

# Other Contributions

## NATURE NOTES

### Amphibia: Anura

#### Family Bufonidae

***Incilius marmoreus* (Wiegmann, 1833). Reproduction.** The distribution of the Marbled Toad, *Incilius marmoreus*, a Mexican endemic, extends from northern Sinaloa to Chiapas along the Pacific coastal plain, with an isolated population in Veracruz (Frost, 2017); on the Atlantic versant, Lemos Espinal and Dixon (2016: 354) also noted that this species occurs from “northern Hidalgo to the Isthmus of Tehuantepec.” Hardy and McDiarmid (1969) reported that most individuals in Sinaloa were found on the road at night during or just after rains, and that most females were collected in July and contained eggs. In Hidalgo, *I. marmoreus* aggregates in temporary ponds during the rainy season (Lemos Espinal and Dixon, 2016). Herein, I present data from a histological examination of *I. marmoreus* gonadal material from Colima and Sinaloa, and provide the minimum sizes for reproductive activity in males and females. The use of museum collections for obtaining reproductive data avoids removing additional animals from the wild.

I examined 42 specimens of *I. marmoreus* (11 from Colima, collected in 1967, and 31 from Sinaloa, collected in 1960, 1962, 1963, and 1968). The combined samples consisted of 17 males (mean snout–vent length [SVL] = 54.5 mm ± 3.1 SD, range = 48–58 mm), 21 females (mean SVL = 60.9 mm ± 4.5 SD, range = 54–70 mm) and four juveniles from Sinaloa (mean SVL = 38.4 mm ± 7.1 SD, range = 29–44 mm); the specimens are maintained in the herpetology collection of the Natural History Museum of Los Angeles County (LACM), Los Angeles, California, United States (Appendix 1). I used an unpaired *t*-test to analyze the differences in mean SVL between the sexes (Instat, vers. 3.0b, Graphpad Software, San Diego, California, United States).

I made a small incision in the lower part of the abdomen and removed the left testis from males, and a piece of the left ovary from females. I embedded the gonads in paraffin and cut sections at 5 μm, stained them with Harris hematoxylin followed by eosin counterstain (Presnell and Schreiber, 1997), and deposited the histology slides at LACM.

The testicular morphology of *I. marmoreus* is similar to that of other anurans, as described by Ogielska and Bartmanska (2009a). Within the seminiferous tubules, spermatogenesis occurs in vesicles called cysts, which remain closed until the late spermatid stage is reached; the cysts then open and differentiating sperm reach the lumina of the seminiferous tubules (Ogielska and Bartmanska, 2009a). All 17 males exhibited sperm formation, as evidenced by an intertwined mass of spermatozoa in the lumina of the seminiferous tubules (Table 1). As my samples included specimens collected from July to August, (Table 1), I have no definitive information as to when the testicular cycle commences or concludes. The smallest reproductively active male (open cysts with sperm) measured 48 mm SVL (LACM 6130) and was from July.

**Table 1.** One stage present in the monthly testicular cycle of 17 adult *Incilius marmoreus* males from Mexico.

Months	<i>n</i>	(1) Sperm Mass in Lumina of Seminiferous Tubules
June	2	2
July	13	13
August	2	2

The mean SVL of *I. marmoratus* females was significantly larger than that of males ( $t = 4.9$ ,  $df = 36$ ,  $P < 0.0001$ ). The ovaries of *I. marmoratus* are typical of other anurans in being paired organs lying on the ventral sides of the kidneys, which in adults are filled with diplotene oocytes in various stages of development (Ogielska and Bartmanska, 2009b). Mature oocytes are filled with yolk droplets; the layer of surrounding follicular cells is stretched thinly. The smallest reproductively active female measured 54 mm SVL (LACM 50903) was in spawning condition, and was from August. Another female of the same size from July (LACM 87841) was not in spawning condition and contained only primary growth oocytes (*sensu* Uribe, 2011). Conceivably, it spawned earlier that year.

Three stages were present in the spawning cycle (Table 2). The “Pre-spawning Condition” was evident in two females collected in July (LACM 6132, 87838), which contained yolk filled oocytes that were smaller than those seen in stage 2 (ready to spawn females) and were similar to Secondary Growth Stage 5 “progressive accumulation of yolk platelets” in Uribe (2011). Since it was early in the *I. marmoratus* spawning season, apparently there was sufficient time for these oocytes to complete their development for ovulation. Three females collected in July and one in August (Table 2) were “Not in Spawning Condition.” One of them (LACM 36967), collected in July, contained corpora lutea = postovulatory follicles from a recent spawning. These form when the ruptured follicle collapses after ovulation; the follicular lumen disappears and proliferating granulosa cells are surrounded by a fibrous capsule (Redshaw, 1972). Postovulatory follicles in most anuran species are short-lived and are resorbed after a few weeks (Redshaw, 1972). Another female collected in July (LACM 87839) contained occasional mature oocytes and might have completed spawning. The third non-reproductive female (LACM 87841) was discussed above. The female collected in August and “Not in Spawning Condition” (Table 2) contained numerous atretic oocytes. Atresia (spontaneous degeneration of oocytes) is a widespread process occurring in the ovaries of all vertebrates (Uribe, 2009). Increased incidences of follicular atresia are common late in the reproductive season (Goldberg, 1973). High levels of follicular atresia can remove females from the breeding population (Goldberg, 2017). Sixty-seven percent (10/15) of the *I. marmoratus* spawning females (Table 2) contained occasional atretic oocytes. Four smaller *I. marmoratus* (mean SVL = 38 mm) were not reproductively active, and I considered them subadults.

**Table 2.** Three monthly stages in the ovarian cycle of 21 adult *Incilius marmoratus* from Mexico; \*corpora lutea (= postovulatory follicles) from previous spawning present in LACM 36967.

Month	<i>n</i>	(1) Pre-spawning Condition	(2) Spawning Condition	(3) Not in Spawning Condition
June	1	0	1	0
July	16	2	11	3*
August	4	0	3	1

In conclusion, *I. marmoratus* apparently exhibits a spawning cycle that is timed to coincide with the rainy season in western Mexico. In order to determine the duration of the breeding season, an examination of *I. marmoratus* gonads from other months of the year are warranted.

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**Appendix 1:** *Incilius marmoratus* ( $n = 42$ ) from Colima and Sinaloa, Mexico examined from the herpetology collection of the Natural History Museum of Los Angeles County (LACM), Los Angeles, California, United States.

Colima ( $n = 11$ ) LACM 36958, 36961, 36963, 36967–36970, 37908, 37099–37101.

Sinaloa ( $n = 31$ ) LACM 6130–6133, 6135–6137, 50902–50905, 87829–87848.

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## Does the environment influence the coloration of *Rhinella alata* (Bufonidae) in Gamboa, Panama?

Color change is a mechanism that allows animals to alter their presence in response to environmentally changing conditions or because of the influence of predators (Hernández-Gallegos and Domínguez-Vega, 2012). In amphibians, coloration can vary due to their functionality (e.g., sexual dimorphism, aposematism, mimicry), and also can facilitate intra- and intersexual communication (McElroy, 2015). The effectiveness of spatial or seasonal habitat heterogeneity is related to the characteristics of the substrate where the prey is located, and depends on the background characteristics (Savage, 2002).

Other mechanisms, such as camouflage, reduce the risks of predation of animals. Although, background matching provides probabilities for non-detection (Stevens and Marilaita, 2009), it also depends on the vision of the predator (Stevens and Cuthill, 2006). Correlational selection on prey coloration and escape behavior can lead to intraspecific differences in anti-predator behavior (Brodie, 1992; Forsman and Appelqvist, 1998).

Mendelson et al. (2011) proposed the change of some species of *Bufo* to *Rhinella*, and dos Santos et al. (2015) clarified the taxonomy of populations of the *R. margaritifera* complex, to which *R. alata* has been assigned. Although these authors noted a wide range of dorsal and ventral coloration in preserved specimens, no explanation for this phenomenon was provided. dos Santos et al. (2015) re-delimited *R. alata* as restricted to Panama and Chocó Colombia and Ecuador, and Frost (2018) noted the distribution of this species as “western Panama through Chocó western Colombia and Ecuador.” The primary objective of this study was to determine if color pattern variation in individuals of *R. alata* is associated with environmental factors or the size of the toads, and to provide ecological data associated with the observed individuals.

I conducted a study on toads on a trail called “El Oleoducto” (DMS coordinates: 09°08' 04.5"N, 79°43'20.2"W; elev. 49 m), in Parque Nacional Soberanía, Gamboa, Colón, Panama, on 25–26 November and 2–4 December 2017. The toads generally were active from 0700 to 1400 h. On each day I searched a different transect of 400 m along the trail, with each individual transect separated by a distance of 100 m. The predominant vegetation in the study area included species of *Arecaceae*, *Araceae*, *Bromeliaceae*, *Fabaceae*, *Moraceae*, and *Sapindaceae*.

To identify the toads, I followed Ibáñez et al. (1999) and dos Santos et al. (2015). I followed McCranie and Castañeda (2007) for the measurements, and used a Mitutoyo vernier caliper, (to the closest 0.01 cm) to measure the snout–vent length (SVL) of individuals, and a Pesola 10 g scale to determine the body mass of each individual. For each toad ( $n = 49$ ) I recorded the time of capture, the air temperature (taken with a standard thermometer), and the relative humidity (taken as the difference between the dry and wet bulb) following FAO (1993).

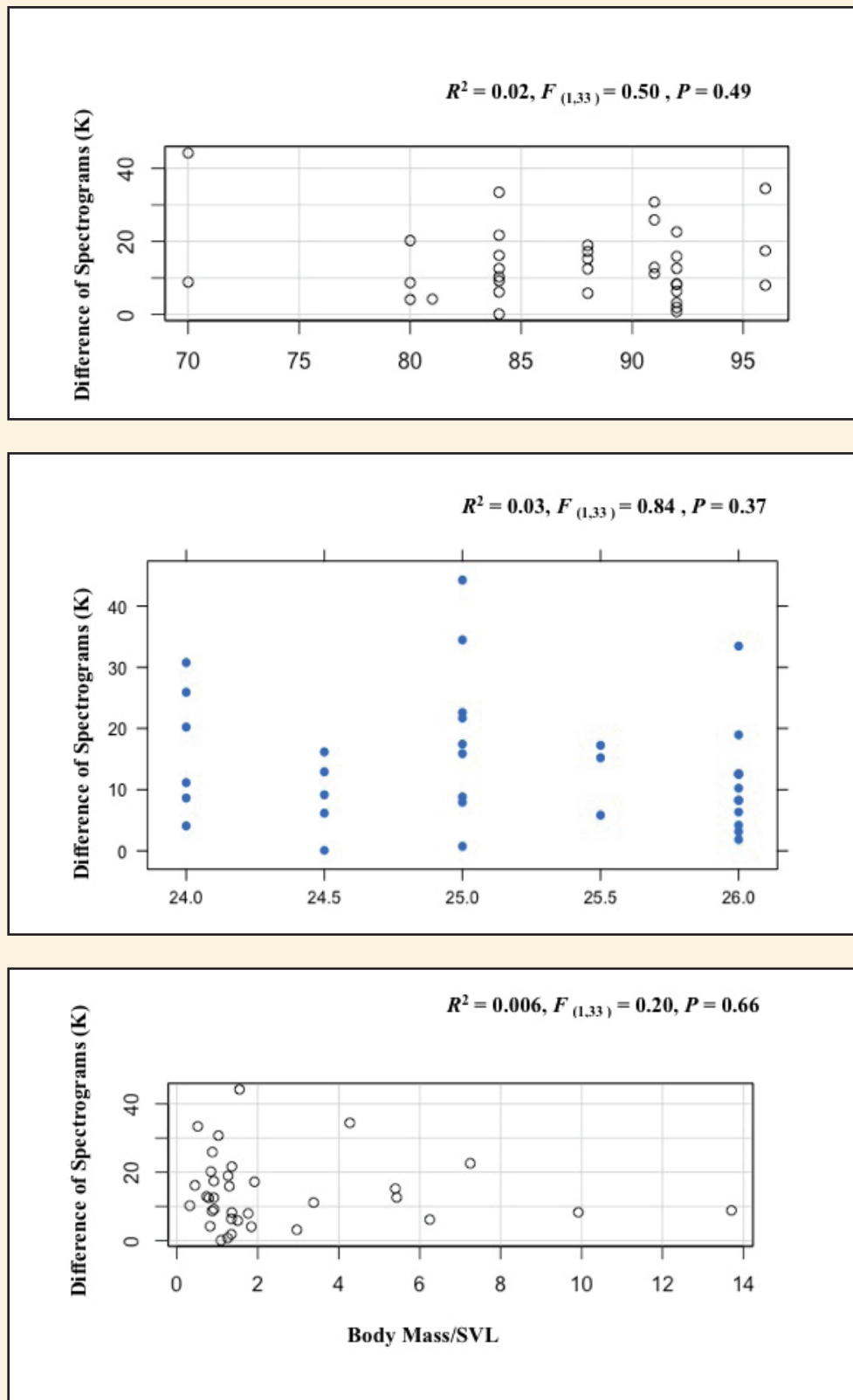
I estimated the spectrum from standardized photographs of 35 toads using the software program Image J. For the analysis, I used the difference of the spectrum from the toad from its background (substrate), and for the linear regressions used the statistical program R version 2.12 for explaining the relationships among the spectrum of the toads with the spectrum of the substrate relative humidity and temperature of the air, and the proportion of the body mass/SVL.

After a sampling effort of 25.5 h, I found no difference between the spectrum of the substrate and the toads ( $< 50$  K), while the relative humidity ranged from 80 and 96% ( $R^2 = 0.02$ ,  $df = 1,33$ ,  $P = 0.49$ ), and found no relation between the spectrums and the air temperature (Fig. 1;  $R^2 = 0.03$ ,  $df = 1,33$ ,  $P = 0.37$ ).

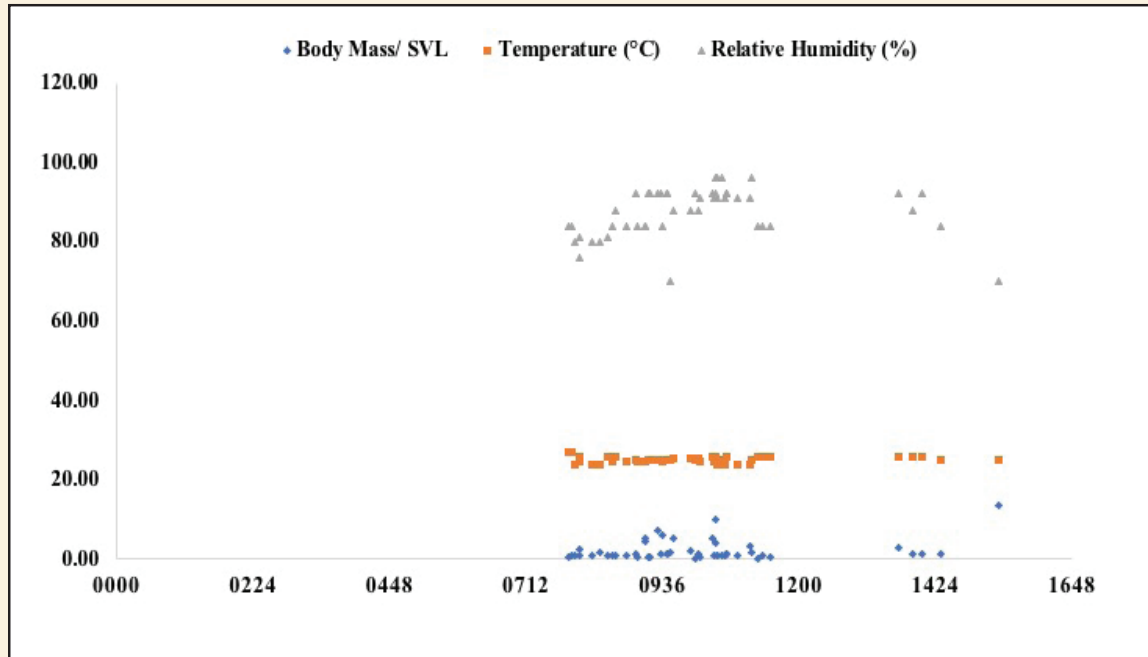
Although disruptive patterns might attain an optimum size influenced by the body size of the animal (Stevens, 2007; Stevens and Marilaita, 2009), I found no difference among the spectrums and the proportion of the body mass/SVL of the toads ( $R^2 = 0.006$ ,  $df = 1,33$ ,  $P = 0.66$ ). Even though I found smaller individuals (proportion  $> 1$ ) from 0756 to 1400 h when the air temperature ranged from 24 and 27°C and the relative humidity from 80 to 96%, I encountered larger individuals from 0808 to 1531 h when the air temperature ranged from 24 and 27°C and the relative humidity from 70 to 96% (Figs. 1, 2).

Based on the experiments of McElroy (2015: 6) some patterns function as disruptive coloration and not as background matching, and he noted, “we cannot reject the hypothesis that background matching may function in real toads to reduce avian attacks in the wild.” Countershading, a color pattern in which the more brightly illuminated aspect of the body (usually the dorsum) is darker than the less illuminated surface (the venter) and renders the animal less distinguishable from its background (see Lillywhite, 2008) might be involved, as many forest floor dwelling amphibians and reptiles tend to resemble dead leaves.

For example, Savage (2002) indicated that some species of the family Centrolenidae take advantage of their coloration and remain undetected while ovipositing on leaves. In addition to the information presented in McElroy (2015), and based on my observations, the substrate on which I found amphibians is an important factor for going undetected by predators. Nonetheless, this does not explain if it could be a determinant factor in defining the coloration of individuals during development.



**Fig. 1.** Results based on 35 individuals of *Rhinella alata*. (A) No relation found between the difference of the spectrum with the relative humidity of the air ( $P > 0.05$ ); (B) no relation found between the difference of the spectrum with the temperature of the air ( $P > 0.05$ ); and (C) no relation found between the difference of the spectrum with the proportion body mass/SVL ( $P > 0.05$ ).



**Fig. 2.** Relationship of the body mass/SVL with the relative humidity and air temperature, and time recorded for 49 individuals of *Rhinella alata*.

Ibáñez et al. (1999), and McElroy (2015) noted that *Bufo typhonius* (= *R. alata*) is a diurnal species that can be found among the fallen leaves of the forest floor, but I also found individuals near, between, and under rocks, under logs, and rotten woods, close to bodies of water, and along trails used by the leafcutter ant, *Atta colombica*. I saw adults of *R. alata* feeding on ants of this species. In general, I found individuals from 700 and 1400 h, when the air temperature ranged from 24 to 27°C and the relative humidity from 70 to 96%.

As proposed by McElroy (2015), *R. alata* represents a cryptic anti-predator strategy that is best characterized by disruptive coloration, but we must consider that specific predators have not been recorded for this toad. Accordingly, *Nasua* (commonly known as Pizotes or Coati-Mundis), are mammals that rely primarily on olfactory cues and secondarily on visual cues to find their prey (Hirsch, 2010), and possibly are predators of this toad (McElroy, 2015). In this study, I observed *N. narica* (including a family of three individuals) on two transects while toads were active. I found that the variation in color pattern in *R. alata* was not affected by the coloration of the substrate, the air temperature and relative humidity, or the proportion in the body mass/SVL of individuals. Stevens and Marilaita (2009), however, noted the characteristic importance of the substrate in which an animal is found for background matching. This phenomenon requires further study to determine which factors are related, for example, altitudinal gradients, vegetation or even predator/prey dynamics, proposed by McElroy (2015).

Conversely, the related factors presented in this study require further examination, for a longer period of time during each day and in different seasons. Interestingly, because of the limited number of ecological studies on *R. alata*, the information presented here is starting to reveal the relationships of this species with its environment.





**Fig. 3.** Individuals of *Rhinella alata* found in this study. (A, C, D, E) Juveniles found on leaves on the forest floor; (B) an adult female found under a rotten log; and (F) an adult female on leaves on the forest floor. 📷 © Manfredo A. Turcios-Casco

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## Family Ranidae

***Lithobates berlandieri* (Baird, 1859).** **Diet.** The Distribution of the Rio Grande Leopard Frog, *Lithobates berlandieri*, extends from central and western Texas and southern New Mexico, in the United States, and in Mexico in the states of Chihuahua, Coahuila, Nuevo León, Tamaulipas, San Luis Potosí, Querétaro, Hidalgo, and across the Transvolcanic Belt to Colima, as well as in Veracruz and Tabasco, at elevations from sea level to slightly over 3,000 m (Lemos-Espinal and Dixon, 2013; Ramírez-Bautista et al., 2014). This species also has been introduced into the lower Colorado River and lower Gila River drainages in Sonora and Baja California del Norte in Mexico, and in California and Arizona in the United States (Frost, 2017).

The diverse diet of adult *L. berlandieri* is characteristic of a generalist and opportunistic predator. In an overview of the diet of this frog in parts of southern and western Texas, Parker and Goldstein (2004) recovered 309 food items they identified as classified in 14 orders and 30 families, including butterflies and their larvae, beetles, cockroaches, crickets, damselflies, true bugs, wasps, bees, spiders, and two reptiles, one colubrid snake, and one skink (see Lemos-Espinal and Dixon, 2013). Parker and Goldstein (2004) also documented a dietary shift in this species among the different seasons.

On 12 October 2017 at 1450 h, along the Río La Silla, municipio de Guadalupe, Nuevo León (25°40.323'N; -100°14.721'W; WGS 84; elev. 487), while collecting frogs for a study on internal parasites we found an individual (sex undetermined) of *L. berlandieri* (UANL-8131; snout–vent length (SVL) = 883 mm; body mass (BM) = 64.7 g; Fig. 1A) that later regurgitated an undigested Brahminy Blindsnake, *Indotyphlops braminus* (UANL-8132; SVL = 84.91 mm; tail length = 14 mm; total length = 98.91 mm; BM = 0.32 g; Fig. 1B). Herein we document the first report of the native frog, *L. berlandieri*, preying on an introduced snake, *I. braminus*, in Mexico. To date, this parthenogenetic species has been reported to occur in at least 20 states in Mexico (Heimes, 2016; Uetz et al., 2018).



**Fig. 1.** (A) An adult *Lithobates berlandieri* that regurgitated (B) an *Indotyphlops braminus*.

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## Amphibia: Caudata

### Family Plethodontidae

***Bolitoglossa rufescens* (Cope, 1869), sharing refuge with *Cupiennius salei* (Araneae: Ctenidae).** The Northern Banana Salamander, *Bolitoglossa rufescens*, is a small species with a short tail, small hands and feet that are pad-like, and show phalangeal reduction; the type locality of this species is Orizaba, Veracruz, Mexico (Parra-Olea et al., 2004). Molecular evidence, however, suggests the presence of different identifiable and allopatric populations (Parra-Olea et al., 2004; Hess et al., 2017; Frost, 2018). Campbell (1998) reported this salamander as living live in bromeliads or under the sheets of banana plants (*Musa* sp.). *Cupiennius salei* is a large, nocturnal spider in which the dorsal pattern of females is chocolate brown with small spots and darker longitudinal stripes, and the legs, patella, and femurs contain paler circles. The coloration of males is not as dark as females, and they lack stripes, except for a black stripe on the abdomen (Tomasinelli, 2000). This spider typically lives within bromeliads and the bracts of *Musa* sp. (Barth, 1988).

Several studies have commented on the interactions between salamanders and arthropods that share potential prey and microhabitats, and generally have involved the negative associations resulting from competition between the species, but not predation (e.g., Gall et al., 2003; Hickerson et al., 2004; Hickerson et al., 2012; Hickerson et al., 2017).

On 3 October 2017 at 1326 h, in Colonia Agrícola Rincón de las Flores, Tezonapa, Veracruz, Mexico (18°43'3.03"N; 96°50'55.57"W; WGS 84; elev. 1,056 m), we found an adult *B. rufescens* within a bract of a *Musa* sp., sharing refuge with *C. salei* (Fig. 1). Both species were moving within the bract, and the salamander eventually hid under the spider's extremities. Subsequently, on 12 November 2017 at 1016 h, at Centro Ecoturístico Rancho Fermín, Atoyac, Veracruz, Mexico (18°54'4.32"N; 96°48'18.89"W; WGS 84; elev. 553 m), we observed an adult *B. rufescens* in a field planted with coffee (*Coffea arabica*) and bananas (*Musa* sp.), also sharing a refuge with *C. salei* within a bract of *Musa* sp. (Fig. 2). In this case, the spider was startled and fled.

In both events, during the time of observation the individuals of *C. salei* showed no predatory interest in the *B. rufescens*, and the salamanders showed no defensive behavior toward the *C. salei*. To the best of our knowledge, in this note we provide first report of *B. rufescens* sharing refuge with *C. salei*.



**Fig. 1.** A *Bolitoglossa rufescens* and a *Cupiennius salei* found sharing a refuge at Colonia Agrícola Rincón de las Flores, Tezonapa, Veracruz Mexico. © Arleth Reynoso-Martínez





**Fig. 2.** A second event in which a *Bolitoglossa rufescens* and a *Cupiennius salei* were found sharing a refuge, at Centro Ecoturístico Rancho Fermín, Atoyac, Veracruz, Mexico. © Arleth Reynoso-Martínez

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## Reptilia: Squamata (lizards)

### Family Anguidae

***Gerrhonotus infernalis* Baird, 1859 (1858). Predation by *Urocyon cinereoargenteus* (Mammalia: Canidae).** The Texas Alligator Lizard, *Gerrhonotus infernalis*, occurs in the Edwards Plateau, the Big Bend region, and in an isolated population along the Colorado River at La Grange, Texas, in the United States, and in Mexico in disjunct localities in the states of Chihuahua, Coahuila, Durango, Nuevo León, Tamaulipas, and San Luis Potosí (Good, 1994; Greene et al., 2009; Lemos-Espinal and Smith, 2007). In Nuevo León, *G. infernalis* is known to inhabit the Sierra Madre Oriental, from the Sierra de Gomas southward along sierras to Galeana (Lazcano-and Banda Leal, *In Press*).

For decades, Parque Ecológico Chipinque (PECh) has been used as a tourist attraction, and people in the Metropolitan Area of Monterrey also use the park for leisure and sporting activities. Because of the importance of preserving the condition of the park, for the last several years various survey and reforestation programs have been underway. One important activity was the implementation of a monitoring program for terrestrial vertebrates. Accordingly, through the use of a cam trap activity camera (Bushnell Trophy Cam HD Aggressor, Model 119774), the predation of an adult *G. infernalis* by a Gray Fox (*Urocyon cinereoargenteus*) was recorded on 24 July 2017 at 1448 h, air temperature 27.7°C (25°36'14"N, -100°21'14"W; datum WGS 84; elev. 1,390 m; Fig. 1). The photograph shows that the fox captured the *G. infernalis* along a trail (La Manzanita) in oak-pine forest, and was holding the lizard by the head. Both *U. cinereoargenteus* and *G. infernalis* are abundant species in PECh, and *G. infernalis* often is found dead on roads in the park (Lazcano et al., 2017). García-Bastida (2013) and García-Bastida et al. (2013) documented several aspects of the ecology of this lizard, but did not include predation information in the park. *Gerrhonotus infernalis* primarily is active in the fall, during cool and humid days, but the event recorded here occurred during the summer, when the activity of this species decreases because of the hot and dry days.

The distribution of *U. cinereoargenteus* extends from the United States to Central America; in Mexico, this species is found in every state in the country (Hershkovitz, 1953; Fritzell and Haroldson, 1962; Leopold, 1972; Hall, 1981; Leopold, 1987). *Urocyon cinereoargenteus* is an omnivorous predator that has been reported to feed on fruits, nuts, and grains, invertebrates such as grasshoppers, beetles, butterflies, and moths, reptiles such as Texas Horned Lizards (*Phrynosoma cornutum*) and Round-tailed Horned Lizards (*P. modestum*), mammals such as Cottontails (*Sylvilagus floridanus*), mice (*Microtus* sp., *Peromyscus* sp.), woodrats (*Neotoma* sp.), and Cotton Rats (*Sigmodon hispidus*), and carrion (Trapp and Hallberg, 1975; Carey, 1982; Fritzell and Haroldson, 1982; Munger, 1986; Sherbrooke and Mason, 2005; Cunningham et al., 2006; Larson et al., 2015; EOL, 2018).

Conversely, *G. infernalis* is a slow moving lizard that feeds largely on arthropods, including grasshoppers, crickets, beetles, spiders, scorpions, and other invertebrates, and perhaps small vertebrates such as lizards and snakes (Greene et al., 2009; Lemos-Espinal and Smith, 2009; Lemos-Espinal and Dixon, 2013). In 2006, one of us (DL) found a *G. infernalis* eating a juvenile *G. parvus* in Cañon San Isidro, Santiago, Nuevo León. *Gerrhonotus infernalis* can be found in variety of plant communities, at elevations from 1,350 to 3,400 m (Lemos-Espinal and Dixon, 2013). To our knowledge, this is the first report of a *G. infernalis* as a food item for *U. cinereoargenteus*. This observation also contributes to our understanding of the trophic relationship between mammals and reptiles in oak-pine forest in northeastern Mexico.



**Fig. 1.** A Gray Fox (*Urocyon cinereoargenteus*) with a Texas Alligator Lizard (*Gerrhonotus infernalis*) in its mouth, found in Parque Ecológico Chipinque, Garza García, Nuevo León, Mexico. 📷 © Parque Ecológico Chipinque

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## Isolated example of a shared sleeping perch in *Norops cusuco* (Squamata: Dactyloidae) from Parque Nacional Cusuco, Honduras


The genus *Norops* (Dactyloidae) currently is represented by 125 species in Mexico and Central America ([www.mesoamericanherpetology.com](http://www.mesoamericanherpetology.com)); 39 of these species have been recorded from Honduras, and 18 are endemic to the country (McCranie and Kohler, 2015). The sleeping behavior of anoline lizards is a fascinating aspect of their natural history, and a growing amount of literature has detailed species-specific sleeping activities (e.g., Kattan, 1984; Clark and Gillingham, 1990; Shew et al., 2002; Poche et al., 2005; Singhal, et al., 2007; Traverzo, 2008; Cabrera-Guzmán and Reynoso, 2010). Despite the interest in behavioral ecology of sleeping anoles, observations of a shared sleeping perch remain unpublished.

*Norops cusuco* McCranie, Köhler and Wilson, 2000, is an understudied species of Neotropical anole that has been assigned to the *N. laeviventris* species subgroup (McCranie et al., 2000) of the *N. auratus* species group (Nicholson et al., 2012). This species has been listed as Endangered by the IUCN (Mayer, 2011), and formerly was known only from the vicinity of the type locality “Parque Nacional El Cusuco Centro de Visitantes” (elev. 1,575 m); subsequently, however, this species has been recorded from additional localities, from the Departamento de Santa Bárbara and Parque Nacional Cerro Azul, Departamento de Copán, in northwestern Honduras (McCranie and Kohler, 2015). Clause and Brown (2017) reported additional natural history observations on *N. cusuco*, including aspects of its territoriality, reproduction, and diet, and also noted that populations appeared stable at the type locality following annual observations from 2012 to 2015 by TWB. Nevertheless, the core habitat at this locality is substantially threatened due to the ongoing conversion of natural forest to agricultural lands (Townsend et al., 2006; Gilroy et al., 2017), and the current population might be jeopardized if this pace of deforestation continues. Accordingly, Johnson et al. (2015) calculated the EVS (Environmental Vulnerability Score) for *N. cusuco* as 17, placing it in the middle portion of the high vulnerability category. Herein we present an isolated observation of a shared sleeping site in *N. cusuco*.

### Observations

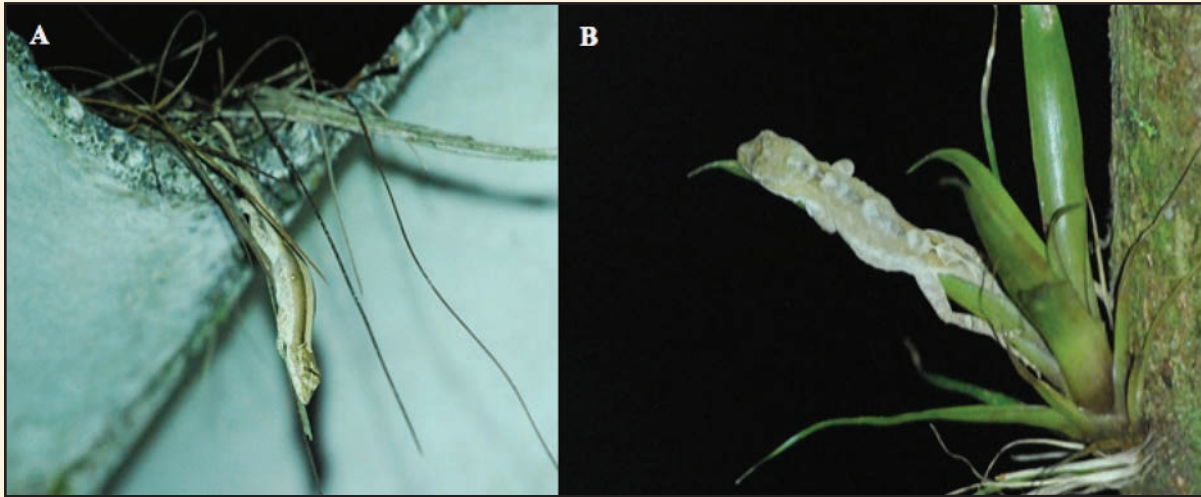
On 6 June 2017 at 2130 h, during a night survey near the type locality of this species at Parque Nacional Cusuco, Departamento de Cortés, Honduras (15.4964°N, 88.21186°W; WGS 84) elev. 1,575 m, one of us (CA) encountered three adult *N. cusuco* (one male, 2 females) sleeping communally on an entrance sign to the park; the anoles were sleeping along the tip of a metal wire on the upper part of the sign. We did not disturb the individuals, and identified them by the presence of a large dirty white dewlap in the male and rudimentary dewlaps in the females (McCranie and Köhler, 2015). Both of the females were positioned in an outward direction toward the tip of the wire, whereas the male was clinging to the wire and facing inward. All three individuals were sleeping in close proximity to one other, with portions of their bodies and tails overlapping (Fig. 1). To the best of our knowledge, communal sleeping is extremely rare in anoles, and previously has not been reported in *N. cusuco*.




**Fig. 1.** Opposite views of a communal sleeping event (1 male, 2 females) of *Norops cusuco* at Parque Nacional Cusuco, Departamento Cortes, Honduras.  © Tom W. Brown



Since we purposely did not disturb the anoles, the following evening, as well as on other occasions, we returned to see if these anoles were exhibiting the same behavior. In all the subsequent visits we encountered three individuals (but occasionally more) sleeping on the sign, but in different locations. The individuals we encountered were using groups of pine needles overhanging the roof of the sign as perches (Fig. 2A), and there also appeared to be no shortage of suitable sleeping sites. We observed single individuals sleeping on other substrates, including on a bromeliad (Fig. 2B).



**Fig. 2.** Solitary sleeping sites used by *Norops cusuco*. The varied substrates used for sleeping include pine needles (A) and a bromeliad (B).  © Cristina Arrivillaga

## Discussion

As determined by the behavioral, neurological, and electrophysiological evidence, anoles (and reptiles in general) sleep during distinct periods (Meddis, 1975; Mathews and Amlaner, 2000). Many organisms spend up to one-half (or sometimes more) of each day sleeping, but this behavior mostly remains an understudied aspect of their ecology (Singhal et al., 2007). Previous research has found that the choice of sleeping perches is influenced by the need to ensure quality sleep (Lima et al., 2005), safely, when they are least alert and most vulnerable to predation (Anderson, 1998), and to awaken in close proximity to essential resources (Kattan, 1984; Clark and Gillingham, 1990).

In the area surrounding the type locality of this anole, we routinely found male and female *N. cusuco* sleeping on neighboring plants and nearby substrates, and documented over 40 sleeping sites (TWB, unpublished). Importantly, all of these individuals were solitary. The ones found sleeping in the same general area, or even on the same plant, presumably had more to do with the overlap of male and female territories than to grouping or pair bonding. As anoles largely are solitary and territorial (Schnoener and Schnoener, 1982; Jenssen et al., 1998), close proximity observations, especially at night, are rare. Male territories tend to encompass those of several females, but the overlap among female territories often is greater (Losos, 2009). Additionally, males usually are territorial toward other males (e.g., see Clause and Brown, 2017), especially during the breeding season, and throughout the year females have been found to be territorial toward similar-sized individuals, males, and occasionally heterospecific anoles (Rand, 1967; Stamps and Crews, 1976; Stamps, 1977). Based on the literature, individual anoles generally are found separately because of territoriality, which raises the question as to why the three anoles reported herein chose to sleep in close proximity to one another.

Although a conclusive explanation is not available, we suggest that because the group consisted of one male and two females, that the shared sleeping perch might have been breeding-related. This situation might be associated with the overlap of male and female territories, or by the anoles awakening close to necessary resources. Conceivably, however, courtship might have been interrupted by nightfall, and the orientation of the sleeping male ensured that courting would continue the following morning. Pair bonding and social monogamy previously has

been suggested for closely sleeping male-female individuals of some anoles species (Talbot, 1979; Gorman, 1980; Rios-López and Puente-Colón, 2007; Harrison, 2013), although the presence of two females in this observation complicates this interpretation.

## Conclusion

After more than eight months of fieldwork by TWB in Parque Nacional Cusuco during a five-year period, all other sleeping observations of *N. cusuco* involved solitary individuals. Consequently, this observation was exceptionally rare, and the precise reason for this behavior remains unknown. This observation perhaps represents a random event or an alternation of sleeping sites among individual anoles, heightened by the fact their territories primarily consisted of a sign in the park and the adjacent vegetation. Nevertheless, the observations contrast the typical view of anole territoriality, and we hope this note illustrates the importance of studying species-specific behaviors and documenting behavioral interactions.

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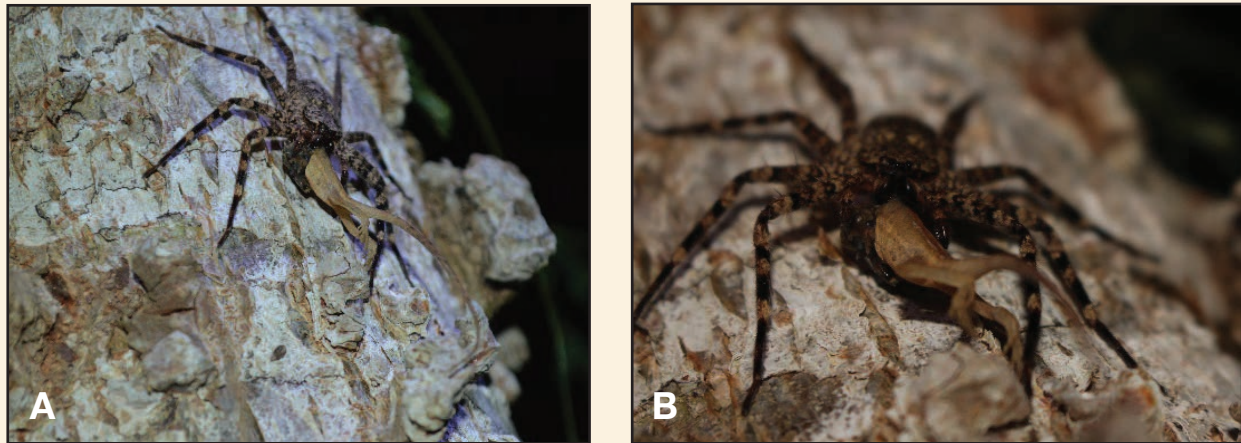
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## Family Dactyloidae

***Norops nebulosus* (Wiegmann, 1834). Predation.** The Clouded Anole, *Norops nebulosus*, is a small (snout–vent length [on the mainland, see below] to 34 mm, with a long tail) characterized by the presence of a large and deployable dewlap that extends from the throat to the thorax region, which is orange with a white margin and noticeably larger in males than females (García and Ceballos, 1994; Rorabaugh and Espinal, 2016). The general dorsal coloration is grayish brown, the venter is pale yellow, a dark line is present between the eyes and transverse lines on the lips, dark “V”-shaped markings extend along the body of males and a tan middorsal stripe bordered with darker colors is present in females, and thin bars are present on the limbs (Alvarado-Díaz and Huacuz-Elias, 1996; García and Ceballos, 1994; Rorabaugh and Espinal, 2016). This species is endemic to Mexico, and is distributed from southwestern Chihuahua and eastern Sonora southward to Oaxaca, Morelos, and Puebla, at elevations from sea level to 2,500 m (Wilson and Johnson, 2010; Mata-Silva et al., 2015; Rorabaugh and Espinal, 2016); an unusual population, which is larger in size, is found on an islet off the coast of Jalisco (Senczuk et al., 2014). *Norops nebulosus* inhabits low deciduous forest, medium evergreen forest, riparian vegetation and disturbed habitats where it can be found in trees, shrubs, and on the walls of houses. This diurnal and arboreal species feeds on insects and is oviparous in reproduction (Alvarado-Díaz and Huacuz-Elias, 1996; García and Ceballos, 1994).

On 10 October 2016 at 2221 h, at Estación de Biología Chamela (Universidad Nacional Autónoma de México), in Chamela, Municipio de La Huerta, Jalisco, Mexico (19°29'49.91"N, 105°2'42.92"W) we observed a spider of the genus *Selenops* (Araneae: Selenopidae) feeding on juvenile *N. nebulosus* (Fig. 1) along a trail in low deciduous forest at an elevation of 75 m. We found the spider on a tree, as it was consuming the anterior portion of the lizard. Soon after taking the photographs, however, we left the scene to avoid any further disturbance. Spiders of the family Selenopidae are stealthy nocturnal hunters that use exceptional speed to capture their prey (Adams and Manolis, 2014). Although many species of spiders are known to consume small vertebrates (Neill, 1948; Groves and Groves, 1978), herein we provide the first record of a spider in the genus *Selenops* feeding on a *Norops nebulosus*.



**Fig. 1.** A spider of the genus *Selenops* found preying on a *Norops nebulosus* at Estación de Biología Chamela, in the municipality of La Huerta, Jalisco, Mexico. © Antonio Yolocali Cisneros-Bernal (A) and Luis Eduardo Bucio-Jiménez (B)

**Acknowledgments.**—We thank Rubén Alejandro Ramírez-García for identifying the spider, and Estación de Biología Chamela of the Universidad Nacional Autónoma de México for providing the lodging and use of its facilities.

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## Reptilia: Squamata (snakes)


### Family Charinidae

***Ungaliophis panamensis*. Schmidt, 1933. Predation on *Gonatodes albogularis*.** The distribution of *Ungaliophis panamensis* extends from southeastern Nicaragua to northwestern Colombia (Savage, 2002). In Costa Rica *U. panamensis* is known to occur along the Caribbean versant of the country, and on the Pacific versant from only south of the Río Grande de Tárcos (Savage, 2002; Solórzano, 2004). This species is secretive and seldom seen, although apparently it is not uncommon. We are aware of individuals encountered in the roofs of houses in rainforest, as well as in gardens, but usually they are found in bromeliads or coiled in epiphytes. Individuals also have been found in banana shipments to other countries (Bogert, 1968; Corn, 1974).

*Ungaliophis panamensis* is known to feed on frogs and lizards (Savage 2002; Solórzano, 2004), including undetermined geckos, and recently it was reported to feed on birds (Dwyer, 2017) and bats (Solórzano, 2017). Herein we report a predatory event by a subadult or adult *U. panamensis* on an adult White-throated Gecko, *Gonatodes albogularis*. While guiding a tour group in Quepos, Provincia de Puntarenas, Costa Rica, on 21 June 2017 from 1946 to 2003 h, AE observed an adult *U. panamensis* after it had seized and was in the process of constricting the gecko. A closer inspection of the photographs and video (Fig. 1; see below) revealed the gecko as a female.

A selected video clip of the event can be seen at: [www.youtube.com/watch?v=wRVSnPXSDQ4&t=6s](http://www.youtube.com/watch?v=wRVSnPXSDQ4&t=6s)



**Fig 1.** An adult individual of *Ungaliophis panamensis* from Quepos, Puntarenas, Costa Rica, subduing a female *Gonatodes albogularis*.  © Andrés Espinoza

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## Family Colubridae

***Mastigodryas melanolomus* (Cope, 1868). Diet.** The distribution of the Salmon-bellied Racer, *Mastigodryas melanolomus*, extends from Sonora, on the Pacific versant and Tamaulipas on the Atlantic versant of Mexico, southward to Panama (Canseco-Márquez and Gutierrez-Mayen, 2010). This species is found in all the lowland and premontane tropical forests and marginally into lower montane forests, as well as in extensively modified areas (McCranie, 2011). This active diurnal snake is both terrestrial and arboreal (Duellman, 1963; Solórzano, 2004).

On 12 September 2016 at 1028 h, in ejido Copoya, Municipio de Tuxtla Gutierrez, Chiapas, Mexico (16.706166°N, 93.134983°W; datum WGS 84; elev. 933 m), I observed a large individual of *M. melanolomus* (estimated total length = 780 mm) on the base of a tree preying on an adult *Sceloporus variabilis* (Fig. 1). The vegetation in the area consisted mostly of a cattle pasture and a cornfield. The *M. melanolomus* had captured the *S. variabilis* by its right side (including the front leg), and the lizard appeared dead. The snake soon crawled into well-vegetated area, which made it difficult to observe, and then went past a wire fence and disappeared. Unfortunately, I was unable to observe the swallowing process.

*Mastigodryas melanolomus* is well known as a lizard eater, but frogs, snakes, reptile eggs, small mammals, and even insects also constitute part of its diet (Stuart, 1948; Álvarez del Toro, 1982; Seib, 1984; Lee, 1996, 2000; Platt et al., 2016). Seib



**Fig. 1.** A adult *Mastigodryas melanolomus* preying on an adult *Sceloporus variabilis* in Ejido Copoya, Municipio de Tuxtla Gutierrez, Chiapas, Mexico. © Miguel E. Hernández-Vázquez

(1984) found that lizards comprise 71% of the diet of this species, and Stafford and Meyer (2000) concluded that this species largely is saurophagous. This observation represents the first record of *M. melanolomus* feeding on *S. variabilis*.

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### Family Dipsadidae

***Leptodeira uribei*. (Bautista and Smith, 1992).** **Diet.** Uribe's False Cat-eyed Snake, *Leptodeira uribei*, is a Mexican endemic species that inhabits tropical dry forest and tropical semi-deciduous forest along the Pacific coastal lowlands from Jalisco to Oaxaca, at elevations from sea level to 500 m (Ponce-Campos and García, 2007; Reyes-Velasco and Mulcahy, 2010). Although this snake apparently is uncommon and its current population trend largely is unknown, it has been assessed as Least Concern by the IUCN (Ponce-Campos and García, 2007). In contrast, the Secretaría de Medio Ambiente y Recursos Naturales listed *L. uribei* as a species of special protection (Pr; SEMARNAT, 2010), Cruz-Sáenz et al. (2017) assessed its Environmental Vulnerability Score (EVS) as 17, thereby placing it in the middle portion of the high vulnerability category, and Johnson et al. (2017) placed it in Priority Level One given its high EVS score and restriction to a single physiographic region.

Limited information is available on the dietary habits of *L. uribei*. Ramírez-Bautista and Smith (1992) noted that it presumably feeds on such nocturnal lizards as *Hemidactylus frenatus* and *Phyllodactylus lanei*, and Reyes-Velasco and Mulcahy (2010) indicated that an individual maintained in captivity for a few days refused to feed on



geckos, but readily accepted frogs. Herein we provide the first observation of *L. uribei* feeding in the wild, and to our knowledge the first record of a snake preying on a Shovel-headed Treefrog, *Diaglena spatulata*. We also present additional information on the diet of *L. uribei* in captivity.

On 19 January 2014 at ca. 1100 h, during a herpetofaunal survey in coastal Jalisco at Ejido Emiliano Zapata, Municipio de La Huerta, one of us (JTTC) encountered an adult individual of *D. spatulata* (estimated snout–vent length [SVL] = 70 mm), while it was being consumed by an adult (estimated total length = 650 mm) *L. uribei* (Fig. 1). The predation event occurred on the ground in leaf litter (19°23'23.22"N, 104°56'56.97"W; datum WGS 84; elev. 46 m), in an area of secondary vegetation within tropical dry forest. After ca. 20 min, the snake completed ingesting the frog and retreated into the nearby vegetation. The air temperature was recorded as 27°C and the relative air humidity as 72%.

We determined the identification of the *D. spatulata* because this species is the only known anuran in coastal Jalisco in which the tips of the fingers and toes expand into definite discs, and it also exhibits a conspicuous labial shelf (Ramírez-Bautista, 1994). We identified the *L. uribei* based on its color pattern, which characteristically consists of an orange blotch on the head and a pattern of numerous dark bands on the body (Ramírez-Bautista and Smith, 1992).

Additionally, an adult *L. uribei* (INIRENA-CHUM 1042) (SVL = 640 mm) collected by Gil Paz-Gutiérrez at Palos Marías, in the municipality of Coahuayana, Michoacán (18°49'0.24"N, 103°33'13.52"W; datum WGS 84) on 23 July 2011 and maintained in captivity for ca. 10 days, readily accepted an adult *Norops nebulosus* (Fig. 2) that was offered as food. Considering the limited amount of available information on the diet of *L. uribei*, the above observations augment our knowledge of the natural history of this species.



**Fig. 1.** An individual of Uribe's False Cat-eyed Snake (*Leptodeira uribei*) feeding on a Shovel headed Treefrog (*Diaglena spatulata*).

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**Fig. 2.** A captive Uribe's False Cat-eyed Snake (*Leptodeira uribei*) feeding on a *Norops nebulosus*.

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**Acknowledgments.**—The snake was collected under permit SGPA/DGVS/07501/10, issued by the Dirección de Vida Silvestre (SEMARNAT) to Javier Alvarado.

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### Family Natricidae

***Thamnophis proximus* (Say, 1823). Maximum elevation in Honduras.** The distribution of the Western Ribbonsnake, *Thamnophis proximus*, extends from Wisconsin and Indiana, in the United States, south and westward through the central part of the country and thence throughout much of eastern Mexico to parts of the Yucatan Peninsula, and in western Mexico along the coast of Guerrero and in Oaxaca and Chiapas, and in Central America mostly in isolated populations on both versants to central Costa Rica (see map in Rossman et al., 1996). The elevation of this species extends from sea level to 2,500 m (Köhler, 2008; Wilson and Johnson, 2010). In Honduras *T. proximus* is known to occur at elevations from sea level to 1,100 m, in Lowland Moist Forest, Lowland Dry Forest, Premontane Wet Forest, Premontane Moist Forest, Premontane Dry Forest, and Pine-oak Forest formations (Wilson and Townsend, 2007; McCranie, 2011).

On 22 December 2012, while conducting a survey in the area of Las Uvas, near Zambrano, Departamento de Francisco Morazán, on road CA5 between the departments of Francisco Morazán and Comayagua (14°17'27.16"N, 87°25'59.53"W; WGS 84; elev. 1,488 m), at 0912 h I observed a subadult *T. proximus* in a shallow pond. Although higher elevations have been reported for this species in Mexico and in central Costa Rica (1,751 m; Savage, 2002), this voucher represents the highest known elevation for *T. proximus* in Honduras, extending the previously known maximum elevation by 388 m. A photo voucher of this individual is deposited in the University of Texas at Arlington Collection of Vertebrates Digital Collection (UTADC-9170).



**Fig 1.** (A) A *Thamnophis proximus* (UTACD-9170) from Las Uvas, near Zambrano, Departamento de Francisco Morazán, found at an elevation at 1,488 m, which is the maximum known for this species in Honduras; and (B) the pond and surrounding habitat where the snake was observed. © José Mario Solís

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# DISTRIBUTION NOTES

## Amphibia: Anura

### Family Bufonidae

*Incilius signifer* (Mendelson, Williams, Sheil, and Mulcahy, 2005). PANAMA: LOS SANTOS: Distrito de Las Tablas, Corregimiento El Pedregoso (7.699981°N -80.336544°W; WGS 84) elev. 153 m; 19 November 2012; Ángel Sosa-Bartuano, Yaritza González, and Nohelys Canto. Three photographs of the individual are deposited at the Natural History Museum of Los Angeles County (photo vouchers LACM PC 2352–2354; Fig. 1A). The toad was found on the ground along a dirt road at 1953 h (Fig. 1B), and represents the 4<sup>th</sup> record for the province, a new record for the district, and the first locality for *Incilius signifer* outside of a protected area in the province of Los Santos, with the closest reported locality ca. 35 km (airline distance) to the SW at Buenos Aires, Reserva Forestal La Tronosa, Provincia de Los Santos (Cedeño et al., 2006; Rodríguez, 2009), and ca. 57 km (airline distance) to the NW at Reserva Forestal El Montuoso, Provincia de Herrera (Jaramillo et al., 2010).



**Fig. 1.** (A) An *Incilius signifer* (LACM PC 2354) from El Pedregoso, Distrito de Las Tablas, Provincia de Los Santos, Panama; and (B) a photo of the habitat where the individual was observed. 📷 © Angel Sosa-Bartuano

**Acknowledgments.**—I thank Aydeé Cornejo, Yaritza González, and Nohelys Canto for field assistance, and Neftali Camacho for providing the photo voucher numbers.

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**Family Hylidae**

***Charadrahyla taeniopus* (Günther, 1901).** MEXICO: HIDALGO: Municipio de Metztlán, Los Parajes (20.672385°N, -98.706271°W; WGS 84) elev. 2,133 m; 3 March 2017; Miguel Ángel Flores-Hernández. During an owl (Strigiformes) survey in pine-oak forest, at 2012 h and during a light rain we heard two *Charadrahyla taeniopus* calling. A photo voucher of one individual (CH-CIB 104) is deposited in the photographic collection of the Herpetological Collection of the Centro de Investigaciones Biológicas, Universidad Autónoma del Estado de Hidalgo. This voucher represents a municipality record, with the closest known locality ca. 6.6 km to the NE (air-line distance) at a locality noted as “4 Km al SO de Tianguistengo,” in Municipio de Tianguistengo (Lemos-Espinal and Dixon, 2016).

**Acknowledgments.**—We thank Irene Goyenechea for allowing us to deposit the image of the frog in the photographic collection of the Herpetological Collection of the Centro de Investigaciones Biológicas.



**Fig 1.** A *Charadrahyla taeniopus* (CH-CIB 104) from Los Parajes, Municipio de Metztlán, Hidalgo, Mexico.

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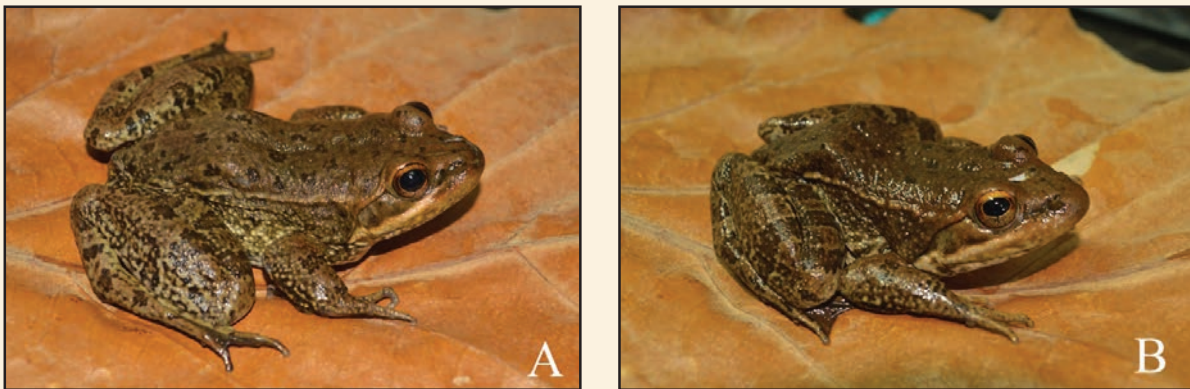
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## Family Ranidae

***Lithobates psilonota* (Webb, 2001).** MEXICO: ZACATECAS: Municipio de Valparaiso, ca. 2.6 km (airline distance) S of San Juan Capistrano (22.619822°N, -104.090828°W; WGS 84); elev. 1,133 m; 10 July 2017; Jorge A. Bañuelos-Alamillo. Two females measuring 85 mm (Fig. 1A) and 76 mm (Fig. 1B), respectively, were found foraging at 2000 h in a stream coursing through xerophytic scrub in dry forest. Photo vouchers of these individuals are deposited at the San Diego Natural History Museum (SDSNH\_HerpPC\_05356–57), and the specimens are deposited in the Vertebrate Collection of Universidad Autónoma de Aguascalientes (CZUAA-ANF-310-311). These individuals represent a new municipality record and the second known locality from Zacatecas, and extend the distribution of this species ca. 172 km (airline distance) to the NW from the previous known locality in Zacatecas at 1 km N of Mezquital del Oro (Ahumada-Carrillo et al., 2011), and ca. 83 km (airline distance) to the NW from the closest known locality at 7.2 km W of Villa Guerrero, Jalisco (Webb, 2001).



**Fig. 1.** Two females of *Lithobates psilonota* (A = SDSNH\_HerpPC\_05356; and B = SDSNH\_HerpPC\_05357) found in Municipio de Valparaiso, Zacatecas, Mexico. © Jorge A. Bañuelos-Alamillo

**Acknowledgments.**—We thank Bradford Hollingsworth for providing the photo voucher numbers. The specimens were collected under permit SGPA/DGVS/030709/16, issued by Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) to Gustavo Ernesto Quintero-Díaz.

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## Amphibia: Caudata

### Family Plethodontidae

*Isthmura gigantea* (Taylor, 1939). MEXICO: HIDALGO: Municipio de Acaxochitlán, Ejido Almonamique (20.18052°N, -98.19969°W; WGS 84) elev. 2,255 m; 17 November 2016; Miguel Ángel Flores-Hernández. A photo voucher of the salamander (CH-CIB 101) is deposited in the photographic collection of the Herpetological Collection of Centro de Investigaciones Biológicas, Universidad Autónoma del Estado de Hidalgo. This voucher represents a new municipality record, with the closest known locality ca. 27.4 km to the NE (airline distance) in Municipio de San Bartolo Tutotepec (Vite-Silva et al, 2010; Ramírez-Bautista et al., 2014; Badillo-Saldaña et al., 2015; CH-CIB 680). The salamander was found during a faunal diversity project for forest management, under a woodpile in pine oak forest. This individual, a juvenile, was found in early winter in a regenerating forest. Badillo-Saldaña et al. (2015) previously noted that juveniles in the state had been encountered only in undisturbed sites.



**Fig 1.** A juvenile *Isthmura gigantea* (CH-CIB 101), from Ejido Almonamique, Municipio de Acaxochitlán, Hidalgo, Mexico.

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## Family Plethodontidae

***Pseudoeurycea gadovii* (Dunn, 1926).** MEXICO: VERACRUZ: Municipio de Coscomatepec, El Aserradero (19°3'30.43"N, 97°10'42.76"W; WGS 84); elev. 2,669 m; 22 October 2017. The individual, an adult (Fig. 1), was found in heavily degraded pine forest around 1232 h (Fig. 1). Because *Pseudoeurycea gadovii* is listed as Vulnerable (IUCN, 2016) and in the category of special protection (SEMARNAT, 2010), permits were not available for us to collect the individual. Thus, we deposited a photograph in the photographic collection of the Museo de Zoología, Facultad de Estudios Superiores Zaragoza, Universidad Nacional Autónoma de México (MZFZ IMG 158). This voucher represents a new municipality record, and is located 9.23 km (airline distance) to the N of Xometla (the type locality). It also represents the 13<sup>th</sup> recorded municipality in the distribution of this species, which includes the states of Tlaxcala, Puebla, and Veracruz (Solano-Zavaleta et al., 2009).



**Fig. 1.** An adult *Pseudoeurycea gadovii* (MZFZ IMG 158) from El Aserradero, Municipio Coscomatepec de Bravo, Veracruz, Mexico. 📷 © Jorge Luis Castillo-Juárez

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## Reptilia: Squanata (lizards)

### Family Anguidae

*Abronia taeniata* (Weigmann, 1828). MEXICO: HIDALGO: Municipio de Huejutla de Reyes (21.15405°N, -98.39175°W; WGS 84); elev. 125 m; 28 July 2017; Claudio Alberto Mendoza-Paz. The lizard was found and photographed at 2338 h, in an area containing cattle near a gas station. A photo voucher (CH-CIB 97; Fig.1) is deposited in the photographic collection of the herpetological collection of the Centro de Investigaciones Biológicas, Universidad Autónoma del Estado de Hidalgo. This voucher represents a new municipality record, with the closest reported locality ca. 22.16 km to the S (airline distance) in the vicinity of Tlaltozonco, Municipio de Huazalingo, Hidalgo (Lemos-Espinal and Dixon, 2016). The known elevational range of this species has been reported as from 1,000 to ca. 2,400 m (Wilson and Johnson, 2010; Ramírez-Bautista et al., 2014; Lemos-Espinal and Dixon, 2016), so this voucher represents the lowest reported elevation for this species. Nevertheless, the elevation for the closest record listed in Lemos-Espinal and Dixon (2016) lies at an elevation of 316 m, which provides further evidence that *Abronia taeniata* inhabits lower elevations than previously reported in the literature. Still, additional sampling for more individuals near the observation site, as well as in other areas of the Huasteca Hidalguense, is necessary to corroborate the occurrence of *A. taeniata* in these lowland areas.





**Fig 1.** An adult *Abronia taeniata* (CH-CIB 92) from Municipio de Huejutla de Reyes, Hidalgo, Mexico.

© Claudio Alberto Mendoza-Paz

**Acknowledgments.**—We thank Irene Goyenechea for allowing us to deposit the photo in the photographic collection of the Herpetological Collection of the Centro de Investigaciones Biológicas, and Luis Canseco-Márquez for confirming the identification of lizard.

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## Family Dactyloidae

*Norops sagrei* (Duméril & Bibron, 1837). HONDURAS: YORO: El Progreso, (15°23'46"N, 87°48'48"W; WGS 84) elev. 60 m; 8 April 2017; Diana Mencía-B. and Luis Herrera-B. We found an adult male of the introduced *Norops sagrei* (UVS V1070) at 1530 h, on a fence surrounding a school (Fig 1A). This specimen represents the first record of this species in the department of Yoro, as well as the fifth departmental record for *N. sagrei* from the country (Fugler, 1968; Meyer and Wilson, 1973; Espinal et al., 2014; McCranie and Köhler, 2015). During 10 additional visits to this site (from March to October 2017), we observed or collected more individuals of this species, including several adults (UVS V1104–05) (Fig. 1B), subadults, and juveniles. Consequently, we confirm an established population of *N. sagrei* in the city of El Progreso, located 25 km to the SE of the closest reported locality in the city of San Pedro Sula, in the department of Cortés (McCranie and Köhler, 2015). We deposited the collected specimens in the Vertebrate Collection at the Universidad Nacional Autónoma de Honduras en el Valle de Sula (UNAH-VS).



**Fig. 1.** (A) An adult male (UVS V1070) and (B) an adult female (UVS V1105) of *Norops sagrei* found in El Progreso, Departamento de Yoro, Honduras.  © Luis Herrera-B.

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## A confirmed established population of *Lepidodactylus lugubris* (Duméril and Bibron, 1836) (Squamata: Gekkonidae) in Mexico

The Mourning Gecko, *Lepidodactylus lugubris*, is a widely distributed species that occurs in coastal areas of the Indian and Pacific oceans, from Sri-Lanka and India (i.e., the Andaman and Nicobar islands; see Hoogmoed and Avila-Pires, 2015) east to Taiwan, south throughout the islands of the South China Sea, throughout the Indo-Australian Archipelago, and east throughout the islands of the Pacific Ocean to Hawaii (Grismer, 2011). This species has been introduced into several areas of the New World, including Guadeloupe (French West Indies), Brazil, Surinam, Venezuela, Colombia, Ecuador (including the Galápagos Islands), Panama, Costa Rica, Nicaragua, Mexico, and the state of Florida in the United States (Brown and Parker, 1977; Savage, 2002; Hoogmoed and Avila-Pires, 2015; Señaris et al., 2017). This nocturnal, arboreal, insectivorous, and parthenogenetic species is capable of dispersing into many areas outside of its original distribution (Köhler, 2008). Although Brown and Parker (1977) reported this species as occurring in Mexico, its presence in the country has remained unverified because the authors did not provide literature references or indicate any examined material. Although more recent literature has listed this species in Mexico, but without providing additional information (Bahuer and Henle, 1994; Manthey and Grossman, 1997; Röhl, 2002, Somaweera and Das, 2008; Kraus, 2009; Somaweera and Somaweera, 2009; Montes et al., 2012; De Lisle et al, 2013), Hoogmoed and Avila-Pires (2015) considered that the reports from Mexico apparently were based on repeated information from earlier publications and concluded that the species was not present in the country. Additionally, some publications have not included this species in herpetofaunal lists for Jalisco (Chávez-Avila et al, 2015; Cruz-Sáenz et al., 2017) or as a member of the Mexican herpetofauna (Flores-Villela, 1993, Flores-Villa and Canseco-Márquez, 2004). Herein we document the first confirmed locality for *L. lugubris* in Mexico.

On the evening of 10 October 2016, we found an individual of *L. lugubris* climbing on a window of a restaurant at Marina Vallarta, Municipio de Puerto Vallarta, Jalisco (20°39'48.33"N, 105°15'9.49"W; WGS 84; elev. 5 m). A photograph of this individual is deposited in the University of Texas at Arlington Collection of Vertebrates Digital Collection (Photo voucher UTADC 9163; Fig.1). The gecko was found near a pier used by boats from around the world, so apparently this species was introduced as a stowaway on one of the boats. The following year we saw several individuals of *L. lugubris* in this area, confirming that a population of this species has become well established.



**Fig. 1.** An adult *Lepidodactylus lugubris* (UTADC 9163) photographed at Marina Vallarta, Puerto Vallarta, Mexico.

© Iván Trinidad Ahumada-Carrillo



**Acknowledgments.**—We thank Carl J. Franklin for providing the photo voucher number, and Louis W. Porras for his helpful comments on this note.

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## Reptilia: Squamata (snakes)

### Family Colubridae

*Leptophis ahaetulla* (Linnaeus, 1758). MEXICO: YUCATÁN: Municipio de Yaxcabá, ca. 1.9 km (airline distance) S of Libre Unión (20.690244°N, -88.812646°W; WGS 84); elev. 23 m; 14 July 2015; Rubén A. Carbajal-Márquez, Christian M. García-Balderas, Tania Ramírez-Valverde, and Pablo M. Beutelspacher-García. The snake was found dead on a road through tropical deciduous forest at 1300 h (Fig. 1). A photo voucher is deposited at the San Diego Natural History Museum (SDSNH\_HerpPC\_05359). This voucher represents a new municipality record and the second confirmed locality from the state of Yucatán, extending the distribution ca. 128.5 km (airline distance) SW of 3.2 km SE of Colonia Yucatán, Tizimín, Yucatán (Torres-Solís et al., 2017).



**Fig. 1.** A road-killed adult of *Leptophis ahaetulla* (SDSNH\_HerpPC\_05359) found at Libre Unión, Yucatán, Mexico.

© Pablo M. Beutelspacher-García

**Acknowledgments.**—We thank Bradford Hollingsworth for providing the photo voucher number and Pablo M. Beutelspacher-García for field assistance.

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## New records of *Masticophis mentovarius* (Squamata: Colubridae) from the state of Quintana Roo, Mexico

The Neotropical Whipsnake, *Masticophis mentovarius*, is a widely distributed species that ranges from the states of Sonora (on the Pacific versant) and Tamaulipas (on the Atlantic versant) in Mexico southward to Colombia and Venezuela, at elevations from near sea level to 2,500 m (Lee, 1996; Wilson and Johnson, 2010; Heimes, 2016). Lee (1996) noted that this the species probably occurs throughout the entire Yucatán Peninsula, although there are no confirmed records from central Campeche or southern Quintana Roo; however, a specimen later was collected at La Unión along the border with Belize (Cedeño-Vázquez et al., 2003). Herein, we report four new records from southern Quintana Roo (one observation, and three road-killed specimens deposited in the herpetological collection of El Colegio de la Frontera Sur, Unidad Chetumal [Reptile Collection record number: QNR.RE.034.0697]): (1) Municipio de Othón P. Blanco, Chetumal (18.504273°N, -88.336126°W, datum WGS 84); elev. 11 m; 22 August 2016; an adult female (UTEPObs:Herp: 125 Fig. 1) observed by PMBG; (2) ECO-CH-H3988, Municipio de Felipe Carrillo Puerto, road 293, 2.2 km SE Presidente Juárez (19.323463°N, -88.54177°W; datum WGS 84); elev. 31 m; 26 March 2017; Pedro Gabriel Blanco Catzin; a male (total length [TL] = 2,005 mm, snout–vent length [SVL] = 1,465 mm); (3) ECO-CH-H4008, Municipio de Bacalar, between Bacalar and Reforma (18.758138°N, -88.479396°W, datum WGS 84); elev. 28 m; 1 June 2017; PMBG; a male (TL = 1,427 mm, SVL = 1,032 mm); and (4) ECO-CH-H4014, Municipio de Felipe Carrillo Puerto, road 293, 2 km NE Presidente Juárez (19.339537°N, -88.546561°W; datum WGS 84); elev. 34 m; 2 June 2017; Pedro Gabriel Blanco Catzin; a female (TL = 1,164 mm, SVL = 950 mm). These new locality records suggest a continuous distribution for *M. mentovarius* in Quintana Roo. Survey efforts in central Campeche are necessary to confirm the panpeninsular distribution of this species in the Yucatan Peninsula (see distribution maps in Lee [1996, 2000], Köhler [2008], and Heimes [2016]).



**Fig 1.** An adult female *Masticophis mentovarius* (UTEPObs:Herp: 125) found in Chetumal, Municipio de Othón P. Blanco, Quintana Roo, Mexico.  © Pablo M. Beutelspacher-García

**Acknowledgments.**—We thank Nidia Gabriela Blanco-Campos for helping to process the collected specimen, Louis W. Porras for providing valuable suggestions that improved the manuscript, and Teresa Mayfield for kindly providing the photo voucher number. The collecting permit (SGPA/DGVS/01205/17) was issued by SEMARNAT to Fausto R. Méndez-de la Cruz (Instituto de Biología, UNAM), with an extension to JRCV.

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***Tantilla cuniculator* Smith, 1939.** MEXICO: QUINTANA ROO: Rancho Israel, 5 km NW of Mahahual, Municipio de Othón P. Blanco (18.75935°N, -87.723841°W; datum WGS 84); elev. 6 m; 22 June 2017; Alicia Coronado-Ávila and Rodolfo Coronado-Kin. The snake, a male measuring 205 mm in total length and 150 mm in snout–vent length (Fig. 1), was found active on the ground early in the evening, near a mound with debris in the vicinity of a shack surrounded by semi-evergreen forest and exotic and native fruit trees. The specimen is deposited in the herpetological collection of El Colegio de la Frontera Sur, Unidad Chetumal (ECO-CH-H4021, Reptile Collection record number: QNR.RE.034.0697). This individual represents the first record for the municipality, and extends the distribution of this species ca. 84.5 km to the E (airline distance) from the closest reported locality at Rancho Santa Lupita, Bacalar, Quintana Roo (Cedeño-Vázquez et al., 2016). According to the distribution maps in Lee (1996, 2000), Köhler (2008), and Wilson and Mata-Silva (2014), this record represents the easternmost reported locality for this species, and confirms its presence in the coastal area of Quintana Roo. Although the distribution map in Heimes (2016) appears to marginally extend to this area, no specimens are referenced as vouchers.





**Fig 1.** Dorsal (A) and ventral (B) views of a specimen of *Tantilla cuniculator* (ECOCH- H4021) found at Rancho Israel, municipality of Othón P. Blanco, Quintana Roo, Mexico. © Humberto Bahena-Basave

**Acknowledgments.**—We thank Nidia Gabriela Blanco-Campos for helping to process the specimen, Humberto Bahena-Basave for taking the photographs, and Louis W. Porras and Vicente Mata-Silva for reviewing this note. The collecting permit (SGPA/DGVS/01205/17) was issued by SEMARNAT to Fausto R. Méndez-de la Cruz (Instituto de Biología, UNAM), with an extension to JRCV.

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## Family Elapidae

### The Sonoran Coralsnake, *Micruroides euryxanthus* (Kennicott, 1860), in the state of Jalisco, Mexico

Two genera of coralsnakes are distributed in North America, *Micrurus* Wagler, 1824, and *Micruroides* Schmidt, 1928. The genus *Micruroides* is monotypic, and differs from *Micrurus* by a combination of the following morphological characteristics: a single pair of chin shields; the prefrontal bones are separated by the frontals; the first ventral is separated from the chin shields by five or more scales; the maxillae contain hollow fangs followed by one or two solid teeth; and a pale parietal or nuchal ring is followed by a black ring (Roze, 1974; Campbell and Lamar, 2004). The distribution of the single species of *Micruroides*, *M. euryxanthus* (Kennicott, 1860), is restricted to the southwestern United States and northwestern and western Mexico (Campbell and Lamar, 2004; Cruz-Sáenz et al. 2008; 2017; Heimes, 2016; Woolrich-Piña et al., 2016).

The conservation status of *M. euryxanthus* has been assessed as Least Concern (LC) by the IUCN (Frost et al., 2007), and as threatened (Amenazada [A]) by the Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT, 2010). Additionally, Wilson et al. (2013) determined an Environmental Vulnerability Score of 15 for this species, thereby placing it in the lower portion of the high vulnerability category.

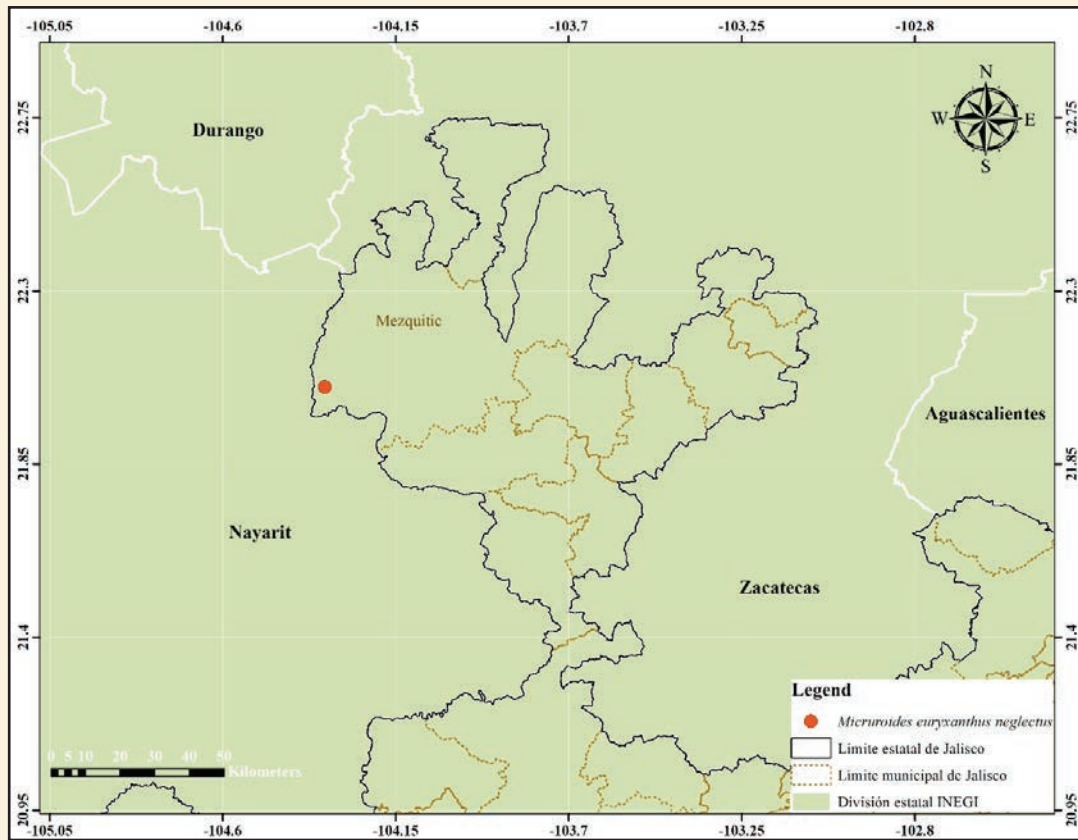
Historically, three subspecies have been assigned to *M. euryxanthus* (*M. e. euryxanthus* [Kennicott, 1860]) from Arizona and New Mexico in the United States, and Sonora and Chihuahua in Mexico; *M. e. australis* Zweifel and Norris, 1955, from southern Sonora, southwestern Chihuahua, and northern Sinaloa, and *M. e. neglectus* Roze, 1967, from central Sinaloa (Roze, 1974; Campbell and Lamar, 2004). The population from the state of Sinaloa is known only from three vouchered specimens, two males used in the original description, from 25–32 km north of Mazatlán (Roze, 1967), and a single female collected in 2006 at Cosalá, Sinaloa (Meik et al., 2007).



**Fig. 1.** A *Micruroides euryxanthus* (ECO-CH-H-3991) from 2.5 km south of San Miguel Huaixtita, in the municipality of Mezquitic, Jalisco, Mexico. © Iván T. Ahumada-Carrillo

On 22 September 2015, a juvenile *M. euryxanthus*, presumably a female (Fig. 1), was found 2.5 km south of San Miguel Huaixtita, Municipio de Mezquitic, Jalisco, Mexico (22.050361°N, -104.334153°W; WGS 84); elev. 1,460 m; in Cañón Huaynamota, Sierra Los Huicholes (ECO-CH-H-3991; Fig. 2); Iván T. Ahumada-Carrillo and Miguel Ángel López-Cuellar. The snake was found under a rock in an ecotone between tropical deciduous forest and oak forest, with *Quercus magnoliifolia*, *Byrsonima crassifolia*, *Lysiloma acapulcensis*, and *Dioon sonorensis*

as the dominant species (Fig. 3). We noted the following characteristics for the specimen: 232 ventrals; 24 subcaudals; 2 black tail rings; 16 black body rings (a higher number than in previously known specimens); black body rings 5–7 dorsal scales long; a pale nuchal ring, 3 scales long, does not extend onto parietals; pale body rings 1.5–2 scales long (similar to what was observed in MZFC-19683; Table 1); 101 red scales extend along the middorsal line of the body (excluding the tail) (the lowest number reported for the Sinaloan population, and correspond to “*M. e. neglectus*” (Table 1); snout–vent length 170 mm; and tail length 12 mm.



**Fig. 2.** Map showing a new locality (red spot) for *Micruroides euryxanthus* in the Sierra de los Huicholes, Municipio de Mezquitic, Jalisco, Mexico. Map courtesy of Giovanni Angeles.

**Table 1.** Morphological data (numbers for selected scale characters and color pattern characteristics) for specimens of *Micruroides euryxanthus* from Sinaloa, Mexico.

Specimen Numbers	Ventrals	Subcaudals	Black Rings on Body	Black Rings on Tail	Red Scales along Middorsal Line
UMMZ-114637 (Holotype)	206	25	13	2	106
J.F.C. 62-65 (Paratype)	207	26	12	2	106
MZFC 19683	226	24	13	2	112
ECO-CH-H-3991	232	24	16	2	101



Our record fills a gap in the distribution of *M. euryxanthus*, between the closest localities at ca. 188 km to the S in the vicinity of Arcediano, Jalisco (Cruz-Sáenz et al, 2008), and a record from the state of Nayarit (Woolrich et al, 2017; information on the specific locality was not provided). This voucher also confirms the presence of this species in an ecotone between tropical deciduous forest and oak forest, in the state of Jalisco (Fig. 2). Cruz-Sáenz et al. (2008, 2017) listed the occurrence of *M. euryxanthus* in Jalisco, and Woolrich-Piña et al. (2016) in Nayarit, all based on photographic material. The southernmost recoded locality for this species is Techaluta de Montenegro, in the municipality of San Cristobal de la Barranca, Jalisco (Cruz-Sáenz et al. 2017: 92). The specimen reported herein, therefore, confirms the presence of this species in Jalisco, based on a specimen deposited in a herpetological collection.



**Fig. 3.** Habitat where the *Micrurus euryxanthus* was found, in an ecotone between oak forest and tropical deciduous forest.

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**Acknowledgments.**—We thank Jesus Padilla-Lepe for field assistance and identifying the plant species, and Giovanni Angeles for producing the map. The specimen was deposited in the herpetological collection of El Colegio de la Frontera Sur (ECOSUR) at Chetumal, Quintana Roo, Mexico (ECOCH-H), and was collected under permit SGPA/DGVS/030709/16, issued by Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) to Gustavo Ernesto Quintero-Díaz.

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## Family Viperidae

***Crotalus totonacus* Gloyd and Kauffeld, 1940.** MEXICO: SAN LUIS POTOSÍ: Municipio de Río Verde, ca. 1.9 km (airline distance) SW of Los Alamitos (21.933735°N, -100.221793°W; WGS 84); elev. 1,628 m; 12 July 2017; Lucero de el Alba Santillán-Moreno. The rattlesnake, an adult female, was found basking in pine-oak forest at 1430 h. A photo voucher of this individual is deposited at the San Diego Natural History Museum (SDSNH\_HerpPC\_05358), and represents a new municipality record and the third known locality for this species from the state of San Luis Potosí. Previously, *C. totonacus* was reported from Los Sabinos, 11.2 km N of Ciudad Valles (Lemos-Espinal and Dixon, 2013), and then from 1.9 km NE of Nueva Reforma, Alaquines (Carbajal-Márquez et al., 2017). The report herein extends the distribution of this species ca. 76 km (airline distance) to the SW from the second locality.



**Fig. 1.** An adult female *Crotalus totonacus* (SDSNH\_HerpPC\_05358) found at Municipio de Río Verde, San Luis Potosí, Mexico. © Lucero de el Alba Santillán-Moreno

**Acknowledgments.**—We thank Bradford Hollingsworth for providing the photo voucher number. The snake was handled under permit SGPA/DGVS/030709/16, issued by Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) to Gustavo Ernesto Quintero-Díaz.

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***Crotalus triseriatus* Wagler, 1830.** MEXICO: HIDALGO: Municipio de Almoloya, Ejido San Luis del Valle (19.75010°, -98.24368°W; WGS 84) elev. 3,113 m; Alejandro Howar Tepango-Benítez. During a forest management faunal diversity project, on 24 April 2017 two individuals of *Crotalus triseriatus* were encountered in a grassy area within pine forest. We deposited photo vouchers of the snakes in the herpetological collection of the Centro de Investigaciones Biológicas, Universidad Autónoma del Estado de Hidalgo (CH CIB 093, 094 respectively; Fig. 1A, B). These vouchers represent a new municipality record, with the closest known locality ca. 34.6 km to the N (airline distance) in the vicinity of El Encinal, Municipio de Cuautepec de Hinojosa (Cruz-Elizalde, 2010; Ramírez-Bautista et al., 2010; 2014; Fernández-Badillo et al., 2017).



**Fig 1.** Individuals of *Crotalus triseriatus* (A = CH-CIB 93), and (B = CH-CIB 94) found at Ejido San Luis del Valle, Municipio de Almoloya, Hidalgo, Mexico. 📷 © Leonardo Fernández-Badillo

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## Four herpetofaunal records from Municipio de Ixmiquilpan, Hidalgo, Mexico

From July 2016 to June 2017, we conducted fieldwork at El Alberto, Municipio de Ixmiquilpan, Hidalgo, Mexico. Herein, we report new records for *Tantilla rubra*, *Leptodeira septentrionalis*, *Senticolis triaspis*, and *Kinosternon integrum*. We collected and photographed one individual of each species, and subsequently released them. We deposited a photo voucher of each individual in the Colección Nacional de Anfibios y Reptiles, Instituto de Biología, Universidad Nacional Autónoma de México. During our fieldwork in this area, we also encountered adults of the following herpetofaunal species: *Dryophytes arenicolor*, *Spea multiplicata*, *Anaxyrus punctatus*, *Rana spectabilis*, *Aspidoscelis gularis*, *Sceloporus spinosus*, *Trimorphodon tau*, *Drymarchon melanurus*, *Masticophis schotii*, *Tropidodipsas sartori*, and *Rena dulcis*.

### Reptilia: Squamata (snakes)

#### Family Colubridae

***Senticolis triaspis* (Cope, 1866).** EL ALBERTO: Municipio de Ixmiquilpan (20°25.519'N, 99°14.299'W; WGS 84); elev. 1,831 m; 27 February 2017; Marcelo Rojas-Oropeza; UNAM; IBH-RF 449 (Fig. 1A). This individual was found at 1405 h, under a rock in an area comprised primarily of xerophytic scrub. This record lies ca. 60 km to the S of the closest reported locality, listed as “Highway 85, 9.9 mi (15.9 km) S (by road) to Jacala” (MVZ 109503; VertNet, 2018).

***Tantilla rubra* (Cope, 1987).** EL ALBERTO: Municipio de Ixmiquilpan (20°24.762'N, 99°12.824'W; WGS 84); elev. 1,779 m; 23 April 2017; Nathalie Cabirol, Mauricio Obregón, Marcelo Rojas; UNAM; IBH-RF 450 (Fig. 1B). The individual was found at 2047 h, under a rock in the yard of a house. This record lies ca. 20 km to the E from the closets reported locality, listed in Wilson and Mata-Silva (2014: 49) as “15.5 mi (= 24.8 km) E Huichapan (MSUM H-4022).”

#### Family Dipsadidae

***Leptodeira septentrionalis* (Kennicott, 1859).** EL ALBERTO: Municipio de Ixmiquilpan (20°24.677'N, 99°12.925'W; WGS 84); elev. 1,772 m; 23 April 2017; Mauricio Obregón-Esparza; UNAM; IBH-RF 451 (Fig. 1C). The individual was found at 2110 h, in riparian vegetation along a body of water. The closest locality for the individual reported herein is ca. 51 km to the E in the municipality of Metztlán (Vite-Silva, 2008).

## Reptilia: Testudines

### Family Kinosternidae

***Kinosternon integrum* (LeConte, 1829).** El ALBERTO. Municipio de Ixmiquilpan, Hidalgo (20°24.902'N, 99°16.293'W; WGS 84); elev. 1,950 m; 8 August 2016; Mauricio Obregón-Esparza, Nathalie Cabirol, Marcelo Rojas; UNAM; IBH-RF 452 (Fig. 1D). We found an individual of *Kinosternon integrum* at 2213 h, in a shallow spring surrounded by xerophytic scrub. This photo voucher represents a new municipality record, with the closest localities at ca. 40 km to the NW in the municipality of Zimapán (Ramírez-Bautista, et al., 2010).

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**Fig. 1.** New records for reptiles from El Alberto, Municipio de Ixmiquilpan, Hidalgo, Mexico: (A) *Senticolis triaspis*; (B) *Tantilla rubra*; (C) *Leptodeira septentrionalis*; and (D) *Kinosternon integrum*.

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# MISCELLANEOUS NOTES

## Leucism in *Bolitoglossa engelhardti* (Caudata: Plethodontidae), with notes on elevational distribution

Coloration in amphibians is defined by the arrangement of specific epidermal cells called chromatophores (Duellman and Trueb, 1994). The best-known case for coloration anomalies is albinism, where individuals show a total lack of dark pigmentation due to the absence of melanin. Albino individuals are identified by the white coloration of the skin and red coloration of the iris. In contrast, individuals with leucism are differentiated from albinos by the normal coloration of the iris. In addition, leucistic individuals do not appear to be more vulnerable to sun exposure and do not have vision problems due to the lack of pigment in the retina epithelium, as in albinos (Spadola and Insacco, 2010). Albinism is more frequent than leucism, and individuals with a leucistic phenotype are very rare.

*Bolitoglossa engelhardti* is an uncommon species that has been assessed as Endangered by the IUCN because it occurs in fewer than 5,000 km<sup>2</sup>, and its distribution is highly fragmented by the loss of habitat due to agricultural, agro-industrial, and forestry activities (Parra-Olea et al., 2008). The range of this species extends from southeastern Chiapas, Mexico, along the Pacific versant to southwestern Guatemala, at elevations from 1,100 to 2,600 m (Wilson and Johnson, 2010). Since 2008, one of us (DAS) has conducted numerous trips to Volcán Chicabal and has encountered individuals of *B. engelhardti*, but never one with a color pattern anomaly.

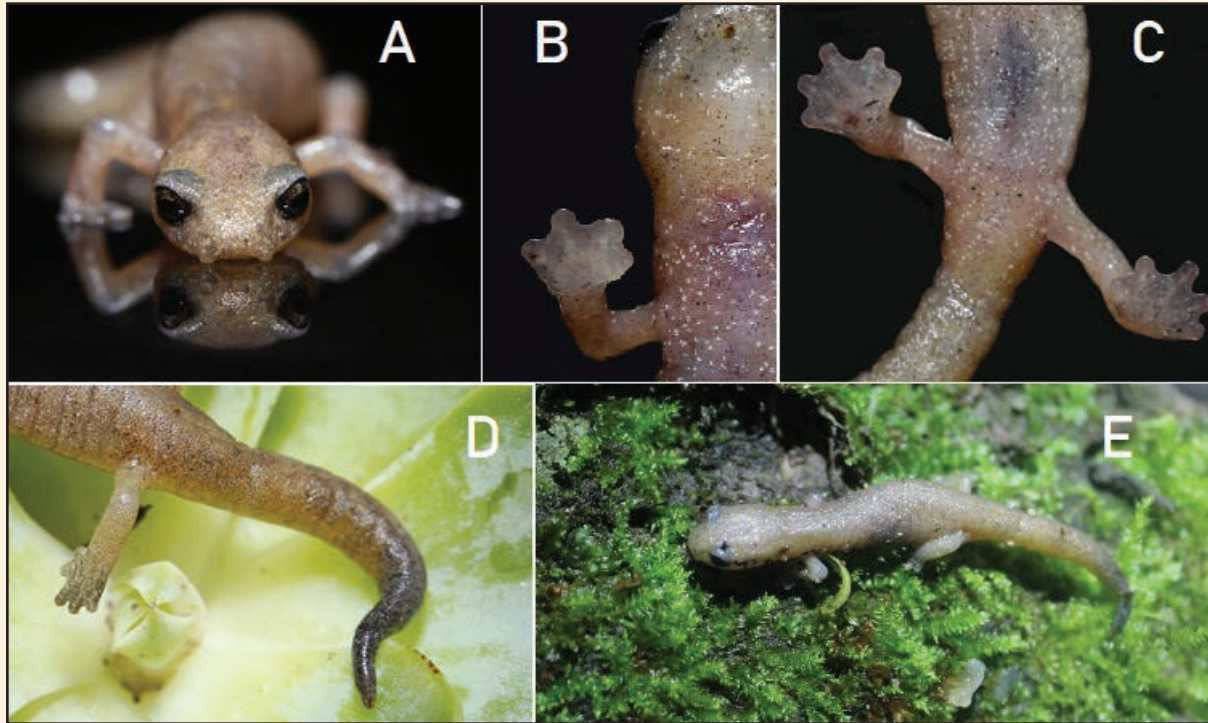
On 26 August 2017, we found five individuals of *B. engelhardti* along the crater ridge trail of Volcán Chicabal, Quetzaltenango, Guatemala (14°47'18.01"N, 91°39'04.94"; WGS 84), at elevations between 2,810 and 2,840 m (Fig. 1). The upper elevation represents an increase of 240 m from that reported for this species (Wilson and Johnson, 2010). One of the individuals differed in coloration from the others, and we determined this to be a case of leucism, a phenotype that to the best of our knowledge has not been reported in the genus *Bolitoglossa*. We found the leucistic *B. engelhardti* (Fig. 2), which measured 48 mm in total length and 30 mm in snout–vent length, at an elevation of 2,838 m as it was walking over the moss-covered trunk of a living Mexican Alder (*Alnus jorullensis*) at a height of about 50 cm above the ground.

In salamanders, leucism has been observed mostly in such holarctic species as *Plethodon cinereus* (Russell et al., 2011; Moore and Ouellet, 2014), *Ambystoma opacum* (Mitchell and Church, 2002), *Salamandra salamandra*, *Triturus carnifex*, *Hydromantes sarrabusensis*, *Hydromantes flavus*, *Hydromantes supramontis* (Lunghi et al., 2017), *Ambystoma flavipiperatum* (Cortés-Vásquez et al., 2016), and in the genera *Taricha* and *Aneides* (Nussbaum et al., 1983), and we believe this is the first report of leucism in a tropical salamander.

We released the leucistic individual where it was found, so as to maintain the presence of this phenotype within the population. The elevational increase for *B. engelhardti* fits within a pattern reported for other high elevation amphibians (Rovito et al., 2009; Ariano-Sánchez and Gil-Escobedo, 2015) and might be a product of climate change, which has pushed highland species to the limits of their available habitats.



**Fig 1.** Normal colored individuals of *Bolitoglossa engelhardti* found at an elevation of 2,840 m at Volcán Chicabal, Quetzaltenango, Guatemala.  © Daniel Ariano-Sánchez



**Fig. 2.** A leucistic individual of *Bolitoglossa engelhardti* found at an elevation of 2,838 m on Volcán Chicabal, Quetzaltenango, Guatemala: (A) frontal view showing a lack of overall pigmentation, but normal colored eyes; (B) ventral view of the chin, chest, and right arm; (C) ventral view of the lower abdomen, legs, cloacal area, and adjacent tail; (D) lateral view of the lower left portion of the body, including dark coloration of the tail tip; and (E) dorsal view of the entire individual on the moss covered trunk where it was found. © Luis Rios (A–D) and Daniel Ariano-Sánchez (E)

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## Bicephaly in *Gonatodes albogularis* (Squamata: Sphaerodactylidae)

Bicephalia in reptiles is a common axial anomaly during development that frequently has been reported in snakes (Wallach, 2007; Rufino de Albuquerque et al., 2013) and turtles (Palmieri et al., 2012). In lizards this condition is not as common, and is known from an extinct lizard: a two-headed fossil of *Hyphalosaurus* was reported from the Cretaceous in China (Buffetaut et al., 2007). The most reported saurian with axial duplication is in the family Anguillidae: *Anguis fragilis* (Riches, 1955; Reichenbach and Elkan, 1965; Bellairs, 1981; Payen, 1995). In the family Lacertidae, supranumerary vertebrae have been reported in *Psammotriton algirus* (Barbadillo and Barahona, 1994), and in *Lacerta agilis* (Pleticha, 1968), *Darevskyya (Lacerta) saxicola* (bicephalia), *Podarcis muralis* (one head, two bodies), and *Zootoca vivipara* (bicephalia) (Payen, 1995). In the family Scincidae, posterior axial duplication has been noted in *Egernia striolata* (Matz, 1989), and bicephalia in *Trachylepis (Mabuya) striata*, *Tiliqua scincoides*, and *Tiliqua (Trachydosaurus) rugosus* (Payen, 1995). In the family Varanidae, anterior axial bifurcation was reported in *Varanus varius* (Payen, 1995).

Among the geckos (families Diplodactylidae, Geckkonidae, Sphaerodactylidae, Phyllodactylidae, and Eublepharidae), developmental congenital anomalies are centered in chromatic aberrations such as xantomatosis in *Uroplatus* and *Naultinus* (Garner et al., 1999), scale anomalies like variation of the dorsal pattern in *Sphaerodactylus micropithecus* (Dodd, 1984), polydactyly in *Lepidodactylus lugubris* (Bauer et al., 2009), and anecdotically as an anomalous position of the heart (ectopia cordis) in *Correlophus (Rhacodactylus) ciliatus* (Melidone et al., 2009).

In geckos, Payen (1995) reported axial duplication in *Hemidactylus frenatus* (bicephalia), *H. turcicus* (bicephalia), and *Phelsuma* (one head, two bodies). In *Gonatodes*, only a bifurcated tail of embryological origin has been reported for *G. albogularis* (Payen, 1995).



Herein we report on a bicephalic *G. albogularis* from Río Frío de Sarapiquí, Provincia de Heredia, Costa Rica, based on a single photograph taken by Jordan Rodríguez (Fig. 1). The individual was a neonate with two differentiated heads, an original one and perhaps an extra left one. The left head exhibited an angular orientation of 90° with respect to the spinal axis, which supposedly was the accessory head. In the absence of an X-ray that would have allowed us to determine the exact point of axial spinal duplication, the almost normal position of the left forelimb and the dorsal view of the spinal column confirmed a bifurcation cranially to the pectoral girdle. These facts suggest that the duplication most likely occurred in the cervical vertebrae, without affecting the thoracic vertebrae. Thus, this observation confirms the first report of bicephalia in *G. albogularis*, in the genus *Gonatodes*, and in the family Sphaerodactylidae.

Possible etiologies for bicephaly include those induced by exposure of the embryo to inadequate environmental factors, toxins and/or infectious agents, and those induced by genetic mutations (Raynaud, 1985). Regardless, bicephaly is mainly accepted as developing as a consequence of aberrant temperatures affecting not only the sex of the embryo, but also the development of the head or fusion of twins (Deeming and Ferguson, 1989; Webb and Cooper-Preston, 1989; Innis, 1995; Mader, 1996).

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**Fig 1.** A bicephalic neonate of *Gonatodes albogularis* from Río Frío de Sarapiquí, Provincia de Heredia, Costa Rica. We are unaware if the animal survived, as it was released soon after it was photographed. © Jordan Rodríguez

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## Protocol for DNA extraction from Helodermatid blood samples preserved on FTA cards

During a study to determine the genetic structure of a wild *Heloderma charlesbogerti* (Helodermatidae) population and genotypes for captive individuals, I developed a customized DNA extraction protocol. Adequate DNA templates are necessary for any study that requires a Polymerase Chain Reaction (PCR) to amplify specific regions reliably and generate robust data. The goal of a proper DNA extraction protocol is to provide the best template possible, free of cellular components or other molecules and ions, or even excess DNA that might inhibit the PCR (Wilson, 1997; SantaLucia, 2007).

The convenience of preserving blood samples on FTA cards is obvious, because it allows simple storage at room temperature. Whatman (2011) suggested that a PCR can be performed directly over a disc obtained from the FTA card after rinsing it with the FTA purification reagent and TE buffer, but I found this protocol unsuccessful. Whatman (2010) previously suggested using several kits and methods, such as Chelex, including an organic extraction protocol using phenol and chloroform washes, and a precipitation in isopropanol. I used this protocol, as it allowed me to obtain a DNA solution that could be quantified and diluted to desirable concentrations, thereby making it ideal for the PCR master mix recipes.

This protocol, however, resulted in very low yields for the extraction of eight initial samples consisting of one disc (2 mm in diameter) of the FTA card with blood tissue. On a final volume of 30  $\mu$ L, it produced an average concentration of 50 ng/ $\mu$ L (SD = 39.4). Thus, I used this protocol as the basis for the one proposed in this note.

The lysis buffer (10 mM Tris-HCl, pH 8.0; 10 mM EDTA, disodium salt, pH 8.0; 100 mM sodium chloride; and 2% v/v SDS) remained the same as in the Whatman (2010) protocol, but was freshly prepared. I also prepared a Proteinase K stock solution (20 mg/mL).

As a first step, I punched five 2 mm-discs on a 1.5 mL sterile tube and added 500  $\mu\text{L}$  of lysis buffer and 20  $\mu\text{L}$  of Proteinase K stock solution. I macerated the discs manually with a plastic pistil, which previously had been sterilized in an autoclave. I incubated the tubes in a Shake and Bake oven at 56°C for 4 h, instead of overnight as suggested in the manufacturer's protocol. I then added 500  $\mu\text{L}$  of phenol/isoamyl alcohol (24:1) to the tube, and mixed the contents thoroughly in a vortex and centrifuged them for 10 min at maximum speed. The aqueous upper phase was transferred to a tube containing 500  $\mu\text{L}$  of chloroform, mixed with a vortex and centrifuged again for 10 min at maximum speed. I retrieved the aqueous phase once more and transferred it to a tube with 50  $\mu\text{L}$  of 3.5M ammonium acetate. Subsequently, I added 800  $\mu\text{L}$  of 100% isopropanol at -20°C and immediately stored the tubes overnight for DNA precipitation.

The following day I retrieved the samples and centrifuged them for 30 min at maximum speed, at a temperature of 4°C. In the absence of a refrigerated centrifuge, a refrigerated room allows this step to be accomplished at this temperature. By colligative properties, a cold precipitation increases the final yield of the extraction. I discarded the supernatant, and diluted the DNA pellet in 30  $\mu\text{L}$  of warm (54°C) TE buffer. I then made a 1:20 dilution for spectrophotometric quantification of the stock DNA solution.

This protocol yielded an average concentration of 122 ng/ $\mu\text{L}$  (SD = 45.8) for 11 samples, which included an atypical extraction that yielded only 30 ng/ $\mu\text{L}$ . If this sample is discarded, the average concentration is elevated to 131.5 ng/ $\mu\text{L}$  (SD = 37.1).  $A_{260}/A_{280}$  values were acceptable across all samples (1.7–2.2). From the 11 samples extracted, I selected eight and made a paired *t*-Student test to compare both treatments ( $P = 0.0001$ ), and concluded that the modified method produced significantly higher yields than the one presented by Whatman (2010).

With helodermatid lizards, the blood tissue proved to be a good source of DNA because of the presence of nuclei in their red-blood cells. This result makes this protocol useful for reptile or bird blood tissue. A digestion with Proteinase K is necessary, however, because hemoglobin might inhibit PCR amplification if it is not properly eliminated (Wilson, 1997). In this study I found few recalcitrant products (I obtained 95.5% of the possible products), and amplification was successful for every sample.

The method I describe for extracting and preserving DNA from blood samples is more cost effective than using such kits as Chelex, requires no refrigeration or reagents to preserve the samples, and can be performed with basic laboratory equipment and reagents. This method can be used to ensure quality DNA extraction in almost any context, and at low budgets, especially when these limitations affect scientists in developing countries who wish to conduct molecular studies.

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## Herpetofaunal road mortality in the municipality of Cuauhtémoc, Colima, Mexico

Roads are recurrent avenues used for the transportation of people and supplies, and vehicular traffic has been well documented as an important agent in reducing populations of amphibians and reptiles. Road mortality can contribute to local and regional declines in herpetofaunal populations, especially during peak periods when animals tend to cross roads (Lazcano et al., 2009, 2017). Coelho et al. (2012) noted road mortality as one of the principal causes of amphibian population decline worldwide.

In addition to habitat fragmentation due to logging, farming, and urbanization, vehicular traffic is responsible for a high degree of vertebrate mortality. Most road-builders do not attempt to prevent or ameliorate the environmental impact of their construction, and in many cases concrete barriers between lanes prevent animals from crossing roads. Although roads should be constructed with passages that allow animals to cross these structures safely, such practices often are not considered because of their cost and the disruption it would cause to the flow of traffic. In this note, we document road mortality in amphibians and reptiles in the state of Colima.

### Study Methods

We conducted daily surveys during two time periods: from 6 June to 11 December 2014, and from 24 April 2015 to 29 November 2016. The section of road in this study is located in the eastern part of Colima, in the municipality of Cuauhtémoc, between Cuauhtémoc and Buenavista. The section of the road we surveyed is approximately 8.5 km long. We conducted the surveys early in the morning and during the afternoon, by driving and recording the individuals found dead on the road (DOR) that had been killed by vehicular traffic. We recorded the data for every individual found, including the species identification, date, and location.

We based the identification of each species from the primary literature, including such publications as Smith and Taylor (1966), Flores-Villela (1993), Flores-Villela and Canseco-Márquez (2004), and Frost et al. (2006); for more current nomenclature we followed the taxonomy used in Wilson et al. (2013a, b) and Cruz-Saenz et al. (2017). We photographed all the individuals observed, and then removed them from the road to avoid counting them again.

### Results

During the two survey periods, which spanned over portions of three years, we recorded 401 DOR individuals classified in 14 families and 32 species (10 anurans, six lizards, 14 snakes, and two turtles; Table 1). We recorded two or more species in eight families (Bufonidae, Hylidae, Ranidae, Phrynosomatidae, Teiidae, Colubridae, Dipsadidae, and Viperidae (Table 1). The species most affected were the anurans *Rhinella horribilis* (125 of 401 individuals; 31.2%) and *Lithobates forreri* (52; 13.0%), the lizard *Ctenosaura pectinata* (33; 8.2%), the snakes *Masticophis mentovarius* (23; 5.7%) and *Leptodeira maculata* (42; 10.5%), and the turtle *Kinosternon integrum* (18; 4.5%). The 32 species represented in our study comprise 21.3% of the 152 herpetofaunal species recorded from the state of Colima (García et al., 2016), and include 10 of 34 species of amphibians and 22 of 136 species of squamates and turtles.

In an effort to reduce the threat posed by vehicular traffic on members of the Colima herpetofauna, we suggest the implementation of such precautionary measures as the construction of wildlife passages, the removal of barriers that might deter wildlife from crossing roads, and the placement of signs alerting drivers where amphibians and reptiles regularly cross roads.

<b>Table 1.</b> Number and identification of individuals found DOR during the study period.					
<b>Family</b>	<b>Species</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>Abundance</b>
Bufonidae	<i>Incilius marmoreus</i>	0	1	0	1
Bufonidae	<i>Rhinella horribilis</i>	28	40	57	125
Hylidae	<i>Agalychnis dacnicolor</i>	1	2	5	8
Hylidae	<i>Diaglena spatulata</i>	1	0	0	1
Hylidae	<i>Smilisca baudini</i>	4	3	2	9
Hylidae	<i>Smilisca fodiens</i>	1	3	1	5
Hylidae	<i>Trachycephalus typhoni</i>	1	0	1	2
Leptodactylidae	<i>Leptodactylus melanonotus</i>	0	1	0	1
Ranidae	<i>Lithobates forreri</i>	14	14	24	52
Ranidae	<i>Lithobates neovolcanicus</i>	0	0	1	1
Dactyloidae	<i>Anolis nebulosus</i>	1	0	0	1
Iguanidae	<i>Ctenosaura pectinata</i>	5	9	19	33
Phrynosomatidae	<i>Sceloporus horridus</i>	1	1	7	9
Phrynosomatidae	<i>Sceloporus melanorhinus</i>	0	0	1	1
Teiidae	<i>Aspidoscelis communis</i>	0	0	2	2
Teiidae	<i>Holcosus sinister</i>	0	0	3	3
Boidae	<i>Boa sigma</i>	6	2	4	12
Colubridae	<i>Masticophis mentovarius</i>	6	7	10	23
Colubridae	<i>Drymarchon melanurus</i>	3	4	3	10
Colubridae	<i>Drymobius margaritiferus</i>	1	0	0	1
Colubridae	<i>Lampropeltis polyzona</i>	3	4	7	14
Colubridae	<i>Leptophis diplotropis</i>	0	2	0	2
Colubridae	<i>Salvadora mexicana</i>	2	1	0	3

Colubridae	<i>Senticolis triaspis</i>	1	0	3	4
Colubridae	<i>Trimorphodon tau</i>	1	0	0	1
Xenodontidae	<i>Clelya scytalina</i>	1	4	3	8
Xenodontidae	<i>Conophis vittatus</i>	0	1	1	2
Dipsadidae	<i>Leptodeira maculata</i>	14	3	25	42
Viperidae	<i>Agkistrodon bilineatus</i>	2	0	1	3
Viperidae	<i>Crotalus basiliscus</i>	1	0	2	3
Geoemydidae	<i>Rhinoclemmys pulcherrima</i>	0	0	1	1
Kinosternidae	<i>Kinosternon integrum</i>	1	2	15	18
<b>Totals</b>		<b>99</b>	<b>104</b>	<b>198</b>	<b>401</b>

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### Distribution notes and comments on the diurnal activity of the Central American Bushmaster, *Lachesis stenophrys* (Cope, 1875), in Panama

*Lachesis stenophrys* is a large pitviper distributed primarily along the Caribbean versant of Central America from southern Nicaragua to east-central Panama, at elevations from near sea level to 1,100 m (Campbell and Lamar, 2004; Solórzano, 2004; Köhler, 2008; Wallach et al., 2014; Ray, 2017; Uetz et al., 2017). The distribution of *L. stenophrys* in the province of Veraguas, Panama, presents an interesting situation. Zamudio and Greene (1997), Ripa (2000), Campbell and Lamar (2004), Köhler (2008), Ray and Knight (2013), Wallach et al. (2014), and Fuentes and Corrales (2016) listed the presence of *L. stenophrys* in the northern part of Veraguas; Pérez Santos (1999) and Young et al. (1999) did not include the occurrence of this species in this province; Lotzkat (2014) suggested that the species might be found in this province; and Ray (2017) presented conflicting information, as a dot does not appear on the distribution map for Veraguas (p. 188), but the name of the province was indicated for its range (p. 189).

On 22 April 2009 at 1125 h, Edgar Toribio photographed a subadult *L. stenophrys* while it was resting at Alto de Piedra, Distrito de Santa Fe, Provincia de Veraguas (8.516667°N -81.116667°W; WGS 84), elev. 860 m. Three photographs of this individual are deposited in the University of Texas at Arlington Digital Collection (photo vouchers UTADC 9156–9158; Fig. 1A). No morphometric measurements were taken, and the sex was not determined. I identified the species as *L. stenophrys* based on the dorsal pattern of the head, which usually is uniform reddish tan or brown, and laterally contains a darker postocular stripe (Campbell and Lamar, 2004).

On 25 October 2009 at 1258 h, I observed an individual of *L. stenophrys* on the upper part of the Río Santa María, Parque Nacional Santa Fe, located in the northern portion of the province of Veraguas (8.604255°N -81.070807° W; WGS



**Fig. 1.** (A) A subadult *Lachesis stenophrys* from Alto de Piedra, Distrito de Santa Fe, Provincia de Veraguas, Panama, and (B) an adult *L. stenophrys* found active on the ground during the day in cloud forest at Parque Nacional Santa Fe, along the upper part of the Río Santa María.

© Edgar Toribio (A) and Ángel Sosa (B)

84), at an elevation of 1,008 m. The snake was moving slowly under a fallen tree (UTADC 9159; Fig. 1B). I did not capture or measure the individual, but estimated its total length as 1.8 m. The snake showed no signs of defensive behavior. This species mainly is considered to be nocturnal and crepuscular, although some authors have noted that males move during the day in the mating season (in February and March; Solórzano, 2004) or during the rainy season (Ray and Knight, 2013). These vouchers represent a new record for the national park and confirmed records for the province, and a range extension from the nearest localities at ca. 124 km (airline distance) to the NE on the pipeline road, Comarca Ngöbe-Buglé and ca. 53 km (airline distance) to the NW in Distrito de Donoso (Lotzkat, 2014). This record also provides with an additional observation of activity by *L. stenophrys* during the rainy season.

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