other there is an anterior and posterior subocular on one side, and only a posterior subocular on the other. (See page 579 for a discussion of these plates.) The gastrosteges are 232 and 238, the urosteges 45 and 55. Anal plate entire.

One specimen shows an interesting anomaly in the labial plates, in that from the upper margin of the two plates that precede the one below the orbit two small plates have been cut off that correspond in shape and relative position to the suboculars. These we believe to represent a more advanced stage in the breaking up of the supralabials than is shown by the presence of the suboculars alone. (See p. 579.)

These specimens are more richly colored than most specimens of *P. c. sayi*. There are the usual three rows of dorsal blotches but those of the second lateral row are not well defined, and those of the lowest row are in the form of short vertical bars. In the smaller specimen the blotches on the anterior two-thirds of the body are light reddish brown, posteriorly they are dark red with darker edgings. Tail crossed by a series of very dark red bars. The scales of the interspaces are pale yellow, with bright

orange keels. Head pale yellow with a dusky bar across the junction of the preoculars and prefrontals with the supraoculars and frontal, and a few brown spots on the top of the head. A few labials slightly margined with dusky. Belly yellowish white, with a row of brown spots on either at intervals of two or three scutes. Ventral surface of tail with a series of pale spots on either side that connect with the dorsal cross bars, but do not fuse mesially to form a black band.

In the larger specimen the colors are somewhat duller as is to be expected. The median dorsal series of blotches are chocolate brown anteriorly, very dark red posteriorly, and all margined with darker. The lateral series of blotches are not at all well defined for most of the length, but become more so posteriorly. Tail with one series of black cross bars. Interspaces anteriorly pale yellow, posteriorly bright orange yellow. Head light brown with a trace of the usual dusky bar across the anterior part of the interorbital area and a few spots on the top of the head. Both supralabial and infralabial plates well margined with black. Belly white with a row of black blotches along either side, the free edges of the scutes also often margined with black. On the tail the urostegial blotches fuse with the dorsal cross bars and with each other along the median ventral line, except posteriorly where the median ventral band is broken up.

Habitat Relations.—This Bull Snake is a plains form but further than this little is recorded on its habits, although they are probably similar to those of the eastern form. At Tucson it occurs commonly on the Greasewood plains, and is doubtless also to be found on the mountains, as Dr. Stejneger¹ records a specimen that was taken in the Huachuca Mts. at an elevation of 5,300 feet. As in the case of many other snakes in this region, while probably not nocturnal it is seldom seen during the hotter part of the day, being found principally in the morning and evening. The large specimen (No. 1043), which was taken about sun down on August 22, had recently swallowed an adult ground squirrel.

Range.—The range of this snake cannot as yet be definitely determined owing to the fact that it has been frequently confused with *P. c. sayi*. It is a Great Basin form, however, being found between the Rocky and Sierra Nevada Mountains. To the northward it extends into Idaho, but its southern limit in Mexico is unknown. In the extreme southern part of the United States it is found across southern California and Arizona from the western margin of the Mojave Desert to the Proplateau region of southeastern Arizona. As shown above it occurs at Tucson, but east of this point it is undoubtedly soon replaced by *P. c. sayi*.

¹ Proc. U. S. Nat. Mus., XXV, 153.

***Gyalopium canum* Cope.**

Gyalopium canum COPE, Proc. Acad. Nat. Sci. Phila., 1860, 243; *ibid.*, 1866, 310.—COUES, Wheeler's Surv. West of the 100th Merid., V, 1875, 624.—COPE, Bull. U. S. Nat. Museum, I, 1875, 36.—YARROW, *ibid.*, XXIV, 1883, 14, 88.—COPE, Amer. Natur., XXX, 1896, 1014.—COPE, Rept. U. S. Nat. Museum, 1898 (1900), 947-948.

Locality.—A small specimen (No. 123) of this species was found dead on the shore of Lake Walters, at the White Sands, west of Alamogordo, N. M.

Description of Specimen.—Form rather robust; head broad and short, tail short. Total length of the single specimen obtained 155 mm., tail 20 mm. Rostral high, protuberant, and projected backward on the upper surface of the snout, broadly separating the internasals and pushing well in between the prefrontals. Superior surface of rostral concave. Internasals much reduced in size. Nostril situated between two plates, the posterior one small and lying entirely behind the nares, the anterior large, extending from the internasal to the margin of the mouth. No loreal, the prefrontals extending to the posterior nasal and second labial scutes. Supralabials 7, infralabials 7-8. Oculars 1-2. Dorsal scales broad and smooth; formula 19 (for short distance only)-17. Two pair of geneials, the posterior pair very small. Gastrosteges 145, urosteges in 29 pairs. Anal plate divided.

Color above light brownish gray with 49 (40 on body, 9 on tail) transverse, brown blotches with black edges. These spots become narrower on the sides, and persist to the gastrosteges, forming on the anterior and posterior parts of the body a single series of cross bars. On the middle of the body, however, they alternate with a second series of narrow bars extending from the first to the sixth rows. Head olive gray with a broad brown band across the parietals and embracing the apex of the frontal. A second band extends between the eyes across the line of junction of the supraoculars and frontal with the prefrontals; this band is continued below the eye to the margin of the mouth, embracing all of the fourth labial. The four anterior infralabials are margined with darker. Belly white, without markings.

Habitat Relations.—The single specimen of this snake taken was found, as before stated, on the shore of Lake Walters to the east of the White Sands. This makes it evident beyond question that the species occurs in the Atriplex association, as the specimen is immature and was undoubtedly bred in the immediate vicinity. Whether or not it occurs elsewhere is as yet an unsettled question.

Range.—As far as I know but two other specimens of this species have been recorded. One of these is listed simply "Southern Arizona," the

other, the type, came from Fort Buchanan in southeastern Arizona. This, the third specimen, therefore, extends the range of the species across the Proplateau to the East Front Ranges in New Mexico.

***Thamnophis eques* Reuss.**

Locality.—Three specimens of this species were taken in the lower part of Sabino Cañon, Santa Catalina Mountains, Ariz., August 18, 1906.

Description of Specimens.—Although one of the more pallid forms this species is one of the most beautiful members of the genus. It has been confused with *T. marciana*, *T. vagrans*, and *T. parietalis (ornata)*, but is easily distinguishable. Form rather slender. Lateral stripe on the second and third rows; dorsal stripe narrow, being confined to the median row. Dorsal scale formula 19–17. Cephalic plates normal. Supralabials 8, infralabials 10, oculars 1–3. Gastrosteges 165, 168, 168. Urosteges 78 and 93. Anal plate entire in all specimens.

Color above dark chocolate brown. First row of scales dusky yellow or brownish olive, with a pair of black spots at intervals on the margins of the scales. Lateral stripe pale yellow, the dorsal light orange yellow. Two rows of black spots on the skin between the stripes, encroaching only slightly on the involved scales. Two large black nuchal blotches. No postoral crescent. Head above dark olive in one specimen splashed with black. Supralabials light yellow, except the last one which is light olive, all well margined with black. Belly pale yellow anteriorly, light grayish slate posteriorly; gastrostegial spots small and mostly concealed beneath the overlapping edge of the preceding scute.

Habitat Relations.—All of the specimens of *T. eques* obtained, were found near the stream in the cañon. Two were lying on rocks in mid stream, the other on the immediate shore. When frightened they immediately took to the water, swimming in the swift current with apparent ease. They doubtless subsist largely upon the frogs and tadpoles which abound in this habitat.

It is gratifying to be able to make these habitat notes, meager as they are, for practically nothing has been heretofore recorded on the habitat relations of this species, and a knowledge of these is essential in the determination of its relationships.

Range.—The range of this species is, as far as known at present, confined to the Mexican plateau and Proplateau. It has been recorded several times from the southern end of the peninsula of Lower California,¹ evidently

¹ Cope, Rept. U. S. Nat. Museum, 1898, 1051. Van Denburgh, Proc. Acad. Nat. Sci. Phila., Ser. 2, V, 151. Cope, Proc. Acad. Nat. Sci. Phila., 1861, 299.

on the basis of a single specimen (No. 5023) in the United States National Museum, said to have been collected by John Xantus. Since, however, there are two specimens of this number in the National Museum, the above and a specimen of *Lichanura*, one being from Fort Buchanan and the other from Cape San Lucas, the garter snake is very probably the Arizona specimen.

***Thamnophis marciana* Baird & Girard.**

Locality.—An adult specimen (No. 1029) of this species taken by Prof. Thornber near old Fort Lowell, was presented to the party.

Description of Specimen.—Adult. Cephalic plates normal. Supralabials 8, infralabials 9–10. Oculars 1–3. Dorsal scales keeled with the exception of the first row, formula 21–23–21–19–17. Gastrosteges 157. Anal plate entire.

Color? Three rows of alternating black spots on skin and scales, the lowest being below the lateral stripe which is narrow and occupies the third row only for most of the length, posteriorly including also the second. The dorsal stripe also occupies but one row of scales, the median dorsal. Large nuchal blotches and well defined postoral crescents. Supralabials, with the exception of the sixth, dark olive and well margined with black, the sixth with the postoculars being decidedly lighter. A small black spot on the base of each gastrostege.

Habitat Relations.—The single specimen obtained was secured by Prof. Thornber, in a cultivated field on the bank of Pantano Wash near Old Fort Lowell. These are the only notes obtained on the occurrence of this species, but brief as they are they comprise the first authentic data on the local distribution of the form in Arizona.

Range.—*Thamnophis marciana* ranges throughout central Texas and across the Proplateau region to Tucson. Two specimens in the U. S. National Museum bear the locality of Fort Yuma, but as this is the only record for the desert region of southwestern Arizona it may be held in question until confirmed by other specimens.

***Elaps euryxanthus* Kennicott.**

Elaps euryxanthus KENNICOTT, Proc. Acad. Nat. Sci. Phila., 1860, 337–338.—COPE, *ibid.*, 1861, 296; *ibid.*, 1866, 307.—COPE, Bull. U. S. Nat. Museum, I, 1875, 34.—COUES, Wheeler's Surv. West of 100th Merid., V, 1875, 611.—STREETS, Bull. U. S. Nat. Museum, VII, 1877, 40.—YARROW, *ibid.*, XXIV, 1883, 13, 82. (Part.)—GARMAN, Mem. Mus. Comp. Zool., VIII, No. 3, 1883, 107, 169.—“CRAGIN, Bull. Washburn Coll. Labor., I, 1884, 8.”—COPE, Bull. U. S. Nat. Museum, XXXII,

1887, 86.—COPE, Proc. U. S. Nat. Museum, XIV, 1892, 681.—STEJNEGER, Rept. U. S. Nat. Museum, 1893, 362–363.—COPE, Amer. Natur., XXX, 1896, 1014.—COPE, Rept. U. S. Nat. Museum, 1898 (1900), 1125–1126.—BROWN, Proc. Acad. Nat. Sci. Phila., 1901, 95.—STEJNEGER, Proc. U. S. Nat. Museum, XXV, 1902, 157.

Locality.—A specimen (No. 1028) of this Coral Snake was captured by Prof. Thornber near Rosemont, Arizona, and presented by him to the expedition.

Description of Specimen.—Body rather stout; head small and little distinct; tail short and blunt; eyes small. The body is covered above by 15 rows of smooth scales, below by a single row of 227 gastrosteges, and a double series of urosteges consisting of 25 pairs. Anal plate divided. Head plates small except the rostral which is large. Supraorbitals proportionately broad, frontal narrow. Preoculars and posterior nasals broad. No loreal. Seven plates in both the upper and lower labial series. Oculars 1–2, temporals 1–2.

The color is somewhat faded, but the pattern is distinct. It consists of alternating bands of black, white, and bright red, that completely encircle the body. The black and red bands (11 in number between head and anus) are separated from each other by the narrower white rings which are therefore twice as numerous (23 between head and anus). The coloration of the tail consists of a proximal and distal broad black band separated by a narrower one of white. The head is entirely black with the exception of the tips of the parietals and a part of the posterior labials (instead of entirely including the last labial)¹ which lie within the following white band.

Habitat Relations.—The habits of this species are unknown. I have known persons in Arizona who have handled this snake repeatedly, and who scoff at the idea of its being venomous. It is true that the experiments that have proven the toxicity of the bite of the Coral Snakes have been confined to the eastern species, *E. fulvius*, but as *E. euryxanthus* also possesses well developed fangs, there is no reason to believe that it is any less venomous than the eastern form. That it enjoys the reputation it does is probably due, as in *E. fulvius*, to its amiable disposition and the fact that it is easily confused with some of the harmless snakes.² Dr. Stejneger writes of the genus as follows: "It is granted that *Elaps* is comparatively rare; that it is retiring in its habits, mostly living under ground, and that it has a very gentle and amiable temperament. When it does bite, however, its bite is as venomous as that of a rattlesnake or moccasin of the same size, and even more so."³

¹ Kennicott, Proc. Acad. Nat. Sci. Phila., 1860, 337.

² The resemblance that exists between some of the harmless snakes and the *Elaps* of the same region has been frequently commented upon. Stejneger (Rept. U. S. Nat. Mus., 1893, 356–358) has described how the forms in the United States may be readily distinguished.

³ Rept. U. S. Nat. Museum, 1893, 355.

Range.—So few specimens of *E. euryxanthus* have been taken that its distribution cannot as yet be determined. Stejneger defines its known range as follows: "It belongs to the Lower Sonoran province, but seems restricted to the regions east of the great Colorado River and west of the Continental divide. It has been found as far north as Fort Whipple and at various places in southern Arizona, extending south into Mexico at least as far south as Batopilas, in the state of Chihuahua, in the interior, and to Guaymas, Sonora, on the Gulf of California. In Arizona it reaches an altitude above the sea of at least 5,000 feet."¹

***Crotalus atrox* Baird & Girard.**

Crotalus atrox BAIRD & GIRARD, Cat. of North Amer. Reptiles, 1853, 5-6, 156.—DUMÉRIL & BIBRON, *Erpétologie Générale*, VII, Pt. 2, 1854, 1482.—HALLOWELL, *Proc. Acad. Nat. Sci. Phila.*, 1856, 307.—BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 14.—BAIRD, *Rept. Pac. R. R. Surv.*, X (Whipple-Ives Route), 1859, 39.—COPE, *Proc. Acad. Nat. Sci. Phila.*, 1859, 337.—COOPER, *Proc. Calif. Acad. Sci.*, IV, 1870, 66.—COPE apud Yarrow, *Wheeler's Surv. West of 100th Merid.*, V, 1875, 534.—STEJNEGER, *Rept. U. S. Nat. Museum*, 1893, 436-439.—VAN DENBURGH, *Proc. Calif. Acad. Sci.*, Ser. 2, V, 1895, 156-157.—VAN DENBURGH, *ibid.*, Ser. 2, VI, 1896, 348.—STEJNEGER, *Proc. U. S. Nat. Museum*, XXV, 1902, 158.—BAILEY, *North Amer. Fauna*, No. 25, 1905, 49-50.—DITMARS, *The World Today*, Oct., 1906, 1049.

Caudisoma atrox "COPE apud MITCHELL's *Researches ven. Rattle.*, 1861, 121."—COPE, *Proc. Acad. Nat. Sci., Phila.*, 1866, 309, 310, 311.

Crotalus atrox atrox BROWN, *Proc. Acad. Nat. Sci. Phila.*, 1901, 103-104; *ibid.*, 1903, 551, 553.

Crotalus adamanteus atrox "JAN. *Rev. Mag. Zool.*, 1859, 28."—JAN. *Elenc. Sist. Ofid.*, 1863, 123.—COPE, *Bull. U. S. Nat. Museum*, I, 1875, 33.—STREETS, *ibid.*, VII, 1877, 40, 41.—COPE, *ibid.*, XVII, 1880, 24.—YARROW, *ibid.*, XXIV, 1883, 12, 75-76.—GARMAN, *Mem. Mus. Comp. Zool.*, VIII, No. 3, 1883, 113, 172.—COPE, *Proc. Amer. Phil. Soc.*, 1885, 287.—COPE, *Bull. U. S. Nat. Museum*, XXXII, 1887, 90.—COPE, *Proc. U. S. Nat. Museum*, XI, 1888, 398.—COPE, *ibid.*, XII, 1889, 147.—COPE, *ibid.*, XIV, 1892, 690.—COPE, *Proc. Acad. Nat. Sci. Phila.*, 1892, 366.—COPE, *Amer. Natur.*, XXX, 1896, 1013.—COPE, *Rept. U. S. Nat. Museum*, 1898 (1900), 1164-1167.—STONE & REHN, *Proc. Acad. Nat. Sci. Phila.*, 1903, 33.

Caudisoma adamanteus atrox COUES, *Wheeler's Surv. West of 100th Merid.*, V, 1875, 607.

Caudisoma atrox sonorænsis KENNICOTT, *Proc. Acad. Nat. Sci. Phila.*, 1861, 207.—COPE, *ibid.*, 1861, 292.

Crotalus adamanteus sonoriensis JAN, *Elenc. Sist. Ofid.*, 1863, 124.

Caudisoma scutulata KENNICOTT, *Proc. Acad. Nat. Sci. Phila.*, 1861, 207-208.—COPE, *ibid.*, 1866, 307.

Crotalus scutulatus COPE apud Yarrow, *Wheeler's Surv. West of 100th Merid.*, V, 1875, 533.

¹ *Rept. U. S. Nat. Museum*, 1893, 356.

Crotalus adamanteus scutulatus COPE, Bull. U. S. Nat. Museum, I, 1875, 33.—YARROW, *ibid.*, XXIV, 1883, 12, 76.—COPE, Proc. Amer. Phil. Soc., 1885, 287.—COPE, Proc. U. S. Nat. Museum, XIV, 1892, 690.

Caudisoma adamantea scutulata COUES, Wheeler's Surv. West of 100th Merid., V, 1875, 607-608.

Crotalus adamanteus "JAN, Icon. Ophid., 1874, livr. 46, Pl. II, fig. 1."

Locality.—Five specimens of this rattlesnake were taken in the vicinity of Tucson, Ariz. Not found at Alamogordo, N. M., although it occurs there.¹

Description of Specimens.—The specimens obtained range in length from 606 to 1026 mm. Head flat. Orbit depressed, surrounded below and behind by a single series of small plates which are separated from the reduced supralabials by three rows of scales. Two preoculars, the inferior bordered in front by the pit, the superior by the loreal and the lower end of a cephalic scute. Two nasals, the nostril situated in the posterior, the anterior in contact with the rostral. A group of small scales occupies the triangular space in front of the pit, between the nasal, rostral and supralabial scutes. Rostral narrow. Supralabials 14-15, infralabials 15-18.

The cephalic plates are variable. In all of the specimens there is a pair of small plates immediately behind the rostral. From the external side of these plates an elongated scute extends backward along the superior margin of the anterior and posterior nasals, the line of contact being along the canthus rostralis. Posterior to this plate is a second enlarged scute which is in contact posteriorly with the supraocular and bends over the canthus rostralis to meet the upper preocular and loreal. The supraoculars are large and margined on the inner side by a single series of small plates. The scutellation of the muzzle within the marginal scales just described varies in the different specimens. In one individual the space is occupied by small scales irregularly disposed. In another the first pair of interorbital scutes are a little enlarged, and each one is preceded by a similar enlarged plate, both pairs being separated by smaller paired scutes in line with the internasals. In a third the first pair of interorbitals are enlarged and in contact, but the preceding pair of scutes are separated by small scales. In the fourth the pair of scutes preceding the first pair of interorbital plates, which are in contact, are separated only by two narrow scutes, while in the fifth they are in contact, and the scutellation of the upper surface of the muzzle consists of four pairs of rather large scutes, extending from the rostral to between the eyes. Thus there seems to be revealed in these specimens a tendency toward the fusion of the cephalic plates.

The body is robust and the tail short. The dorsal scales are keeled

¹ Stone and Rehn, Proc. Acad. Nat. Sci. Phila., 1903, 33.

with the exception of the outer two which are smooth. The arrangement is 25-23-21-19 in two, but in the others there is an increased number on the neck, where the scales are much smaller than elsewhere on the body. The gaurosteges vary in number from 175-186. The urosteges range from 18-26 and are mostly entire with the exception of the distal 1-5. Anal plate single.

The color is strikingly pallid. In four specimens the ground color is light brownish or yellowish ash. The dorsal rhombs are light brown or dark ash, the centers being lighter, and they are margined with pale yellow. The anterior and posterior angles of these rhombs are nearly always truncate, those on the anterior part of the body often notched. On the posterior part of the body the dorsal blotches are compressed into cross bands that on the tail form 3-5 black cross bars. In these specimens there is evidence of two rows of dusky blotches on the body below the dorsal rhombs, but these are very faint. Head above about the same as the ground color of the dorsal surface of the body. End of muzzle to the first facial stripe about the same. The facial stripes are light yellow. The first includes the preoculars and runs downward and backward to embrace all of the supralabials posterior to the seventh. The second is narrower and extends from the posterior angle of the supraoculars to the angle of the mouth. Between the facial stripes, and extending from the eye to the angle of the mouth is a dusky band about two and one-half to four scales wide. Belly yellowish white, immaculate.

In a large old male the ground color posteriorly is dull orange red becoming dove gray tinged with pink anteriorly, the entire upper surface being marked with fine black spots. The rhombs are dark reddish brown, lighter toward the center, and with light margins. The tail bars are jet black, the interspaces pale yellow.

Habitat Relations.—I find nothing recorded on the habits of this rattlesnake. About Tucson it is common both on the plains and slopes. Individuals are, however, seldom observed during the heat of the day, except after heavy rains or on cloudy or foggy days, when they are more abundant. Mr. F. E. Lloyd informed us that he has, when sleeping on the ground, been awakened in the night by a snake of this species crawling over his blankets, which with the vertical pupil indicates nocturnal habits.

The partially digested remains of a full grown ground squirrel was removed from the stomach of a specimen which I discovered one morning under a Crucifixion thorn bush. In the stomach of another a stone was found which measured 14 mm. in diameter. Since this snake measured but 760 mm. in length the stone is too large to have been contained in the crop

of any bird which it could swallow, and it was probably picked up accidentally in seizing or swallowing food.

Range.—This is one of the few forms secured by the expedition, that ranges from the low deserts of southern California and southwestern Arizona across the Proplateau region into New Mexico and Texas. In Texas it occupies the territory lying between the ninety-seventh meridian and the Staked Plains, south of the Canadian River. It ranges up the Pecos Valley at least as far as Santa Rosa, through the Trans-Pecos region, and to some extent up the Hueco bolson and Rio Grande Valleys.

Crotalus atrox Baird & Girard.

| Habitat | Field No. | Locality | When Collected | Collector |
|---------------------|-----------|-------------------------------|----------------|----------------|
| Creosote bush Assn. | 761 | Alamogordo, N. M. | Aug. 8-06 | G. von Krockow |
| " | 1002 | Plains south of Tucson | Aug. 20-06 | " |
| " | 1015 | Plains east of Tucson | Aug. 21-06 | A. G. Ruthven |
| " | 909 | Mesa west of Santa Cruz River | Aug. 15-06 | G. von Krockow |
| " | 1045 | Plains east of Tucson | Aug. 24-06 | F. E. Lloyd. |
| | | Mesa west of Santa Cruz River | | |

TESTUDINES.

Kinosternon sonoriense Le Conte.

Kinosternon sonoriense LE CONTE, Proc. Acad. Nat. Sci. Phila., 1854, 184.—COUES, Wheeler's Surv. West of 100th Merid., V, 1875, 589.—COPE, Bull. U. S. Nat. Museum, I, 1875, 52.—YARROW, *ibid.*, XXIV, 1883, 6, 31.—STEJNEGER, Proc. U. S. Nat. Museum, XXV, 1902, 149.

Thyrosternum sonoriense AGASSIZ, Contrib. Nat. Hist. U. S., I, 1857, 428.—BAIRD, U. S. and Mex. Bound. Surv., II, 1859, 3.

Locality.—A single specimen (No. 988) of this turtle was taken in the lower part of Sabino Cañon, Santa Catalina Mountains, Ariz.

Description of Specimen.—Plastron rather large nearly closing the shell. Carapace rather strongly convex, wider and sloping steeply posteriorly, converging gradually both dorsally and laterally toward the anterior end. Three dorsal keels, the median along the vertebrals, the lateral along the upper part of the costal scutes. Nuchal plate rectangular. Marginals 22. Costals 8. Vertebrals 5. Plastron broadly rounded in front, emarginate behind. Skin of throat and sides of neck roughly tubercular, becoming smooth on the nape. Both on the dorsal and ventral surface of the neck

there are small scattered papillæ and a well defined row of larger ones in line with the upper margin of ear; another less well defined row extends backward beneath the lower jaw. In the latter row there are two pairs of more prominent ones situated respectively near the symphysis of the lower jaw and angle of the mouth. Several poorly defined rows of small tubercles on the tail, and a fringe of them about the anus. Tail terminating in a strong nail. Three large scales on the forearm, and three near the heel. Tail strongly sulcate beneath.

Carapace dull reddish brown, plastron dull yellow, all scutes faintly but broadly margined with black. Skin of upper surfaces black. Head above mottled with dull reddish brown and black. Beak light horn color splashed with black. Throat densely spotted with pale yellow and black. Under surface of limbs blackish brown.

Length of carapace 112.5 mm.; width of carapace between fifth marginals 70.5 mm., between eighth marginals 73. Greatest width of plastron (across anterior part of abdominals) 56 mm. Length of plastron 100.6 mm.

Habitat Relations.—Little is recorded on the habits of this species. Stejneger records it as occurring in cañons in the Huachuca Mountains. Our specimen was found on a stone in the stream in Sabino Cañon.

Range.—The only three localities previously recorded for the species are Tucson, Huachuca Mountains, and Guadalupe Cañon, all in south-eastern Arizona.

***Terrapene ornata* Agassiz.**

Cistudo ornata AGASSIZ, Contrib. Natur. Hist. U. S., I, 1857, 445.—COPE, Bull. U. S. Nat. Museum, I, 1875, 53.—COUES & YARROW, Bull. U. S. Geol. Surv. Terr., IV, 1878, 260.—COPE, Bull. U. S. Nat. Museum, XVII, 1880, 13.—YARROW, *ibid.*, XXIV, 1883, 7, 37.—“GARMAN, Bull. Essex Inst., XVI, 1884.”—COPE, Proc. U. S. Nat. Museum, XI, 1888, 397.—“BOULENGER, Cat. Chelonians Brit. Mus., 1889, 118.”—GARMAN, Bull. Ill. State Lab. Nat. Hist., III, 1892, 220–221.—HAY, 17th Ann. Rept. Ind. Geol. and Nat. Hist. Surv., 1892, 595.—COPE, Proc. Acad. Nat. Sci. Phila., 1892, 333.

Terrapene ornata BAUR, Science, N. S., XVII, 1891, 190.—BAUR, Am. Natur., XXVII, 1893, 678.—TAYLOR, Proc. U. S. Nat. Museum, XVII, 1895, 573–588.—VAN DENBURGH, Proc. Calif. Acad. Sci., Ser. 2, VI, 1896, 338.—JORDAN, Manual of Vertebrates of North. U. S., 8th ed., 1899, 211.—BROWN, Proc. Acad. Nat. Sci. Phila., 1903, 544, 553.

Locality.—Three live specimens and a part of the shell of a fourth individual of this species were taken on the plain near Alamogordo. The residents state that it is not abundant and is only occasionally seen. Van Denburgh has recorded a specimen from the vicinity of Tucson, but we failed to find it in that region.

Description of Specimens.—The specimens obtained agree closely with Taylor's diagnosis and their description may be summarized as follows: Quadrato-jugal absent. Claws on fore-feet 5, on hind feet 4. Digits without distinct web. Phalanges in fore foot 2 in each digit. Carapace flattened above making it broadly oval in cross section. A median ridge is present but no keel, and the third vertebral plate is less than two-thirds as long as wide. Plastron widest across abdominal plates.

In all of the specimens the head is light brown above, with small spots of greenish gray; the throat is grayish yellow, and the neck above a dark gray. Likewise in all three specimens the skin on the body and legs is a uniform dull gray, and the large scales on the fore-legs have light yellow centers and dark brown borders.

In No. 462 the ground color above is light chocolate brown marked with small irregular greenish yellow maculations. These markings are rather indistinct, form no distinct pattern, and become quite obscure on the last two costal and sixth vertebral scutes. The plastron is a dull yellow with large dull brown blotches.

In No. 827 the ground color of the carapace is dark chocolate brown with distinct markings of dull greenish yellow, in the form of narrow bands which exhibit a tendency to radiate from the growth centers of the scutes and to form a median dorsal line. The plastron is dark chocolate brown with very numerous irregular bands of dull greenish yellow.

In No. 828 the ground color of the carapace is blackish relieved by numerous distinct greenish yellow bands that show a pronounced tendency to radiate from the growth centers, and form a nearly continuous vertebral line along the dorsal ridge. The ground color of the plastron is the same as that of the carapace, with numerous irregular bands of dull greenish yellow.

Habitat Relations.—These specimens were all taken on the plains in the Mesquite and Atriplex associations. It was not observed above the plains and, while this is in no way indicative that it does not occur on the mountain slopes, it is doubtful if it does so, as the stony nature of the ground would seem to be unfavorable to its burrowing habits. It was only observed after rains.

Range.—This Box Tortoise inhabits the more arid parts of the United States. Its home may be defined as the Great Plains and Prairie regions of central United States, and the arid plains of the Proplateau, but the limits of its range are yet to be drawn. Taylor¹ gave it in 1895 as occurring "from the Rocky Mountains east to Lake Michigan and Indiana, south to the Ozark

¹ Proc. U. S. Nat. Museum, XVII, 582-583.

Mountains, and east to western Indian Territory and central Texas, and from the Rio Grande River north to the Yellowstone River." Since then, however, Van Denburgh¹ has recorded a specimen from near Fort Lowell (Tucson, Ariz.), which extends the range considerably further to the westward. Taylor notes the fact that no species of *Terrapene* has been reported west of the Rocky Mountains, and suggests that this may be due to the "great elevation and consequent climate of the mountains." This explanation is probably the true one on the Great Plains, for being an arid type the increased moisture that characterizes the slopes of the Rockies, as well as the increased altitude and lower temperatures, probably serve to limit its habitat on the west. In the Proplateau region, however, this barrier does not exist, as the arid basins form a highway by which plains types may push into the southern parts of New Mexico and Arizona. That the Western Box Turtle takes advantage of this highway is shown by the following locality records: San Antonio to Fort Inge, Texas (Taylor); Alamogordo and Las Cruces, N. M., and El Paso, Texas (Taylor); Fort Lowell, Arizona (Van Denburgh).

Terrapene ornata Agassiz.

| Habitat | Field No | Locality | When Collected | Collector |
|----------------|----------|---|----------------|----------------|
| Mesquite Assn. | 178 | Alamogordo, N. M. Plains south of Alamogordo | July 11-06 | G. von Krockow |
| " | 327 | Plains west of Alamogordo | July 16-06 | " |
| " | 328 | " | " | " |
| Atriplex Assn. | 462 | " | July 19-06 | A. F. Zimmer |

SUMMARY AND CONCLUSIONS.

In the following table the local distribution of the different species of reptiles² taken at Alamogordo, N. M., and Tucson, Ariz. has been summarized.

¹ Proc. Calif. Acad. Sci., Ser. 2, VI, 338.

² The data on the habitat distribution of the amphibians of this region is entirely too small to permit of any generalizations at present.

Habitat Distribution of the Reptiles taken at Alamogordo, New Mexico, and Tucson, Arizona.

| ALAMOGORDO, NEW MEXICO | | | TUCSON, ARIZONA | | |
|------------------------|---|--|--|---|--------------|
| Fauna | Habitat | Species | Species | Habitat | Fauna |
| Summit Type | Mountain slopes between 7000 and 10,000 ft. (Pine-Spruce Assn.) | Phrynosoma hernandesi | (?) | Mountain summits (Pine-Spruce Assn.) | Summit Type |
| | Mountain slopes between 5500 and 7,000 ft. (Piñon-Cedar Assn.) | (<i>Uta ornata</i>) <i>Sceloporus consobrinus</i> (<i>Phrynosoma hernandesi</i>) <i>Pituophis catenifer sayi</i> | (<i>Uta ornata</i>) (<i>Sceloporus consobrinus</i>) (<i>Phrynosoma hernandesi</i>) | Higher Mountain slopes (Piñon-Cedar Assn.) | |
| Plateau Type | Wet cañons below 5500 feet | (?) | Kinosternon sonoriense <i>Cnemidophorus gularis</i> <i>Uta ornata</i> <i>Holbrookia maculata approximans</i> <i>Thamnophis eques</i> <i>Sceloporus darkii</i> | Wet cañons below 6,000 feet (Willow-Poplar Assn.) | Plateau Type |
| | | | <i>Sceloporus darkii</i> <i>Uta ornata</i> <i>Cnemidophorus gularis</i> | River banks on plains (Willow-Poplar Assn.) | |
| | Mountain slopes below 5,500 ft. (Sotol-Ocotillo Assn.) | (<i>Uta stansburiana</i>) <i>Crotaphytus collaris baileyi</i> (<i>Sceloporus consobrinus</i>) (<i>Pituophis catenifer sayi</i>) | <i>Uta stansburiana</i> <i>Bascaron piceum</i> <i>Heloderma suspectum</i> <i>Cnemidophorus melanostethus</i> | Alluvial slopes, hills (Sotol-Ocotillo Assn.) | |
| | | | <i>Cnemidophorus melanostethus</i> <i>Crotalus atrox</i> <i>Uta stansburiana</i> | Alluvial slopes, arroyos (Acacia Assn.) | |
| | Dry cañons below 5,500 ft. (Sotol-Ocotillo Assn.) | <i>Cnemidophorus gularis</i> (<i>Holbrookia texana</i>) | <i>Callisaurus ventralis</i> <i>Holbrookia maculata approximans</i> | Alluvial slopes (Creosote bush Assn.) | |

| Arid Plains Type | | | Arid Plains Type |
|--|---|--|--|
| Alluvial slopes (Creosote-bush Assn.) | Cnemidophorus melanostethus Uta stansburiana Sceloporus magister Crotaphytus wislizenii Pituophis catenifer sayi Phrynosoma cornutum Anotia modesta Sceloporus consobrinus | Cnemidophorus melanostethus Uta stansburiana Sceloporus magister Crotaphytus wislizenii Pituophis catenifer deserticola Arizona elegans Phrynosoma solare Bascantion flagellum frenatum Salvadora hexalepis Arizona elegans Crotalus atrox | Plains (Creosote bush Assn.) |
| Alluvial slope arroyos (Sotol-Ocotillo Assn.) | Cnemidophorus gularis | Callisaurus ventralis Holbrookia maculata approximans | Washes on the plains (Acacia Assn.) |
| Margin of plains (Mesquite Assn.) | Cnemidophorus sexlineatus Anotia modesta Phrynosoma cornutum Pituophis catenifer sayi Sceloporus consobrinus Uta stansburiana | (?) | Near streams on plains (Mesquite Assn.) |
| Central depression (Atriplex Assn.) | Cnemidophorus sexlineatus Crotaphytus collaris baileyi Phrynosoma cornutum Anotia modesta Sceloporus consobrinus Uta stansburiana Gyalophilum canum | Cnemidophorus melanostethus Callisaurus ventralis | Salt spots (Atriplex Assn.) |
| White Sands Sumac-Yucca Assn.) | Sceloporus consobrinus (observed on first dunes only) Cnemidophorus sexlineatus Holbrookia maculata flavilenta | | |

From the data in the annotated list, as summarized in the above table, it may be noted:

1. *That each set of environmental conditions which is marked out by a distinct plant association has a definite reptile fauna.*

2. *That the reptile fauna of the Pine-Spruce and Piñon-Cedar association is (considered together) composed of but few species, some of which are partly arboreal in habits.* As the reptiles are a tropical group this is the condition of affairs that we should expect since the environmental conditions in these associations, so far as they affect the reptile life, may be summarized as follows: cold winters and cool summers, greater precipitation, abundant arboreal vegetation.

3. *That the reptile fauna which inhabits the wooded riparian habitat on the plains is very similar to that of the Pine-Spruce and Piñon-Cedar associations.* This is also what we might expect from the similarity in the conditions and the continuity that exists between these two habitats.

4. *That the biota of the terrestrial habitats below the Piñon-Cedar association, with the exception of the riparian habitats, are more nearly related to each other than to those above them, and may be considered as belonging to a single type—that of the Arid plains.* This is shown by the fact that very few of the forms found below the Piñon-Cedar zone are peculiar to a single association, most of them occurring in two or more habitats, while but few occur also in the Piñon-Cedar association or above.

This may be attributed to the fact that the environmental conditions within this area differ gradually and only in a limited degree, so that the biota of the different habitats do not become strikingly different, the effect of the change in the conditions being shown principally by a difference in the relative abundance of the species. The conditions of all the subhabitats are very arid and the vegetation low and scanty, so that the reptile faunas of the different associations must conform to the same general conditions. That they do so is shown by the fact that they all possess the following characteristics: (a) they require a minimum amount of water, (b) they are all ground forms, and those which do not rely for protection upon their powers of defense depend upon their powers of locomotion, the protection of holes or a protective resemblance to the soil, (c) their food consists primarily of ground-forms such as ants, grasshoppers, small mammals, other reptiles, etc.

5. *That the affinities of the biota of the Pine-Spruce and Piñon-Cedar associations are with the Rocky and Sierra Nevada Mountains.* These associations are confined in the Proplateau region to the higher elevations but to the northward spread over the High Plateau. This is well illustrated by the range of three of the characteristic forms.

(a) *Juniperus monosperma*. "Along the eastern base of the Rocky

Mountains from the divide between the Platte and Arkansas rivers in Colorado to western Texas, spreading over the Colorado plateau, over the mountain ranges of Nevada, southern New Mexico and Arizona, and southward into northern Mexico; often covering with the Nut Pine, in southern Colorado and Utah and in northern and central New Mexico and Arizona, great areas of rolling hills 6,000° to 7,000° above the sea level; reaching its largest size in northern Arizona." (Sargent, Manual of the Trees of N. A., 93).

(b) *Pinus ponderosa*. "The form of the Rocky Mountains (var. *scopulorum*, Engelm.), ranging from Nebraska to Texas and over the mountain ranges of Wyoming, eastern Montana and Colorado, and to northern New Mexico and Arizona, where it forms on the Colorado plateau the most extensive Pine forests of the continent." (Sargent, Manual of the Trees of N. A., 16).

(c) *Phrynosoma hernandesi*. "The wooded plateau region of Colorado, Utah, New Mexico, and Arizona." (Stejneger, North Amer. Fauna, No. 3, 113).

6. That most of the reptiles of the Arid plains are characteristic of the Proplateau region and Mexican Plateau, but the fauna shares several forms with central Texas on the east and the Sonoran Desert on the west, and in return receives at its margins several species from these regions. For example, *Cnemidophorus melanostethus*, *Holbrookia approximans* and *Sceloporus magister* may be considered peculiar to the Proplateau region, while *Cnemidophorus sexlineatus* enters its borders on the east from the Prairie region of Central Texas, and *Callisaurus ventralis*, *Phrynosoma solare* and *Heloderma suspectum* on the west from the Sonoran Desert.

7. That several of the Arid plains forms which occur also in central Texas show a tendency to become differentiated from their eastern representatives in southern New Mexico and western Texas. The better known examples of this have been discovered by Stejneger. They are *Pituophis catenifer deserticola* and *P. catenifer sayi*, *Coleonyx variegatus* and *C. brevis*, *Crotaphytus collaris* and *C. collaris baileyi*.

Corresponding, therefore, with the different sets of environmental conditions previously pointed out (the Mountain summit, Plateau and Arid plains habitats), there are three distinct biota in the Proplateau region. Merriam¹ in his map of the life zones of North America does not recognize the Arid plains habitat in southeastern Arizona and southwestern New Mexico, but in eastern New Mexico has defined our three major habitats as Transition (Mountain Summit), Upper Sonoran (Plateau) and Lower Sonoran (Arid plains) zones, and his application of the two former terms

¹ Year book Dept. of Agriculture, 1894.

has been followed by later writers. Cockerell,¹ however, has pointed out that the Arid plains biota is to be distinguished from the rest of Merriam's Lower Sonoran zone (which included central Texas and southwestern Arizona), and has suggested the name of Middle Sonoran for this habitat, which he held to be a part of the Upper Sonoran zone. Bailey,² however, while recognizing the difference between the biota of the Arid plains of the Trans-Pecos region and that of the Prairie region of central Texas, places the former as a subdivision (extreme arid Lower Sonoran) of the Lower Sonoran, thus recognizing that its affinities are with the Prairie region of central Texas rather than with those of the Piñon-Cedar association, which is obviously the case. Furthermore, although Merriam includes this habitat with the low plains of southwestern Arizona in his lower Sonoran zone, it must be recognized that, at least from the standpoint of the reptile life, these two regions are quite as distinct as are the Arid plains of the Proplateau and the Prairie region of central Texas. It is a broad generalization to class these three regions together in one "zone."

On the whole, it seems advisable at the present time, at least from the standpoint of reptiles, not to attempt to stretch any one "zone" over the entire continent, but rather to express the relationships of the biota of the different regions studied, in provincial terms. Until more data shall have been accumulated such wide generalizations serve to obscure the finer details of habitat distribution.

The present distribution of the reptiles of this region has been described above as if the present conditions were stable. They are far from being so, however. The mountains are being rapidly denuded, and the habitat of the Pine-Spruce and Piñon-Cedar associations consequently destroyed. The higher intermontane basins (of the type of the Hueco bolson) are being filled up, as the mountains are lowered, and will in time obtain streams of their own by the headward erosion of the streams in lower and adjoining basins. When this has taken place the Mesquite association will become confined principally to the stream margins, the Creosote bush association will move down upon the plains, and the Atriplex association will become restricted to local areas, a stage which is represented at Tucson at the present time. The arid plains forms thus tend to become the climax type. Davis³ has characterized the advanced stage in the geographical cycle as follows: "the initial relief will be extinguished even under the slow processes of desert erosion, and there will appear instead large, rock-floored plains sloping toward large waste-floored plains; the plains will be interrupted only where

¹ New Mex. Agric. Exp. Sta., Bull. 15, 24, 28. Amer. Natur., XXXIV, 285-293.

² North Amer., Fauna, No. 25.

³ Jour. of Geology, XIII, 388.

parts of the initial highlands and masses of unusually resistant rocks here and there survive as isolated residual mountains." We should expect, therefore, that as the aridity increased the forms in the more arid regions adjoining (southwestern Arizona) would push in, possibly to the exclusion of the present forms.

Far too little is known of the geological history of this region to permit of the application of this order of succession to the solution of the problem of the origin of the different biota at present found in the Proplateau region. Since, however, the characteristic forms of the Arid plains, Piñon-Cedar and Pine-Spruce associations belong to genera which have their greatest development on the plains in this region it seems safe to adopt the conclusion, at least as a working hypothesis, that the reptiles of the Arid plains have had their origin in this general region (Mexican plateau and Proplateau), and that the forms of the Piñon-Cedar and Pine-Spruce associations have been derived from them.

