

TRANSACTIONS  
OF THE  
SAN DIEGO SOCIETY OF NATURAL HISTORY  
VOLUME X, No. 11, pp. 133-216, 2 maps

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THE GECKOS OF THE GENUS *COLEONYX*  
WITH DESCRIPTIONS OF NEW SUBSPECIES

BY

LAURENCE M. KLAUBER

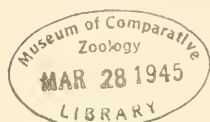
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SAN DIEGO, CALIFORNIA

PRINTED FOR THE SOCIETY

MARCH 9, 1945



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## INTRODUCTION

The geckos of the genus *Coleonyx* are found only in North America. These lizards occur from the arid areas of the southwestern United States southward to the jungles of Panamá. While they have sometimes been placed in a family known as the Eublepharidae, erected by Boulenger in 1883 to comprise three genera characterized by the possession of single parietal bones, more recently they have been re-included in the far more generalized and widespread family Geckkonidae, partly as a result of the work of Noble (1921, p. 1), who determined that the genera assigned to the family Eublepharidae were probably of polyphyletic origin. For this reason the latter family is no longer generally recognized as valid, and the same may be said of the subfamily Eublepharinae suggested by Gadow (1901, p. 512). This decision has, however, been questioned by Walls (1942, p. 623), premised on eye structure.

## HISTORICAL

*Coleonyx* is a genus of geckos moderate to small in size, with bodies largely covered with granular scales. The genus was proposed by Gray (1845, p. 162) for the species *elegans*, type locality Belize, British Honduras.

In 1851 A. Duméril (in Duméril and Duméril, p. 45) described *Gymnodactylus scapularis*, type locality Petén, Guatemala; in 1858 he renamed the same species *Gymnodactylus coleonyx* (p. 483). Both names are now considered synonyms of *C. elegans*, Gray.

In 1858, Baird (p. 254) described *Stenodactylus variegatus*, type locality the Colorado Desert. This was placed in the genus *Coleonyx* by Cope (1866b, p. 310). It was distinguished from *elegans* by its lack of scattered tubercular scales among the granules on the dorsum.

Peters (1863, p. 41) described *Brachydactylus mitratus* from Costa Rica. While this also has been sometimes synonymized with Gray's *C. elegans*, it has more recently been considered a valid species (Schmidt, 1928).

In 1885 Boulenger placed Baird's *variegatus* in the genus *Eublepharis* (originally set up for certain Asian forms), and described two new species: *E. dovii* (p. 233) from Panamá, and *E. fasciatus* from Ventanas, western Durango, Mexico (p. 234). *Dovii* is sometimes considered valid (e.g. Werner,

1912, p. 8), sometimes a synonym of *elegans* Gray, 1845 (e.g. Wettstein, 1934, p. 19), and sometimes a synonym of *mitratus* Peters, 1863 (Schmidt, 1928, p. 194). Most authors, including Stejneger (1893, p. 163) and Van Denburgh (1922, p. 58), have placed *fasciatus* in the synonymy of *variegatus* Baird, 1858; but more recently Taylor (1935, p. 203), having available an additional specimen, which he himself collected in southern Sinaloa, has demonstrated the validity of Boulenger's *fasciatus*.

Stejneger (1893, p. 162) felt that Boulenger's generic arrangement, which was based on the relative sizes of claw sheaths, was artificial in that it split the American forms among two genera, one of which, *Eublepharis*, was largely southwest Asian. He suggested a rearrangement on a basis of the presence or absence of enlarged chin shields. This had the very practical effect of placing all the American species in the genus *Coleonyx*, while the African and Asian species were assigned to *Hemitheconyx* and *Eublepharis*, respectively. This is the generic arrangement currently followed by most authors, (e.g. Werner, 1912, p. 7; Parker, 1930, p. 603; M. A. Smith, 1935, p. 125).

While Stejneger did not recognize *C. fasciatus* of Boulenger, he described the Texas specimens hitherto assigned to *C. variegatus* as a new species, *C. brevis*, based on a shorter snout, smaller anterior nasals, and more numerous labials. Recently H. M. Smith (1933, p. 301) has pointed out additional and more consistent differences between *brevis* and *variegatus*. He likewise extended the known range of the Texan species.

Thus to date eight species of *Coleonyx* have been described, all North American, of which five are usually recognized as valid, as follows:

*C. elegans* Gray, 1845; southern Mexico and northwestern Central America.

Synonyms: *Gymnodactylus scapularis* A. Duméril, 1851.

*Gymnodactylus coleonyx* A. Duméril, 1858.

*C. variegatus* (Baird), 1858; eastern and southern California, southern Nevada, southwestern Utah, western and southern Arizona; and Lower California and northwestern Sonora, Mexico.

*C. mitratus* (Peters), 1863; Salvador to Panamá.

Synonym: *Eublepharis dovii* Boulenger, 1885.

*C. fasciatus* (Boulenger), 1885; western Durango and Sinaloa, Mexico.

*C. brevis* Stejneger, 1893; southern New Mexico, southwestern Texas; and Coahuila, Nuevo León, and eastern Durango, Mexico.

These species may be readily divided into two groups: *variegatus*, *fasciatus*, and *brevis* in the north, characterized by uniformly granular dorsal scales; and *elegans* and *mitratus* in the south, with mixed tubercular and granular scales on the dorsum. There is a considerable territorial gap in central Mexico between the two groups, as far as their ranges are known at this time.

## DISCUSSION OF CHARACTERS

This investigation started in an endeavor to determine whether the banded individuals of *Coleonyx variegatus* from coastal southern California might be recognized as a valid subspecies. Gradually other territorial differences within the species became evident, so that, as is frequently the case, it became desirable to widen the scope of the research.

On the species level in this genus, it has long been known that the most useful differential characters are the presence or absence of enlarged dorsal scales, the shape of the snout, the nature of the scales on the toes (especially the claw sheath), and the number and arrangement of the preanal pores. I have found, on the subspecific level, that the number of gulars touching the mental, the shape of the mental, the extent of separation of the prenasals and also of the supranasals, the number and configuration of body bands, and the head markings are of some value, although by no means all criteria show differences between every pair of subspecies.

Countable characters, or those which are present or absent, are much more useful in keys than those of the ratio or proportionality type (e.g. ratio of width of orbit to length of snout), and are therefore employed wherever possible. Some characters often used in classifying lizards are rather inefficient, or suffer from particular limitations, in this genus. For example, the preanal pores are clearly evident only in the adult males of some species, thus reducing the useful specimens as far as this criterion is concerned. In the young males of *variegatus* the pores are represented by uncolored indentations, and in the females by enlarged, but flat scales, which, however, sometimes are centrally depressed. Even in the adult males, although they are usually yellow or brown, the pores sometimes lack color (probably the result of seasonal inactivity), and occasionally one on the edge of the series, even when colored, will be seen to be rudimentary, represented by a tiny brown dot. As by no means all enlarged scales in the adult males have pores, even though they may seem a part of the pore series, it is evident that counts in females, based only on enlargement or faint indentations, are of doubtful value. This is less true in the tubercular species wherein the females' scales of the pore series are more definitely indented.

The enlarged supralabials can be counted with a fair degree of accuracy by ending the count where the plates are no longer definitely enlarged, that is where they approximate in size, the granular scales comprising the adjacent head covering. This is usually somewhere below the middle of the orbit. The infralabials, on the other hand, curve inward, out of view when the mouth is closed, in such a way that the posterior members of the enlarged series are concealed. They are difficult to limit and it is probable that observers would often disagree as to their number. Thus, while there are average subspecific differences in labials, they have little practical diagnostic value.

It is unfortunate that most scale series in *Coleonyx* are either so small, so irregular in arrangement, or so indefinite as to point of termination, that it is impractical to count them; for I have little doubt some would prove useful in diagnosis, particularly the scales on the top of the head between the eyes or

along the snout, the lamellae on some finger or toe, or the scales bordering the eyelids. In the large species *elegans*, some of these series are of sufficient size and definiteness to be counted with accuracy, but in *variegatus*, where they are most needed, they are too minute and irregular to be of much practical value.

Of the variable but definitely countable scales, I have found those touching the mental (or the mental together with the first infralabials) to be most useful. These can be counted quite readily, even in the smallest specimens, and there is seldom a questionable decision to make respecting any single scale.

The shape of the mental is of some importance but suffers from the usual limitations of characters involving proportions or shape.

Notwithstanding the notable ontogenetic pattern change which takes place in *C. variegatus*, certain localized modes are clearly evident, so that some rather consistent territorial pattern types may be defined. However, these characters of pattern, whether of head, body, or both, are generally useful only with respect to adults, for the juveniles from all areas are much alike.

I have always found it desirable, before utilizing characters in diagnosis, to ascertain their variability within homogeneous series, for obviously their importance in distinguishing between forms must be dependent on their intrasub-specific variation, or rather its opposite, consistency. In the present case the best series of *Coleonyx* available to me is one from desert San Diego County. Hence I shall use this series to define and describe the variability of *Coleonyx variegatus variegatus*, and shall start the discussion of the genus with this subspecies, rather than with *elegans*, which was first described.

#### GENUS COLEONYX Gray

*Coleonyx* Gray, 1845, Ann. and Mag. Nat. Hist., Vol. 16, p. 162. Type species *elegans*.

*Brachydactylus* Peters, 1863, Mon. Berl. Acad., p. 41. Type species *mitratus*.

There is a single parietal bone. The skin is soft and unattached to the bones of the skull. The males have preanal pores in an angular series. There is an ear opening. The eyes are large; the pupils vertically elliptical; the eyelids are functional and are internally pigmented with black. The tail (when original) is subcircular in cross section and regularly tapering, without transverse constrictions. The lower surfaces of the digits are sheathed with a uniform row of strongly imbricate transverse lamellae. They terminate in pointed claws which are partly or entirely hidden by two shell-like lateral scales capped by a pointed terminal. The dorsal scales are finely granular with or without tubercles scattered among them. The ventral scales are flat and imbricate. The gulars contacting the mental are similar to those which follow, although they may be somewhat enlarged; there are seldom as few as 3 contacting the mental.

#### ***Coleonyx variegatus variegatus* (Baird)**

DESERT BANDED GECKO

1858. *Stenodactylus variegatus* Baird, Proc. Acad. Nat. Sci. Phila., Vol. 10, p. 254. Type specimen: USNM 3217. Type locality: Colorado Desert.



1866. *Coleonyx variegatus* Cope, Proc. Acad. Nat. Sci. Phila., Vol. 18, pp. 125, 310.

1885. *Eublepharis variegatus* (part) Boulenger, Cat. Lizards Brit. Mus., Vol. 1, p. 233.

*Type*.—The type specimen, USNM 3217, has apparently been lost. It is figured in Baird, 1859, plate 23, figs. 9–18. It is a specimen of the speckled desert type and therefore an adult, probably a female.

The type locality is sometimes cited as the “Rio Grande and Gila Valleys” but this is merely the range as given in Baird’s original description. The place of collection of the type specimen was the “Colorado Desert,” which, from the itinerary of the collecting party, may be taken as somewhere along the southern border of what is now Imperial County, California.

*Diagnosis*.—On the specific level *variegatus* may be distinguished from the southern Mexican and Central American members of the genus by the absence of tubercles among the scales on the dorsum. From *brevis* it may be segregated by the arrangement of the preanal pores, which, in *brevis*, are divided medianly into two groups by the interposition of small scales without pores, while in *variegatus* the scales carrying the pores are almost invariably confluent at the apex of the series. From *fasciatus*, *variegatus* may be distinguished by its blunter snout and wider head, more slender digits, and differences in pattern and color. The body bands of *fasciatus* are darker than any *variegatus*, and there are only 3 between limb insertions, instead of 4 as in most *variegatus*.

On the subspecific level *variegatus variegatus* may be segregated from the subspecies subsequently to be described as follows: from *slevini* by the higher number of gulars in contact with the mental; from *bogerti* by having fewer preanal pores, on the average, and a deeper mental; from *abbotti* by the loss of the nuchal light line and the presence of spots on the head in the adults; from *utahensis*, *sonoriensis*, and *peninsularis* by the narrow transverse adult body bands, which are usually little or no wider than the interspaces (and are often considerably narrower), whereas, in the other three the bands are much wider than the intervals between. Further, the *variegatus variegatus* bands, having light centers, have a double-barred effect not evident in the others. All of these pattern differences have reference to adults, and to the majority of the specimens found in the center of dispersal of each subspecies. There are occasional deviates, even in these centers, and intergrades are naturally to be expected in areas of contact between subspecies.

*Range*.—The subspecies *variegatus variegatus* is found in the deserts of southeastern California from northern Inyo County southward; southern Nye and southwestern Clark counties, Nevada; Arizona from the central mountain area west and south, but not including the section east of the line Casa Grande-Covered Wells; extreme northwestern Sonora, and extreme northeastern Lower California, Mexico.

*Example Series*.—As its name suggests, *Coleonyx variegatus* is an extremely variable species, especially in markings and, to a lesser extent, in size and form. An examination of adequate series, however, soon discloses that the variations

are not haphazard; on the contrary, they fall into fairly consistent geographical patterns, although somewhat complicated by ontogenetic changes in markings and color. Several of these warrant subspecific recognition.

For purposes of orientation I shall first discuss the typical subspecies; fortunately in this case the original name was applied to the population which comprises the central core of the complex. Following this I shall describe the subspecies which occupy various sections of the peripheral territory.

However, *variegatus variegatus* itself ranges over so large an area that it is subject to some intrasubspecific variability, although without sufficient consistency—at least as far as can be determined from the available material—to warrant further nomenclatorial subdivisions. I shall therefore first describe a still more restricted series and discuss its internal variations in order to determine the extent of the dispersion existing in a homogeneous population. Following this I propose to outline the differences apparent in adjacent territories within the subspecies, and finally shall proceed to the descriptions of the new subspecies.

The best available homogeneous series is from the Borego area of north-eastern San Diego County. Here these geckos are quite common and may readily be collected by driving along the paved highway at night, picking them up in the glare of the headlights. This area is not far distant from the type locality, which is somewhere along the Mexican border, about 50 miles across the desert to the southeast. I have available from the Borego area 143 specimens, mostly in my own collection. In addition, there are at hand 183 specimens of the subspecies from other areas. The following description is based on the Borego series only.

*Morphology.*—A lizard of average habitus, not particularly depressed, either in head or body, as are many geckos. The limbs are relatively short and weak; however, when adpressed they overlap. The head is wedge-shaped, both horizontally and vertically; the snout is rather blunt. The nostrils are large and circular, and lie below the canthal ridge. The ear openings are quite prominent, but vary considerably in relative size. They are usually elliptical in shape with the axis oblique, sloping forward and downward. The eyelids are functional and are lined with black pigment within. The pigment shows through the skin.

Specimens undeformed in preservation have a mid-dorsal groove, with a low rounded ridge on either side. Sometimes there is a pair of secondary ridges. A short mid-ventral umbilical line is present.

The largest specimens in this series (but not the maxima for the subspecies) are two females each measuring 74 mm., snout to vent. Six other females range from 70 to 72 mm., so this length is not to be considered exceptional. The longest male is 69 mm.; there are several measuring 67 mm. Approximately this size difference in favor of the females is found in all subspecies. The smallest individual measures 43 mm.; this, however, must not be taken as a minimum juvenile size, but results from the method of collecting, which is not so prolific of young as that of prying off rocks or overturning debris.



The tails, when complete and original, are about equal to the body in length, the difference seldom exceeding 10 per cent in either direction.

Table 1 gives several measurements of three example adults of each sex.

TABLE 1  
Dimensions of Example Adult *variegatus variegatus*  
Borego Series (in mm.)

	Males			Females		
Snout to vent	63.0	62.0	65.0	69.0	71.0	71.0
Length of head	15.3	15.7	16.5	17.1	16.8	17.4
Width of head	11.5	10.7	11.0	11.8	11.6	12.1
Depth of head	7.0	6.3	7.5	8.1	7.2	8.3
Snout to center of orbit	8.0	7.2	7.6	8.3	7.9	8.2
Snout to ear	14.5	13.2	14.6	14.7	15.0	15.2
Snout to arm insertion	26.0	26.0	25.0	27.0	29.0	26.0
Between limb insertions	34.5	34.0	36.5	38.5	39.0	41.0
Arm to end of fourth finger	19.5	18.5	21.0	20.0	21.0	19.0
Leg to end of fourth toe	25.0	26.5	27.5	29.0	27.5	26.0
Length of cloacal bones	1.9	1.6	1.6	*	*	*
Distance between points of cloacal bones	8.2	7.8	7.7	7.0	6.5	7.6

\* Too small to measure accurately.

There is no difficulty in sexing adults; the males may be easily recognized by the presence of preanal pores, a postanal swelling, and lateral postanal bony spurs, usually termed cloacal bones.

The variation in the preanal pores in the males is as follows (the first figure indicates the number of pores while the second—in parenthesis—gives the number of individuals with that tally): 4 (1), 5 (10), 6 (36), 7 (15), 8 (10), 9 (2); mean 6.39; coefficient of variation 15.9 per cent. Only the adult males are included, since one cannot be sure that all uncolored depressions exhibited by the juveniles will develop into active pores.

The scales containing the pores are in an obtuse angular series with the point forward. The two wings of the angle meet in the center.

A considerable variation in the development of the preanal pores will be noted, even though only adult males be considered. This is believed to be a seasonal effect. At the peak of development (or activity) the pore occupies a considerable part of the scale in which it is centered, although not reaching the comparative size noted in *elegans* and some other species. At the time of maximum activity the pores of preserved specimens will be found to contain a clear yellow core, which may readily be lifted out as a solid cylinder.

Occasionally, in fully developed males, imperfect pores, smaller than the others, are to be noted; these are usually at the posterior end of a series. While

pores generally center in the scales which carry them, asymmetrical settings have been noted. Rarely, there are two pores in a scale.

The cloacal bones in *variegatus variegatus* adult males are moderately wide. They curve outward and forward. They are ridged and sloping on the upper edge, with the points forward. They are somewhat striated and the ridge is often notched. These processes are flexible and have a surface of skin, which is shed like that on the rest of the body. The use of these spurs has been discussed by Greenberg, 1943. The females have rudimentary spurs which are mere tiny points.

*Coleonyx variegatus* lays two eggs, which, at the time of deposition, are quite large. The egg carried on the right side is considerably anterior to that on the left. A specimen 74 mm. long from Yaqui Well, San Diego County, contained eggs measuring  $9\frac{1}{2}$  by  $18\frac{1}{2}$  mm. on May 25. Another from  $2\frac{1}{2}$  miles northeast of Vincent, Los Angeles County, with a head and body length of 70 mm., contained eggs  $9\frac{1}{2}$  by  $20\frac{1}{2}$  mm. on June 21. It is presumed that the eggs would normally be laid at about this time.

The hemipenes are single, with single sulcus. They are distally enlarged and terminate in fine reticulations.

Both males and females have paired post-anal sacs, with slightly oblique openings.

*Scalation*.—The head is covered above and below with non-imbricate circular granules, except for the scutes which border the mouth, nostrils, and eyes. The granules are somewhat enlarged on the snout and where they contact the labials. The rostral is the largest of the head scales except the mental; it is pentagonal in shape, with shorter sides engaging the first supralabials, and longer concave edges contacting a pair of prenasals. The rostral is wider than high and is pointed at the top. The enlarged supralabials, which are not always easy to assign a definite count, since they gradually decrease in size posteriorly until they become granules, number as follows: 6 (1), 7 (73), 8 (139), 9 (48), 10 (2); mean  $7.91 \pm 0.04$ ; coefficient of variation 8.92 per cent. The last enlarged scales are generally anterior to a point below the center of the orbit. The first supralabials are the largest of the series, being both higher and longer than those which follow. There is a pair of slim, triangular prenasals which broadly engage the rostral and barely touch the first supralabials at their lower ends; this contact is occasionally prevented by the interposition of a granular scale. The two prenasals usually touch medianly, but such contact is prevented in 42 specimens out of 138 (30.4 per cent) by the presence of one or more granules between. There is usually a very small subnasal, and two postnasals, the upper being the larger. There is a circular supranasal on each side, larger than the postnasals. The supranasals do not contact each other, as there are one or more granules interposed. Counting the minimum number of scales bridging this gap we have the following dispersion: 1 (4), 2 (28), 3 (83), 4 (18), 5 (5); mean 2.94; coefficient of variation 26.13 per cent.

The eyelids are edged with enlarged and imbricate scales forming a serrated line. There are about 17 scales bordering the upper lid and 19 or 20 the lower.

The scales at the ends of each series are quite small and therefore difficult to count. Posteriorly they are pointed.

The mental is the largest single scale on the head. Along the edge of the mouth it equals or is slightly wider than the rostral. It is somewhat wider than deep, the ratio being about 0.9. The sides are slightly convergent posteriorly. The bottom edge is an arc of rather short radius.

The infralabials usually number 8 to 10, this being the count with the mouth closed. Since these scales curve over the edge of the mouth, the posterior members of the series are not visible unless the mouth be open. The visible enlarged members of this series usually terminate somewhat posterior to the enlarged supralabials, that is, back of the center of the orbit. The first infralabial is considerably deeper than the rest of the series, although not so wide as some of those which follow. There is more reduction in size in the infralabials from front to back than in the supralabials.

The gular scales contacting the mental can be counted definitely and constitute a character differentiating some of the subspecies. In this series the dispersion is as follows: 4 (4), 5 (32), 6 (48), 7 (34), 8 (15), 9 (4), 10 (0), 11 (1); mean  $6.30 \pm 0.10$ ; coefficient of variation 18.7 per cent. The total gulars touching the mental, together with the first infralabial on either side, are: 8 (1), 9 (25), 10 (36), 11 (36), 12 (31), 13 (6), 14 (2), 15 (0), 16 (1); mean  $10.75 \pm 0.11$ ; coefficient of variation 12.1 per cent.

The dorsum is covered with granules of similar size to those on the head. There are no enlarged tubercles. In some specimens the granules become slightly larger posteriorly. On the sides the scales are somewhat enlarged, flatter, and imbricate; at the points of insertion of the limbs, however, they remain small. Ventrally the scales are much larger than the dorsal granules; they are imbricate with rounded ends. There is a tendency toward an increase in size both posteriorly and medianly. Many of these scales have tiny indentations (single or in pairs) on the posterior edges; these may be analogues of the apical scale pits of snakes.

The regularity of the posterior abdominal scales is broken by an umbilical line, which is bordered by irregular scales. The largest abdominal scales are in a preanal patch, which, in the males, includes the angular series containing the preanal pores.

The tail is covered with annular rows of subrectangular and imbricate scales of larger size than those on the body. These are largest ventrally. Where the tail is thickest there are about 36 to 42 scales in a ring. In regenerated tails (which are thicker than originals) the scales are somewhat enlarged, and the rings rather irregular.

The scales on the arms are mostly imbricate, except on the lower or inner side of the upper arm. The scales are largest on the upper side of the wrist. The palmar surface is covered by tubercular scales; the upper sides of the hands and fingers are covered by strongly imbricate scales. Below on the digits there are series of rectangular lamellae. These are so thick and strongly imbricate as to form a series of transverse ridges, thus comprising a longitudinal row of

corrugations. The claws are sharp and delicate; they are formed by lateral compression of scale-like members, and are, therefore, hollow. They are held between a pair of lateral shell-like scales, the infero-laterals of Parker, 1926. On the top, the crevice between these (out of which the claw issues) is capped by a single, pointed scale (the terminal); while on the bottom the crevice is covered by a broader, shorter, and blunter, scale. There are about 17 lamellae on the fourth finger.

The thighs are covered with enlarged imbricate scales on the anterior surface and small granular scales behind. On the lower section of the legs the relationship is reversed; the larger scales are behind, the smaller forward. The coverings of the feet and toes, and the housing of the claws, are similar to those on the fingers. There are about 22 lamellar corrugations on the fourth toe.

*Pattern and Color.*—In the juvenile stage *variegatus variegatus* is not materially different in pattern from the other subspecies, although the head is somewhat lighter in color, and the dorsal cross-bars are both lighter and narrower (compared with the interspaces) than the others.

The juvenile pattern may be described thus: The head above is light-brown, somewhat darker on the snout and laterally. The canthal ridge is light; below this there is a dark bar. The labials, particularly the upper, are mottled with brown; sometimes the color is so disposed that individual scales are either entirely light or dark. Below each eye there is a narrow light line which passes backward above the ear; these lines join to form a loop on the anterior part of the neck. This postparietal or nuchal light loop is highly characteristic of the juveniles of all *variegatus* subspecies, but it is less perfect—that is, less definitely and evenly outlined—in *variegatus variegatus* juveniles than in the other subspecies.

On the neck there is a broad, brown cross-band with pointed extensions carried forward laterally toward the ears. These comprise the posterior borders of the light nuchal loop.

On the body there is a series of medium-brown cross-bands, usually 4 between limb insertions; they are approximately as wide as the cream-colored interspaces or somewhat narrower. They often curve forward laterally. The ventral surface is clear white. The tail (if not regenerated) is also barred; the rings may be slightly darker than those on the body.

The change from the juvenile to adult pattern is quite marked in this subspecies, and there is a considerable variability in the manner of its occurrence. The head first becomes mottled and finally spotted with brown on a cream background. The mottling begins to appear at a body length of from 35 to 45 mm. and constitutes the earliest change from the pattern of *abbotti*. In its final phase the identity of the light nuchal loop is often completely lost, and in any case it becomes ill-defined and irregular. The light canthal lines are generally retained, and the darkest marks on the head are the dashes which comprise their lower borders; these dark lines run from the anterior point of the eye to the nostril.

The rostral is generally light in the center and dark laterally. The prenasals are often conspicuously dark. The serrated scales bordering the upper eyelids

are faintly tinged with gray. The upper labials are mottled; usually 2 or 3 are entirely punctated. The mental is generally clear, and the infralabials less maculate than those above.

Conspicuous changes also take place in the body marks. The more or less regular brown cross-bars of the juveniles become increasingly irregular. Usually they become narrower (along the body) and a series of brown spots or blotches appears in the widened interspaces, first laterally, then entirely across. The bars themselves become lighter in the middle, resulting in a double-barred effect. Much spotting (usually in the form of smaller dots than the spots in the interspaces) appears along the sides between limb insertions. The lower surface remains immaculate cream-color. Sometimes the dorsal bands break up into spots to such an extent that uniform spotting results, all vestiges of bands being lost. Such seems to have been the case in the type specimen.

The tail rings also become lighter, particularly in the centers so that they are double-barred. Spots occasionally appear in the interspaces, but not so generally as on the body. One or two of the terminal rings may be complete ventrally. Regenerated tails are irregularly spotted.

Mid-dorsal light lines, such as characterize *sonoriensis*, are rare but do occur. I might mention that the mid-dorsal groove and its bounding ridges sometimes give a false impression of a light vertebral line.

The cross-bars on the body in this Borego series usually number 4, but other numbers are occasionally encountered. Out of 128 specimens in which the bands are still evident, one has 3 on one side of the body and 4 on the other, eight have 4 on one side and 5 on the other, and seven have 5 straight across; the other 112 have 4 bands. The tail rings vary from 10 to 14, 11 being the mode.

With this Borego series spread out before me, there is hardly a half-dozen adults which, in the relative widths of body bands and interspaces, and in their nature, might be confused with either *sonoriensis* or *utahensis*.

The peritoneal lining in *Coleonyx* is not dark as in many desert lizards (Klauber, 1939, p. 75). However, the eye socket is lined with black as can be seen, not only on the edges of the lids, but through the skin. In fact the skin is so transparent that most specimens have a pinkish cast in life. However, even in the desert specimens there is sometimes a yellowish pigment between the dorsal brown bars.

The following color notes, using Ridgway's standards, were made on a live young adult from Cornville, Yavapai County, Arizona: The spots on the head are Natal Brown upon a background of Dull Lavender. The dorsal body bars are Raisin Black, with Deep Olive Buff interspaces. The legs are Vinaceous Lilac above and Deep Lavender below. The ventrum is White.

A pair of adults from The Narrows, San Diego County, exhibited the following colors: Head spots, Prussian Red to Haematite Red; ground color between head spots, Light Grayish Vinaceous to Vinaceous-Buff; body spots, Hay's Brown, Sorghum Brown, Vandyke Brown; between spots but within blotches, Brownish Vinaceous; interspaces, Olive Buff; tail bands, Natal Brown to Bone Brown; interspaces on tail, Avellaneous; legs above, Vinaceous Buff;



underside of legs, Light Vinaceous Fawn; underside of head, body, and tail, White.

Miss Atsatt (1939, p. 244) has discussed the effects of changes in temperature and light on the color of *Coleonyx*. It tends to become darker at lower temperatures, and, probably, in stronger illumination.

*Intraspecific Trends*.—Having described *variegatus variegatus*, as exemplified by the Borego series, I shall now survey briefly the trends in other areas inhabited by the subspecies. Also, the dispersions of the countable characters will be given for all available material. The following additional specimens have been surveyed, beyond the Borego series of 143.

Northeastern Lower California, Mexico	6
Imperial County, California	30
San Diego County, California	6
Riverside County, California	21
San Bernardino County, California	26
Los Angeles County, California	4
Kern County, California	1
Inyo County, California	9
Nye County, Nevada	2
Clark County, Nevada	2
Mohave County, Arizona	9
Yavapai County, Arizona	9
Maricopa County, Arizona	19
Pima County, Arizona	7
Yuma County, Arizona	26
Northwestern Sonora, Mexico	6
Total	183

The list, of course, excludes all specimens allocated to other subspecies. Also, pattern notes were made on some 68 additional specimens of *variegatus variegatus* which are not included above.

With the material at hand I have been unable to find any important territorial trends in morphology within the subspecies. Specimens approaching the area of intergradation with *bogerti* usually have an increased number of preanal pores.

As I have stated elsewhere, *variegatus variegatus* is the largest of the subspecies. Females exceeding 70 mm., snout to vent, are by no means uncommon on the floor of the desert. The largest specimen I have measured is one from Alameda Junction, 3 miles west of Garnet, Riverside County, which is 77 mm. in body length. Individuals exceeding 70 mm. have been collected in San Diego, Imperial, Riverside, San Bernardino, and Los Angeles counties in California, and Yuma County, Arizona. The largest male measured 69 mm. The smallest available individual of this subspecies measures 33 mm. Mountain specimens do not attain the extreme length of those of the desert, and the same is true of some of the fringe territory approaching the ranges of other subspecies.

The complete distribution of the preanal pores in the males, for the subspecies as a whole, is as follows: 3 (1), 4 (1), 5 (16), 6 (80), 7 (36),



8 (26), 9 (3); total 163; mean 6.45. It will be observed that 6 is strongly the mode in this subspecies, about half the specimens having that number.

There are apparent no important territorial trends in scalation in *variegatus* as a whole, when compared with the Borego series.

The dispersion of the gulars contacting the mental in the subspecies as a whole is as follows: 4 (13), 5 (70), 6 (116), 7 (73), 8 (37), 9 (8), 10 (1), 11 (1); total 319; mean 6.26. The gulars contacting the mental and the first infralabials taken together are: 8 (9), 9 (60), 10 (95), 11 (76), 12 (55), 13 (15), 14 (5), 15 (3), 16 (1); total 319; mean 10.61. The gulars contacting the mental tend to be fewer in the geckos from the northern Mojave Desert; they are most numerous in specimens from around Yuma.

The prenasals fail to make contact in 76 cases out of 324, or 23.5 per cent. Contact most frequently fails in the area between Yuma County, Arizona, and the eastern slope of the coastal range in Imperial and San Diego counties, California.

For the subspecies *variegatus variegatus* as a whole, the dispersion of the granules bridging the gap between the supranasals is as follows: 1 (13), 2 (85), 3 (180), 4 (33), 5 (9), 6 (1); total specimens 321; mean 2.82. The number of these scales tends to be low in the upper Mojave Desert and toward Death Valley, and reaches a maximum in the Yuma area and across the line in northwestern Sonora.

With regard to pattern variations in the subspecies as a whole, we find the following; In Imperial County, especially along the southern border, at some point of which the type specimen was probably collected, the patterns are similar to those of the Borego series. If any difference is present, it lies in an increased tendency toward a complete loss of the bands in the fully-grown adults—to have them break up into spots, as was the case in the type. The same is true in the desert area of northeastern Lower California, as far south as San Felipe, the southern known limit of this subspecies in the peninsula.

In San Bernardino County—the Mojave Desert—there is a tendency to retain the dorsal bands. They narrow and become double-barred by the lightening of the interiors, and the interspaces become filled with spots; but the bars do not break up as completely as is often the case with the specimens from the Colorado Desert further south. The Los Angeles County desert specimens are similar to those of the Mojave.

Further north in Inyo County there is more variability, resulting, no doubt, from the complex terrain. In general, the body blotches tend to be darker and are often wider. They are conspicuously double-barred. The head spots are clear.

In southern Nye County and in southwestern Clark County, Nevada, tendencies toward *utahensis* are found, the bars becoming wider, more irregular, and with the light centers less evident. Those from Las Vegas and Boulder City northeastward are to be considered *utahensis*, though not as extreme as typical Utah specimens; some, in fact, from this area of intergradation, more nearly resemble *variegatus variegatus*.

In Mohave and Yavapai counties, Arizona, the markings are quite dark, especially when from mountain areas. The bars in the adults are sometimes wider than the spaces between. Further south in Maricopa County, the blotches are still dark, the double-barred effect is quite clear, and the head spots prominent. In Yuma County the patterns are much like those of Imperial County, except that the dorsal pattern, in breaking up in the adults, tends to split into relatively larger spots. Where the bars are retained, they are double and narrower than the interspaces. There is little trend toward *sonoriensis*, except in an occasional vertebral light line. The specimens in extreme north-western Sonora, while still *variegatus variegatus*, do show occasional *sonoriensis* tendencies, both in the widening of the dorsal bands and the greater frequency of a light mid-dorsal line.

The number of dorsal body bars and the tail rings do not show any territorial tendencies in *variegatus variegatus*. Four bars on the body are strongly the mode everywhere. The following tabulation gives the distribution for the subspecies as a whole. The figure  $\frac{1}{2}$  indicates a specimen with a higher number on one side and a lower on the other—as is the case where one of the bars has a Y-shape:  $3\frac{1}{2}$  (1), 4 (235),  $4\frac{1}{2}$  (19), 5 (23).

*Relationships with Other Subspecies.*—*Variegatus variegatus* comprises the largest and most centrally located subspecific population. It intergrades with the new subspecies *abbotti*, *utahensis*, *bogerti*, and *sonoriensis*, all of which are peripheral variants. Areas of intergradation will be discussed under each of these. *Variegatus variegatus* may be related to *peninsularis* through *abbotti*, or directly via the east coast of Lower California, or through some presently unknown subspecies; this cannot be decided until much more material shall have become available from central Lower California.

*Field Notes.*—The method of collecting desert reptiles by driving on paved roads at night (Klauber, 1939) has greatly improved both our herpetological collections and our knowledge of reptile habits. This has been the case with *Coleonyx variegatus variegatus*, which was found to be much more common at night in the Colorado Desert than any other lizard, or, in fact, than all other snakes and lizards taken together. As many as 30 have been encountered on the road in a single night. Often we have collected only a few of those seen and have even failed to keep a full record of them. As they were formerly secured only by the hard work of prying off rock flakes, and overturning debris, night driving has converted a rare into a common species. From the coastal side of the mountains, where we are still restricted to the older methods, comparatively few specimens are even yet available.

*Variegatus variegatus* has been met with on the road in a great variety of situations. It is found in every kind of desert habitat to an elevation of about 4000 ft.; in rocks, brush, cacti, and on sandy flats and washes, although probably most plentiful in the latter. But it is not equally common in all parts of the desert; for example, it is less frequently encountered on the run from Adelanto to Kramer Junction, in San Bernardino County, than between The Narrows and Bensons Dry Lake, in San Diego County, although the ecological conditions are not greatly different in the two areas. It occurs among stony

outcrops and also in our most extreme arenaceous territory—the sand dunes some 17 miles west of Yuma. It seems to have been driven out of the irrigated sections of the Imperial and Coachella valleys, although found where the land has reverted to desert. The vertical distribution is from below sea level in the Salton Basin and Death Valley to about 4000 ft. (Wheaton Spring, 4025 ft., Big Pine, 4002 ft.); probably it reaches 4500 or 5000 ft. in the mountains of Inyo and northeastern San Bernardino counties. La Rivers (1942, p. 56) has recorded a specimen from Quartz Spring, Lincoln County, Nevada at 4500 ft. This should probably be assigned to the subspecies *utahensis*.

If one is traveling slowly the geckos are rather easily seen on the road, as they are almost white laterally. Usually they cross slowly and appear like bits of paper blown along the highway. They will often remain quiet if the car is stopped quickly enough to hold the headlights on them; if they are passed, so they are again in the dark, they will occasionally escape. No eye shine has been observed. Where paved roads are not available these geckos may be secured by hunting afoot with a flashlight; however, this scheme is not nearly so fruitful as collecting by auto.

Although their skins are so thin as to be partially translucent, and they have the appearance of being delicate and fragile, they must actually be quite hardy. For while they prefer warm spring nights, they have been found active on nights when the temperature was 60° F. or less, and with so violent a gale blowing that it was difficult to understand how they could cling to the highway surface. I think I have seen them out under more extreme weather conditions than any other desert reptile except possibly *Crotalus cerastes*. On occasional spring trips when the weather conditions were particularly adverse, *Coleonyx* was the only reptile seen. However, I have never encountered one in full daylight except on one occasion when no place of concealment was available. This was on a tiny island in Lake Mead (June 16, 1936) which was about to be inundated for the first time by the rising water of the dam. There were two geckos in plain sight; one was shedding in a peculiar fashion—possibly burned by the sun.

The following records of the number of *variegatus variegatus* found on the road each month will give an indication of seasonal activity:

March	1
April	45
May	340
June	130
July	28
August	24
September	8
October	12
Total	588

This result is partly an index of our own activity rather than that of the geckos; I therefore present another table covering only the Borego area in San Diego County, and reduced to a mileage basis:

<i>Month</i>	<i>Specimens</i>	<i>Miles</i>	<i>Specimens per 100 miles</i>
March	0	42	0.0
April	34	330	10.3
May	274	1413	19.4
June	102	731	13.9
July	13	215	6.0
August	19	170	11.2
September	7	385	1.8
October	10	127	7.9
Total	459	3413	13.4

Even these records are not to be deemed highly accurate since there is certain to be some carelessness in recording so common a creature, but without doubt May is the month of greatest activity.

The best trips disclose specimens at the rate of about one specimen every two miles (24 specimens in 49 miles, May 16, 1941, Borego area).

As to the time of night when they are most active, I have records of about 400 specimens of which the time of collection was noted. These are as follows:

<i>Time</i>	<i>Live Specimens</i>
5:30 to 5:59	1
6:00 to 6:29	1
6:30 to 6:59	1
7:00 to 7:29	21
7:30 to 7:59	42
8:00 to 8:29	58
8:30 to 8:59	72
9:00 to 9:29	54
9:30 to 9:59	47
10:00 to 10:29	34
10:30 to 10:59	34
11:00 to 11:29	18
11:30 to 11:59	10
12:00 to 12:29	1
12:30 to 12:59	4
1:00 to 1:29	2
1:30 to 1:59	1
2:00 to 2:29	0
2:30 to 2:59	0
3:00 to 3:29	1
3:30 to 3:59	1
Total	403

It should be pointed out that this table does not give a true indication of the relative time of activity, since much more collecting was done early in the evening than later. The lizard may be just as active in mid-summer after midnight as before; we have data on only a few trips during those hours. But in the spring they certainly are more active early in the evening before the desert has cooled off. The earliest specimen was recorded at 5:55 PM, October 30, 1939; the latest at 3:37 AM, August 16, 1936 (the latter by Miss Elizabeth Sprague). It has been my experience that the first individuals may be out before darkness is complete, but they are not most active until later. This is correctly indicated by the table, since, while the later hours (after 11:00 PM) are not fairly represented, the early hours are; for these trips were begun at dusk, and if the geckos had been out they would have been recorded. We conclude that maximum activity is reached about two hours after sunset. In the summer this may continue all night, but in the spring most of the lizards retire as the desert cools off.

The air temperatures at times when *Coleonyx* has been found may be summarized as follows:

<i>Temperature</i> <i>Deg. F.</i>	<i>Specimens</i>
60-64	12
65-69	12
70-74	32
75-79	51
80-84	115
85-89	47
90-94	16
95-99	1
Total	286

It will be noted that 40 per cent were taken at temperatures of 80° to 84° F., inclusive. As the average temperature, when all our desert night drives are taken into consideration, was distinctly below this range, there is no question but that a definite preference is here indicated, and that the optimum temperature for this species is slightly above 80° F. The highest air temperature noted when a specimen was collected was 96° F., and the lowest 60° F. I am quite certain I have collected *Coleonyx* at temperatures below the latter figure, but unfortunately no temperature records were then made. It is not at all unusual to find them out in the heavy winds which often sweep across the desert on spring nights.

I have collected this subspecies in the daytime under a variety of objects, such as rock flakes, fallen yucca stems, boards, advertising signs, and other items of debris. In parts of the desert where such kinds of cover are not available, they no doubt take refuge in the many mammal holes, as do most of the other reptiles. One was found in a puddle at night after a brief summer shower.



A captive *Coleonyx* was observed digging in the sand, alternately with front and hind feet. A shedding specimen has been observed to detach and eat patches of the loosened skin; or other captives would remove the patches from their fellow.

They feed readily in captivity (Derbonne, 1934). Greenberg (1943) has reported extensively on various characteristics of behavior in captivity.

*Coleonyx variegatus variegatus*, as seen in the field at night, often runs with the tail curved over the back. Sometimes in the glare of headlight or flashlight the tail will be observed to wave from side to side. The tail is easily broken and will be dropped if the lizard be seized by it. These geckos sometimes emit faint squeaks when caught.

The food comprises insects and other arthropods including beetles, grasshoppers, and sowbugs.

*Coleonyx variegatus* is an important food element on the menu of the nocturnal desert snakes, particularly *Phyllorhynchus*, which, when not large enough to engulf a full-grown lizard consumes its tail at least. *Coleonyx* eggs are also eaten by *Phyllorhynchus* in the spring and early summer. A red racer, *Masticophis flagellum piceus*, when caught, was observed to disgorge a *Coleonyx* (May 18, 1930).

Throughout the Southwest there is a widespread fear of *Coleonyx* among the Mexicans; it seems often thought to be a young Gila Monster. Yet the same fear exists where the Gila Monster does not occur. The fishermen on Cedros Island, when shown specimens of *abbotti*, stated that they were "muy malo." Vorhies (1917, p. 367) and Strecker (1928, p. 10) comment on the general fear of this little harmless and delicate lizard. Sanderson (1941, p. 156) mentions a similar reaction toward *Coleonyx elegans* in British Honduras. But fear of geckos is by no means restricted to this genus; Boulenger (1890, p. 108), Saunders (1912, p. 1341), and M. A. Smith (1935, p. 129) report the same apprehension with regard to the related genus *Eublepharis*, in India.

*Locality Records.*—LOWER CALIFORNIA, MEXICO: San Felipe, Colorado River Delta, Colorado Desert. CALIFORNIA: *San Diego County*—Beattys Ranch, Tubbs Canyon, Borego Valley, Borego Springs, San Felipe Valley, Banner, Scissors Crossing (also 2 mi. e.), Sentenac Canyon (also foot of canyon), Yaqui Well, The Narrows, Bensons Dry Lake (*variegatus* has been collected in every one of the 19 miles of Highway Cal. 78 from Yaqui Well via The Narrows and Bensons Dry Lake to the Imperial County line 3 mi. e. of Bensons Dry Lake), San Felipe Wash, San Felipe (abandoned townsite), La Puerta, Agua Caliente Spring, Carrizo; *Imperial County*—Fish Springs, Sea View (also 2 mi. s.), Salton Sea (nw. of Sea View), Truckhaven (also 3 and 4 mi. n.), Winona, Tule Wash (at U.S. 99), San Felipe Wash (at U.S. 99), 6, 8, 9, and 12 mi. e. of Bensons Dry Lake (San Diego County), Kane Springs Junction (U.S. 99 and Cal. 78) (also 4, 5, 8, and 9 mi. w.), Kane Springs (also 5 mi. n., 3 mi. e., and 3 mi. se.), Harpers Well, Coyote Wells (also 2 and 3 mi. e.), Plaster City, Seeley (also 2 mi. s.), El Centro, Calexico (also 15 mi. e., 3 mi. w.), 6 mi. e. of Bonds Corner, 9 mi. se. of Date City,



Midway Well (intersection U.S. 80 and Cal. 98), (also 5 mi. w.), the sand hills 14, 15, 16, and 17 mi. w. of Yuma, 4 mi. n. of Bard, Palo Verde, Winterhaven (= Fort Yuma = Camp Yuma), Colorado Desert (type locality); *Riverside County*—Banning, Cabazon, Snow Creek, Alameda Junction (= 29 Palms Junction) (also 1 mi. n.), Palm Springs (also 1 mi. n. and 3 mi. se.), Indian Wells, 4 and 6 mi. e. of Indio, Coachella, Coachella Valley, Mecca (also 4 mi. e., and 1 and 3 mi. se.), Box Canyon (near Mecca), Caleb Siding, Hidden Springs, Shavers Well, Edom, Thousand Palms, 2½ mi. sw. of Berdoo Camp, the following canyons on the sw. slope of the Little San Bernardino Mountains—Lone, Wide, Thousand Palms, Fan Hill, Pushawalla, Berdoo, Fargo, (also on Aqueduct Road between mouths of Berdoo and Fargo canyons)—, south base of Coxcomb Mountains, Hopkins Well, 5 mi. s. of Vidal (San Bernardino County), east end Riverside Mountains, Blythe (also 7 mi. w. and 5 mi. n.); *San Bernardino County*—Colton, Slover Mountain (near Colton), Reche Canyon (near Colton), 18 mi. w. of Victorville, Deadmans Point, Lucerne, Adelanto (also 2 and 4 mi. s., and 5, 10, 11, 14, and 15 mi. n.), Kramer Hills, Kramer Junction (U.S. 395 and U.S. 466) (also 2, 4, 6, 9, and 10 mi. s. and 7 mi. n.), Yucca Valley (e. of Morongo), Twentynine Palms (also 2 and 7 mi. w.), 40 mi. nw. of Barstow, 3 mi. s. of Two Springs, 7 mi. n. of Baker, Pisgah, Cima, Wheaton Spring, Needles, Beal. Vidal; *Los Angeles County*—Lovejoy Springs, halfway between Victorville (S.B.Co.) and Pearblossom, Littlerock, 2½ mi. ne. of Vincent; *Kern County*—Mojave, Inyokern; *Inyo County*—Little Lake, Big Pine, Owens Valley, Emigrant Ranger Station (Death Valley), east side of Death Valley (opposite Bennett Wells), Mesquite Spring (Death Valley), Goler Canyon, 2 mi. n. of Sourdough Spring (Goler Canyon, Panamint Mountains), Bruce Canyon (Argus Mountains), 10 mi. s. of Shoshone. NEVADA: *Nye County*—Amargosa River (3½ mi. ne. of Beatty), Beatty; *Clark County*—Colorado River 5 mi. above California border, Jean, 6 mi. se. of Indian Springs Ranch. ARIZONA: *Mohave County*—4 mi. se. of Hoover Mine, 26 mi. n. of Chloride, Kingman (also ½ mi. n., 3, 4, and 7 mi. nw.), Fort Mohave, Toroweap Valley (south of Tuweep, Grand Canyon National Monument); *Coconino County*—Bright Angel Canyon, Grand Canyon National Park; *Yavapai County*—Cornville, McCloud Mountains, near Yarnell, Congress Junction (also 3 mi. n., 4 mi. ne., and 3 mi. s.), 3 mi. w. of Octave, 5 mi. n. of Wickenburg (Maricopa County); *Maricopa County*—2 mi. n. and 2 mi. nw. of Wickenburg, Wittman, Phoenix (also 20 mi. sw.), near Mesa, Big Horn, Agua Caliente, Sentinel, Gila Bend (also 16 mi. e.), Maricopa Mountains (30 mi. e. of Gila Bend), Gila River (below Gillespie Dam), Bella Vista (on Gila Bend-Casa Grande Road); *Pima County*—Bates Well, 2 mi. e. of Dowlings Well, Gunsight, Covered Wells; *Yuma County*—Bouse, 2 mi. n. of Stoval, 5 and 10 mi. e. of Mohawk, Pembroke, Tacna, Wellton, Wellton Mesa, 3 mi. w. of Dublin, Dome Rock Mountains, Yuma (also 2 mi. s.), Gila River (near Yuma), Somerton, 1 mi. n. of San Luis (Sonora). SONORA, MEXICO: Paso MacDougall (n. of Sierra del Pinacate), Sierra Blanca (s. of Sierra del Pinacate), Salina del Pinacate (Bahia de Adair), between Salina del Pinacate and Salina Grande (Bahia de Adair), Punta Peñasco, and 10 mi. sw. of Sonoyta.

***Coleonyx variegatus abbotti*\* subsp. nov.**

## SAN DIEGAN BANDED GECKO

1897. *Coleonyx variegatus* (part) Van Denburgh, Occ. Papers Calif. Acad. Sci., No. 5, p. 40.

*Type*.—No. 34,790 in the collection of L. M. Klauber. Collected in Proctor Valley, San Diego County, California, February 28, 1942, by William Moore. Proctor Valley runs between Jamul and Upper Otay Reservoir.

*Diagnosis*.—A subspecies of *Coleonyx variegatus* characterized by the retention of the banded pattern of the juveniles into the adult stage. From the typical subspecies it may be distinguished by the presence of a narrow and evenly-outlined nuchal light loop in the adults. It differs from *utahensis*, *peninsularis*, and *sonoriensis* in having dark dorsal bands in the adults which are approximately equal to the interspaces, instead of being much wider as in the other three forms. It has fewer gulars in contact with the mental than *slevini*. From *bogerti* it differs in having fewer preanal pores, in possessing a deeper mental, and in the lack of spotting on the heads of the adults.

*Description of Type*.—A gecko with a stubby snout and relatively short and delicate limbs, which overlap. The tail is round. The ear openings are elliptical and oblique. There is a distinct vertebral groove, bounded on either side by a rounded ridge. The type is an adult male.

Except for the scales bordering the mouth, nostrils, and eyes, the head is covered above and below with non-imbricate circular granules, uniform in size posteriorly, but considerably enlarged on the snout and bordering the labials. The rostral is pentagonal in shape, pointed at the top, and wider than high. The two edges touching the nasals are longer than those engaging the first supralabials, and are concave. The supralabials number 6-6, gradually decreasing in size posteriorly. They are replaced by granules just forward of the center of orbit. The infralabials visible when the mouth is closed number 8-7. The anterior are much larger than those which follow. There is a pair of long thin prenasals, which narrowly touch the first supralabials, broadly contact the rostral, and are slightly in contact with each other on the median line. There are two small postnasals on either side, the upper being somewhat larger. The lower might be considered a subnasal. There is a pair of triangular supranasals, medianly separated from each other by 2 granules. Both upper and lower eyelids are edged with enlarged scales which are conspicuously serrated, especially the posterior. The upper scales number about 16; the lower 17. The last are quite small, with points directed outward. The mental is conspicuously the largest head scale. It is slightly wider than the rostral, and is somewhat wider than deep, the dimensions being 2.3 mm. wide by 2.1 mm. deep. The sides are divergent anteriorly; the lower or posterior edge is semi-circular in form. This edge is contacted by 5 gulars. The mental and the first infralabial on each side, when taken together, are contacted by 9 gulars.

\* Named for Mr. Clinton G. Abbott, Director of the San Diego Society of Natural History, a friend, editorial guide, and scientific associate for many years.

The dorsum is covered by granules of similar size to those in the head, there being no enlarged tubercles. On the sides the scales become somewhat enlarged and imbricate, posteriorly first, since the granules are smallest under the arms. On the underside the scales are imbricate and considerably larger than those on the dorsum.

There is a group of especially enlarged scales in the preanal region; of these, six, which are conspicuously larger than the rest, contain preanal pores. These are not colored brown, presumably because of the date of collection; the scales containing the pores are obtusely angular in arrangement with the point forward; the two scales forming the apex of the angle are in contact.

The scales on the arms are mostly imbricate, except on the inner side of the upper arm. They are largest back of the wrist. The palmar surface is tubercular. On the inner surfaces of the digits there are rows of rectangular transverse lamellae, of which there are 13 on the fourth finger. The claws are retracted and barely visible; they are held between a pair of shell-like lateral scales, with a narrow and pointed scale closing the gap above, while below it is closed by the last of the lamellae.

The legs are covered with granular scales on the upper and inner surfaces; they are imbricate below and are largest on the outer areas of the thighs. There are 18 lamellae on the fourth toe.

The cloacal spurs are rather narrow and there is little if any slope to the ridge. They are about 1 mm. in length.

The tail is covered by annular rows of subrectangular and imbricate scales of larger size than any on the body. They are largest ventrally. At the thickest part of the original tail (part is regenerated) there are about 29 scales in a ring.

The principal dimensions of the type, in mm., are as follows: Body length, snout to vent 53; head length 14.5; head width 8.7; rostral to mid-orbit 6.4; rostral to mid-ear 11.5; width of orbit 3.2; arm fully extended, measured to end of fourth finger 18; leg fully extended, measured to end of 4th toe 24; length of tail (regenerated) 45; distance between points of cloacal bones 6.

The head is medium brown above, the color being carried by the tips of the granules. There is a thin, cream-colored line of horse-shoe shape extending from below and behind each eye and above each ear to a loop on the neck. There is also a short light line on the canthus rostralis on either side. The upper eyelid edges are strongly marked with gray. The inner surface of each eyelid is black, except for the edge scales. The rostral is brown, although lighter in the center. The upper labials are punctated, the first, third, and sixth being especially dark. The mental is lightly speckled, as are the lower labials, the fifth being particularly dark. There are scattered punctations on the gulars adjacent to the infralabials.

There is a single wide, dark ring on the neck, which laterally curves forward toward the ears, thus comprising the posterior dark border of the light postparietal or nuchal loop previously mentioned. On the dorsal surface of the body, between limb insertions, there are 4 brown crossbars; they are slightly wider than the interspaces, especially mid-dorsally. They fade out on the sides,

the ventral surface being almost immaculate white; however, tiny punctations are here and there discernible. The light areas between dorsal bands are also punctated. The upper surfaces of the limbs, out to the ends of the fingers and toes, are brown; the inferior surfaces, even of the digits, are lightly speckled.

On the tail there are only 2 rings, for the rest has been regenerated and is spotted.

*Paratypic Material.*—The following is a list of the paratypes which have been available. All are from the coastal side of the mountains, or on the divide.

Los Angeles County

LMK 2011 San Francisquito Hydroelectric Plant 2

Riverside County

LMK 2725 Moreno

San Diego County

LMK 30 Cottonwood

843 Foster

21,249 El Capitan

24,050 San Pasqual

25,303 Jacumba

27,770 Foot Agua Tibia Mountain

32,797 Pala

32,817 Mission Gorge

32,821-2 Black Mt., near La Mesa

34,666 Jacumba

34,786 Mission Gorge

SDSNH 16,702 Rincon

16,988 Mission Gorge

16,989 Jamul

17,012 De Luz

CAS 13,200 Poway

Northern Lower California

LMK 2,593 Ensenada

6,553 65 mi. se. of Tecate

24,390 San José (lat. 31°)

Cedros Island

LMK 5265-6, 27,726, 30,295; SDSNH 15,970-1; CAS 59,625, 79,875-9; MCZ 45,721.

In addition I tentatively assign the following to this subspecies:

MVZ 12,447 Kern River Canyon, 3 mi. above the mouth, Kern County, California

USNM 62,247 Calmallí, central Lower California, Mexico.

Stanford Nos. 15-18, San Jacinto, Riverside County, California, although their condition is such as not to permit a final decision, probably should be considered *abbotti*. Specimens from the vicinity of Colton, San Bernardino

County, although from the coastal side of the mountains, seem nearer *variegatus variegatus*.

*Range*.—Coastal and cismontane southern California and northern Lower California from the San Gabriel Mountains, Los Angeles County, south to the west slope of the San Pedro Mártir Mountains of Lower California, Mexico. Also Cedros Island off the Pacific Coast of Lower California.

*Morphology*.—This is a smaller and seemingly slimmer gecko than those typical of the desert areas to the east. The longest specimen is 68 mm.; this is a particularly light female from De Luz, San Diego County; the next longest is a female 61 mm. in length from the foot of Agua Tibia Mountain. The longest male measures 56 mm. I should estimate that the average adult body length of *abbotti* is about 15 mm. below that of *variegatus variegatus*.

The tails, when complete and original, which is seldom the case, are slightly longer than the bodies. The excess tail length is more pronounced in the young specimens.

The preanal pores in the males vary from 5 to 7, the counts being as follows: 5 (2), 6 (6), 7 (6); average 6.28.

The cloacal bones are rather narrow and sharp. In specimens from Cedros Island they are wider.

*Scalation*.—The rostral is wider than high. The prenasals are long and slim; they touch the first supralabials, and are in contact on the median line in all except one specimen from Cedros Island. The supranasals are separated by from one to three granules, the counts being 1 (1), 2 (19), 3 (17); mean 2.43. The supranasals are larger than the postnasals. Of the latter, there are two on each side, the upper being the larger. The supralabials number from 6 to 9; they average lower in the Cedros Island specimens than those from the mainland.

In the mainland specimens the scales bordering the upper eyelids are large and serrated; the scales of the lower lids are not so conspicuous. The scales bordering the eyelids in the Cedros Island specimens are smaller and less pointed.

As is the case in the other subspecies, the circular granules on the snout are larger than elsewhere on the head, this being especially true of those bordering the supralabials.

Although the mental is sometimes only as wide as the rostral, it is usually conspicuously wider. It is almost as deep as wide, the depth averaging about .9 of the width. The lower edge is a circular arc of moderate radius. The gulars contacting the mental number as follows: 5 (11), 6 (17), 7 (6), 8 (2), 9 (1); mean 5.81. Those contacting the mental, together with the first infra-labial on either side, number as follows: 8 (1), 9 (13), 10 (14), 11 (5), 12 (3), 13 (1); mean 9.97.

*Pattern and Color*.—This subspecies is characterized by the slight ontogenetic change in pattern which it undergoes and by an abundance of pigment evidenced by punctations scattered over the body.



The head continues brown throughout life, with almost no spotting or mottling. The nuchal light loop remains clear and evenly outlined, as do also the light bars on the canthus. The body bands, exclusive of the dark band on the neck, number 4 in all mainland specimens available to me; they are approximately equal to the interspaces in width. Spots are occasionally present in the interspaces when the adult stage is reached, this being especially the case in the Cedros Island individuals. A close examination of the interspaces discloses the presence of many fine dots on the scale tips, thus reducing the contrast between the brown and cream areas; however the bars remain even-edged in the adults. The upper surfaces of the limbs are also speckled, so that they appear grayish. Some of this speckling is evident on the belly, on the ventral surfaces of the limbs, and on the digits; and even the claws themselves are frequently brown in color.

The rostral is always dark, although the center may be lighter than the edges. The supralabials are heavily punctated. The mental may be clear or somewhat mottled. The infralabials are usually darkened and the adjacent gulars are irregularly speckled.

Where the tail has not been broken, the rings number from 9 to 12. Usually only the posterior are ventrally complete. In the mainland specimens the tail rings are little if any darker than the body bars. Regenerated tails are speckled, spotted, or irregularly barred.

The Cedros Island specimens differ somewhat from the mainland in pattern. The body bars tend to be wider than the interspaces. One specimen has 5 bars on one side and 4 on the other, while two others have 5 dorsally, but 4 laterally. There is a greater tendency for spots to develop between bars in the adults. The tail rings are darker than the body bars and are more often complete ventrally. There is less marking on the limbs and digits, both on the upper and lower surfaces, and the claws are light. One specimen has a pattern reminiscent of *peninsularis*; and altogether these island individuals are not so sharply differentiated from either *peninsularis* or *variegatus variegatus* as are those from the mainland.

In a live adult from Cedros Island the dorsal bands were Saccardo's Umber and the interspaces Ecru Olive, by Ridgway's Color Standards.

*Relationships with Other Subspecies.*—*Abbotti* undoubtedly intergrades with *variegatus variegatus* in some of the mountain passes, there being a number low enough for these geckos to range through. Intergradation probably takes place toward the coastal side, as specimens from the eastern slopes of the mountains seem to be *variegatus variegatus*; in fact, in some areas the desert form has encroached on the cismontane terrain, as is the case in the vicinity of Colton, San Bernardino County, where the population is nearer *variegatus variegatus* than *abbotti*.

At the southerly end of its range *abbotti* may eventually be found to intergrade with *peninsularis*, or another desert subspecies occupying the Vizcaino Desert may be interposed.

I have tentatively placed in the *abbotti* category a gecko from Calmalli, central Lower California (USNM 62,247). This specimen has been damaged



so that the scale arrangements on the head cannot be determined. The body bars equal the interspaces in width, thus favoring *abbotti* rather than *peninsularis* in this character.

Another specimen of doubtful allocation is MVZ 12,447 from the Kern River Canyon, 3 miles above its mouth, a locality probably not over 10 miles eastward from Bakersfield. This is the only specimen known to me from the San Joaquin Valley side of the Sierra Nevada. The markings are those of *abbotti*, but the gulars are much enlarged, there being only 4 in contact with the mental. Were future specimens from this area to show similarly low counts, a subspecific segregation might be warranted.

*Field Notes.*—The dark color of this gecko renders it difficult to see at night, which probably accounts for its being so rare in collections, compared to *variegatus variegatus*, which is so easily collected by driving on the desert roads at night. I think that *abbotti*, although having a considerable range, is not so common anywhere as is the type subspecies in the desert.

Most of the specimens in collections were found under stones, rock flakes, or cap rocks. The latter have been the source of a number of San Diego County individuals. Some were found while searching for *Xantusia henshawi*, although they are much rarer than the granite night lizard, at least in these retreats. For example, on March 20, 1926, a single gecko was found under a granite slab at Jamul. This was a cold day when lizards were almost dormant. Fifteen *Xantusia henshawi* were collected under this and other slabs and flakes.

On April 20, 1927, a *Coleonyx v. abbotti* was found under a cap rock on a granite boulder at San Pasqual, and three days later another was collected under the same conditions near Foster. Another was found under a cap rock at Moreno, Riverside County, May 25, 1930. The preference for cap rocks seems to indicate that the geckos cannot stand the temperature changes which *Xantusia henshawi* must sustain under the thin flakes below which it is so often found. Of course, both lizards may be common within the deeper crevices to which the collector cannot gain access.

While not entirely restricted to areas where granite is available, *abbotti* seems to prefer such territories. L. H. Cook, collecting on the south end of Cedros Island, found four specimens by turning over rocks in the daytime.

*Locality Records.*—CALIFORNIA: *Los Angeles County*—San Francisquito Hydroelectric Plant No. 2, Owensmouth; *Riverside County*—Moreno, San Jacinto; *San Diego County*—De Luz, foot of Agua Tibia Mt., Pala, Rincon, Escondido, Lake Hodges, San Pasqual, Poway, Foster, El Capitan, Harbison Canyon, Mission Valley, Alvarado Canyon, Mission Gorge, Black Mt. (near La Mesa), Jamul, Proctor Valley (type locality), Dulzura, Cottonwood (= Barrett P.O.), Jacumba. LOWER CALIFORNIA, MEXICO: Rodriguez Dam, Ensenada, 65 mi. se. of Tecate, San José (lat. 31°), Cedros Island.

Additional records tentatively assigned to this subspecies: Kern River Canyon, 3 mi. above the mouth, Kern County, California; Calmallí, central Lower California, Mexico.

***Coleonyx variegatus peninsularis* subsp. nov.**

## SAN LUCAN BANDED GECKO

*Type*.—No. 37,210 in the collection of the Museum of Comparative Zoology, Harvard University. Collected at La Paz, Lower California, Mexico, by Miguel L. Cornejo, Jr., 1933.

*Diagnosis*.—A subspecies of *Coleonyx variegatus* distinguished from all other subspecies, except *slevini*, *utahensis*, and *sonoriensis*, by the wide transverse dark bars on the body as compared to the narrow light interspaces. From *slevini* it may be segregated by its having a higher number of scales in contact with the mental. From *sonoriensis* it may be distinguished by the following pattern differences: *peninsularis* has less superimposed spotting on the head and body blotches, the anterior ends of the nuchal light loops are higher, and it has a pair of prominent canthal light lines, with an unspotted brown area between, not possessed by *sonoriensis*. The Cape form lacks the mid-dorsal light line characteristic of most Sonoran specimens. From *utahensis* it differs in having even, rather than highly irregular, edges of the dorsal bands, and in having straighter light canthal lines.

*Description of Type*.—An adult male. Except for the scales bordering the mouth, nostrils, and eyes, the head is covered above and below with non-imbricate, circular granules, approaching uniformity in size. They are slightly enlarged on the snout and bordering the supralabials. The rostral is pentagonal in shape and is wider than high. The two edges touching the nasals, which are somewhat concave, are longer than those engaging the first supralabials. The supralabials number 7-7 and decrease in size posteriorly. The infralabials also number 7-7. There is a pair of prenasals, lunar in shape, which contact the first supralabials at a point, broadly contact the rostral, and are in contact with each other on the median line. There are two postnasals, of which the upper is the larger. There is a pair of supranasals considerably larger than the postnasals; they are separated from each other by 3 granular scales. Both upper and lower eyelids are edged with enlarged scales, which are somewhat serrated. The mental is the largest head scale. It is wider than the rostral and is slightly wider than deep, the dimensions being about 1.9 by 1.7 mm. The sides are nearly parallel; the lower or posterior edge has a rather flat curve. This edge is contacted by 6 gulars. The mental and the first infralabial on each side combined are contacted by 10 of the small circular gulars.

The dorsum is covered by granules of a size similar to those in the head, there being no enlarged tubercles. On the sides the scales become somewhat enlarged and imbricate. On the ventrum the scales are imbricate and much larger than those on the dorsal surface.

The scales in the preanal region are further enlarged and include a row carrying 8 brown preanal pores, obtusely angular in arrangement with the point forward. The scales containing the two middle pores are contiguous.

The scales on the arms are mostly imbricate. On the lower surfaces of the digits there are series of rectangular transverse lamellae.

The legs are covered with granular scales on the upper surfaces but are imbricate below. They are largest on the thighs. There are transverse lamellae on the toes. The claws on both fingers and toes are fine and delicate. They are retractile between a pair of laterals and a terminal.

There is a pair of cloacal bones which are broad and ridged, one being conspicuously notched. They are about 1 mm. in length.

The tail is covered by annular rows of subrectangular and imbricate scales, which are largest ventrally. At the widest part of the tail there are about 31 scales per ring.

The principal dimensions, in mm., are as follows: Body length, snout to vent 42; head length 11.5; head width 7.3; rostral to mid-orbit 5; rostral to mid-ear 9.5; width of orbit 2.5. The tail is incomplete.

The head is brown above and cream-colored below. There is a thin light line of horse-shoe shape extending from behind and slightly below each eye and above the ears to a loop on the neck. There is also a well-defined light line along the canthus rostralis on either side. The inner surface of each eyelid is black, except for the edge scales. The rostral is light in the center but is brown along the upper border. The mental is unmarked. The labials, both upper and lower, are lightly punctated with gray at various points. Back of the enlarged labial scales the granules which border the mouth are punctated with gray-brown.

There is a single wide, dark ring on the neck, which laterally curves forward across the ear openings, thus comprising the posterior dark border of the light nuchal loop. On the dorsal surface of the body, between limb insertions there are 4 transverse brown bars, each of which is darker posteriorly. The last is broken at one side by an irregular light mark. The middle bars have a width of about 4 times the interspaces. The ventral surface is immaculate. The upper surfaces of the limbs, out to the ends of the fingers and toes, are stippled with brown.

*Summary of Paratypes.*—The definition of this subspecies is handicapped by lack of adequate material. There are only two paratypes: USNM 67382, a faded juvenile, probably a male, from between Loreto and Comondú; and MVZ 26989, an adult female from San José del Cabo. USNM 62.247 from Calmali is definitely not of this form. One cannot tell from his brief description whether the two specimens reported by Mocquard (1899, p. 300) from Santa Rosalia and Mulegé should be assigned to *peninsularis* or to one of the two subspecies inhabiting the northern half of the peninsula of Lower California. Therefore, the known range of *peninsularis* may be described as the eastern side of the peninsula of Lower California from Lat. 26° N. southward.

*Peninsularis* is probably a small subspecies. The type, although only 42 mm. from snout to vent, has well developed preanal pores and cloacal bones. MVZ 26989 measures 49 mm. and contains eggs. The third specimen is a juvenile only 29 mm. in body length. None of the three has a complete tail.

The three specimens differ in no important item of scalation. The enlarged labials seem to number 7 in all cases. There are 6 gulars in contact with the

mental, and 10 in contact with mental and first supralabials. The prenasals meet in the median line in all three. In two specimens 2 granules separate the supranasals, while the type has 3 interposed.

In pattern they are also much alike. The dorsal blotches are wide, separated by comparatively narrow light lines. The blotches are darkest posteriorly and are somewhat pointed toward the rear. There is some evidence of a mid-dorsal light line in MVZ 26,989.

On the head the light nuchal loop is clearly defined, ending just below the eye on each side. The canthal light lines are clear and even.

*Relationships with Other Subspecies.*—*Peninsularis* most nearly resembles *sonoriensis* in all characters, the principal divergence between them being in the adult pattern. It is also close to *slevini*, from which it differs in having a higher number of gulars in contact with the mental.

*Locality Records.*—Known only from La Paz, San José del Cabo, and the trail between Comondú and Loreto, southern Lower California, Mexico. The species occurs at Mulegé and Santa Rosalía but it is not certain whether this subspecies is the one found there.

### ***Coleonyx variegatus sonoriensis* subsp. nov.**

#### SONORAN BANDED GECKO

1897. *Coleonyx variegatus* Van Denburgh, Proc. Acad. Nat. Sci. Phila., Vol 49, p. 460.

*Type.*—No. 72,140 in the collection of the Museum of Zoology, University of Michigan. Collected by Morrow J. Allen, June 25–29, 1932, 5 miles southeast of Hermosillo, Sonora, Mexico.

*Diagnosis.*—A subspecies of *Coleonyx variegatus* characterized by wide dorsal bands, much wider than the interspaces, and by the frequent presence of a vertebral light stripe splitting the bands into paired rectangles. It differs from *slevini* in having a greater number of scales in contact with the mental, and from *peninsularis* in the frequent presence of the mid-dorsal line and in the head-spotting of the adults. From *variegatus variegatus* it is distinguished by its adult retention of the postparietal light loop and the virtually unbroken body bands, except for the vertebral stripe. From *utahensis*, *abbotti* and *bogerti* it may be segregated by the relative widths of body bars and interspaces.

*Description of Type.*—An adult male. The limbs are rather short and delicate; they overlap when adpressed. The tail is round; the terminal portion is regenerated. The eyelids are functional; the ear openings are oblique.

Except for the scales bordering the mouth, nostrils, and eyes, the head is covered above and below with non-imbricate, circular granules, rather uniform in size. They are slightly enlarged on the snout and somewhat more so where they contact the supralabial scutes. The rostral is pentagonal in shape and is considerably wider than high. The two edges touching the nasals are longer than those engaging the first supralabials; these edges are somewhat concave. The supralabials number 8–7 and decrease in size posteriorly; this count is

discontinued where they are no longer conspicuously larger than the adjacent granules, which is just anterior to the middle of the eye. The infralabials (using the same limitations) are 8-8. The infralabials also decrease in size posteriorly, those touching the mental being much the largest of the series. There is a pair of prenasals, lunar in shape, which touch the first supralabials, and broadly contact the rostral; they are separated from each other by a pair of granules in tandem. There are two small postnasals on each side, and a pair of subtriangular supranasals, separated from each other by 3 granules. Both upper and lower eyelids are edged with enlarged scales which are very slightly pointed at the outer edges. The upper scales number about 19, the lower 21. The mental is conspicuously the largest head scale. It is slightly wider than the rostral and is somewhat wider than deep, the dimensions being 2.4 mm. by 2.0 mm. The sides converge posteriorly and the lower edge is a circular arc. This edge is contacted by 6 granules. Twelve granules touch the mental and the first infralabial on either side, when taken together.

The dorsum is covered by granules of a size similar to those in the head, there being no enlarged tubercles. On the lower sides the scales become somewhat enlarged and imbricate, posteriorly first, since the granules are smallest under the arms. On the belly the scales are imbricate and definitely larger than those on the dorsum; they increase in size toward the mid-ventral line, and to a small extent posteriorly.

The scales in the preanal region are further enlarged and include a row with conspicuous, brown preanal pores. The latter total 6; the scales containing them are obtusely angular in arrangement with the point forward. Posteriorly there is a rapid decrease in scale size toward the vent.

The scales on the arms are mostly imbricate, except on the lower side of the upper arm. They are largest back of the wrist. The palmar surface is tubercular. On the lower surfaces of the digits there are series of rectangular, transverse and strongly imbricate lamellae. The claws are extremely delicate.

The legs are covered with granular scales on the upper surfaces and imbricate below. They are largest on the anterior upper areas of the thighs. The scales on the soles of the feet are tubercular. There are imbricate lamellae on the underside of the toes. The claws are similar to those on the fingers. They are sheathed between a pair of shell-like laterals, capped by a somewhat shorter terminal. Normally, in preserved specimens, they protrude well beyond the sheath.

The cloacal bones are about 1.1 mm. in length. They are slender and pointed.

The tail is covered by annular rows of subrectangular and imbricate scales of larger size than any on the body. They are largest ventrally. At the widest part of the tail there are about 38 scales in a ring.

The principal dimensions in mm. are as follows: Body length, snout to vent 53; head length 15.5; head width 9; rostral to mid-orbit 6.4; rostral to mid-ear 11.7; width of orbit 3; arm fully extended, measured to end of 4th



finger 16; leg fully extended, measured to end of 4th toe 22; length of tail (partly regenerated) 45; distance between points of cloacal bones 6.8.

The head is light-brown above, conspicuously spotted with darker. It is cream-colored below. There is a thin cream-colored line of horse-shoe shape extending from the supralabials to a loop on the neck. There is a light V-shaped mark in front of the eyes, with the point between them. The upper eyelids are faintly punctated posteriorly. The inner surface of each eyelid is black, except for the edge scales. The rostral is light in the center but brown on either edge. The mental is unmarked. There are dark spots on the first, fourth, and last supralabials; and on the third, and last infralabials.

On the neck there is a pair of brown rhomboidal blotches bounded by narrow light lines. On the dorsal surface of the body, between limb insertions, there are 4 transverse brown bands, all of which are split centrally by a light mid-dorsal line which runs from the postparietal loop to the base of the tail. Laterally, the bands terminate in a spotted area; they are somewhat darker on the edges, and show faint spots within. The ventral surface is immaculate cream-colored. The upper surfaces of the limbs, out to the ends of the fingers and toes, are spotted and punctated with brown.

On the tail there are 4 rings, followed by a spotted regenerated section.

*Paratyptic Material.*—There is available a series of 11 topotypes (MZUM 72,141-51), and 6 other specimens (MZUM 72,152a-f) from 15 miles south-east of Hermosillo. Dr. E. H. Taylor has kindly loaned me the following EHT-HMS material: Nos. 10,538-41, 10,561-65, from 5 miles southwest of Hermosillo, and Nos. 10,542-60 from La Posa, 10 miles north of Guaymas. Miscellaneous specimens include CAS 53,410 from Tepoca Bay and MVZ 20,839 from Ensenada del Perros, Tiburón Island, Gulf of California. A specimen (USNM 16,808) recorded from Nogales, Arizona, should probably be allocated to this subspecies; yet knowing how frequently early specimens were attributed to the point of shipment rather than that of collection, I hesitate to include this subspecies in the fauna of the United States until more material from around the U. S. boundary shall become available. Other specimens available from between Nogales and Tucson are not *sonoriensis*. Specimens from northwestern Sonora, from Punta Peñasco and beyond, while showing some trends toward *sonoriensis*, are clearly nearer *variegatus variegatus*.

*Range.*—West-central Sonora, Mexico, from Tepoca Bay to Guaymas and inland to Hermosillo; also Tiburón Island in the Gulf.

*Morphology.*—*Sonoriensis* is rather small in size compared with *variegatus variegatus*. The largest specimen out of about 40 adults, a female, measures 58 mm., rostral to vent. The tail is incomplete. The largest male measures 55 mm. Few specimens have complete, original tails. Where they are complete, the tails approximately equal the body in length. Aside from this matter of ultimate size, I find no consistent difference between *sonoriensis* and *variegatus variegatus* in head or body shape. There seems to be a considerable individual variation in the shape of the snout and the ear opening. The preanal pores in



the males are distributed as follows, the figure in parentheses indicating the number of specimens: 4 (1), 5 (2), 6 (7), 7 (3), 8 (3), 9 (1); mean 6.61. The cloacal bones are somewhat narrow.

*Scalation*.—The pentagonal rostral is wider than high. The prenasals are long and lunar in shape. They usually touch the first supralabials but occasionally a granule is interposed. The postnasals are small; sometimes they are two in number, sometimes three; the upper is the largest. The supranasals are larger than the postnasals. The prenasals are not in contact in 2 out of 48 specimens, or 4.17 per cent. The separation of the supranasals is effected by the following numbers of granules (counting the minimum number bridging the gap): 1 (2), 2 (12), 3 (31), 4 (3); mean 2.73. The visible enlarged supralabials usually number 7 or 8, but sometimes 6 or 9, or even 10. The scales on the edges of the eyelids are somewhat less pointed than in *variegatus variegatus*. The granules on the top of the snout are larger than those on top of the head back of the eyes; the largest, however, are on the sides immediately above the supralabials. The mental is usually somewhat wider than the rostral and is slightly wider than deep. The sides are posteriorly convergent and the bottom is a circular arc. The number of gulars contacting the mental are as follows: 5 (9), 6 (12), 7 (14), 8 (10), 9 (2), 10 (1); mean 6.73. The numbers of gulars contacting the mental and the first infralabials, when taken together, are as follows: 9 (8), 10 (11), 11 (14), 12 (10), 13 (2), 14 (1), 15 (0), 16 (1); mean 10.83. The gulars contacting the infralabials are often larger than those touching the mental.

*Pattern and Color*.—The outstanding pattern characteristics of this subspecies are the wide transverse body bands (as compared to the narrow interspaces) and the mid-dorsal light line, which is present, at least to a slight degree, in nearly every adult. In this species an ontogenetic pattern change is evident, as it is in all subspecies; in this case it involves a lightening of the dorsal color, and the superposition of brown spots on the light-brown of the head and body blotches. But the main blotches, instead of breaking up into paired, transverse bands, or into irregular blotches or spots, as in *variegatus variegatus* or *bogerti*, are retained almost without change in relative size. The longitudinal borders are usually curved, but are not serrated, or highly irregular, as in *utahensis*. The nuchal light horse-shoe is retained without much loss of definition, which is quite different from *variegatus variegatus*. Only rarely are spots developed in the light interspaces, in the manner so characteristic of *variegatus variegatus*, *bogerti* and *utahensis*. The greatest ontogenetic change is the development of the mid-dorsal light line. The transverse body bars in this subspecies are seldom other than 4. Out of 48 specimens one has 4 on one side and 3 on the other; another has 4 in the middle on the back, but 5 on either side; the other 46 have 4 bars.

The rostral is always mottled and there are conspicuous collections of punctations on several of the supralabials; these are often restricted to single scales. The infralabials are less marked. The mental is often spotted, usually on the upper edge or laterally. In this it differs from *selevini*. The rings on

original tails are approximately equal to the interspaces. They number about 11 to 14. The last few are complete ventrally. Regenerated tails are usually spotted.

Of the three available specimens which are not from either the vicinity of Guaymas or Hermosillo, MVZ 20,839 from Ensenada del Perros, south end of Tiburón Island, seems to be without material difference from the others. The vertebral stripe is quite clear. CAS 53,410 from Tepoca Bay has definite *variegatus variegatus* tendencies, the blotches being more broken up than in most *sonoriensis*; thus, although I classify it in the latter category, it approaches intergradation. MVZ 10,165 from Sierra Alamo, 30 miles west of Caborca, also is an intergrade, but has been placed in the *sonoriensis* category.

*Relationships with Other Subspecies.*—*Sonoriensis* most closely resembles *peninsularis*, from which it has only moderate pattern differences. Nevertheless, there cannot now be intergradation between the two, as the Gulf of California divides their ranges. Although good series of *sonoriensis* are available from two localities, we lack specimens from both the north and northwest. Intergradation with *variegatus variegatus* in northwestern Sonora is strongly indicated; contact with *bogerti* in the north is much less certain. Vertebral light lines in some specimens of *bogerti* may suggest a close relationship.

In the nature of the superimposed spotting on head and body, and in the shape of the cloacal bones, an affinity with *brevis* is suggested. However, there is a wide gap between the ranges of the two forms, as far as at present known. Although *sonoriensis* is to be expected to the south of Guaymas, there is no indication of any trend toward *fasciatus*, for the latter is different in many important characters, as Taylor (1935, p. 203) has pointed out.

*Field Notes.*—"Taken only at night on the open desert with the exception of two or three specimens found under stones on a hillside." Morrow J. Allen (1933, p. 4).

"Thirty-eight specimens of *Coleonyx variegatus* (Baird) were collected in Sonora, and with one exception, in which the specimen was found hidden under a rock, they were discovered at night running about over gravelly soil near the beach and in the mountains . . . The specimens of this species usually run with the tail lifted, often curved over the back. The bright light from my lantern tended to bewilder them, and they were caught at night with little difficulty." E. H. Taylor (1936, p. 479).

*Locality Records.*—This subspecies has been collected at the following points, all in Sonora, Mexico: In the vicinity of Hermosillo (5 miles southwest, 5 miles southeast [type locality], and 15 miles southeast); at and near La Posa (10 miles northwest of Guaymas); Tepoca Bay; Sierra Alamo (30 miles west of Caborca); and Ensenada del Perros at the south end of Tiburón Island. It has also been reported from San Miguel de Horcasitas, which is some 70 miles slightly east of north from Hermosillo (Van Denburgh, 1897, p. 460). A specimen of this subspecies said to be from Nogales, Arizona, is to be considered of doubtful origin until verified by additional material.

***Coleonyx variegatus slevini*<sup>\*</sup> subsp. nov.**

SANTA INEZ ISLAND BANDED GECKO

1922. *Coleonyx variegatus* (part) Van Denburgh, Occ. Papers Calif. Acad. Sci., No. 10, vol. 1, p. 58.

*Type*.—No. 51,697 in the collection of the California Academy of Sciences. Collected on South Santa Inez Island (Lat. 27° N.) on the Gulf of California coast of Lower California, Mexico, on May 13, 1921, by Joseph R. Slevin.

*Diagnosis*.—A subspecies of *Coleonyx variegatus* characterized by the enlargement of the gular scales bordering the mental, so that this subspecies averages fewer scales making this contact than any other. It also usually has 5 instead of 4 body bars as in the other subspecies.

*Description of Type*.—An adult male. This lizard has relatively short legs, although when adpressed they overlap. The tail is round. The snout is somewhat blunt. The eyelids are functional, and the ear openings evident.

Except for the scales bordering the mouth, nostrils, and eyes, the head is covered above and below with non-imbricate, hemispherical granules, exceedingly small but rather uniform in size. They are slightly enlarged on the snout and are conspicuously so where they border the labials. The rostral is pentagonal in shape and is wider than high; the two edges touching the nasals are longer than those engaging the first supralabials. The enlarged supralabials number 7-7 and decrease in size posteriorly; this count is discontinued where the labials become no larger than the adjacent granules, which is just forward of the center of the orbit, and refers to those which can be seen with the mouth closed. The infralabials also decrease in size posteriorly, and to a more marked extent than the upper labials, those touching the mental being much the largest of the series. Those exteriorly visible number 7-8. The nostril is below the line of the canthus rostralis. There is a pair of prenasals, triangular in shape, which contact the first supralabials, the rostral, and are broadly in contact with each other on the median line. There are two small postnasals on either side, and a pair of subcircular supranasals, separated from each other by 3 granules. The post- and supranasals are smaller than the prenasals. Both upper and lower eyelids are edged with serrated scales. The upper scales number about 17; the lower 15, but there seems to be an abnormal gap at the end of the series. The mental is conspicuously the largest head scale. It is somewhat narrower than the rostral but is deeper; its dimensions are 2.1 mm. wide by 2.0 mm. deep. The sides are nearly parallel; the lower or posterior edge is semicircular in form. This edge is contacted by 4 enlarged round gulars. The mental and the first infralabial on each side are contacted by a total of 8 scales. The scales contacting all infralabials are conspicuously enlarged, compared to those covering the central gular area.

The dorsum is covered by granules of similar size to those on top of the head. There are no enlarged tubercles. On the sides the scales become somewhat

\* Named for my good friend Mr. Joseph R. Slevin, Curator of Reptiles, California Academy of Sciences, San Francisco, to whom I have been greatly indebted for many favors and courtesies during the past twenty years.

enlarged and imbricate, posteriorly first, since the granules are smallest under the arms. On the ventrum the scales are imbricate and definitely larger than those on the dorsum. They are subcircular in shape and increase in size posteriorly.

The scales in the preanal region are further enlarged and include a row with conspicuous, brown preanal pores. The latter total 6; the scales containing them are obtusely angular in arrangement with the point forward. The two middle scales are very closely in contact so that the pores touch.

The scales on the arms are mostly imbricate, except on the outer part of the forearm and the lower side of the upper arm. They are largest on the outer forearm. The lower surfaces of the digits are covered by rectangular transverse lamellae, which form corrugated ridges. The claws are extremely delicate, and are held between a pair of shell-like lateral scales, capped by a third.

The legs are covered with granules on the inner surfaces, but with imbricate scales outwardly and below. The claws on the toes are fine and delicate, similar to those on the fingers. There are 21 lamellae on the fourth toe.

There is a spurlike cloacal bone protruding laterally and upward on either side just posterior to the vent. These bones are about 1.2 mm. in length. At the top they are ridged rather than conical.

Most of the tail has been lost, and the regenerated portion is quite short. The original part is covered by annular rows of subrectangular and imbricate scales. They are largest ventrally. At the thickest part of the tail there are about 40 scales in a ring.

The principal dimensions in mm. are as follows: Body length, snout to vent, 56; head length 15; head width 10; rostral to mid-orbit 7.5; rostral to mid-ear 12; width of orbit 3.6; arm fully extended, measured to end of 4th finger 17.5; leg fully extended, measured to end of 4th toe 23; distance between points of cloacal bones 9.

The head is mottled light-brown above and cream-colored below. There is a thin and rather irregular cream-colored line of horse-shoe shape extending from below each eye and above each ear to a loop on the neck. It is interrupted on each side of the neck in a manner characteristic of this subspecies. There is also a short light mark on the canthus rostralis on either side. The bordering scales of the upper eyelids are marked with gray, particularly posteriorly. The inner surface of each eyelid is black, except for the edge scales. The rostral is light in the center but has a dark spot on either side. The mental is unmarked. The upper labials are punctated with brown, but not uniformly, some being dark, others almost immaculate. The posterior infralabials are slightly stippled.

There is a single wide, dark transverse band on the neck, which laterally curves forward under the ears, thus comprising the posterior dark border of the light postparietal or nuchal loop previously mentioned. On the dorsal surface of the body, between limb insertions, there are the mottled and irregular remnants of 5 transverse brown rings, which are much wider than the interspaces. There are rows of brown dots in the interspaces, thus increasing the mottled effect. The ventral surface is cream-colored and immaculate. The



upper surfaces of the limbs, out to the ends of the fingers and toes, are punctated with brown.

*Summary of Paratypes.*—In addition to the type, 19 other specimens, CAS 51,698–51,716, are available from South Santa Inez Island. In the following summary, where statistics are given, the type is included, thus making a total of 20.

In the paratypic series there are 10 adults exceeding 50 mm., snout to vent, and 4 young adults in the 40–50 mm. range. Only one specimen out of 20 has a complete tail. This is a higher ratio of loss than is customary, even in this species with its notably fragile tail, so it is presumed that this subspecies has some active enemy. Some of the juveniles probably lost their tails in the course of capture. The specimen with a complete tail (CAS 51,712) measures 45 mm. in body length, the tail being 41 mm. The longest individual, a female, measures 60 mm.; the shortest is 33 mm. The largest male measures 57 mm.

Of the males sufficiently adult to have active preanal pores, 1 has 5 pores, 5 have 6, and 2 have 7; average 6.13. The mental varies in width from slightly less than the rostral to considerably wider. The mental is usually about as long as wide; in some the sides are parallel, others narrow posteriorly. The posterior edge is curved in a relatively flat arc. The gulars in contact with the mental vary from 3 to 5; average 3.95. This is lower than in any other subspecies. The gulars in contact with the mental and first infralabials (taken together) vary from 7 to 9; average 7.90. The supranasals are separated by either two or three granules; average 2.4. No specimen has the prenasals separated; the median contact is broader than in most other subspecies. The visible, enlarged supralabials number from 6 to 8 and the infralabials the same.

In pattern this subspecies is characterized by the irregularity of the transverse body bands, even in the juveniles, for they are often broken or branched so that there are more on one side than the other. Out of 20 specimens only 3 have 4 bands; 7 others have 4 on one side and 5 on the other, while 10 have 5 bands, a much higher proportion with this number than any other subspecies. The only specimen with a complete tail has 13 dark bars thereon, of which the last 5 are complete ventrally.

In the young the body bars are slightly wider than the interspaces dorsally, and each bar is darker posteriorly. They are not even-edged. They narrow laterally, but at their termini on the sides they tend to spread into thin lateral lines, usually with a forward projection. The body marks are much lighter than the tail bars.

As the lizards age, the dorsal marks become lighter and widen at the expense of the interspaces. The cross bands become somewhat mottled, and a series of spots appears in the interspaces, so that in the largest specimens the cross bands almost lose their identity, and the general effect is of a mottled surface. A vertebral light stripe is sometimes in evidence anteriorly.

The top of the head is brown and unicolor in the young and somewhat mottled or spotted in the adults; the spots, when present, are superimposed on the normal brown. The light postparietal loop, so characteristic of the species, remains narrow and well-defined, even in the largest of the adults;



however, it has a peculiar wavy irregularity and often has a short gap or two in the vicinity of the ear. Sometimes the light line, which comprises the posterior edge of the dark neck band, curves forward and almost joins the postparietal loop.

The rostral is usually dark, particularly at the sides. The upper labials are alternately light and dark, although the spotting does not rigidly follow scale edges, nor is the pattern regular. The mental is clear. The lower labials are spotted, although less so than the supralabials. These spots often extend onto the adjacent gulars.

The cloacal bones are rather broad, with the points at the anterior end of the ridge, and are usually without notches.

To the subspecies *slevini* I also tentatively assign two specimens (CAS 51,463-4) from the larger nearby island of San Marcos. Both of these specimens are young males. One has 6 preanal pores, the other 7. The prenasals are in contact and the supranasals separated by 3 granules. One has 3 gulars in contact with the mental, the other 5. The body rings are irregular but are wider and posteriorly more pointed than in typical *slevini*, thus resembling *peninsularis*. The body bands are 4 in one specimen and 4-5 in the other.

*Relationship with Other Subspecies.*—*Slevini* is most nearly related to *peninsularis* and *sonoriensis*, as would be expected geographically. It is readily distinguished from all other subspecies by the low number of gulars in contact with the mental. Taking only the 20 specimens from South Santa Inez Island, we have the following distribution: 4 have 3 scales; 13 have 4 scales; and 3 have 5 scales; average 3.95. Of the two specimens from San Marcos Island, one has 3 and the other 5 in contact with the mental. With respect to all other subspecies out of 621 specimens examined, not one has only 3 scales in contact. Those with 4 gulars touching the mental are occasional in several other subspecies, but they are comparatively infrequent; for example, in *variegatus* only 13 out of 319, or 4.1 per cent number 4 (none less); whereas in *slevini* those with 4 or less number 18 out of 22, or 82 per cent. This difference is highly significant.

The high number of specimens having 5 body bands (not counting the one on the neck) is also characteristic of this subspecies. In the adult retention of the narrow postparietal light loop *slevini* resembles *peninsularis* and *abbotti*, and to a less extent *sonoriensis*, *utahensis*, and *bogerti*, although the wavy nature and frequent breaks in the line are solely characteristic of *slevini*. The spotting on the upper labials is more conspicuous in *slevini* than in the other subspecies. In the wide character of the bands in the adults the resemblance is nearest *utahensis* and *sonoriensis*, although without the vertebral light line which is often—but not always—present in the latter. There is also, in the nature of these bands, a resemblance to *peninsularis*, especially in the specimens from San Marcos Island, which in this character, must be considered intergrades. These, in fact, in their intermediate nature, justify the subspecific status assigned to the Santa Inez Island individuals, which I should otherwise have considered a full species.

*Field Notes.*—Mr. Slevin tells me he found these geckos on Santa Inez in a rocky ledge about three feet high. They were captured by pulling off the crumbling pieces of rock. Those on San Marcos Island were under stones.

*Locality Records.*—Reported only from Santa Inez and San Marcos Islands, gulf coast of Lower California, Mexico.

### ***Coleonyx variegatus utahensis* subsp. nov.**

#### UTAH BANDED GECKO

1920. *Coleonyx variegatus* Pack, Copeia, No. 88, p. 101.

*Type.*—No. 35,792 in the collection of L. M. Klauber. Collected at Watercress Spring, Washington County, Utah, by Dr. Ross Hardy, April 16, 1941. Watercress Spring is about 1 mile northwest of Saint George.

*Diagnosis.*—A subspecies of *Coleonyx variegatus* characterized, in the adult stage, by the possession of wide, irregular dorsal bands, the irregularity being increased by the merging of the bands with intercalated spots. The bands in *utahensis* are relatively wider than those of the other subspecies except *slevini*, *sonoriensis*, and *peninsularis*. From the first named, *utahensis* differs in having a greater number of gulars in contact with the mental; from *sonoriensis* in having bands not so wide compared with the interspaces, with less regularity of the interspaces, and usually without a mid-dorsal light line. From *peninsularis* it differs in having more irregular dorsal blotches, which are not so wide compared with the interspaces, and in having more wavy light canthal lines. It is noted that where *utahensis* intergrades with *variegatus variegatus* there is first a narrowing (along the body) of the dorsal bands, which coincidentally begin to exhibit lighter centers (not present in *utahensis*) thus producing the double-barred effect characteristic of many *variegatus variegatus* adults.

*Description of Type.*—An adult male. Except for the scales bordering the mouth, nostrils, and eyes, the head is covered above and below with non-imbricate, circular granules, rather uniform in size, except that they are enlarged on the snout and bordering the labials. The rostral is pentagonal in shape and is higher than wide; it is noticeably pointed at the top. The two edges touching the prenasals are longer than those engaging the first supralabials. The supralabials number 7-7 and decrease in size posteriorly, the first being considerably longer than the rest. The infralabials number 8-8, and also decrease in size posteriorly. Such enlarged members of both labial series—to the extent that they can be seen with the mouth closed—terminate under the middle of the eye, the infralabials somewhat posterior to those of the upper series. There is a pair of prenasals, long and narrow; their contact with the first supralabials is prevented by the presence of a tiny scale on either side. They broadly contact the rostral but are prevented, by a single small scale, from meeting each other on the median line. There are three postnasals on each side, the upper being the largest. There is a pair of triangular supranasals, separated from each other by 2 granules. Both upper and lower eyelids are edged with enlarged scales which are slightly serrated, particularly posteriorly. The upper scales number about 19; the lower 15. The mental is conspicuously the largest head scale. It is slightly narrower

than the rostral and is somewhat wider than deep, the dimensions being about 2.7 mm. wide by 2.2 mm. deep. The sides converge posteriorly, the lower edge being a circular arc of small radius. This edge of the mental is contacted by 5 granules. The mental and the first infralabial on each side, taken together, are contacted by 10 granules.

The dorsum is covered by granules similar in size to those on the head. There are no enlarged tubercles. On the sides the scales become somewhat enlarged and imbricate, first at the middle of the body, since the granules are smallest near the arms and legs. On the underside the scales are imbricate and definitely larger than those on the dorsum; they increase in size posteriorly. There is a midventral umbilical line bordered by about 14 scales on either side. The scales in the preanal region are enlarged and include a row of 7 with preanal pores. These are not brown, possibly because of the use of formalin preservative. The scales containing the pores are obtusely angular in arrangement with the point forward.

The scales on the arms are mostly imbricate, except on the lower side of the upper arm. They are largest on the inner edge of the wrist. The palmar surface is tubercular. On the lower surfaces of the digits there are series of rectangular transverse lamellae which are so imbricate as to form sharp corrugations. The claws are extremely delicate; they are brownish in color.

The legs are covered with granular scales outwardly and imbricate anteriorly. These scales are largest on the anterior lower areas of the thighs. The scales on the soles of the feet are granular. The transverse lamellae on the 4th toe number 21. The claws are similar to those on the fingers, fine and delicate, and colored brown. The sheaths, beyond which the claws protrude, comprise a pair of laterals, and a somewhat shorter, pointed terminal.

The cloacal bones are rather sharp, without conspicuous ridges; they are about 1.3 mm. in length.

The tail is covered by annular rows of subrectangular and imbricate scales of larger size than any on the body. They are largest ventrally. At the widest part of the tail there are about 35 scales in a ring.

The principal dimensions in mm. are as follows: Body length, snout to vent 63; head length 14.4; head width 10.1; rostral to mid-orbit 7.2; rostral to mid-ear 13.5; width of orbit 3.5; arm fully extended, measured to end of 4th finger 19; leg fully extended, measured to end of 4th toe 24; length of tail 67; distance between points of cloacal bones 8.

The head is spotted brown above and cream-colored below. There is a thin cream-colored line of horse-shoe shape extending from behind each eye and above each ear to a loop on the neck. It is rather straight across the neck and has a characteristic dip at the ear. There is also a light wavy line on the canthus rostralis on either side. The upper eyelid edges are marked with gray, particularly posteriorly. The inner surface of each eyelid is black, except for the edge scales. The rostral is light in the center but punctated on either side. The mental is speckled anteriorly. The prenasals are dark. The labials, both upper and lower, are punctated with brown, but not uniformly, some being dark, others almost immaculate. Back of the enlarged labial scales the granules which

border the mouth are punctated with gray-brown. A dark mid-gular line is faintly visible through the skin; it is not on the surface. There is a single wide, dark ring on the neck, which laterally curves forward to the ears, thus comprising the posterior dark border of the light postparietal or nuchal loop previously mentioned.

On the dorsal surface of the body, between limb insertions, there are 4 transverse, highly irregular, light-brown bands, slightly wider laterally, and dorsally much wider than the irregular interspaces. These bars terminate on the sides, the ventral surface being immaculate cream-colored. The upper surfaces of the limbs, out to the ends of the fingers and toes, are spotted with brown.

On the tail there are 13 irregular rings, none of which completely circles the tail.

*Paratype Material.*—There have been available 29 specimens from the collection of Dixie Junior College, Saint George, Utah, and 17 from the private collection of Dr. Ross Hardy, all from Washington County, Utah. I have also examined CAS 55,219–20 and 65,116 from Saint George, Utah. In my own collection there are four specimens, Nos. 36021–4, from the type locality, Watercress Spring.

Eighteen specimens from Clark County, Nevada, have been at hand. Those from the Las Vegas-Bunkerville area and the vicinity of Lake Mead are to be considered *utahensis*, although not typical in all characteristics; indeed some are nearer to *variegatus variegatus* than to *utahensis*, showing this to be an area of intergradation. Other specimens from around Indian Springs are also nearer *variegatus*; however, one from Beatty, Nye County, has a pattern somewhat like *utahensis*. Nine specimens from Mohave County, Arizona, and nine from Inyo County, California, have been examined. None of these is typical *utahensis*, although one from Littlefield, Arizona, is nearer *utahensis* than *variegatus variegatus*.

*Range.*—Washington County, Utah, extreme northwestern Mohave County, Arizona, and northeastern Clark County, Nevada. Intergrades with *variegatus variegatus* on the southern and western periphery of this range.

*Morphology.*—The description which follows is based on the material from Utah, omitting the Nevada and Arizona specimens which may be *variegatus variegatus* intergrades in some characters. This is a moderately large subspecies, although it does not reach the size of the central desert form. The largest female has a snout to vent length of 68 mm.; the largest male 64 mm. The smallest individual is 33 mm. The tail, when complete and original, is about as long as the body.

The preanal pores in the males vary from 5 to 8; the counts being as follows: 5 (1), 6 (17), 7 (6), 8 (2); mean 6.35. The cloacal bones are rather sharp and narrow, without conspicuous ridges.

*Scalation.*—The rostral is wider than high; it is rather pointed above. The prenasals are long and slim; the contact with the first supralabials is very narrow, and in some cases is prevented by the interposition of a granule. The



prenasals are in contact on the median line in 32 cases out of 52, a lower proportion than in any other subspecies. The supranasals are separated by from two to four granules, the dispersion of the separating scales being as follows: 2 (23), 3 (28), 4 (1); mean 2.58. The supranasals are larger than the postnasals; of the latter there may be 2 or 3, the upper largest; the lower might be considered a subnasal.

The enlarged supralabials number 6 to 9, 7 or 8 being the more usual. The visible infralabials number 7 to 10, 8 being the most frequent number. The enlarged infralabials extend further posteriorly than the supralabials. The scales of the eyelid edges are only moderately serrated. The granules on the snout are considerably enlarged, compared to those on top of the head; those touching the labials are particularly large.

The sides of the mental are not parallel but converge posteriorly; sometimes the posterior boundary of the entire scale approaches a circular arc. The gulars contacting the mental number as follows: 5 (5), 6 (16), 7 (22), 8 (6), 9 (3); mean 6.74. Those contacting the mental and the first infralabial on either side total as follows: 9 (3), 10 (13), 11 (20), 12 (11), 13 (5); mean 11.04. These contacting scales average higher in number than in any other subspecies.

*Pattern and Color.*—This subspecies is characterized by a considerable ontogenetic change, involving a net increase in pigment. In the young the usual 4 transverse brown body bands are in evidence. These are even-edged and are about as wide as the interspaces, or the dark bars may be slightly narrower. There are no lateral marks. The heads are somewhat lighter brown than the body marks, and are without conspicuous spots. The nuchal light loop is clearly outlined. The tail rings are of the same color as those on the body. The limbs are speckled, particularly on the upper side.

As the lizards age the dark body bands widen conspicuously at the expense of the interspaces, although not reaching the proportional width evident in *sonoriensis* and *peninsularis*. At the same time, as is the case in most of the subspecies, spots appear in the interspaces; however, in *utahensis* these usually become confluent with the main transverse bars, which not only widens the latter but causes their borders to become highly irregular. The bars seldom lighten in the center, thus not attaining the double-barred effect so common in *variegatus variegatus*.

The head becomes conspicuously spotted with dark-brown on a light-brown background; and the band on the neck, also, is mottled, although not so conspicuously. The postparietal or nuchal light loop remains evident, although it becomes somewhat wavy, square on the neck and with a dip downward at the ear. Forward it terminates just below the center of the eye. Light canthal lines are often in evidence, but they also are wavy, becoming lyre-shaped.

The rostral is usually light in the center with dark lateral rings. The prenasals are characteristically dark, much more so than in *variegatus variegatus*, wherein they are usually light at the top, where they approach each other. The upper eyelids are generally tipped with gray, especially posteriorly. The labials



are mottled, the upper more than the lower. The mental may be clear but is usually lightly punctated near the edge of the mouth. Some of the gulars may be spotted. The limbs are darkly suffused with brown above or may be spotted, this being particularly true of the hind legs. They are sometimes punctated below. Some have the palmar surfaces darkened. The claws are often brown. A few specimens have the ventrum lightly stippled posteriorly. Nearly all specimens have a dark line below the surface in the mid-ventral position under the head. This may be evident only in this subspecies because of the use of formalin preservative in the series available to me.

The following color notes, using Ridgway's standards, were made on live adult specimens kindly sent me by Dr. Ross Hardy from the type locality: The dorsal body bars are Mummy Brown with interspaces of Naples Yellow. The spots on the head are Dark Vinaceous-Drab upon a background of Light Vinaceous-Drab. The upper leg surfaces are Light Vinaceous-Drab with Lavender below. The ventrum is White with a pinkish tinge of blood showing through.

*Relationships with Other Subspecies.*—This subspecies is obviously an offshoot of *variegatus variegatus*, with which it probably intergrades over a considerable area, especially in central Clark County, Nevada. In addition to these areas of contact, specimens of *variegatus variegatus* from the mountains scattered throughout its desert range are likely to show *utahensis* tendencies in an increase in the width of the dorsal blotches. But in most of their respective ranges they are quite distinct. In addition to the differences in pattern, *utahensis* has a more pointed rostral. The first supralabials in *variegatus variegatus* are higher in relation to the position of the nostril than in *utahensis*. The eyelid scales are more pointed in the typical desert subspecies. In *utahensis* the mental more often exceeds the rostral in width than in any other subspecies. Superficially, *utahensis* is most like *sonoriensis* and *peninsularis*, yet is separated from the ranges of these two subspecies by the wide desert area inhabited by *variegatus variegatus*. This seems more likely a case of the retention of original characters than one of parallel development.

*Field Notes.*—Dr. Ross Hardy advises me that most of the specimens collected at Watercress Spring (the type locality) were found beneath red-sandstone slabs.

I have collected specimens in the evening in the Boulder City, Nevada, area by driving on the roads at night. I found two in the daytime on an island in Lake Mead when they were forced to the peak by the rising water.

*Locality Records.*—UTAH: *Washington County*—Saint George, Red Hill (1 mi. n. of Saint George), Watercress Spring (type locality), Diamond Valley, Washington Fields (3 mi. s. of Washington), Ivins, Zion National Park, Beaver Dam Slope, Gunlock, summit 25 mi. w. of Saint George, Castle Cliffs. ARIZONA: *Mohave County*—Littlefield, Lake Mead (20 mi. above Boulder Dam). NEVADA: *Clark County*—Glendale, near mouth of Virgin river, mouth of Boulder Wash, Boulder City, 8 mi. s. of Railroad Pass, Mesquite Dry Lake, mouth of Kyle Canyon (Charleston Mts.), and various islands in Lake Mead. The Las Vegas—Boulder Dam area is one of intergradation

between *utahensis* and *variegatus variegatus*, and many specimens from the above mentioned localities in Clark County show pattern mixtures of both subspecies. La Rivers (1942, p. 56) records two specimens from Lincoln County, Nevada, (2 mi. s. of Carp on Muddy River at 3100 ft. and Quartz Spring at 4500 ft.) which may tentatively be assigned to this subspecies. A specimen occasionally mentioned in the literature from Farmington, Davis County, Utah, is no longer available. This is far beyond the known range of the species, and unless verified by additional material is to be considered an inaccurate record.

### ***Coleonyx variegatus bogerti*\* subsp. nov.**

#### TUCSON BANDED GECKO

1893. *Coleonyx variegatus* (part) Stejneger, North American Fauna, No. 7, p. 162.

*Type*.—No. 32,486 in the collection of L. M. Klauber. Collected by Lee W. Arnold, at Xavier, Pima County, Arizona, July 17, 1939. Xavier is a railroad siding across the Santa Cruz River from San Xavier Mission, and about 10 miles south of Tucson.

*Diagnosis*.—A subspecies which differs from the others in having a higher number of preanal pores in the males, *bogerti* usually having 8 or more, while the others generally have 7 or less. In addition, it differs from all except *variegatus variegatus* in the adult pattern. In *bogerti* the transverse bars on the dorsum are usually equal to, or narrower than, the interspaces and have edges darker than the centers; in *utahensis*, *sonoriensis*, *peninsularis*, and *slevini* the bars exceed the interspaces in width and lack the double-barred effect resulting from the lighter interiors characteristic of the Tucson subspecies. *Bogerti* adults have heads which are conspicuously spotted or mottled, which is not true in *abbotti*. The mental of *bogerti* is wider, in proportion to its depth, than is the case in *variegatus variegatus*.

*Description of Type*.—An adult male. The head is covered above and below with non-imbricate, circular granules, rather uniform in size, except that they are enlarged on the snout and where they border the labials. The rostral is pentagonal in shape and is wider than high. The two concave edges touching the prenasals are longer than those engaging the first supralabials; the latter are convex. The supralabials number 7-7 and decrease in size posteriorly; the enlarged series terminates just anterior to the center of the orbit. The infra-labials visible with the mouth closed number 8-8. There is a pair of prenasals, lunar in shape but wider above, which contact the first supralabials, the rostral and are broadly in contact with each other on the median line. There are two circular postnasals, and a tiny subnasal on either side. There is a pair of supranasals, larger than the postnasals and separated from each other by 3 granules. Both upper and lower eyelids are edged with a series of enlarged

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\* Named for Mr. Charles M. Bogert, Curator of Reptiles, American Museum of Natural History, whose interest in herpetology I have watched expand from a boyhood hobby to important and admirable research.

scales, which are serrated at the outer edges. The upper row numbers about 17; the lower 14. The mental is conspicuously the largest head scale. It is equal in width to the rostral and is considerably wider than deep, the dimensions being about 2.7 mm. wide by 2.2 deep. The sides are curved; the posterior edge comprises a rather flat circular arc. This edge is contacted by 7 gulars. The mental plus the first infralabial on each side are contacted by 11 gulars.

The dorsum is covered by granules of similar size to those in the head, there being no enlarged tubercles. On the sides the scales become somewhat enlarged and imbricate; the lateral granules are smallest at the limb insertions. On the underside the scales are imbricate and definitely larger than those on the dorsum. They are longest posteriorly and medianly.

The scales in the preanal region are further enlarged and include a row with conspicuous, brown preanal pores. The latter total 10; the scales containing them are obtusely angular in arrangement with the point forward. The two central scales overlap, one being somewhat forward of the other.

The scales on the arms are mostly imbricate, except on the outer edge. The palmar surface is tubercular. On the lower surfaces of the digits there are series of rectangular transverse lamellae, which form a serrated ridge. The claws are extremely delicate. They protrude from a sheath comprising a pair of large laterals, capped by a shorter, pointed terminal.

The legs are covered with granular scales on the upper surfaces and imbricate below. They are largest on the lower areas of the thighs. The lamellae on the toes and the claws are similar to those on the fingers.

There is a spurlike cloacal bone protruding laterally and upward on either side just posterior to the vent. These cloacal bones are about 1.3 mm. in length. At the top they are ridged rather than conical, the point of the ridge being forward. There is no notch in the ridge.

The tail is covered by annular rows of subrectangular and imbricate scales of larger size than any on the body. They are largest ventrally. At the widest point there are about 41 scales in a ring.

The principal dimensions in mm. are as follows: Body length, snout to vent 64, head length 17.2, head width 9.8, rostral to mid-orbit 7.4, rostral to mid-ear 13.4, width of orbit 3.2, arm fully extended, measured to end of 4th finger 20, leg fully extended, measured to end of 4th toe 25, length of tail (regenerated) 48, distance between points of cloacal bones 7.1.

The head is light-brown above, spotted with dark-brown. There is a wide cream-colored line of horse-shoe shape extending from below each eye and just above each ear to a loop on the neck. There is also a short, wavy light line on the canthus rostralis on either side. The scales edging the upper eyelids are posteriorly marked with gray. The inner surface of each eyelid is black, except for the edge scales. The rostral is light in the center but punctated with brown on either side. The mental is also punctated anteriorly. The labials, both upper and lower, are speckled with brown, but not uniformly, some being dark, others immaculate. Back of the enlarged labial scales the granules which border the mouth are punctated with gray-brown. The gular surface is cream-colored and without spots.

There is a single wide, dark ring on the neck, which laterally curves forward under the eyes, thus forming the posterior dark edge of the light postparietal loop previously mentioned. However, an irregular light line passes backward from the loop, almost separating the dark nuchal band into two parts. On the dorsal surface of the body, between limb insertions, there are 4 transverse brown bars, the centers of which are somewhat lighter than the borders. These bands are narrower than the interspaces. There are several dark spots in the interspaces. The sides are spotted but the ventral surface is immaculate cream-colored. The upper surfaces of the limbs, out to the ends of the fingers and toes, are punctated or spotted with brown.

On the tail there are only 2 rings, since most of it has been regenerated. The new portion is speckled.

*Paratypic Material*.—I have had available for study 83 specimens from Pima County, most of them from Tucson or from points within 15 miles of that city. In addition there are 47 specimens from Pinal County, 11 from Gila, 3 from Graham, one from Greenlee, and 4 from Santa Cruz.

*Range*.—Southeastern Arizona from the vicinity of Casa Grande, Pinal County, south to the Mexican border, and northeast to the Roosevelt Reservoir, thence southeastward to the New Mexican line at Duncan, Greenlee County. It undoubtedly occurs in extreme southwestern New Mexico, westward of the Continental Divide, but I have seen no specimens from that state. The line of separation from *variegatus variegatus* is taken as the line Casa Grande-Covered Wells, but additional specimens will be required to define the area of intergradation with greater assurance.

*Morphology*.—The description which follows is based only on the specimens from the Tucson area. *Bogerti*, while probably not reaching the extreme size of *variegatus variegatus*, is nevertheless as large or larger than any of the other subspecies. The largest specimen is a female measuring 69 mm., snout to vent. The largest male is 64 mm. The smallest individual from the Tucson area is 30 mm.; a specimen 28 mm. in length is available from the Sierra Ancha Mountains, Gila County.

In body proportions and the shape of the snout this subspecies seems to be similar to *variegatus variegatus*. There is considerable variation in the ear opening, both as to size and shape; it may be either round or elliptical.

The preanal pores in the males are distributed as follows in the individuals from about Tucson: 8 (12), 9 (15), 10 (7), 11 (2), 12 (1); mean 9.05. While this is a considerably higher average than that of any other subspecies, it is obvious that there is some overlapping and therefore these pores do not comprise an invariable key character. In *bogerti* there is a tendency of the median scales in the series carrying pores to overlap.

*Scalation*.—The rostral, which is pentagonal in shape, is always wider than high. The crescent-shaped prenasals taper almost to a point, where they contact the first supralabials. There are usually two postnasals, of which the upper is the larger; a small infranasal is sometimes present. The supranasals are larger than the postnasals, and are triangular or circular in shape. The prenasals are



usually broadly in contact on the median line; this contact is prevented by the interposition of granules in only 3 out of 81 specimens. The supranasals are separated by the following numbers of granules (counting the minimum series in each case): 1 (3), 2 (16), 3 (61), 4 (1); mean 2.74. The enlarged supralabials usually number 7 or 8; the infralabials 7 to 9. The scales bordering the eyelids form a serrated series. The scales on the snout are conspicuously enlarged, compared with those on top of the head; however, the largest head scales are those contacting the mental or labials. The mental is usually slightly wider than the rostral; in some specimens it is conspicuously wider, but in others equal or even a trifle narrower. The mental is more semicircular in shape and is shorter in proportion to its width than is the case in *variegatus variegatus*. The average ratio of depth to width in *bogerti* is about 0.8. The number of gulars contacting the mental varies as follows: 4 (5), 5 (13), 6 (34), 7 (20), 8 (5), 9 (3); mean 6.20. The gulars in contact with the mental and first infralabials on either side when taken as a unit are 7 (1), 8 (4), 9 (10), 10 (27), 11 (25), 12 (8), 13 (4); mean 10.41.

*Pattern and Color.*—The young of *bogerti* are much like the other subspecies in color and pattern. The cross bands on the body are even-edged and somewhat narrower than the interspaces; occasionally they are much narrower. The tail rings may be of the same shade as the body bars or slightly darker. The head is unicolor light-brown on top—lighter than the body bands. The nuchal light loop is narrow and moderately well-defined. Canthal light lines are present.

The first ontogenetic change is the appearance of spots on the head. These may be in evidence when the body length reaches 35 to 38 mm. This is followed by the appearance of spots between body bars and punctations along the sides.

The fully adult gecko has very conspicuous dark-brown spots on top of the head. The postparietal or nuchal light loop is widened and without even borders; in some specimens it almost disappears. The light canthal dashes are retained; with a light cross mark in front of the eyes, they form a triangle. The rostral is light in the center but dark at the sides. The apex is usually light, but may be punctated. The prenasals are dark, usually to their points of contact. The supranasals are light. The labials are irregularly spotted. The mental is usually marked anteriorly, but may be clear.

The ontogenetic change in the body bars generally involves the interposition of spots between the dorsal bars. At the same time the bars become rather irregular. The anterior and posterior borders become darker than the centers, thus giving a double-barred effect. The width of the bars remains about equal to the interspaces. There is also considerable lateral spotting. The ventral surface of the body is immaculate. If the tails remain complete, spots appear between the original bands. Regenerated tails may be spotted or speckled. The arms are usually suffused above, while the legs are spotted.

Of the specimens from the Tucson area, 68 out of 75 have 4 body bars, counting only those between the limb insertions. One has 3 on one side of the body and 4 on the other; five have 4 bars on one side of the body and 5 on the



other; and a single specimen has 5 complete bars. The tail bands vary from 9 to 14, 11 or 12 being the most prevalent. Somewhat less than half of the posterior bands may completely encircle the tail, but they are rarely as distinct ventrally as above. Mid-dorsal light lines are evident in only two specimens out of 75.

A live specimen from Tucson, sent me through the courtesy of Dr. Charles T. Vorhies, had the following coloration, by Ridgway's Standards: The head spots were dark Purple-Drab on a background of Light Vinaceous-Drab. The nuchal ring was Pale Grayish Vinaceous. The dorsal body bars were Dusky Brown on the edges and Vinaceous-Drab in the centers. The interspaces were Colonial Buff. The venter was White. The anterior tail rings were Warm Blackish-Brown with Colonial Buff interspaces. The legs were Light Purple-Drab above and Light Brownish-Vinaceous below.

*Intraspecific Trends.*—Specimens from the vicinity of Florence, Pinal County, are much like those from near Tucson, with no great reduction evident in the number of preanal pores in the males; 12 specimens average 8.83, compared with a mean of 9.05 in the Tucson specimens. The pattern is unchanged—double-barred primary blotches with conspicuous spots between, especially laterally. There is a somewhat greater tendency toward a mid-dorsal light line, characteristic of *sonoriensis*, particularly in specimens from about Picacho. Only two specimens out of 47 have other than 4 cross bars, one with 5 on one side, one with 5 straight across.

From further west in Pinal County, from such points as Covered Wells, Gunsight, Dowlings Well, and Bates Well, there are too few specimens to make sure whether they should be assigned to *bogerti* or *variegatus variegatus*. There are 7 preanal pores in two males, so that tentatively I have placed them in the latter category.

The specimens from Santa Cruz County are also too limited in number to make a definite allocation, particularly as only one is a male and two are juveniles. The one adult suggests *bogerti* rather than *sonoriensis*. One specimen (USNM 16,808) recorded from Nogales, Arizona, is certainly *sonoriensis*, but the locality records of these early specimens, owing to the method of cataloguing, are often of doubtful accuracy.

From mountain areas in Gila County, there are eleven specimens available. Their assignment to this subspecies is only tentative. Most of the available specimens are juveniles; the few adults indicate that the inhabitants of this area are probably stunted. The juvenile head marks are retained with little spotting in the adults. The body bars are somewhat wider than in the Tucson specimens, and some irregularity is in evidence. One specimen has 3 bars on one side, 4 on the other; another has 4 and 5, and still another 5 and 6. The number of preanal pores suggests that they be considered *bogerti*.

Two males from Graham County have 8 preanal pores. The body bars are somewhat darker and wider than in the Tucson specimens. These specimens show no *brevis* tendencies; undoubtedly the geckos of this area should be considered *bogerti*.

The only specimen at hand from Greenlee County (Cornell 777) is the most easterly available representative of the species *variegatus*. It is fortunately a male and, having 9 preanal pores, shows no tendency toward *brevis*; quite the contrary, in fact, for the pores are very close together at the apex, whereas in *brevis* they are not only few in number (generally 4) but likewise are separated at the anterior point of the series. The dorsal bars are rather wider than in most *bogerti*; unfortunately we have no way of knowing whether the full growth has been reached, although the pores are fully developed.

*Relationships with Other Subspecies.*—*Bogerti* is closest to *variegatus variegatus*, with which it probably intergrades over a wide area in eastern Maricopa County, western Pinal County, and western Pima County. It may contact *sonoriensis* in north central Sonora, but material from south of Nogales and Douglas will be required to determine this. The relationships with the other subspecies are through *variegatus variegatus*.

There is no evidence of a direct connection between *bogerti* and *brevis*, notwithstanding their close territorial proximity; they may in fact, overlap. *Brevis* more nearly resembles *sonoriensis* than *bogerti*, and if it should ever be demonstrated that *brevis* and *variegatus* are conspecific, the connection is likely to be found in Mexico.

*Ecological and Field Notes.*—*Bogerti*, when collected in the daytime, has been found under stones, fallen advertising signs, debris in a city dump, and the dried carcass of a steer. I have caught them by driving on the road at night in the vicinity of San Xavier Mission and Wrightstown (east of Tucson), but they seemed not nearly so plentiful as is *variegatus variegatus* in the Borego area. Two were found together at 11:20 P. M. with the air temperature 79° and another at 11 P. M. with the temperature 91°. Dr. A. I. Ortenburger unearthed a specimen while digging for a snake; it was found about 1½ feet below the surface and 8 feet from the entrance of the mammal burrow in which it had taken refuge (1926, p. 103). Charles E. Shaw reports specimens having eaten beetles, grasshoppers, and sow bugs.

*Locality Records.*—ARIZONA: *Pima County*—Tucson (also 6 and 8 mi. w. and 6 mi. n.), Tucson Mountains, "A" Mountain (near Tucson), Fort Lowell, Wrightstown, Sabino Canyon (also 2 and 3 mi. w.), Steam Pump Ranch (13 mi. n. of Tucson), San Xavier Mission (also 3 mi. n.), Xavier (type locality), Tanque Verde Ranch (also 3½ mi. e.), Foothills Station (Santa Catalina Mountains), Romero Canyon (Santa Catalina Mountains), Saguaro National Monument, base of Santa Rita Mountains, 11 and 27 mi. w. of Tucson (on the road to Sells), Silverbell; *Santa Cruz County*—Tubac, Cayetano Mountains (near Calabasas); *Cochise County*—Tombstone, Turner, Huachuca Mountains; *Greenlee County*—Duncan; *Graham County*—9½ mi. sw. of Safford, 7 mi. se. of Solomonsville; *Gila County*—Sierra Ancha Mountains, Roosevelt Reservoir, Miami (also 16 mi. w.), Rice; *Pinal County*—Coolidge Dam (may be Gila County), Southwestern Arboretum, Florence Junction (also 1, 2, 3, 4, 5, 6, 7, 8, and 11 mi. s.), Florence (also 2, 3, 5, 6, 8, and 9 mi. n., 30 mi. e., 1 mi. s., and 3 mi. w.), Coolidge, Canyon del Oro, 3 mi. se. of Picacho, Sacaton (probably *variegatus variegatus* intergrade), Casa Grande

(also 5, 6, and 12 mi. w., this being an area of intergradation with *variegatus variegatus*). The area of intergradation between *bogerti* and *variegatus variegatus* in central Pima County has not yet been determined with accuracy. Probably there is a gradual change. I have tentatively assigned to *variegatus variegatus* specimens from Gunsight, Covered Wells, Bates Well, and 2 mi. e. of Dowlings Well.

*Bogerti* undoubtedly occurs in Hidalgo County, New Mexico, but no definite records are available to me.

### **Coleonyx fasciatus (Boulenger)**

#### BLACK BANDED GECKO

1885. *Eublepharis fasciatus* Boulenger, Cat. Liz. Brit. Mus., Vol. 1, p. 234.

Type specimen in the collection of the British Museum. Type locality Ventanas, Durango, Mexico.

1893. *Coleonyx variegatus* (part) Stejneger, N. Am. Fauna, No. 7, p. 162.

1935. *Coleonyx fasciatus* Taylor, Univ. Kan. Sci. Bull., Vol. 22, no. 9, p. 203.

*Type*.—The type specimen in the British Museum has not been seen. In addition to the original description, an expanded description of this specimen, with a figure, will be found in Günther, 1893 (p. 84, plate 31, fig. A).

*Diagnosis*.—A species without dorsal tubercles, differing in this respect from *elegans* and *mitratus*. From *brevis* and all subspecies of *variegatus* it differs in being without enlarged postnasals and in having more robust limbs and digits. It has three, instead of four or more, dark dorsal bands between limb insertions, and the bands are much darker—being black or almost black—than in any *brevis* or *variegatus*.

*Description*.—Only two specimens of this gecko are known, the type and a specimen EHT-HMS 10,537 (field number 556) collected about 10 miles south of Presidio, Sinaloa, Mexico, by Dr. E. H. Taylor, June 19, 1934. Dr. Taylor has kindly permitted me to examine his specimen, upon which the following description is based. I have used my own terminology rather than copying Dr. Taylor's own excellent description (Taylor, 1935) in order to parallel the descriptions of the other species and subspecies.

The specimen is an adult male. The head is covered above and below with non-imbricate, closely-set, circular granules, rather uniform in size, except that they are much enlarged on the snout and where they border the labials. The rostral is pentagonal in shape and is wider than high. The sides engaging the first supralabials are shorter than the two concave edges touching the prenasals. The supralabials number 6-7 and decrease in size posteriorly; the enlarged series terminates just behind the center of the orbit. The infralabials visible with the mouth closed number 7-7. There is a pair of prenasals, lunar in shape, but wider above, which contact the first supralabials, the rostral and touch each other on the median line. (These scales are separated by a granule in the type.) The nostril is circular and moderate in size; it is below the canthal ridge. The postnasals are not enlarged; about six granules contact each nostril

posteriorly. There is a pair of supranasals, separated from each other by 3 granules. Both upper and lower eyelids are edged with a series of enlarged scales, of which the posterior are pointed. The upper row numbers about 18; the lower 23. The mental is conspicuously the largest head scale. It is wider than the rostral and is considerably wider than deep, the dimensions being about 3.0 mm. wide by 2.1 deep. The sides are posteriorly convergent; the posterior edge comprises a circular arc. This edge is contacted by 6 gulars. The mental, together with the first infralabial on each side, is contacted by 9 gulars. The side granules touching the labials are larger than those contacting the mental.

The dorsum is covered by granules of larger size than those in the head; there are no enlarged tubercles. On the sides the scales become somewhat enlarged and imbricate; the lateral granules are smallest behind the arms. On the underside the scales are imbricate and definitely larger than those on the dorsum. They are largest posteriorly and medianly. The after edges are circular. The scales which contact the umbilical line are irregular.

The scales in the preanal region are further enlarged and include a row of rectangular scales with conspicuous, brown pores. The latter total 11; the scales containing them are obtusely angular in arrangement with the point forward. The median scale of the series is triangular and contains a pore.

The scales on the arms are mostly imbricate. They are largest on the inner edge of the forearm, and smallest on the lower side of the upper arm. The palmar surfaces are tubercular. The digits are sheathed with imbricate scales; on the underside of each there is a series of lamellae, with semi-circular outer edges, which are so strongly imbricate as to constitute a corrugated ridge. These are heavier than in *variegatus*. The fingers terminate in sharp claws, which are housed by, and are probably retractile between, a pair of lateral shell-like scales, larger than the corresponding members in *variegatus*. The upper crevice between the shells is capped by a single sharply pointed scale; below, the crevice is closed by the terminal lamella. The claws protrude less than in *variegatus*, thus showing a tendency toward *elegans*. There are 13 lamellae on the fourth finger.

Of the scales on the legs the largest are on the anterior edge of the thigh, and the smallest on the posterior. The toes are sheathed similarly to the fingers. There are 18 lamellae on the fourth toe.

There is a spurlike cloacal bone protruding laterally and upward on either side just posterior to the vent. These spurs are shorter than those in *variegatus* specimens of similar size. There is a postanal swelling and paired postanal sacs.

The tail is covered by annular rows of subrectangular and imbricate scales of larger size than any on the body. They are largest ventrally. At the widest point there are about 25 scales in a ring.

The principal dimensions in mm. are as follows: Body length, snout to vent  $58\frac{1}{2}$ , head length  $14\frac{1}{2}$ , head width 9.7, rostral to mid-orbit 7.4, rostral to mid-ear 12.8, width of orbit 3.5, arm fully extended, measured to end of 4th finger 17, leg fully extended, measured to end of 4th toe 23, length of tail (regenerated) 53, distance between points of cloacal bones 7.2.



The head is very dark-brown above, and almost black posteriorly and on the outer edges. There is a wide tan-colored line of horse-shoe shape extending from below each eye and just above each ear to a loop in the parietal area. The posterior part of this loop is wider and further forward than in *abbotti*. There is also a short, straight, tan line on the canthus rostralis on either side. The scales edging the eyelids are light, except that those above are posteriorly marked with gray. The inner surface of each eyelid is black, except for the edge scales. The rostral, mental, and labials are unspotted. The gular surface is clear, but is tinged with greenish on either side below the infralabials.

There is a single wide, dark band on the neck, which laterally curves forward across the ears, thus forming the posterior dark edge of the light parietal loop previously mentioned. An extension of this band is carried backwards, just above each arm insertion, to join the first body band. On the dorsal surface of the body, between limb insertions, there are 3 transverse, even-edged, dark bands, the centers of which are dark-brown and the edges black. These bands are more than twice as wide as the interspaces. The bands terminate on the sides. The interspaces are tan. The ventral surface is immaculate yellowish-tan. The upper surfaces of the limbs, out to the ends of the fingers and toes, are grayish.

On the tail there is one wide, black ring and the beginning of a second. Posterior thereto the tail has been regenerated and comprises a gray ground color with darker spots. Although the tail of the type specimen is also regenerated, it can be seen from the figure that the rings in this species are fewer and wider than in *variegatus* or *brevis*, and probably they tend to be more complete ventrally.

*Relationships with Other Species.*—This is a well-differentiated species. While it has many homologous items of morphology, scalation, and pattern with both *variegatus* and *brevis*, it is so well separated that the territorially nearest specimens of *variegatus* (*sonoriensis*) or *brevis*, except for a darkening in color, seem to show no particular *fasciatus* tendencies.

*Field Note.*—"The specimen was obtained late in the afternoon ensconced beneath a pile of small logs in the forest, June 19, 1934. Here the trees (really only overgrown shrubs, usually about 15 to 20 feet high) were thick, and beginning to leaf out, since the rains had begun just a short time previously." Taylor, 1935, p. 204.

*Locality Records.*—At present this species is known only from two points: Ventanas, Durango (type locality), and 10 miles south of Presidio, Sinaloa, Mexico.

### **Coleonyx brevis Stejneger**

TEXAS BANDED GECKO

1858. *Stenodactylus variegatus* (part) Baird, Proc. Acad. Nat. Sci. Phila., Vol. 10, p. 254.

1880. *Coleonyx variegatus* Cope, Bull. U. S. Nat. Mus., No. 17, p. 13.



1885. *Eublepharis variegatus* (part) Boulenger, Cat. Lizards Brit. Mus., Vol. 1, p. 233.

1893. *Coleonyx brevis* Stejneger, North American Fauna, No. 7, p. 163.  
Type specimen: USNM 13,627. Type locality: Helotes, Bexar Co., Texas.

*Type*.—Stejneger originally distinguished *brevis* from *variegatus* premised on its having a shorter snout, less developed anterior nasals, and more numerous labials. Although he named a type specimen, No. 13,627, which is still in the U. S. National Museum, he did not describe it. Strecker (1933, p. 77) has given an interesting picture of the type locality, Marnock's Ranch on Helotes Creek, some 22 miles northwest of San Antonio, Bexar County, Texas.

*Diagnosis*.—*Brevis* may be distinguished from the southerly members of the genus by the absence of enlarged tubercular scales among the granular scales of the dorsum. Although the characters first used by Stejneger to distinguish *brevis* from *variegatus*, proved, with the availability of more material, to lack consistency, the species are indeed different, other divergences having been discovered. H. M. Smith, in 1933, pointed out that the preanal pores are fewer in *brevis* (seldom other than 4), and are separated into two lateral series by unpitted scales at the apex, while in *variegatus* the two series contact at the apex; he also discussed the pattern differences, and differences in the cloacal spurs. In *brevis* the supranasals are somewhat smaller and more widely separated than in *variegatus*. From *fasciatus*, *brevis* may be distinguished by the lower number of anal pores and by the spotting of the adults.

*Range*.—*Brevis* occurs from central New Mexico south throughout the trans-Pecos region of Texas, and in the Rio Grande area southwest of a line from Crockett County to Kleberg County, with a northeast extension into Medina and Bexar counties. In Mexico it has been collected in northern Tamaulipas, northern and central Nuevo León, southern Coahuila, and western Durango. No doubt this range will some day be considerably enlarged, particularly into northern Coahuila and Chihuahua.

*Material*.—The following specimens have been available for study:

New Mexico	2
Trans-Pecos Texas	61
Middle Southwestern Texas	42
Extreme Southern Texas	39
Coahuila, Mexico	7
Nuevo León, Mexico	5
Tamaulipas, Mexico	1
Durango, Mexico	5

*Morphology*.—*Brevis* is a lizard of moderate body proportions, not particularly flattened either in head or body. The legs are relatively short and

weak; however, when adpressed they overlap. The head is wedge-shaped and the snout not especially pointed. It seems slightly blunter than in *variegatus*. The nostrils are circular. The ear openings are conspicuous; they differ considerably in relative size and may be either circular or elliptical. The eyelids are functional and are interiorly pigmented with black. There is a mid-dorsal groove bounded on either side by a rounded ridge. There is a conspicuous umbilical line. The peritoneum is unpigmented.

Out of the 162 specimens which I have studied, the largest is a female, measuring 59 mm., snout to vent. This is from Langtry, Texas. Other specimens closely approach this length, which therefore is not exceptional. The longest male measures 56 mm. Thus *brevis* is considerably smaller than *variegatus variegatus*, wherein females exceeding 70 mm. are not unusual. The smallest *brevis* measures 22 mm.

The tails are seldom original and complete. When complete they approximate the body in length, tending to be slightly shorter, proportionally, in the adults.

The lateral cloacal spurs are relatively wider than in *variegatus*, with a ridge paralleling the side of the tail. The spur bends slightly forward so there is an anterior point. Notches are occasionally present.

The dispersion of the preanal pores in the adult males is as follows: 3 (1), 4 (62), 5 (5), 6 (2); mean 4.11. The propensity to 4 is strongly evident. There are usually several median scales separating the two side series of enlarged scales carrying the pores; these separating scales number as follows: 0 (3), 1 (12), 2 (30), 3 (15), 4 (11); mean 2.27. While enlarged scales are present in the females, and often have depressions corresponding to the true pores in the males, they have not been tabulated, as there are some of intermediate size, of which one cannot be certain. But in general, like the males, the females possess a pair of enlarged scales on either side, separated by from 1 to 4 smaller median scales. This almost universal separation of the scales carrying the pores is a character which readily distinguishes *brevis* from *variegatus*.

*Scalation*.—The head is covered above and below with hemispherical granules, except for the scutes which border the mouth, nostrils, and eyes. The granules are somewhat enlarged on the snout, particularly where they abut the labials; in fact, the enlargement adjacent to the labials is generally greater than in *variegatus*.

The rostral is the largest of the head scales except the mental. It is pentagonal, with concave sides contacting the prenasals. The prenasals are lunar in shape and wider above. They usually touch the first supralabials. Often the prenasals meet on the median line, but in 53 cases out of 155 (34.2 per cent) this contact is prevented by the interposition of a granule. The supranasals are quite small, and are widely separated from each other by the small scales of the snout. The minimum scales bridging the gap between the supranasals are as follows: 3 (30), 4 (92), 5 (29), 6 (1); mean 4.01. This tabulation omits a single peculiar specimen from southern Coahuila having only

one scale interposed; this will be discussed later. There are 2 to 4 postnasals (the lower might be considered a subnasal), the distribution being as follows: 2 (148), 3 (128), 4 (20); mean 2.57.

The enlarged supralabials decrease in size posteriorly, gradually merging into granules. The first is the largest of the series, being the highest and usually the longest as well. The enlarged scales terminate somewhat anterior to a point below the center of the eye. The counts of the supralabials are as follows: 5 (1), 6 (32), 7 (124), 8 (104), 9 (13), 10 (3); mean 7.38.

The eyelids are edged with pointed scales numbering about 18 to 20 above and 20 to 23 below.

The mental is the largest scute. It is usually considerably wider than the rostral. Posteriorly it is semi-circular in shape, seldom having parallel anterior sides, as in some *variegatus*. The enlarged infralabials, visible with the mouth closed, generally number 6 to 8.

The gulars contacting the mental are usually smaller than those touching the anterior infralabials. Those touching the mental are distributed thus: 4 (1), 5 (15), 6 (54), 7 (56), 8 (21), 9 (7); mean 6.66. The total gulars touching the mental, together with the first infralabial on either side are: 8 (3), 9 (12), 10 (55), 11 (48), 12 (24), 13 (9), 14 (1), 15 (1); mean 10.75.

The dorsal surface of the body is covered by granules somewhat like those on the head. They are usually larger posteriorly and medianly, although this is not always the case. The smallest body scales are at the limb insertions. Ventrally the scales become imbricate and are considerably larger than those on the dorsum. These ventral scales are usually largest posteriorly and medianly.

The tail is covered with annular rows of imbricate scales, usually larger than any on the body.

The arms and legs are covered with scales which are usually imbricate, although granular posteriorly, especially at points of insertion.

The palmar surfaces and scales are covered with tubercular scales. The fingers and toes are sheathed with overlapping scales. The lower surfaces are covered with strongly imbricate scales, thus presenting a corrugated surface. There are about 14 corrugations on the fourth finger and 16 on the fourth toe. The claws are delicate and hollowed out below. They are housed and are retractile between two large lateral shell-shaped scales, capped above by a long thin pointed scale (the terminal).

*Pattern and Color.*—In the juvenile stage *brevis* is not greatly different from the various subspecies of *variegatus*. There are four brown even-edged cross bands on the body between limb insertions, and another on the neck forming the posterior border of a light nuchal loop. The body bars are about equal in width to the interspaces. The bars terminate on the sides, the ventrum being immaculate. The head, anterior to the nuchal loop, is lighter than the body bars. It is somewhat mottled and with light canthal lines. The nuchal loop is wider than in *variegatus*. The tail rings are usually narrower than the interspaces. They number 6 to 11, averaging about 9. Sometimes the tail bands are darker than the body bands. The limbs are punctated above.

The change to the adult pattern is as extensive as in *variegatus variegatus*, but somewhat different in character. The earliest changes take place on the head, which begins to show spots when a length of about 30 mm. is reached. Then spotting begins on the body, first laterally and between blotches, but gradually all over. The essential difference from the *variegatus* subspecies lies in the even distribution of the body spots in the final adult dorsal pattern; for in *brevis* the dorsal spots are evenly superimposed over almost the entire surface, producing a leopard-like effect, whereas in *variegatus* they are accentuated in, or restricted to, the areas between the dark cross bars. Simultaneously, the original body bands grow at the expense of the interspaces, which are often reduced to thin, highly irregular light lines. The nuchal loop also becomes thin and wavy. The spots are dark-brown, while the bands, now highly irregular and often confluent, present a somewhat lighter ground color. A few specimens become so completely spotted that all traces of the original bands are obliterated. On the other hand, some specimens retain the dorsal bands into the adult stage, the spotting being most in evidence laterally. Original tails retain the rings of the juvenile state but add spots between. Sometimes the bands become lighter in the centers. Regenerated tails are heavily spotted.

The rostral in the adults is usually light in the center, with dark wings. The snout is mottled, the even canthal lines of the young being lost. The labials are mottled or punctated, and the entire under-jaw is usually spotted or blotched with brown; or there may be areas in which the usual white pigment is lost, thus giving the appearance of a dark blotch.

The ventral surface of the body is often marked with scattered, fine black dots, which may only be evident with magnification.

The limbs of the adults are spotted; the fingers and toes are punctated with black or brown, both above and below.

*Intraspecific Trends.*—The series of *brevis* which has been available to me inadequately represents both the extreme northern section of the range (New Mexico), and the southern, (lower Coahuila and eastern Durango). There may therefore be territorial trends that I am unable to determine, which may ultimately involve subspecific segregations.

With regard to the Texas specimens, the geckos of the Bexar-Medina area seem to be somewhat different, in some characters, from the others. The median scales separating the two series containing the preanal pores average somewhat lower here than elsewhere, and there is a slightly greater tendency toward a separation of the prenasals. At the same time there is a somewhat reduced number of scales between the supranasals. It is also noted that in this area the ontogenetic pattern change seems to take place later; that is, larger specimens are found still retaining the juvenile barred pattern, with spots only evident laterally.

Specimens from trans-Pecos Texas are more prominently spotted in the gular region than those from southern Texas or Mexico.

USNM 113,063 collected by Dr. Hobart M. Smith near Saltillo, Coahuila, Mexico, is a peculiar specimen in several particulars. The anterior nasals are

broadly in contact, and the supranasals are quite large and are separated by only one scale. This is the only individual that has less than 3 scales between the supranasals, out of 153 which have been checked for this character. The pattern is also peculiar; the three posterior body bands have coalesced to form a central longitudinal dark line, bordered with light, and then again by dark. Three other specimens, which Dr. Smith tells me were collected only a mile or so away, and in a similar environment, show none of these peculiarities. Therefore this specimen must be considered a freak, until such time as others showing similar abnormalities might come to light.

*Relationship with Other Species.*—There are no present indications of intergradation between *brevis* and *variegatus*, although they seem more closely related to each other than either is to *fasciatus*, the only other non-tubercular species. It appears significant that *bogerti*, the subspecies of *variegatus* territorially nearest to *brevis* in the United States, is the most divergent from it in the important character of the preanal pores. These forms may, in fact, overlap in southwestern New Mexico. Dr. Smith advises me that Mr. H. W. Parker has reported a typical *variegatus* from El Paso in the British Museum collection. However, knowing how frequently in the past our southwestern reptiles have been recorded in museums as coming from the place from which they were sent, rather than the actual point of collection, I deem it best not to consider overlapping proved until verified by other specimens. Of the *variegatus* subspecies, *brevis* seems nearest related to *sonoriensis* and intergradation between these two, while improbable, is not impossible. If it occurs it will be across southern Chihuahua, although the mountains here are high enough to render any present contact quite doubtful.

*Field Notes.*—"I found it rather abundantly in the rocky hills of the first plateau northwest of San Antonio, but did not observe it in that region north of that point either on the Guadalupe or the Llano. It is found in holes under stones, towards evening, and generally in pairs, a peculiarity I have not observed in any other lizard. Its manners are also peculiar. It carries its thick tail coiled vertically on one side of its back like a spitz dog. Its movements are quick but feeble, and its short legs forbid the speed of other lizards. *Coleonyx* is one of the few genera of Gecconidae which have eyelids, and as these are thick, and their movement in winking is slower than in other lizards, the physiognomy is quite peculiar. When handled, this species chirrups and squeals feebly like a singing mouse. One specimen which I took was about to shed its skin, so I placed it in a jar to observe the process. This took place in the night, for next morning it was so clear and its color so bright, that it looked as though gotten up for some special occasion. As no trace of the skin could be found, I suppose that it ate it, after the manner of the Batrachia. In life, the colors are very elegant; the pale cross-bands are citron-yellow, and the brown ones bright chestnut. The inferior surfaces and all parts of the limbs are flesh or rose color." E. D. Cope, 1880, p. 13.

"I collected a single example of this little gecko in the Chisos foot-hills. It was running around among rocks on a hillside, just before dusk and on



account of its rather feeble movements was easily captured. In the living specimen the bands were brown and sulphur-yellow." J. K. Strecker, 1909, p. 13.

"This little gecko is abundant in the vicinity of Helotes and has been collected within two or three miles of San Antonio. It is found in rocky places and the specimens represent two types—one banded, the other spotted." J. K. Strecker, 1922, p. 17.

"Fifteen specimens of *Coleonyx brevis* were found in hiding under small flat rocks. In no instance was more than one found under the same rock, and no two specimens were found near one another. The peculiar mouse-like squeak of this species is quite characteristic of small geckos." J. K. Strecker, 1933, p. 78, describing collecting at the type locality of *C. brevis*, Marnock's Ranch on Helotes Creek, 22 mi. nw. of San Antonio, Bexar County, Texas.

"They are scarce and found in rocky sections only. I have taken but four of them during the past fifteen years. They seem to prefer certain special areas. I found two under rocks on top of a certain hill; then two years later found one at the same locality (near Somerset, Texas)." A. J. Kirn, by letter, Sept. 10, 1943.

*Locality Records.*—NEW MEXICO: *Santa Fe County*—Waldo; *Otero County*—Alamogordo. TEXAS: *El Paso County*—El Paso; *Hudspeth County*—near El Paso; *Culberson County*—Apache Canyon (40 mi. n. of Van Horn); *Reeves County*—Pecos, Vitro Draw; *Jeff Davis County*—Cherry Canyon, Musquiz Creek (6½ mi. s. of Fort Davis), Kingston Ranch (Madera Canyon on n. side of Davis Mts.); *Pecos County*—Sheffield, Iraan; *Crockett County*—17 mi. w. of Ozona; *Brewster County*—½ mi. w. of Banta, 14 mi. n. of Terlingua, Tornillo Creek (10 mi. above San Vicente); and the following in the Chisos Mountains area—3 mi. s. of Chisos Mts., Glenn Spring, Juniper Canyon, The Basin (at 5100 and 5200 ft.), foothills e. and 6 mi. ne. of The Basin, flats ne. of Chisos Mts., desert slope n. of Nugent Mt. (at 3250 ft.), Green Gulch (3 or 4 mi. above Burnham Ranch), Wade (Pine) Canyon, Government Spring (Burnham Ranch), Oak Creek, foothills e. and ne. of Chisos Mts., Cottonwood Creek (9 mi. ne. of Chisos Mts.), 4 mi. w. of Chisos Mts. CCC Camp, Hot Springs; *Terrell County*—Sanderson (also 15 mi. e.); *Val Verde County*—½ mi. ne. of Shumla, Del Rio, Pecos River Canyon near bridge and near mouth, Devil's River (near mouth and 3 mi. above big bridge), Devil's River Crossing; *Kinney County*—Brackettville; *Medina County*—Diversión Lake (Rio Medina), 12 and 18 mi. n. of Castroville; *Bexar County*—San Antonio (also rocky hill of first plateau nw.), Marnock's Ranch (Helotes Creek) (type locality), Helotes; *Maverick County*—Eagle Pass; *Webb County*—15 mi. n. of Laredo; *Zapata County*—Zapata (also 15 mi. s.), 20 and 32 mi. se. of Laredo, 2 mi. s. of San Ygnacio; *Jim Hogg County*—Hebbronville; *Kleberg County*—Kingsville; *Starr County*—Rio Grande City (also 5 mi. e., and 3 and 5 mi. se.), Arroyo Los Olmos, 5 mi. w. of Roma; *Hidalgo County*—7 and 10 mi. n. of La Joya, 25 mi. w. of Edinburg, Mission (also 10 to 12 mi. nw. and 15 mi. wnw.). There is also a record from Live Oak Creek which might be in Crockett, Zavalla, or Dimmit County. MEXICO. COAHUILA: Monclova, Saltillo (also 4 mi. w.). NUEVO LEÓN: 5 mi. s. of Sabinas Hidalgo, near

China, Ciénega (Ciénega de Flores), Mamulique Pass. TAMAULIPAS: Mier. DURANGO: 6 mi. ne. of Pedriceña, 32 and 35 mi. wsw. of San Pedro (this San Pedro is in Coahuila about 15 mi. ese. of Torreón).

### ***Coleonyx elegans elegans* Gray**

#### YUCATAN BANDED GECKO

1845. *Coleonyx elegans* Gray, Ann. and Mag. of Nat. Hist., Vol. 16, p. 162. Type specimen in the British Museum. Type locality: Belize, British Honduras.
1851. *Gymnodactylus scapularis* A. Duméril, in Duméril and Duméril, Cat. Meth. Coll. Rept., p. 45. Type specimen in Muséum d'Histoire Naturelle de Paris. Type locality: Petén (Department), Guatemala.
1858. *Gymnodactylus coleonyx* A. Duméril, Arch. Mus. Hist. Nat., Vol. 8, p. 483. Same type specimen as *G. scapularis* above.

*Type*.—The type specimen in the British Museum, from Belize, British Honduras, has not been examined. From the brief summary of characters given by Gray in describing both the genus and the species, somewhat elaborated by Boulenger (1885, p. 235), the type specimen seems quite representative of the species as found in the lowlands of the Yucatán Peninsula.

*Diagnosis*.—*Elegans elegans* differs from *brevis*, *fasciatus*, and *variegatus* and its subspecies, in having tubercular scales scattered profusely among the smaller granules of the dorsum. From *mitratus* it differs in having longer scales sheathing the claws, and in the possession of a more triangular mental and first infralabials. The postnasal depression is more evident in *elegans* than in *mitratus*. *Elegans elegans* differs from *e. nemoralis* in having the upper prenasals more completely in contact, and in the greater profusion of the dorsal and lateral tubercles.

*Range*.—From central Veracruz eastward along the lowlands bordering the Gulf of Mexico, and throughout the Yucatán Peninsula to northern Guatemala and British Honduras.

*Material*.—I have examined 15 specimens from Veracruz, 2 from northern Oaxaca, 2 from Tabasco, 1 from Chiapas, 3 from Campeche, 28 from Yucatán, 15 from northern Guatemala, and 5 from British Honduras; total 71.

*Morphology*.—A lizard of moderate habitus, not particularly depressed. The head is wedge-shaped, with a more evenly tapering snout (viewed vertically) than *variegatus*. The neck is rather long and slender. The limbs are relatively short and weak, yet they overlap; in fact, the tips of the toes reach the elbows. The nostrils are large and circular; they lie well below the canthal ridge. The ear openings are prominent; they are elliptical in shape, with the long axis almost vertical, but advanced slightly forward at the lower end. The eyes have vertically elliptical pupils. The eyelids are functional and are lined with black pigment within. The peritoneum is uncolored.

Well preserved specimens show four median dorsal ridges, of which the central two are somewhat more prominent than the outer. They are most

evident posteriorly. There is a short mid-ventral umbilical line. The tail is round in section.

*E. elegans* grows to a considerably larger size than the non-tubercular species. The longest, a female from Potrero Viejo, Veracruz, is 97 mm. from snout to vent. The longest male measures 92 mm. The shortest specimen is 36 mm.

The tails, when complete, are about equal to the body in length. The tails of the juveniles are proportionately somewhat longer than in the adults.

The males may be recognized by their more prominent preanal pores; however in this species the females have definite depressions corresponding to the pores in the males. The lateral cloacal spurs are relatively much less in evidence than in *variegatus* and the other non-tubercular species; in fact, they are little more prominent than the nearby tubercles. They are short and flexible, and flattened transversely into a sharp ridge. Postanal sacs are present; and there are postanal swellings in the males.

The variation in the number of preanal pores is as follows: 7 (2), 8 (7), 9 (28), 10 (16), 11 (9), 12 (0), 13 (1); mean  $9.43 \pm .15$ ; coefficient of variation 11.4 per cent. The females have been included in these statistics since there is no sexual dimorphism in numbers of pores or depressions. The arrangement of the scales carrying the pores differs somewhat from that in *variegatus*; in *elegans* the two series meet in a sharper point mid-ventrally, for each side series curves inward slightly. Occasionally there are two pores in tandem at the apex, and sometimes there are two pores within a single scale. At the season of maximum activity the pores are relatively much larger in *elegans* than in *variegatus*; in some specimens the core of the secretion, which may be lifted out as a clear yellow cylinder, occupies almost the entire scale in which it centers.

*Scalation*.—Except for larger scutes bordering the mouth and nostrils, the head is covered above and below with small non-imbricate granules, interspersed with enlarged tubercles. The rostral is the largest of the head scales excepting only the mental; it is pentagonal in shape, with a wide base, two shorter sides contacting the first supralabials, and longer, slightly concave sides engaging the prenasals. The upper point is rather obtuse (about  $135^\circ$ ). There is a series of enlarged supralabials which decrease in size posteriorly. They generally number 6, 7, or 8, with an extreme range of 5 to 9; the mean is  $7.09 \pm .06$ . These enlarged labials terminate approximately under the center of the orbit, posterior to which the mouth is bordered by granules. There are two prenasals on either side, the upper much the larger, and contacting its fellow medianly. This contact is prevented by the interposition of an extra scale in three specimens out of 69, and in one other the contact is prevented by an elongated rostral. The lower prenasals are small and triangular. The supranasals are so small that they do not stand out conspicuously, as compared with the other scales on the snout, nor are the remaining scales touching the nasal orifice especially enlarged. The scales posteriorly bordering the upper prenasals from nostril to nostril, number as follows: 5 (1), 6 (7), 7 (22), 8 (20), 9 (13), 10 (3), 11 (1); mean  $7.75 \pm .14$ . Posterior to the nostril, and extending as far back as the beginning of the third supralabial, there is a shallow

longitudinal depression in which the scales are conspicuously smaller than those above and below. The eyelids are edged with serrated scales. The rest of the head surface is covered with circular granules which are considerably enlarged on the upper surface of the snout, and where they abut the supralabials. Those which contact the supralabials are often elliptical in shape. Among the granules covering the head there are enlarged subcircular tubercles scattered at fairly even intervals; these increase in size toward the neck. A few tubercles are evident laterally below the commissure, but not on the under surface of the head, which, except for the scutes bordering the mouth, is covered with granules. The mental is large with the two sides converging posteriorly. The posterior edge is slightly convex. The first infralabials are triangular in shape, with points directed inward along the converging edges of the mental. The remaining lower labials are subrectangular, decreasing in size posteriorly, until, at a point somewhat back of the orbit, they are no longer conspicuously enlarged. The visible enlarged scales number from 6 to 9, with 7 predominating; the mean is  $7.16 \pm .06$ . The granules contacting the mental and infralabials are considerably enlarged, compared with those toward the center of the lower jaw. The largest of these scales abut the posterior infralabials rather than the mental; they are somewhat elongated in shape. The scales touching the mental number as follows: 3 (1), 4 (3), 5 (17), 6 (20), 7 (16), 8 (6), 9 (8); mean  $6.37 \pm .17$ ; coefficient of variation 22 per cent. Those touching the first infralabials number 3 (13), 4 (84), 5 (42), 6 (2); mean  $4.23 \pm .05$ ; coefficient of variation 15 per cent. It is to be understood that there is duplication in these tallies, in that one scale in each instance touches both the mental and a first infralabial. Of the scales touching the first infralabials, those nearest the second infralabials are usually the largest.

The neck and dorsal surface of the body are covered with granules, among which there are scattered tubercles that tend to become larger posteriorly, and more closely spaced laterally. The dorsal tubercles are often keeled and have posterior peaks. Ventrally the granules and tubercles are replaced with uniform, flat, imbricate scales, which increase in size posteriorly, and are especially enlarged where they abut the series carrying the preanal pores.

On the tail the dorsal granules of the body are replaced with rings of imbricate scales. These are enlarged ventrally. There are a number of rings containing tubercles, which, however, are not evident ventrally; these rings comprise about one-seventh of the total. Regenerated tails lack tubercles.

Tubercles are also present on the arms and legs, being most prevalent on the posterior edge of the forearm and the upper sides of the legs. The posterior edges of the upper arm and thigh are covered with granules.

The hands and feet have imbricate scales above and tubercular granules below. The fingers and toes taper only slightly. They are sheathed with imbricate scales dorsally, with a single row of lamellae below. The latter are so imbricate as to form a corrugated ridge. There are about 17 lamellae on the fourth finger and 20 on the fourth toe. The claws in preserved specimens are completely hidden by the scales which sheath them; these comprise, on each finger or toe, a pair of shell-like convex lateral scales, partly capped



above by a long slim pointed scale (the terminal). In this subspecies these sheaths are longer, relatively, than in any other subspecies. Only rarely is the tip of a claw evident.

*Pattern and Color.*—In the juvenile stage *elegans* has a fairly simple pattern, comprising three major body triads, each of which consists of a wide central cross-band of fawn color, bordered in front and behind by a narrow dark-brown edge. Between the triads are narrow interspaces of buff, approximately equal in width to the dark edges which bound the triads. All marks terminate on the sides, the ventral surfaces being immaculate cream color. The legs are punctuated with brown. The tail is also marked by triads like those on the body, except that posteriorly the bordering dark bars widen at the expense of the light centers until the bands are uniform dark-brown or black. Also posteriorly a few rings are complete ventrally. On the head there is usually a light parietal loop with narrow dark borders, and a second light central ellipse. There are dark vertical bars marking the upper labials.

In the adults a marked change takes place. The dark borders of the dorsal triads widen at the expense of the light centers, so that they often become confluent, especially dorso-laterally. Irregular dark spots may appear within the triads. The light cross bars remain between triads; usually they are clearest mid-dorsally where they are also widest. On the sides dark blotches appear, conspicuously speckled by the tubercles, most of which have become almost white. Thus, while the basic pattern of the three dorsal triads usually remains in evidence, it assumes a considerable irregularity.

The tail rings number 8 to 10 in the complete tails. The anterior rings are triads, while the posterior are uniform dark-brown, almost black. The last two or three may be complete ventrally. Regenerated tails are spotted or speckled, rather than banded.

The head is either streaked with dark or may be marked by a series of irregular concentric ellipses. The sides are mottled. There is generally a light cross streak, between dark edges, on the snout. The rostral is light in the center, but dark laterally. The legs are spotted. The lower surfaces of the head and body are clear.

*Intrasubspecific Trends.*—I have been unable to detect any important intrasubspecific trends in *elegans elegans*. Specimens from Veracruz have a slightly reduced number of scales in contact with the mental, as compared to those from the Yucatán Peninsula. In the adult specimens from British Honduras, or northern Guatemala, there is a somewhat greater tendency to have the dark edges of the triads joined dorsally into hour-glass figures than is the case further westward in Veracruz.

In certain areas of the Yucatán Peninsula some of the specimens have the normal cross bars on the body replaced with longitudinal stripes. There is a mid-dorsal light line, bordered on either side by a wider brown band. The sides are mottled, the tubercles being light. Where the replacement of cross bars by longitudinal stripes is only partial, it is effected anteriorly; in any case the tail remains ringed. This is not an adult development, the aberrant pattern being evident in some juveniles as well.



*Relationships with Other Forms.*—*Elegans elegans* is only distantly related to the non-tubercular species, its nearest relative being *fasciatus*, to which it shows some affinity (through *nemoralis*) in the robust digits, the long claw sheaths, and pattern. While I consider it specifically distinct from *mitratus*, because of the differences in the claw sheaths, and the shapes of the mental and first infralabials, it should be noted that there is a trend within *mitratus* toward *elegans elegans*, with respect both to the mental shape and pattern, just as would be the case if it intergraded with *elegans elegans*. Thus, while intergradation between the species *elegans* and *mitratus* is improbable, it cannot be deemed impossible, since no specimens are available from the area (central and southern Guatemala) where either intergradation or overlapping might occur.

*Field Notes.*—Ruthven (1912, p. 311) states that two individuals were seen under boards in the sheds at San Juan, Veracruz, Mexico.

Stuart (1935, p. 41) reports four specimens, collected at La Libertad, Guatemala, in the bush or from the savanna country. He believes it possible that the species is a wet-season form, which accounts for his not securing it during the dry season.

In Yucatán they occur, among other places, in caves. "One, Puz Cave, Oxkutzcab, July 20, on wall of an inner chamber 63 m. from the mouth, in complete darkness, at a depth of about 20 m. below the surface, and beyond two artificial walls with small doorways, food was insects; one, Gongora Cave, July 17, 15 m. from mouth, food, two cave-crickets; one Ziz Cave, July 24, 12 m. from mouth. Another specimen, which was not saved, was seen in Xkyc Cave, Calcehtok Hacienda, San Bernardo, August 7, 13 m. below the surface and more than 35 m. from the mouth." Helen T. Gaige, 1938, p. 297.

Sanderson, 1941, p. 156, reports it in cohune logs and stumps, in British Honduras.

*Locality Records.*—*Elegans elegans* has been collected at the following points: MEXICO. VERACRUZ: Jalapa, Potrero Viejo (about 10 mi. e. of Córdoba), El Potrero (or Potrero) (near Córdoba), near Orizaba, Tezonapa, Presidio (Tierra Caliente), Cuatotolapam, San Juan. OAXACA: San Cristóbal (Río Valle Nacional), Cosolapa. TABASCO: Tenosique, Teapa. CHIAPAS: La Esperanza (near Acapetahua). CAMPECHE: Tuxpena Camp, Aposote, Encarnación. YUCATAN: Chichen Itzá, Mayapan, Puz, Ziz, and Gongora Caves (near Oxkutzcab), Xkyc Cave (near San Bernardo), Mujeres Island. BRITISH HONDURAS: Belize (type locality), Benque Viejo, Skates Lagoon, Silk Grass, Stann Creek Valley. GUATEMALA: Departamento de Petén; Piedras Negras, Uaxactun, near La Libertad, Poza de la Jicoteo.

### ***Coleonyx elegans nemoralis* subsp. nov.**

COLIMA BANDED GECKO

1905. *Coleonyx elegans* Gadow, Proc. Zool. Soc. London, Vol. 2 of 1905, p. 212.

*Type.*—No. 10,509, in the E. H. Taylor-H. M. Smith collection. Collected at Hacienda Paso del Río, Colima, Mexico, July 8, 1935, by Dr.

Hobart M. Smith. This location is shown on most maps as Paso del Río, at the great bend of the Río Armería.

*Diagnosis.*—This subspecies is a form having tubercular scales scattered on the dorsum, thus differing from *variegatus*, *brevis*, and *fasciatus*. From *mitratus*, *nemoralis* differs in having elongated scales forming the claw sheaths, which completely, or almost completely, hide the claws, whereas in the more southerly form the sheaths are shorter and the claws prominently in evidence. From *elegans elegans*, *nemoralis* varies in having the upper prenasals less often in contact, with a shorter juncture when there is a contact, and in having fewer tubercular scales, especially laterally. Also, the mental is more nearly triangular in *nemoralis*.

*Description of Type.*—An adult male. The head is covered above and below with non-imbricate, circular granules, larger anteriorly and interspersed with tubercles posteriorly. The rostral is pentagonal in shape and is wider than high. There are two short sides touching the first supralabials and two longer edges contacting the prenasals. The apex is rounded. The supralabials number 7-5 and decrease in size posteriorly; the enlarged scales end anterior to the center of the eye. The infralabials visible with the mouth closed number 6-5. There are two prenasals on each side, the upper being considerably the larger. The upper prenasals are, however, smaller than in *elegans elegans*; they are triangular in shape and are prevented from meeting on the median line by a granular scale. The supranasals are not enlarged compared with other contiguous scales; they are small and circular. The scales from nostril to nostril along the prenasals number 8. The nostrils are large and oval. There are shallow horizontal depressions back of the nostrils, the scales within which are especially small. The scales edging the eyelids are rounded rather than serrated. The ear openings are long and narrow. The mental is the largest head scale; it is equal in width to the rostral. It is triangular in shape, with the sides posteriorly convergent. The posterior end comprises a short circular arc, which is contacted by 5 gulars. The mental plus the first infralabial on each side are contacted by 11 gulars. The first infralabials are triangular, with ends pointed inward along the mental. They are much deeper (but not so long) as the succeeding infralabials.

The dorsum is covered by granules of similar size to those on the head, among which there are interspersed enlarged tubercles in irregular rows. There are about 19 of these rows at mid-body; adjacent to the mid-dorsal line there are about 23 tubercles between centers of limb insertions. The tubercles are larger than those on the head and neck. Dorsally, they tend to be slightly keeled; some are peaked posteriorly. Laterally and ventrally the granules and tubercles are replaced with flat, imbricate scales which become larger posteriorly. The lateral scales are smallest at the limb insertions. There is a short umbilical line which interrupts the regularity of the adjacent scales.

The scales in the preanal region are further enlarged and include a row with conspicuous preanal pores. The latter total 10; the scales containing them are acutely angular in arrangement with the point forward. The two median scales at the apex are in contact.

The scales on the arms are imbricate above; the enlarged scales, which are analogous to the tubercles, are not sharply differentiated from the rest. The back of the hand is covered with imbricate scales; the palmar surface is granular. On the lower surfaces of the digits there are series of rectangular transverse lamellae, which form corrugated ridges. There are 14 lamellae on the fourth finger. The fingers terminate in a pair of large shell-like laterals, capped by a long wedge-shaped terminal. The claws are completely hidden by the sheaths.

The legs are covered with granular scales on the upper surfaces, interspersed with conspicuous tubercles. The toes are sheathed like the fingers. There are 17 lamellae on the fourth toe. The claws are concealed by the large laterals.

The cloacal spurs are comparatively small. They are placed on each side of, and slightly posterior to, the vent; they are hardly more conspicuous than the dorsal tubercles. In this character there is a notable difference from the much enlarged spurs of the non-tubercular forms.

The tail is covered by annular rows of subrectangular and imbricate scales which are largest ventrally. There are tubercles dorsally in every sixth or seventh ring; these, however, do not occur on the regenerated posterior section.

The principal dimensions in mm. are as follows: Length, snout to vent 88, head length 23, head width 16, rostral to mid-orbit 12, rostral to mid-ear 21, width of orbit  $5\frac{1}{2}$ , arm fully extended, measured to end of fourth finger 25, leg fully extended, measured to end of fourth toe 30, length of tail (part regenerated) 63, distance between points of cloacal bones  $9\frac{1}{2}$ .

The head is light-brown above, streaked with dark-brown. There is a light bar across the snout, and concentric light and dark semicircular stripes in the parietal region. The labials are alternately light and dark. The gular surface is light.

The dorsum is barred, alternately chocolate-brown and buff. These marks make up three triads between limb insertions. Each triad consists of two dark bars with a light center. These light centers are narrower dorsally than laterally and are more irregular than the light interspaces between triads, which are widest dorsally. The lateral areas are considerably mottled. The ventrum is unmarked. The limbs are brownish above and lighter below. The original part of the tail is alternately ringed with buff and dark-brown; the regenerated portion is mottled.

*Range*.—The coastal area of Mexico from Colima to southeastern Oaxaca, where there is intergradation with *Coleonyx elegans elegans*.

*Summary of Paratypes*.—Four paratypes are available, one of which is a topotype. Of the others, two are from Agua del Obispo, Guerrero, and the last is from 4 to 5 miles north of Acapulco, Guerrero. All are in the Taylor-Smith collection.

Sixteen additional specimens are available from southern Oaxaca, particularly from the vicinity of Tehuantepec, but these are to be regarded as *elegans-nemoralis* intergrades, and will be discussed later. Thus only the Colima and Guerrero specimens are to be considered paratypes; and even those from

Guerrero may be less differentiated from *elegans elegans* than the ones from the extreme west. The type is included in the numerical figures given below.

The longest specimens, a male and a female, both measure 88 mm. from snout to vent. The smallest is 53 mm. long, with a 54 mm. tail. No other specimen has a complete tail.

The preanal pores (or pits in the females) number 7, 7, 9, 9, 10. They are arranged in a sharply angular series.

The upper prenasals are separated by a scale in 4 specimens out of the five available. (In *elegans elegans* only 4 out of 69 have these plates separated.) The prenasals narrow dorsally; in the single specimen in which contact is made the median suture is quite narrow. The supranasals are so small as to be virtually undifferentiated from the adjacent scales above. The scales from nostril to nostril number 6, 7, 8, 9, and 10. There are shallow postnasal depressions covered with small scales. The apex of the rostral is rounded. The enlarged supralabials number 5 (1), 6 (1), 7 (5), 8 (3); the second is usually the largest. The mental is triangular but has a rounded posterior apex. The enlarged infralabials number 6 (2), 7 (2), 8 (6). The first infralabials are considerably deeper than the rest of the series, with long points carried inward along the mental. The gulars contacting the mental number 3 (1), 4 (1), 5 (2), 6 (1); those touching the first infralabials are 3 (1), 4 (7), 5 (2). *Nemoralis* mentals are more pointed posteriorly and with fewer gulars in contact than is the case in *elegans elegans*.

There are 19 to 21 rows of tubercles, counting across at mid-body; and 23 to 32 in a line mid-dorsally between points opposite the limb insertions. The laterals are long, as in *elegans*; only rarely is the tip of a claw visible.

The head pattern consists of a series of alternating light and dark longitudinal streaks joined by semicircles posteriorly. The labials are mixed light and dark.

The body pattern comprises three dorsal triads, each consisting of a pair of narrow dark-brown transverse bands, with buff or light-brown between. The light interspaces separating the triads are cream and are widest mid-dorsally. As the lizards age the dark bands widen within the triads, until they sometimes coalesce mid-dorsally, forming hour-glass shaped figures. There are lateral irregular blotches. Dorsally the tubercles tend to become darker than the ground color of the dark blotches in which they are placed; while laterally the tubercles tend to stay light, thus spotting the sides, although less conspicuously than in *elegans elegans*. The only individual with a complete tail has 10 rings.

*Trends and Relationships.*—Since *Coleonyx elegans* has been collected in the coastal areas of both the Gulf and Pacific slopes, but not on the plateau between, it seems probable that they do not occur there. If a connection between the Pacific and Gulf coastal populations exists today, it is probably across the Isthmus of Tehuantepec, where the terrain seems suitable for an uninterrupted range. From southeastern Oaxaca (the southern end of this isthmus) there are 16 specimens available. Five out of the 16 have separated

prenasals. I think, therefore, they should be considered *elegans-nemoralis* intergrades. Their other counts are as follows:

Prealan pores or pits	6 (1), 7 (1), 8 (6), 9 (6), 10 (0), 11 (1).
Supralabials	6 (11), 7 (16), 8 (4).
Infralabials	6 (12), 7 (17), 8 (3).
Scales, nostril to nostril	5 (1), 6 (6), 7 (6), 8 (2), 9 (1).
Gulars contacting mental	5 (1), 6 (2), 7 (5), 8 (6), 9 (0), 10 (1).
Gulars contacting first infralabials	2 (5), 3 (14), 4 (12).

The longest specimen, a male, measures 96 mm. snout to vent. Where the tail rings are complete they vary from 8 to 10. I note no pattern differences in this series, either from *elegans elegans* or typical *e. nemoralis*. As usual, the posterior tail rings are solid, rather than triads, and are complete ventrally. Two juveniles from this area show rather unusual patterns; they have wide, dark bands which are only slightly lighter interiorly. These differ from the ordinary juvenile pattern of *elegans*, in which the bands are medium-brown, only narrowly edged with dark-brown fore-and-aft.

*Field Notes.*—Gadow (1905, p. 212) states that this gecko is distinctly a forest form. He found it a few miles from the coast of Guerrero in a moist patch of thick lowland forest on the ground under stones and rotten stumps.

"All the local geckos are much feared for their supposedly venomous qualities, but this genus especially is abhorred. One specimen was found 2 feet underground in the crevices of adobe brick ruins." Hartweg and Oliver, 1940, p. 14, discussing the intergrades found near Tehuantepec.

*Locality Records.*—Typical *nemoralis* has been collected at the following points: COLIMA: Hacienda Paso del Río (type locality). GUERRERO: Agua del Obispo and 4-5 mi. n. of Acapulco. One reported by Gadow (1908, p. 439) from Pacific Camp, near Copala, Guerrero, is no doubt assignable to this subspecies. The following from southeastern Oaxaca are considered locality records of *nemoralis-elegans* intergrades: Tehuantepec (also 2 km. ne.), Mixtequilla (also mountains nearby), Tapanatepec, Tres Cruces, Cerro Arenal, Cerro de Chipecua, Cerro de Guengola, Ranchero Poso Río, Palo Colorado, Chimalapa (Santa María).

### **Coleonyx mitratus (Peters)**

#### CENTRAL AMERICAN BANDED GECKO

1863. *Brachydactylus mitratus* Peters, Mon. Berl. Acad. Wiss., p. 41. Type specimen in the Berlin Museum. Type locality: Costa Rica.
1875. *Coleonyx elegans* Cope, Journ. Acad. Nat. Sci. Phila., 2nd Ser., vol. 8, p. 118.
1885. *Eublepharis dovii* Boulenger, Cat. Liz. Brit. Mus., Vol. 1, p. 233. Type specimen in the British Museum. Type locality: Panamá.
1893. *Coleonyx dovii* Stejneger, North American Fauna No. 7, p. 163.



1928. *Coleonyx mitratus* Schmidt, Field Mus. Nat. Hist., Zoöl. Ser., Vol. 12 no. 16, p. 194.

*Type*.—The type specimen, in the Berlin Museum, has not been seen. It was collected in Costa Rica. Peters' description is quite adequate.

*Diagnosis*.—A *Coleonyx* with tubercular scales scattered among the granules of the dorsum, thus differing from *variegatus*, *brevis*, and *fasciatus*. From *elegans elegans* and *e. nemoralis* it differs in having shorter scales sheathing the claws; these are exposed in *mitratus* but concealed (or with only the tips showing) in *elegans*. Also, the first infralabials are quadrilateral in *mitratus* and triangular in *elegans*. Further, there is a longitudinal area of small scales back of the nostril in *elegans* not present in *mitratus*.

*Range*.—Honduras, El Salvador, Nicaragua, Costa Rica, and Panamá.

*Material*.—I have examined the following specimens: Honduras 17, El Salvador 2, Nicaragua 6, Costa Rica 5, uncertain 1; total 31.

*Morphology*.—A lizard of moderate body proportions, not especially flattened. The snout is somewhat blunt and the neck long. The limbs are relatively short but overlap when adpressed. The nostrils are circular. The ear openings are large and vertically elliptical. The pupils are vertically elliptical. The eyelids are functional and are internally lined with black pigment. The peritoneum is unpigmented.

There are four median dorsal ridges, the central two being the more evident. There is a mid-ventral umbilical line, which interrupts the regularity of the adjacent scales. The tail is circular in cross section.

This species, similar to *elegans elegans* in size, is considerably larger than *variegatus variegatus*, the largest of the non-tubercular forms. The longest specimen at hand is a male from Nicaragua, measuring 91 mm. from snout to vent. The longest female is 88 mm. The shortest specimen is 41 mm. The tails, when complete, approximate the body in length.

The males may be recognized by the presence of preanal pores and post-anal swellings. The females have scale pits, analogous to the preanal pores in the males. The lateral cloacal spurs in this species are less prominent than in *variegatus*; they are little more evident than the adjacent tubercles. They are longitudinally flattened and ridged.

The variation in the number of preanal pores or pits is as follows: 5 (2), 6 (5), 7 (11), 8 (10), 9 (3); mean  $7.23 \pm .19$ ; coefficient of variation 14.6 per cent. The females have been included in these statistics. The pore arrangement is similar to that of *elegans*, the two series making an angle of about  $90^\circ$ . Males captured at the season of maximum activity have large pores almost filling the scales they occupy. In these there is solidified a yellow transparent core.

The hemipenes are undivided with single sulcus. They are distally enlarged, the outer part being covered with reticulated fringes.

*Scalation*.—The head is covered above and below with circular granules, mixed with enlarged tubercles. There are large scutes bordering the mouth and nostrils, of which the rostral is the largest. It has two short sides touching the first supralabials, and two longer sides contacting the prenasals. The apex

is rather blunt. There is a series of enlarged supralabials which reduce in size posteriorly; they generally number 6 or 7, but vary from 5 to 9, with a mean of  $6.87 \mp .10$ . The enlarged supralabials are supplanted by granules back of the center of the eye. There are two prenasals on either side, the upper much the larger. The lower may be considered the nasal itself, since there seems to be no suture between it and the nostril. The upper prenasals are in contact medianly in all specimens. The supranasals are small and undifferentiated from the other scales on the snout, nor are the rest of the scales bordering the nasal orifice enlarged. The granules posteriorly in contact with the upper prenasals, from nostril to nostril, number as follows: 6 (9), 7 (15), 8 (5), 9 (1); mean  $6.93 \mp .14$ . There is a small postnasal depression. The rest of the head surface is covered with circular granules which are considerably enlarged on the upper surface of the snout, and where they touch the supralabials. Those which contact the supralabials are often horizontally elliptical in shape. Interspersed with the granules covering the head there are enlarged tubercles; these increase in size toward the neck. There are a few tubercles below the angle of the mouth, but not on the under surface of the head. The mental is large, with the two sides usually somewhat convergent posteriorly. The posterior edge is slightly convex, or may be angular. The enlarged infralabials usually number 6 or 7; the range is 5 to 8, and the mean  $6.68 \mp .08$ . The first infralabials are generally quadrangular in shape, rather than triangular as in *elegans*, the two sides contacting the mental and second infralabial being substantially parallel, although the side touching the mental is considerably the longer of the two. The subsequent infralabials are rectangular and decrease in size posteriorly; the enlarged scales terminate somewhat behind the center of the orbit. The granules contacting the mental and infralabials are considerably enlarged, compared with those toward the center of the lower jaw. The scales touching the mental number as follows: 4 (1), 5 (10), 6 (8), 7 (8), 8 (2), 9 (1); mean  $6.10 \mp .21$ . Those touching the first infralabials number 2 (1), 3 (44), 4 (14); mean  $3.22 \mp .06$ . There is duplication in these tallies, for one scale in each instance touches both the mental and one first infralabial.

The neck and dorsal surface of the body are covered with granules interspersed with tubercles, becoming larger posteriorly, and more closely spaced laterally. There are about 21 to 23 irregular rows of tubercles across the dorsum. Some tubercles are keeled and posteriorly pointed. The belly is covered with flat, imbricate scales, which increase in size posteriorly; they are especially enlarged in the area of the series carrying the preanal pores, beyond which they decrease in size rapidly to the anal opening.

On the tail the dorsal granules of the body are replaced with rings of imbricate scales, which are enlarged ventrally. Dorsally, a few of the rings (about one in six) include dorsal tubercles. Regenerated tails lack tubercles.

Tubercles are evident on the posterior edges of the forearms and the upper surfaces of the legs; they are especially profuse on the latter. The posterior parts of the upper arm and thigh are covered with granules.

The hands and feet have imbricate scales above and tubercular granules below. The fingers and toes taper slightly; they are covered with imbricate

scales dorsally, and a single row of lamellae below. The latter are wider than long; they are imbricate and form a corrugated row. There are about 13 or 14 lamellae on the fourth finger and 16 to 18 on the fourth toe. The claws in preserved specimens are clearly in evidence, thus differing from *e. elegans* and *e. nemoralis*, in which they are hidden by the elongated sheaths. The sheaths in *mitratus* comprise a pair of shell-like convex lateral scales, partly capped above by a pointed terminal scale. They are relatively shorter than in *elegans*.

*Pattern and Color.*—In the juvenile stage *mitratus* has a pattern comprising three body bars between limb insertions, separated by narrow cream or buff cross bars. The bars may be either uniformly dark-brown or triads with lighter centers. There is a parietal light loop ending at the eyes, and a light stripe across the snout. The lateral areas are lighter, while the lower surfaces are immaculate buff. The tail is banded with wide dark bars, of which the posterior are complete ventrally. The legs are punctated.

In the adults a considerable pattern change occurs. The body bars become indented laterally and the sides mottled; the same change takes place in the tail. In specimens from some areas the dark bars maintain their identity; but in others, especially those from Honduras, they become much spotted anteriorly. The head becomes spotted or mottled dorsally, and the parietal light loop, while retained, is more irregular. The light cross bar on the snout is almost lost in the general spotting. The sides of the head are irregularly mottled. The legs are speckled or spotted. The rostral is light in the center and dark laterally. The lower surfaces of the head and body are clear, except that the infralabials are blotched.

While there are nearly always three body bands or triads, four have been noted on one specimen from El Salvador. There are usually 9 or 10 bands on the tail, if complete.

*Intraspecific Trends and Relationships.*—The specimens from the vicinity of San Pedro, northwestern Honduras, are somewhat different from the geckos of Nicaragua and Costa Rica, and, were adequate material available from the latter areas, a subspecific segregation might be warranted.

In the Honduran specimens the sides of the mental are more convergent. The rostral is slightly more pointed and the proportionate median contact between the upper prenasals somewhat reduced. They have, on the average, fewer scales in contact with the upper prenasals, between the nostrils.

It is in pattern that the differences are most evident. In the juvenile specimens, those from Honduras have body triads comprising light-brown bands between dark edges, while in a juvenile from Costa Rica the blotches are quite dark throughout.

In the adults the Honduran individuals are usually light, with the triads much spotted interiorly; while the specimens from Nicaragua and Costa Rica tend toward darker and more unicolor dorsal bands.

It may be noted that all these differences indicated a directional trend within *mitratus* toward *elegans*. Assuming that these geckos are distributed throughout the lowlands bordering the Caribbean Sea, it is not impossible that

intergrades between *mitratus* and *elegans elegans* may be found around the head of Lago de Izabal in eastern Guatemala (from which area no specimens are available), although the divergence in the claw sheaths, first infralabials, and postnasal depressions, renders this doubtful.

Boulenger, at the time he described *dovii*, placed *mitratus* Peters in the synonymy of *elegans* (1885, p. 235). But Peters' description of the claws and the mental leaves no doubt that the type of *mitratus* belongs to the clawed form which ranges from Honduras to Costa Rica, and this is further verified by the type locality (Costa Rica). Thus, unless the geckos of Panamá show an unexpected difference from those of Costa Rica, *dovii* must be placed in the synonymy of *mitratus*. Neither Boulenger's description, nor Günther's plate (1893, plate 31) indicates that there is such a difference, but the final decision must await the availability of more material from Panamá. So far as I know, the type of *dovii* is the only specimen that has been collected there.

*Field Notes*.—Cope (1879, p. 217) reports that Zeledon collected *mitratus* in ant hills on the tableland near San José, Costa Rica.

Mr. Karl P. Schmidt has kindly permitted me to abstract the field notes of his collecting trip to Honduras in the spring of 1923. Altogether, 17 specimens of *mitratus* were taken, 13 at Hacienda Santa Ana west of San Pedro, the rest at Lake Ticamaya. All were caught at night on the ground; those from the former locality were mostly along a path following a hydroelectric penstock down a hill from 1000 ft. to 500 ft. elevation. The vegetation was scrubby, low forest interspersed with cohune palms. At Lake Ticamaya there were some larger trees as well. Here the geckos were found in dry leaves on the forest floor.

One specimen had a miller in its mouth. On another evening two were caught only a foot apart.

*Locality Records*.—HONDURAS: San Pedro, Hacienda Santa Ana (west of San Pedro at 800 ft. altitude), Santa Ana (near San Pedro), Lake Ticamaya (east of San Pedro, between Río Chamelecon and Río Ulua), Progreso, and Atlantida (Dept.). EL SALVADOR: Divisidero (Dept. Morazán). NICARAGUA. COSTA RICA (type locality): San José, Tableland near San José, Turrialba, Bebedero, Chica (= Chira?) Island (Gulf of Nicoya). PANAMA.

### INTERGENERIC RELATIONSHIPS

I have given some thought to splitting the present genus *Coleonyx*, into two genera, one to include the tubercular members, the other, those covered with uniform granules. The gap between these two is consistent, both in characters and range. However, the directive approach between *nemoralis* and *fasciatus* in some characters finally deterred me from this step, notwithstanding I do not believe *nemoralis* to be the most primitive of the tubercular group or subgenus.

Of the latter I consider *mitratus* the most primitive, since the toe sheaths, and the scales on the snout are less highly specialized than in the others. *Elegans elegans* I regard as a derivative of *mitratus*. The former in turn, diverges on the two coasts, separated by the central plateau of Mexico, with



*e. nemoralis* of the Pacific slope deviating sufficiently to warrant subspecific recognition.

I believe *variegatus* and *brevis* originally spread northward from a primitive forest type not greatly different from *fasciatus*. I visualize them as first spreading through the southwest from some center in central Mexico. The juvenile patterns of both would suggest that *abbotti* is probably the present form most nearly retaining the ancestral pattern. There was first a division between *variegatus* and *brevis*, as they came northward over divergent routes, followed by a further subdivision within *variegatus*. Although *variegatus variegatus* today clearly comprises the central core of the *variegatus* group, through which the other subspecies are interrelated, I do not consider *variegatus variegatus* as having retained the greatest number of primitive characters. I am of the opinion that differentiation by isolation in the several fringe populations was effected after the area was largely inhabited by a fairly uniform population. As these fringe populations gradually diverged from the ancestral type, and therefore from each other, the central population, *variegatus variegatus* also changed, in some particulars more than did the fringes. We may assume that this resulted from the greater dessication of the central area. This course of development would explain why contiguous populations are not always most alike. Thus, *utahensis* is somewhat like *sonoriensis*, and some *bogerti* resemble *abbotti* in pattern. *Brevis* is closer to *sonoriensis* than to its nearest neighbor *bogerti*. The enlarged chin scales of *slevini* are more probably a reversion than the retention of an ancestral character.

### GENERIC DIFFERENTIATION

On the generic level *Coleonyx* may be distinguished from the genera with which it has some superficial resemblance, by means of the following key:

- |     |  |                         |
|-----|--|-------------------------|
| 1 a | Two enlarged laterals on either side of the claw sheath                | <i>Lepidoblepharis</i>  |
| 1 b | A single enlarged lateral on either side of the claw sheath            | 2                       |
| 2 a | Digits with mixed or irregular scale formations on the ventral surface | 3                       |
| 2 b | Digits with a regular series of transverse lamellae below              | 4                       |
| 3 a | Tail with transverse constrictions forming a series of corrugations    | <i>Hemitheconyx</i>     |
| 3 b | Tail without transverse constrictions                                  | <i>Aeluroscalabates</i> |
| 4 a | Tail with transverse constrictions forming a series of corrugations    | <i>Eublepharis</i>      |
| 4 b | Tail without transverse constrictions                                  | <i>Coleonyx</i>         |

In some specimens of *Eublepharis* much of the tail has been lost, with or without regeneration; in such cases the transverse constrictions will not be evident, since they are not present in regenerated tails, and even in original tails are not prominent anteriorly. The following additional differences between *Eublepharis* and *Coleonyx* may be mentioned: *Eublepharis* has a relatively larger, and particularly a wider, head; the ears are larger and are edged with tubercles; the terminals are less sharp at the ends; the preanal pores form a



more obtuse angle (greater than  $135^\circ$ ); there are usually 2 gulars posteriorly in contact with the mental, while *Coleonyx* seldom has as few as 3.

These generic differences are by no means exhaustive; I have only superficially examined a few specimens of the genera other than *Coleonyx*.

### KEY TO THE SPECIES AND SUBSPECIES OF *Coleonyx*

- |     |   |                                |
|-----|---|--------------------------------|
| 1 a | Dorsum covered with uniform granular scales   | 2                              |
| 1 b | Dorsum with enlarged tubercular scales scattered among the granules   | 10                             |
| 2 a | Usually three black body bands between limb insertions; digits robust   | <i>fasciatus</i>               |
| 2 b | More than three brown body bands between limb insertions, or dorsum spotted; digits delicate  | 3                              |
| 3 a | Scale series carrying the preanal pores in the males* divided medianly by the interposition of one or more small scales; seldom more than 4 pores | <i>brevis</i>                  |
| 3 b | Scale series carrying the preanal pores in the males* continuous across the median apex; usually more than 4 pores                                | 4                              |
| 4 a | Usually 4 or fewer gular scales in contact with the mental  | <i>variegatus slevini</i>      |
| 4 b | Usually 5 or more gular scales in contact with the mental   | 5                              |
| 5 a | Preanal pores in the males usually number 8 or more   | <i>variegatus bogerti</i>      |
| 5 b | Preanal pores in the males usually number 7 or less   | 6                              |
| 6 a | Dark transverse body bars in the adults considerably wider than the light interspaces   | 7                              |
| 6 b | Dark transverse body bars in the adults about equal to, or narrower than, the light interspaces; or bars obsolete, replaced by uniform spotting   | 9                              |
| 7 a | A mid-dorsal light, longitudinal line usually splitting the dorsal body bars in the adults  | <i>variegatus sonoriensis</i>  |
| 7 b | No light mid-dorsal line splitting the dorsal body bars in the adults   | 8                              |
| 8 a | Adults with the longitudinal edges of the dark body bars highly irregular, often confluent with spots in the interspaces                          | <i>variegatus utahensis</i>    |
| 8 b | Adults with the longitudinal edges of the dark body bars even, with narrow, uniform interspaces   | <i>variegatus peninsularis</i> |
| 9 a | Dark body bands in the adults unicolor; top of head unicolor; nuchal light loop narrow and clear  | <i>variegatus abbotti</i>      |

\* Although only the males have true preanal pores, the corresponding scales in the females are usually enlarged and are sometimes pitted.

- 9 b Dark body bands in the adults with lighter centers, producing a double barred effect, or bars obsolete and replaced by spotting; top of head spotted; nuchal light loop irregular or obsolete *variegatus variegatus*
- 10 a Scales of the claw sheath shorter, with claws conspicuously in evidence *mitratus*
- 10 b Scales of the claw sheath longer, with the claws hidden, or only the tips in evidence 11
- 11 a Prenasals usually in contact; tubercles in greater profusion laterally *elegans elegans*
- 11 b Prenasals usually separated; tubercles fewer in number laterally *elegans nemoralis*

## ACKNOWLEDGMENTS

I am grateful to the following individuals and institutions for the loan of specimens, and for other assistance without which this study could not have been made: Mr. Charles M. Bogert, American Museum of Natural History; Mr. Joseph R. Slevin, California Academy of Sciences; Mr. M. Graham Netting, Carnegie Museum; Dr. Howard K. Gloyd, Chicago Academy of Sciences; Messrs. Karl P. Schmidt and Clifford H. Pope, Chicago Natural History Museum; Dr. A. H. Wright and Mrs. K. Kapp, Cornell University; Dr. Ross Hardy, Dixie Junior College; Mr. Albert J. Kirn, Somerset, Texas; Dr. Howard R. Hill, Los Angeles Museum; Mr. Stanley Mulaik, Salt Lake City, Utah; Mr. Arthur Loveridge, Museum of Comparative Zoölogy; Mr. Thomas L. Rodgers, Museum of Vertebrate Zoölogy, University of California; Dr. Hobart M. Smith, University of Rochester; Miss Margaret Storey, Natural History Museum, Stanford University; Dr. Doris M. Cochran, United States National Museum; Dr. Raymond B. Cowles, University of California at Los Angeles; Dr. Edward H. Taylor, University of Kansas; Mrs. Helen T. Gaige, University of Michigan; Dr. Charles T. Vorhies, University of Arizona.

I wish to thank Mr. Robert Menzies for his courtesy in making translations.

I am greatly indebted to Messrs. C. B. Perkins and C. G. Abbott for criticisms and editorial assistance.

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## SUMMARY

*Coleonyx*, a genus of geckos inhabiting the southwestern United States, Mexico and Central America, has been surveyed. There are two groups, or subgenera, one in which the bodies are covered with rather uniform granules, the other having enlarged tubercular scales scattered over the dorsum. The former occupies the southwestern United States and northern Mexico; the latter southern Mexico and Central America. As far as is now known, the two groups do not overlap territorially. Of the non-tubercular group there are three species, *variegatus*, *brevis*, and *fasciatus*. Six new subspecies of *variegatus* are described: *slevini*, *peninsularis*, *abbotti*, *utahensis*, *bogerti*, and *sonoriensis*. There are two tubercular species: *elegans* and *mitratus*. A new subspecies of *elegans*, *nemoralis*, is described. Ranges and field notes are set forth, and relationships are discussed.

