Other Contributions

NATURE NOTES

Amphibia: Anura

Another surviving population of the Critically Endangered *Atelopus varius* (Anura: Bufonidae) in Costa Rica

Neotropical harlequin toads of the genus *Atelopus* are among the most threatened anurans on the planet. A substantial amount of research has been conducted to raise awareness about declining populations of amphibians worldwide, and members of this genus have become flagship species for conservation initiatives, and also have been used in several environmental and pathological studies (La Marca et al., 2005; Rueda Almonacid et al., 2005). Currently, 96 species of *Atelopus* are recognized (Frost, 2015), and most taxa have been assessed into the following categories by the International Union for the Conservation of Nature (IUCN, 2015): three = Extinct (EX); 72 = Critically Endangered (CR); eight = Endangered (E); five = Vulnerable (VU); and three = Data Deficient (DD).

The following four species of *Atelopus* have been reported from Costa Rica (Savage, 2002; Savage and Bolaños, 2009; Köhler, 2011): *A. chirripoensis* (CR), *A. chiriquiensis* (CR), *A. senex* (CR), and *A. varius* (CR). *Atelopus chirripoensis* is known from a single specimen collected in Costa Rica in 1980, and has not been seen since; *A. chiriquiensis*, with a distribution in Costa Rica and Panama, has not been encountered in Costa Rica since 1996, and no records from Panama are available since the late 1990s; and *A. senex*, a Costa Rican endemic, has not been found in the country since 1986; thus, these three species appear to be extinct (IUCN, 2015). The distribution of *A. varius* was more extensive, however, as this species was known to occur from northwestern Costa Rica to western Panama; in Costa Rica, it was an abundant element of the lowland and midland forests in all the cordilleras of the Pacific and Caribbean versants at elevations from 16 to 2,000 m (Savage 1972, 2002). Over 100 populations of *A. varius* were known from Costa Rica (Pounds et al., 2008), but in the 1980s and early 1990s populations began to decline dramatically, including from such known well-known localities as Monteverde (Pounds and Crump, 1994). Lips and Papendick (2003) and Lips et al. (2006) noted a wave of the highly pathogenic fungus *Batrachochytrium dendrobatidis* (*Bd*) as the cause, and indicated that it was heading eastward from Costa Rica to Panama; soon after, many populations of several species of amphibians, including *A. varius*, were in severe decline or had vanished in the region. By 1996 *A. varius* was considered extirpated from Costa Rica, but in 2004 a glimmer of hope came when a population was discovered in the Pacific lowlands at Fila Chonta, ca. 10 km NW of Quepos, Provincia de Puntarenas (Pounds et al., 2008). Surveys in 2005, however, yielded no additional populations (Ryan et al., 2005). More recently, González-Maya et al. (2013) reported the rediscovery of a breeding population of *A. varius* on private property at the Las Tablas Protected Zone near San Vito, Coto Brus, Provincia de Puntarenas, at an elevation of 1,300 m; interestingly, surveys conducted from 2002 to 2004 had failed to find this species in the area (Santos-Barrera et al., 2008). Solano-Cascante et al. (2014) then reported finding an individual of *A. varius* close to Buenos Aires, Provincia de Puntarenas, at an elevation of 840 m; the individual, however, either died or was sacrificed to examine its stomach contents. In Panama, Hertz et al. (2012) reported seeing four individuals of *A. varius* at Cerro Negro, Provincia de Veraguas; none appeared to be sick, and a histological examination showed no evidence of *Bd*. Subsequently, Perez et al. (2014) found *A. varius* persisting at multiple sites in western Panama, although evidence of *Bd* was found on other anuran species.

Herein we report the discovery of another surviving population of *A. varius* from the Pacific versant of Costa Rica, at an elevation of ca. 400 m; we indicate the general area as Uvita de Osa, Provincia de Puntarenas, but do not provide the exact locality to discourage visitors to the area because of the dangers from illicit collecting or the potential introduction of disease.

In early June of 2015, one of us (CLBA) was told that some "yellow and black frogs" had been sighted along a stream in the vicinity of Uvita de Osa. After interacting with residents from the area and showing them photographs, CLBA contacted the guard in charge of the private reserve where the animals were seen and asked for permission to visit the property. On 26 June 2015 at ca. 1300 h, accompanied by a friend and the guardian of the reserve, after walking for 90 min in rainforest without following a trail we arrived at a stream used to provide water for the property (Fig 1); several high waterfalls prevented us from hiking to the site by walking upstream. Soon after reaching the stream, we observed nine adult male *A. varius*, as well as one dead, decomposing individual lying on a wet rock (Figs. 2–6). CLBA collected the carcass and performed a skin swab on one live individual; each individual was handled with a new set of gloves. He later sent the specimen and skin swab to JA to conduct a test for *Bd*. A number of similar streams and creeks are found in the area of Costa Ballena and Corridor Paso de la Danta, but despite intensive fieldwork in the area CLBA has not encountered another population of *A. varius*.

Ecomorphs and Variation

As its specific name implies, *Atelopus varius* is among the most variable of anurans. Savage (1972), in his seminal work on Costa Rican *Atelopus*, recognized 13 ecomorphs of *A. varius*, of which the one at Uvita de Osa approaches patterns A and H (p. 85: fig. 8), which later were modified as patterns F and J (p. 192: fig 7.19) in Savage (2002). The color pattern of the Uvita de Osa population is as follows: ground color pale to vivid yellow, with a dorsal pattern of black blotches, inverted and sometimes interrupted chevrons, and spotting (Figs. 2A, C, D, E, F, and 3A, B, C); a single individual contained irregular red-orange dorsal markings on the yellow ground color (Fig. 3D); upper arm yellow, followed by a long black band connecting the upper and lower arms, in which a spot on the elbow is yellow; another black band extends from above to the lower portion of the wrist; the upper portion of the hand is yellow, and the fingers mostly are black but with varying amounts of yellow; the black banding on the thighs and legs is more evenly dispersed, although the bands often are irregular in shape and contain yellow spotting; and, the venter of one individual (Fig. 2B) is white except for isolated black or brown spots of varying sizes, with the undersides of the hands, feet, vent, and posteroventral portion of the thighs orange. For individual variation in color pattern, see Figs. 2 and 3.

Fig. 1. Habitat of the population of *Atelopus varius* along a short and narrow (< 5 m) stream in Uvita de Osa on the Pacific versant of the Cordillera Brunca, Provincia de Puntarenas, Costa Rica.

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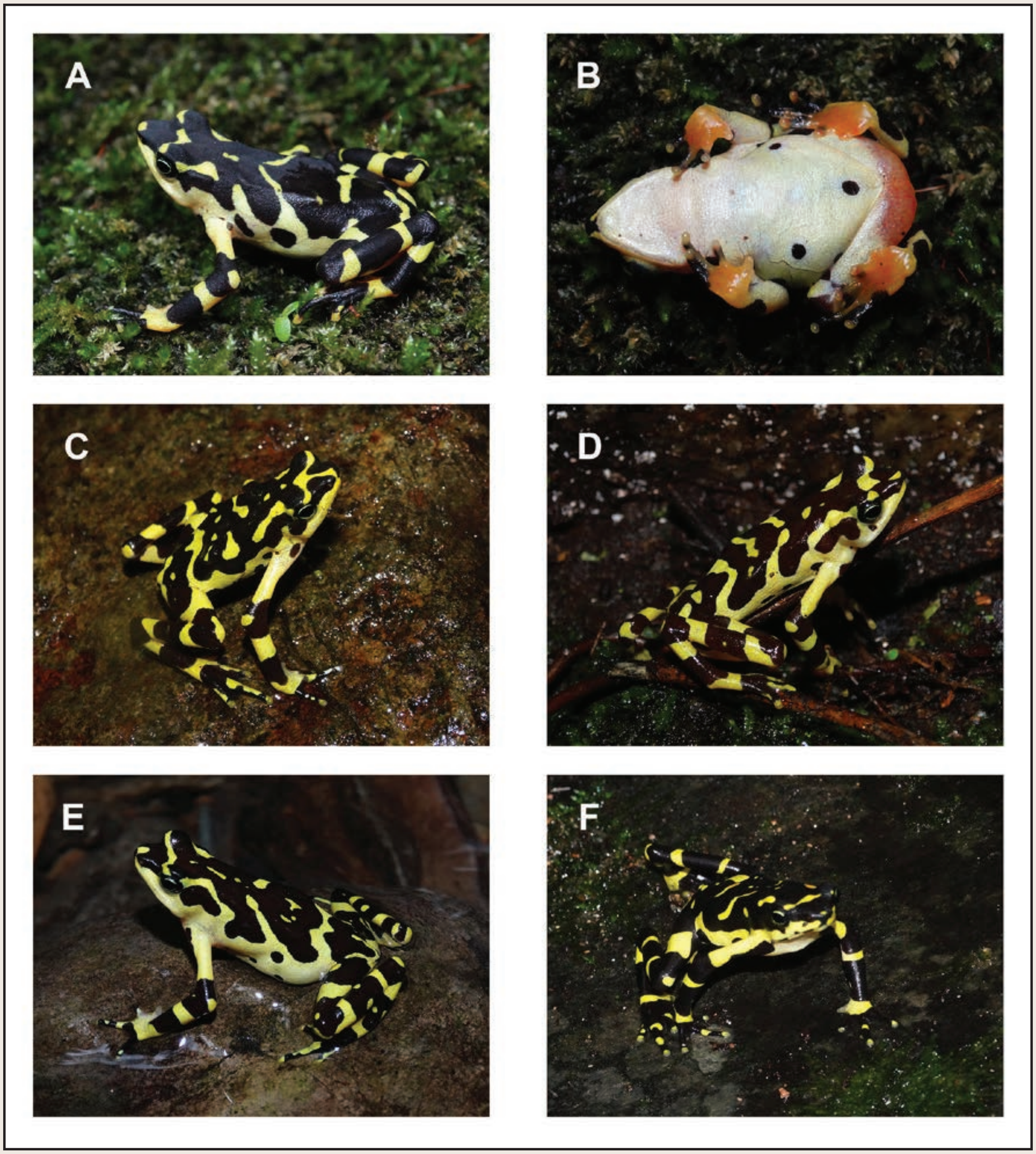

Fig. 2. Interpopulational variation in the population of *Atelolus varius* at Uvita de Osa.

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Laboratory Results

We tested two *Atelopous varius* for the presence of *Bd*, the one found dead (Fig. 5) and the body placed in 96% ethanol, and the live individual from which a skin swab was taken before it was released. We used a cotton swab, following the protocols of Kriger et al. (2006). Following the methods outlined by Hyatt et al. (2007), we extracted DNA from the swab with PrepMan Ultra (Applied Biosystems, Carlsbad, California), and analyzed the samples using the standard real-time quantitative polymerase chain reaction assay. The DNA extraction and diagnostic real-time PCR was conducted at the at the Centro de Investigación en Estructuras Microscópicas, Universidad de

Costa Rica, following the standardized procedures in Boyle et al. (2004) with the following exception: the nucleic acids were extracted using 50 µl PrepMan, a negative control (H2O), a positive control swab dipped in a broth of *Batrachochytrium dendrobatidis* culture from CostaRican strainJGA01. For the PCR reaction we used a TaqMan® Gene Expression Assay (Applied Biosystems, Carlsbad, California) mix that contained TaqMan MGB probe mark with FAM™ and the two primers ITS1-3 Chytr and 5.8S Chytr.

To ensure the integrity of the results, we ran the samples in triplicate. We determined a sample as positive when the target sequence amplified in the three replicate wells of the assay. We used an internal positive control (IPC) to detect inhibitors (Hyatt et al., 2007), and an Applied BioSystems Prism 7500 Sequence Detection System to test for the presence of *Bd*. This PCR was run with samples of other projects, but positive extraction of *A. varius* was maintained at -20°C, for posterior triplicate reruns of positive samples, due to limited sampling. When more samples are available, the quantification of DNA equivalent zoospores numbers will be performed. The IPC was running well in the six replicates, three replicates of the dead specimen sample tested positive for *Bd*, and the three replicates from the living specimen tested negative. So the prevalence of 50% is due to the low sample size.

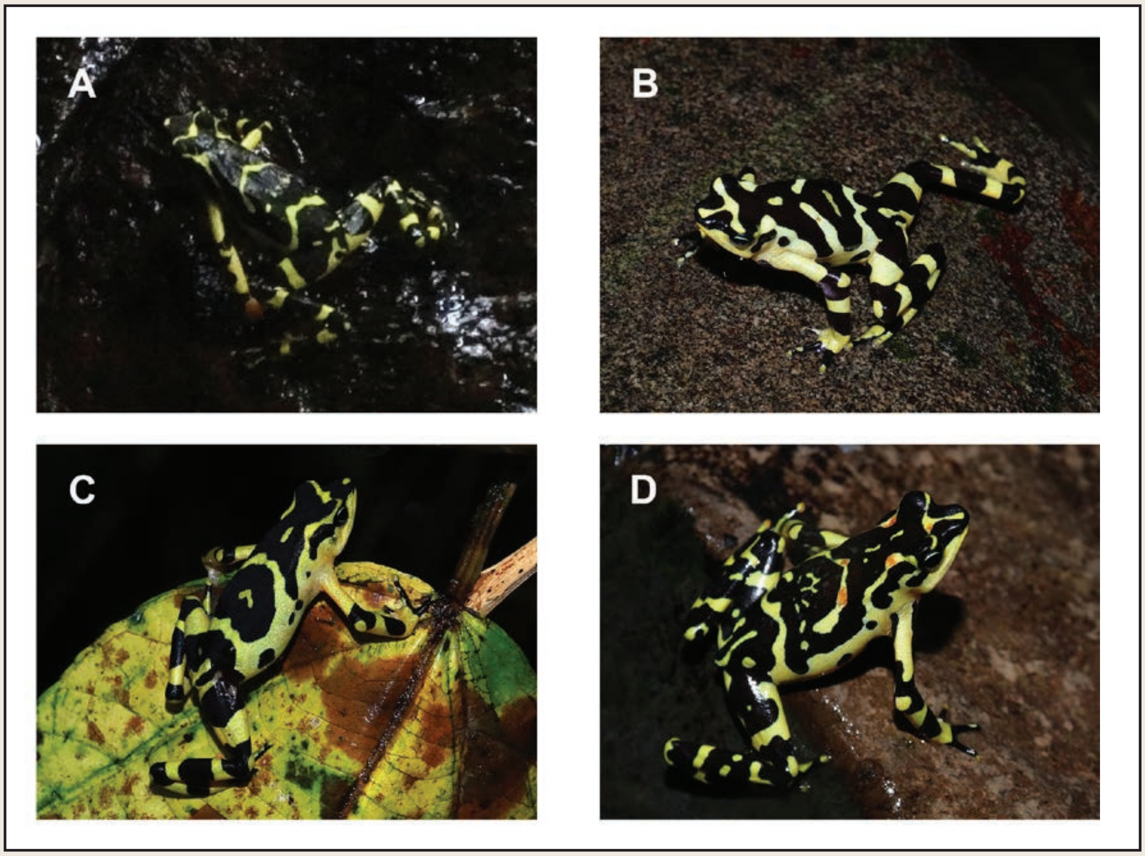

Fig. 3. Interpopulational variation in the population of *Atelolus varius* at Uvita de Osa. © César L. Barrio-Amorós

Observations of the Natural Habitat

The stream where this population of *Atelopus varius* was found is located within a private reserve where no one is allowed to enter without permission. This situation offers some guarantee of protection, at least against threats by humans, as the owner is not planning on developing the area and strongly defends it against unwanted visitors.

The stream is located in primary forest. We walked a distance of about 300 m up and down the stream, from 1430 to 1600 h. We observed only one *A. varius* under direct sunlight (Fig 4; the same individual as in Fig 2C), and the remaining individuals were found in the shade, but mostly exposed; five individuals were situated on moss-covered boulders in the stream, and three were somewhat camouflaged because they were lying on wet, black rocks and seen only when they jumped away. The level of crypsis shown by this morph was notable, especially when animals on the wet, black boulders remained still. Curiously, individuals become visible as soon as they attempt to escape, after which they walked away slowly or quickly, or took short hops. We saw no females, tadpoles, or juveniles.

Fig. 4. An *Atelopus varius* from Uvita de Osa basking in sunlight. To obtain this photograph the individual was handled with gloves and photographed in the spot where it was originally seen. 📷 © César L. Barrio-Amorós

The presence of a dead toad that tested positive for *Bd* among apparently healthy individuals (one of which tested negative) makes us suspect that at this elevation and environmental conditions the immune system of sick individuals can be suppressed but later attacked by the *Bd*, which can become a deadly pathogen (as reported by Ellison et al., 2014). The typical pattern of skin epidermal infection caused by the effects of *Bd* is shown in Fig. 5, so it is plausible that *Bd* was the cause of death. A *Bd* test on all the amphibian species in the area might reveal valuable data on the presence or absence of *Bd*, and how this pathogen affects other species.

The surviving populations of *A. varius* in Panama (Hertz et al., 2012; Perez et al., 2014) and Costa Rica (indicated here) make this species an excellent candidate for studying and monitoring the prevalence of *Bd* and other diseases in these anuran populations.

Fig. 5. An individual of *Atelopus varius* found dead and rotting at Uvita de Osa, and collected for further analysis.
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Conservation Remarks

Savage's (2002) map (p.189) shows 66 populations of *Atelopus varius* in Costa Rica, and Pounds et al. (2008) were aware of over 100. This population of *A. varius* is the fourth known to have survived in Costa Rica, but only the second viable one after the one at Las Tablas (González-Maya et al., 2013). No information on the survival of the Quepos population has been reported since the publication of Ryan et al. (2005), or on the survival of the Buenos Aires population (Solano-Cascante et al., 2014). Concerted efforts are necessary to study the surviving populations of *A. varius*, as well as to search for others. *Atelopus varius* is assessed as Critically Endangered by the IUCN, and therefore can be regarded as a flagship species in attempting to conserve the general areas where it survives.

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Thanatosis in four poorly known toads of the genus *Incilius* (Amphibia: Anura) from the highlands of Costa Rica

Anurans are known to use myriad defensive strategies to avoid and deter predators, including cryptic and aposematic coloration, immobility, fleeing, inflating the body, toxic skin compounds, fighting, and thanatosis (Toledo et al., 2011). The behavior in which potential prey feign death to avoid predation is called thanatosis (Edmunds, 1974). Feigning death might confuse a predator, and when combined with urination, defecation, or skin secretions makes the prey species appear unpalatable to the predator or makes ingestion difficult (Rogers and Simpson, 2014). Thanatosis occurs in diverse groups of animals, both invertebrates and vertebrates (Edmunds, 1974; Mângia and Santana, 2013). In anurans, this behavior has been reported in 99 species in at least 16 families (Toledo et al., 2011; Escobar-Lasso and González-Duran, 2012). Whereas thanatosis is known to occur in a large number of anuran families, the number of species exhibiting this behavior is approximately 1.5% of the 6,554 known anuran species (Frost, 2015), a small percentage likely due to the lack of natural history information available for most species.

Several semi-fossorial and diurnal species of toads inhabit highland areas of Costa Rica, where they live in leaf-litter on the forest floor (Novak and Robinson, 1975; Boza and Solano, 2009). These species are poorly known, and include *Incilius chompipe*, *I. epioticus*, *I. guanacaste*, and *I. holdridgei*. The first three of these species formerly resided in the genus *Crepidophryne* (see Vaughan and Mendelson, 2007), but in a phylogenetic study based on morphology, life history, and molecular data Mendelson et al. (2011) found *Crepidophryne* nested within *Incilius* and placed the former genus in the synonymy of the latter. These toads are difficult to detect in nature and some have been affected by population declines (Mendelson and Mulcahy, 2010; Abarca, 2012), so much of their biology remains understudied. An important aspect of these toads is their locomotion, which primarily is accomplished through slow walking (Savage, 2002); thus, one might think they have few options against predatory attacks and must use other methods for defense. Herein we describe a defensive behavior (thanatosis) in four Costa Rican bufonid species.

The Study Species

From 2012 to 2014 we conducted a series of observations at four sites in the mountains of central and northwestern Costa Rica: Cerro Chompipe, Provincia de Heredia (10.086388°N, 84.071111°W; elev. 2,070 m); Cascajal de Coronado, Provincia de San José (10.029722°N, 83.93888°W; elev. 1,740 m); Río Macho de Orosi, Provincia de Cartago (9.760555°N, 83.870555°W; elev. 2,000 m); and Parque Nacional Rincón de la Vieja, Provincia de Guanacaste (10.808055°N, 85.3325°W; elev. 1,880 m). The life zones in these areas consist of Premontane Rainforest and Lower Montane Rainforest (Savage, 2002). We used visual encounter surveys in appropriate habitats to locate the toads. When finding individuals, we recorded their initial behavior and within one minute gently touched them with tweezers. We then captured the toads by hand and turned them upside down on the substrate, and recorded the time it took for them to assume an upright position. When individuals remained in a "belly up" position, we touched, tugged, and finally pressed their extremities gently with tweezers.

Fig 1. An adult *Incilius chompipe* from Cerro Chompipe, Parque Nacional Braulio Carrillo, Provincia de Heredia, Costa Rica.

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We encountered three juveniles and six adults of *I. chompipe* at Cerro Chompipe and Coronado (Fig. 1); six juveniles and four adults of *I. epioticus* at Río Macho (Fig. 2);

one juvenile and one adult of *I. guanacaste* at Rincón de la Vieja (Fig. 3); and 14 juveniles, two subadults, and two adults of *I. holdridgei* at Cerro Chompipe. We present accounts of the trials for each of the species below.

Incilius chompipe

When first observed within leaf-litter all individuals remained motionless, but when found on top of the leaf-litter they attempted to escape by walking. When placed upside down, all individuals remained belly up from 20 to 160 sec (Fig. 4). The behavior of juveniles and adults was similar, except that when in the belly up position juveniles pulled their limbs close to their body whereas adults maintained their limbs extended. When we touched their limbs all individuals remained immobile, but when we tugged or pressed on the limbs they showed no resistance and regained an upright position. While in the belly up position the eyes of the toads remained open. Additionally, some individuals puffed up the body (Fig. 4) and one showed a cloacal discharge.

Incilius epioticus

All individuals remained immobile when discovered within the leaf-litter, but fled when we found them on top. If touched, they tried to escape by walking slowly. After we turned them upside down, all individuals remained belly up with their limbs extended from a few to maximum of 120 sec. While in the belly up position the toads remained immobile when we touched the limbs, but they showed no resistance and regained an upright position when we tugged or pressed on the limbs. The eyes of all individuals remained open while in the belly up position, and all adults puffed up their body.

Fig 2. An adult and two juveniles of *Incilius epioticus* from Río Macho de Orosi, Provincia de Cartago, Costa Rica.

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Fig 3. A juvenile *Incilius guanacaste* from Parque Nacional Rincón de la Vieja, Provincia de Guanacaste, Costa Rica.

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Incilius guanacaste

Both adults and juveniles remained immobile when encountered within leaf-litter, but fled when found on top. When touched, adults always tried to escape with short jumps, and when turned belly up they turned upright immediately. The single juvenile remained immobile when touched, and stayed in the belly up position when turned upside down, from five to 264 sec, with its limbs close or extended away from the body. Upon touching the limbs it remained immobile, but when we tugged or pressed on the limbs it regained an upright position. Its eyes remained open while exhibiting the death feigning behavior (Fig. 5).

Incilius holdridgei

Some juveniles and subadults remained immobile when found, but others attempted to escape; when we touched them, however, they all fled. When placed upside down they remained belly up from 20 to 120 sec, and in that position juveniles maintained their limbs extended or close to the body (Figs. 6, 7), but those of subadults were in a stretched position. When we touched or tugged on the limbs of juveniles and subadults they maintained their death feigning posture, but they regained an upright position when we pressed the limbs. The eyes of all individuals remained open while displaying the death feigning behavior.

Of the two adults we encountered, the first one fled by walking away, but when we placed it upside down it turned upright immediately. The second adult was not as active and remained immobile when placed upside down. This individual held that position from 30 to 136 sec, with its legs extended (Fig. 8). Like the juveniles, it remained immobile when we touched or tugged on the limbs, but when the limbs were pressed it returned to an upright position.

Fig 4. An adult *Incilius chompipe* in thanatosis behavior at Cerro Chompipe, Parque Nacional Braulio Carrillo, Provincia de Heredia, Costa Rica. 📷 © Juan G. Abarca

Fig 5. A juvenile *Incilius guanacaste* in thanatosis behavior at Parque Nacional Rincón de la Vieja, Provincia de Guanacaste, Costa Rica. 📷 © Juan G. Abarca

Discussion

Amphibian predators find prey by using the following multi-step process: locating the prey, identification, approach, subjugation, ingestion, and digestion (Toledo et al., 2011). Potential prey items have developed different defensive strategies to counter the early stages of predation, especially location and subjugation (Toledo et al., 2011). Escobar-Lasso and González-Duran (2012) suggested that thanatosis is a strategy used to avoid subjugation. Thanatosis is not considered a spontaneous behavior, as it only occurs after several attempts to escape or manipulations are made by a possible predator (Beux dos Santos et al., 2010; Toledo et al., 2010). In our study animals, the behavior occurred only when individuals were manipulated.

In thanatosis, the limbs can be moved without showing resistance and individuals maintained their eyes open (Toledo et al., 2010; Rogers and Simpson, 2014). During thanatosis, the limbs also might change position (Toledo et al., 2010). The same characteristics were evident in our observations, and thus we consider the described behavior as thanatosis. The toads remained motionless when we touched any part of their body, but ended thanatosis behavior when we pressed or stretched their limbs. Toledo et al. (2010) noted that anurans remain motionless while displaying thanatosis, even when touched. A camouflaged prey item near a predator could be touched but remain undetected, so in this case maintaining thanatosis is a good strategy. Thanatosis may be inefficient if the prey item feels bites, because this means that the predator would know the location of the prey and that it is still alive.

The species of *Incilius* in this study might have developed thanatosis as a defensive strategy against certain predators. In the tepuis of the Guyanan Highlands in South America, toads the genus *Oreophrynella* have developed strategies to defend themselves against specific predators (McDiarmid and Gorzula, 1989). Birds and snakes are known to prey on toads of the genus *Incilius* (Sandoval et al., 2015; Nascimento et al., 2013), but specific predators have not been documented for the four species in this study. Novak and Robinson (1975) reported that individuals of *I. holdridgei* have been found mutilated, missing a part or all of a limb, and suggested the presence of undiscovered predators and noted that the role of birds was unknown. In this regard, Acosta and Morún (2014) reported on a bird (*Catharus frantzii*) taking a frog (*Craugastor podiciferus*) by the legs and repeatedly hitting it against the forest floor, to a point where the frog fell on its back; the bird then flew off with its prey to ingest it. Accordingly, if a toad were to fall on its back during a similar predatory attack and maintained thanatosis behavior, it might go unnoticed. Thanatosis, therefore, could be an effective mechanism against predators that need movement to find their prey, such as diurnal birds (Toledo et al., 2011). The presence of mutilated limbs (Novak and Robinson, 1975) suggests that the toads in this study might be able to survive predatory attacks by birds by using this mechanism.

Fig 6. A juvenile *Incilius holdridgei* with its limbs close to body while exhibiting thanatosis behavior at Cerro Chompipe, Parque Nacional Braulio Carrillo, Provincia de Heredia, Costa Rica.

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Fig 7. A juvenile *Incilius holdridgei* with its limbs extended while exhibiting thanatosis behavior at Cerro Chompipe, Parque Nacional Braulio Carrillo, Provincia de Heredia, Costa Rica.

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We observed thanatosis behavior in the juveniles of all the species in this study, but in some cases adults did not show it (i.e., *I. guanacaste* and *I. holdridgei*); perhaps young individuals were less able to make a quick escape, and thus relied more on camouflage (Toledo et al., 2011; Mângia and Santana, 2013; Rogers and Simpson, 2014). Here, we suggest that young individuals tend to show more thanatosis behavior because their short legs cover less ground than those of adults while walking to escape. Additionally, because of their small size camouflage might be more efficient during the thanatosis. Differences on the effectiveness of escaping and camouflage between the age classes in these species only can be corroborated by further studies.

Thanatosis behavior can improve the effectiveness of cryptic colors for camouflage (Rogers and Simpson, 2014). Non-toxic species usually display cryptic colors (Blount et al., 2009), and thanatosis occurs mostly in non-toxic frogs (Escobar-Lasso and González-Duran, 2012), suggesting that there is a negative correlation between thanatosis and toxicity. Nonetheless, in the family Bufonidae it also occurs in species with some level of toxicity, such as in genera *Dendrophryniscus*, *Melanophryniscus*, *Osornophryne*, *Rhinella*, and *Incilius* (Toledo and Haddad, 2009; Toledo et al., 2010). We cannot assign our study species to a toxicity category, because information on their toxicity is unavailable and we did not observe any discharge from their parotoid glands. Thanatosis, however, can serve more as a defensive strategy against predators by affecting their vision for hunting, such as in birds and snakes (Toledo et al., 2011). More observations are necessary to identify potential predators of the species in this study; nevertheless, this report of thanatosis increases the available natural history information of highland bufonids in Costa Rica.

Fig 8. An adult *Incilius holdridgei* in thanatosis behavior at Parque Nacional Braulio Carrillo, Provincia de Heredia, Costa Rica; we handled the animal to take the photograph after recording the behavior.
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Reptilia: Crocodylia

***Crocodylus acutus* (Cuvier, 1807). Predation on a Brown Pelican (*Pelecanus occidentalis*) in the ocean.** The American Crocodile (*Crocodylus acutus*) has a wide distribution that extends from the southern tip of Florida, United States, and the Caribbean islands of Cuba, Hispaniola, and Jamaica to the Yucatan Peninsula in Mexico, then southward to Colombia and Venezuela, and on the Pacific from northern Sinaloa, Mexico, to northern Peru (Ponce-Campos et al, 2012). In Costa Rica, *C. acutus* is known to occur on both versants in large rivers and streams, often in brackish water near the mouths of rivers, as well as in salt and freshwater marshes, mangrove swamps, and swamp forests, at elevations below 200 m (Savage, 2002). Although typically associated with brackish estuaries and large rivers and streams, *C. acutus* occasionally ventures into marine environments (Savage 2002), indicating some tolerance of saltwater (Wheatley et al., 2012; Platt et al., 2013). Data on the habits and diet of *C. acutus* inhabiting marine or coastal areas, however, remain poorly studied, compared with those of more inland areas (Platt et al., 2013).

On 6 January 2016 at ca. 1000 h, we observed a *C. acutus* preying on a Brown Pelican (*Pelecanus occidentalis*) along the shoreline of Playa Naranjo, Sector Santa Rosa, Area de Conservación Guanacaste, Provincia de Guanacaste, Costa Rica. The event occurred directly across the shore from Laguna El Limbo, an area of beach surrounded by mangroves (10°46'14.11"N, 85°39'42.68"W, WGS 84) in Tropical Dry Forest. At the time of the encounter we were walking along the beach with a group of university students when we observed a large animal moving in the surf about 25 m from our position. Within a few seconds, a *C. acutus* ca. 3 m in total length jumped out of the water holding a pelican in its jaws. The *C. acutus* shook the bird violently for about a second before disappearing underwater, and reappeared a few meters away with the remains of the pelican floating in the water (Fig. 1A). We never saw the pelican alive, so do not believe we witnessed the actual attack. Our observations with binoculars suggest that we interrupted the *C. acutus* attempting to dismember the carcass, and that the crocodile released the pelican because of our presence on the beach. Nonetheless, the *C. acutus* did not flee but for ca. 5 min maintained a position in the surf facing us near the carcass (Fig. 1B). At least once the *C. acutus* made movements suggesting it might be coming onto the beach near our location, but it then swam north, parallel with the shoreline, until it disappeared from view (Fig. 1C).

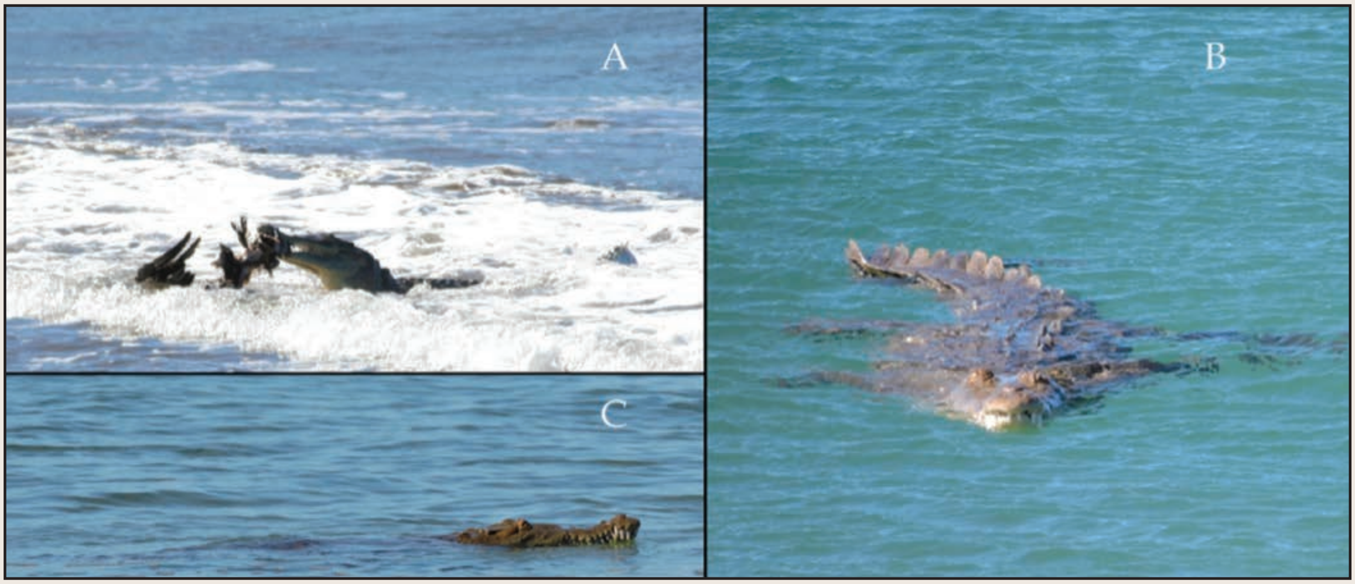

Fig. 1. An American Crocodile (*Crocodylus acutus*) at Playa Naranjo, Sector Santa Rosa, Area de Conservación Guanacaste, Provincia de Guanacaste, Costa Rica: (A) the crocodile dismembering a Brown Pelican (*Pelecanus occidentalis*); (B) the crocodile facing the group after releasing its prey; and (C) the crocodile swimming away after seemingly abandoning its prey.

📷 © Jeff Sartini (A) and Víctor J. Acosta-Chaves (B, C)

Crocodylus acutus is an opportunistic predator known to prey upon a large variety of organisms (i.e., fishes, reptiles, birds, mammals), and as individuals increase in body size they feed on larger vertebrate prey, including large birds (Thorbjarnarson, 1989; Savage, 2002; Villegas and Schmitter-Soto, 2008). We are unaware of any published reports of *C. acutus* preying on *P. occidentalis*, but cormorants (*Phalachrocorax* sp.), which are similar in size, have been reported in the diet of adult *C. acutus* inhabiting marine cays and atolls in Belize (Platt et al., 2013) and in coastal lagoons in Quintana Roo, Mexico (Villegas and Schmitter-Soto, 2008). Furthermore, two recent Internet videos show *C. acutus* swallowing *P. occidentalis* at Parque Nacional Corcovado, Provincia de Puntarenas, Costa Rica (Youtube 2011, 2013), indicating that our observation is not an isolated occurrence.

The foraging behavior of *C. acutus* in the marine and near-shore habitats of Costa Rica requires further study. In addition to further elucidating the life history of this species in marine environments (Platt et al., 2013), this information also might serve to reduce human-crocodile conflicts, because occasional attacks on domestic animals, livestock, and humans by large *C. acutus* also occur in Costa Rica (Savage, 2002). For example, numerous tourists use the beaches at Sector Santa Rosa for recreational purposes (VA, pers. observ.), and a better understanding of how frequently *C. acutus* uses these near-shore marine habitats for dispersal or foraging may serve to better protect human safety while ensuring the conservation of crocodiles in these and other protected areas of Costa Rica.

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Reptilia: Squamata (lizards)

***Abronia graminea* (Cope, 1864)**. **Color variant.** Monomorphic adult color patterns are typical for anguid lizards of the genus *Abronia*, and few documented examples of naturally occurring variation or aberrancies exist. Among the 28 described members of the genus, only *A. lythrochila* is reported to display marked variation in adult color that appears independent of sex or ontogeny. Adult pattern classes in *A. lythrochila* include black-and-white checkered, gray with red spots, and uniform tan—with many intermediate variations (Campbell and Frost, 1993; Langner, 2014). Because *Abronia* are so poorly studied (nearly one-half of the species are known from fewer than 10 specimens), however, there is potential for undiscovered diversity in infraspecific color pattern. Here, we describe an uncommon color variant from a population of *A. graminea* in Mexico.

The population in question occurs in the mountains southwest of Acultzingo, Veracruz, along the border between the states of Veracruz and Puebla, at an elevation of ca. 2,400 m. The habitat is mesic cloud forest composed of *Quercus laurina* and *Q. rugosa*, with sparse to heavy epiphytic growth dominated by the bromeliads *Catopsis paniculata*, *Tillandsia botterii*, and *T. imperialis*. Wild and cultivated varieties of *Crataegus mexican*a are common in the forest understory. We made long-term visits to this area from July to September in 2014 and 2015. Cumulatively, we spent over 1,000 person-hours in the field on *Abronia* surveys for unrelated projects. During this work, we conservatively estimate that we observed over 200 adult individuals of *A. graminea*.

Of this sample, five lizards displayed an aberrant bright to dull orange dorsal coloration. In *A. graminea*, there is notable inter-population variation in normal color pattern, which supports genetic data indicating that species limits are poorly defined in this taxon (I. Solano-Zavaleta, unpublished). In all known populations of *A. graminea*, however, the typical adult color pattern is dominated by bright emerald green. At our site, both males and females also display variable amounts of black pigment on the trunk (typically confined to the basal one-quarter to one-half of some dorsal scales). We provide an illustration of a representative female from this population (Fig. 1). Some females from this area, however, retain dark crossbands on the body and tail. These bands are holdovers from the juvenile color pattern, which differs markedly from the adult color scheme (Fig. 1, inset). Such ontogenetic color variation, with banded juvenile patterns changing to largely monochromatic adult patterns, is commonplace in the genus *Abronia* (Schmidt-Ballardo et al., 2015).

Fig 1. *Abronia graminea* with age-specific typical color patterns. The main photo shows an adult female, and the inset photo a young juvenile.

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Interestingly, all five lizards we observed with aberrant orange coloration were subadults or mature females that retained the dark juvenile crossbands. Below, we briefly describe three lizards that spanned the range of the aberrant color pattern we observed. We encountered the most dramatically colored female (Fig. 2) on 3 September 2014, perched at a height of ca. 1 m in understory shrubs beneath a large *Q. laurina*. On both the body and tail, the interspaces between the dark crossbands were predominantly bright to dull orange—although spots and flecks of black, yellow, green, tan, and brown created complex patterns on some scales. Other color elements typical of this population (bright yellow orbital skin; blue highlights on the supralabial scales; and a yellow snout, lower jaw, and throat) largely were unaltered. We observed a drabber individual (98 mm snout–vent length [SVL], body mass 21.2

g) on 14 July 2015 resting on a *C. mexicana* branch at a height of 1.5 m (Fig. 4A). Her coloration more closely approached the typical adult color pattern. Pale interspaces between the dark crossbands showed extensive turquoise pigment (particularly on the flanks), with dull orange pigment largely restricted to the dorsal two-thirds of the trunk above the lateral fold. Again, the characteristic facial color patterns mostly were unaltered, and flecks of additional colors were present on many trunk and tail scales. A third individual (100 mm SVL, body mass 20.7 g) captured at a height of 2 m on a *Q. rugosa* branch on 16 September 2015, displayed moderately intense orange coloration, but notably also showed white spots in short vertical series on her flanks (Fig 4B).

Fig 2. Habitus (top) and close-up (bottom) of the brightest orange color-variant of *Abronia graminea*. © Adam G. Clause

Given this color variant's obvious rarity within the population (approximate frequency < 3%), it seems to be a variant that is not retained by adaptive advantage. Differences in color expression within the aberrant lizards point away from a Mendelian genetic cause. Sex linkage appears possible given that all five lizards were female, and polygenic inheritance or even epigenetics might also be at play. We suspect, however, that this color variant is an intermediate stage in the ontogenetic transition from juvenile to adult coloration. Confirmation of this hypothesis will require the long-term tracking of aberrant lizards, to determine if they eventually transition to the typical adult color. We also speculate that this color variant might be diet-related, to some degree. The coloration of captive adult *A. graminea* of both sexes rapidly changes from bright emerald green to dull turquoise green, likely due to a dietary deficiency of carotenoids in captivity compared to their wild diet profile. Ingestion of an excess of these dietary carotenoids presumably could contribute to the observed orange color variant. This explanation fits with the variation in intensity and coverage of the orange color among the five lizards reported here. Long-term tracking of wild aberrant lizards, long-term observation of aberrant individuals in captivity, or controlled captive breeding experiments might shed some light on the underlying mechanism. We encourage the Mexican regulatory authorities to consider authorizing such follow-up studies on this legally protected species.

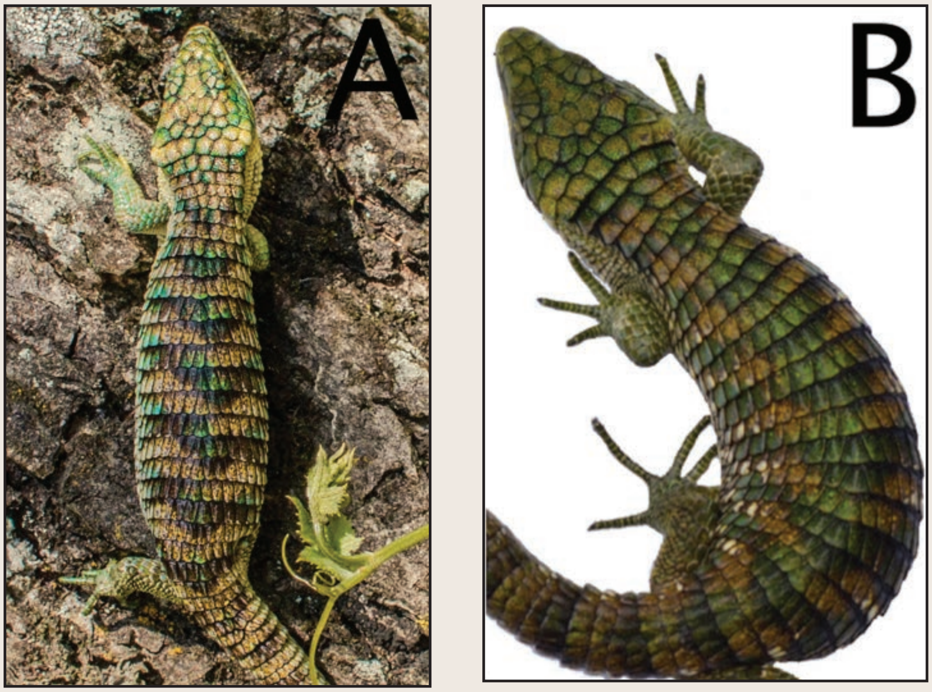

Fig 3. Two additional orange color-variants of *Abronia graminea*, illustrating the extremes of variation. (A) shows the dullest lizard; (B) shows an individual with white spots on the flanks.

📷 © Raúl Gómez Trejo-Pérez and Hibraim (A) and A. Pérez-Mendoza (B)

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***Gonatodes albogularis.* Predation by a Barred Puffbird (*Nystalus radiatus*).** *Gonatodes albogularis* is a small diurnal gecko with a distribution extending from southern Mexico to northern South America, including several adjacent islands, as well as in Cuba, Jamaica, Grand Cayman, and Hispaniola; it also has been introduced into southern Florida (Schwartz and Henderson, 1991). Individuals rarely remain still and move quickly from one place to another, often disappearing into holes, under bark, or any accessible crevice (Savage, 2002). Natural predators of this species include snakes, larger lizards, mammals, and birds (Fitch, 1973; Bello, 2000).

The Barred Puffbird (*Nystalus radiatus*) occurs from central Panama to western Ecuador (Ridgely and Gwynne, 2005). Puffbirds generally perch quietly for long periods, sallying forth to catch large insects or small vertebrates (Skutch, 1989; Angehr and Dean, 2010). Other species of *Nystalus* have been reported to forage on beetles (Coleoptera), caterpillars (Lepidoptera), millipedes (Diplopoda), and small lizards, including anoles (Del Hoyo et al., 2002).

On 4 April 2015 at 1450 h, RL observed a Barred Puffbird (*N. radiatus*) feeding on a male *G. albogularis* at Canopy Camp, Corregimiento de Metetí, Distrito de Pinogana, Provincia de Darién, Panama (8.374044°N, 77.860972°W; WGS 84); elev. 1,47 m. The bird was perched on an exposed branch in the medium canopy with gecko on its beak (Fig. 1), and beat it on the branch while using several lateral head movements. The bird maintained beating the lizard for nearly 15 min, then flew off with the prey and was not observed swallowing it. Soon, however, the bird returned to the same branch without the gecko. Greeney et al. (2004) reported the remains of a praying mantid (*Choeradodis* spp.: Mantidae) in the nest of an *N. radiatus*, and the Cornell Lab of Ornithology (http://neotropical.birds.cornell.edu/portal/species/gallery?p_p_spp=289496; accessed 20 January 2016) shows photos of *N. radiatus* preying on a grasshopper and a *Gonatodes* sp. This report is the first documenting the predation of *G. albogularis* by *N. radiatus*.

Fig. 1. An adult *Nystalys radiatus* preying a male *Gonatodes albogularis* at Canopy Camp, Corregimiento de Metetí, Distrito de Pinogana, Provincia de Darién, Panama. 📷 © Rafael Lau

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***Norops rodriguezii*. Predation.** Rodriguez's Anole, *Norops rodriguezii*, is a small lizard (snout–vent length 40–45 mm) with diurnal and semi-arboreal habits, which occurs at low elevations on the Atlantic slope from southern Veracruz, Mexico, and across the Yucatan Peninsula to western Honduras (Lee, 1996, 2000; Köhler, 2008). On 25 February 2014, during a nocturnal survey (at 2008 h) we found a huntsman spider (Araneae: Sparassidae) preying on an adult male *N. rodriguezii* on shrubby vegetation at a height of 160 cm above the ground. The event occurred at Chetumal, Quintana Roo, Mexico (18.542920°N, -88.262116°W; datum WGS 84; elev. 14 m) on a trail in a patch of tropical deciduous forest. We observed the spider grabbing and devouring the lizard by its head (Fig. 1), and after taking some photographs we moved away to avoid causing further disturbance.

Many spiders are known to attack and consume small vertebrates (Neill, 1948; Groves and Groves, 1978). Sparassid spiders are active hunters that stalk and capture their prey by ambush, and predation on amphibians and reptiles previously has been reported (Formanowicz et al., 1981; Vyas, 2012); however, this is the first record of a sparassid spider preying on *N. rodriguezii.*

Fig. 1. Two views of a predation event by a huntsman spider (Sparassidae) on an adult male *Norops rodriguezii* in a patch of tropical deciduous forest at Chetumal, Quintana Roo, Mexico. 📷 © Christian M. García-Balderas

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Seasonal polymorphism in male coloration of *Sceloporus aurantius*

Male coloration is an important diagnostic character in distinguishing among species in the *Sceloporus scalaris* group (Smith et al., 1997). Males of each species typically are characterized as having one of the following ventral colorations (Smith et al., 1997; Watkins-Colwell et al., 2006): (1) blue lateral abdominal semeions and no red or orange dorsolateral sides (*S. brownorum* Smith, Watkins-Colwell, Lemos-Espinal, and Chiszar, 1997; *S. scalaris* Wiegmann, 1828; *S. unicanthalis* Smith, 1937), (2) blue lateral abdominal semeions and red or orange dorsolateral sides (*S. aeneus* Wiegmann, 1828; *S. bicanthalis* Smith, 1937; *S. goldmani* Smith, 1937; *S. samcolemani* Smith and Hall, 1974; *S. slevini* Smith, 1937; *S. subniger* Poglayen and Smith, 1958), or (3) red or orange dorsolateral sides and no blue lateral abdominal semeions (*S. aurantius* Grummer and Bryson, 2014; *S. chaneyi* Liner and Dixon, 1992).

A recently published observation (Carbajal-Márquez and Quintero-Díaz, 2015) described ventral color polymorphism in male *S. aurantius*. Whereas previous research based on an examination of adult males collected during the months of April (*n* = 1), May (*n* = 1), July (*n* = 2), and August (*n* = 2) suggested that *S. aurantius* lack blue lateral abdominal semeions (Grummer and Bryson, 2014), Carbajal-Márquez and Quintero-Díaz (2015) found blue lateral abdominal semeions present in adult males at the type locality during the breeding season (February–May). A reexamination of the adult male paratypes reported in Grummer and Bryson (2014) reveals that the two specimens collected during the breeding season (MZFC 24818, MZFC 24831) also show faint traces of blue lateral abdominal semeions, only evident when the specimens are submerged in ethanol. One specimen (MZFC 24818), however, seems to have discolored during the preservation process. The remaining adult males, including the two from the Sierra del Laurel (USNM 346561, 346563) previously designated as paratypes of *S. brownorum* by Smith et al. (1997), appear to lack blue bars on the venter. This finding is substantiated by an earlier color description of one of these specimens (USNM 346561) in McCranie and Wilson (2001: 20), who noted that in life the lizard had only a cream venter with a slight "greenish" tinge.

Carbajal-Márquez and Quintero-Díaz (2015) also reported the discovery of only patternless males of *S. aurantius* during the breeding season. They stated that blue abdominal semeions were present in every adult male they observed, and that the dorsum of all adult males with blue semeions was patternless. Both typical chevron-patterned and patternless morphs are present in males and females of *S. aurantius* (Grummer and Bryson, 2014). Previous studies on polymorphic populations of *S. slevini* determined that pattern polymorphism does not appear to vary seasonally, nor do intermediate patterns exist (Anderson, 1972). The observations by Carbajal-Márquez and Quintero-Díaz (2015), coupled with photos of males in the type series of *S. aurantius*, suggest that this may not be the case for *S. aurantius*. Figure 1 illustrates pattern polymorphism found in *S. aurantius*. The pattern types of the two females (Fig. 1A, D) are strongly contrasting, similar to the pale patternless and brightly patterned morphs of *S. slevini* (Anderson, 1972). The male *S. aurantius* pictured in life during the breeding season in Grummer and Bryson (2014: fig. 6), shown here in Fig. 1E, also shows a distinct patternless dorsum. The two paratype males collected in July (Fig. 1B, C) display intermediate patterns. Both males also appear to show fading of the orange dorsolateral sides compared to the vibrantly colored male collected during the breeding season (Fig. 1E).

Based on the observations in Carbajal-Márquez and Quintero-Díaz (2015) and photos of males in the type series of Grummer and Bryson (2014), apparently the coloration of male *S. aurantius* shifts between the breeding and non-breeding seasons, or at least seasonally. As suggested by Carbajal-Márquez and Quintero-Díaz (2015), it seems prudent to amend the diagnosis of *S. aurantius* to reflect this polymorphism. During the summer, male *S. aurantius* can be distinguished from other regional *S. scalaris* group species based on the presence of orange dorsolateral sides and the absence of blue abdominal semeions; blue bars on the venter are present in all other species in the area. During the winter and spring, blue abdominal semeions may be present in male *S. aurantius*, but based on the photos in Carbajal-Márquez and Quintero-Díaz (2015) and a reexamination of the type series, these blue semeions appear to be relatively subdued, especially in preserved specimens maintained in ethanol. This lighter blue coloration strongly contrasts the vivid or dark blue semeions generally seen in male *S. brownorum*, *S. scalaris*, and *S. unicanthalis* (Smith et al., 1997), the other *S. scalaris* group species found in the region (Smith et al., 1997;

Vázquez-Díaz and Quintero-Díaz, 2005). The darker pigmentation in the abdominal semeions of these latter three species also is easily distinguished from the lighter ventral coloration after long-term storage in preservative (Smith et al., 1997: fig. 2, figs. 5, 6). These species also lack the orange dorsolateral sides found in *S. aurantius*, although occasionally an orange patch is present behind the front legs of *S. scalaris* and *S. unicanthalis*. The blue lateral semeions in *S. brownorum* also appear to be separated by more scales (usually eight or more in *S. brownorum* vs. five or less in *S. aurantius*; Smith et al., 1997; Carbajal-Márquez and Quintero-Díaz, 2015). Interestingly, the only species in the *S. scalaris* group lacking blue abdominal semeions now is *S. chaneyi*, and all the type specimens of this species (n = 17) were collected during the summer in July (Liner and Dixon, 1992).

Fig. 1. Pattern polymorphism in the type series of *Sceloporus aurantius*: (A) holotype female (MZFC 28392), normal pattern; (B) paratype male (MZFC 25106), intermediate pattern; (C) paratype male (MZFC 25101), intermediate pattern; (D) paratype female (MZFC 25103), patternless; and (E) paratype male (MZFC 24818), patternless.

© Robert W. Bryson, Jr. (A–D), and Iván T. Ahumada-Carrillo (E).

Additional research clearly is needed to better understand color polymorphism in *S. aurantius* and other species in the *S. scalaris* group. Most of the taxonomic descriptions of these lizards primarily have been based on the examination of preserved materials (e.g., Smith et al., 1997), and specimen coloration appears to quickly change in preservative. The fading of certain colors, like orange and light blue, combined with seasonal collecting biases might have led researchers to oversimplify the male coloration in this group of lizards. Whereas pattern polymorphism in some species of *S. scalaris* group lizards may be related to crypsis (Anderson, 1972), the mechanistic drivers of adult male color polymorphism in *S. aurantius* and other species may be more nuanced and represents an area ripe for future behavioral studies.

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***Uta palmeri* Stejneger, 1890. Reproduction.** *Uta palmeri* is endemic to Isla San Pedro Mártir (28.38176°N, 112.30632°W), Sonora, Mexico (Grismer, 2002). Based largely on the studies of Wilcox (1980) and Hews (1990), and from personal observations, Grismer (2002) presented a summary of the natural history of *U. palmeri*, in which he included reproductive information. In this note, I present the results of a histological examination of the reproductive organs of *U. palmeri*, based on a sample of museum specimens.

I borrowed 25 specimens of *U. palmeri* from the University of Colorado Museum of Natural History (UCM), Boulder, Colorado, United States. The sample consisted of 10 adult females (mean snout–vent length [SVL] = 65.7 mm ± 4.5 SD, range = 59–73 mm), 13 adult males (mean SVL = 71.1 mm ± 1.9 SD, range = 68–73 mm), and two subadult males (mean SVL = 63.0 mm ± 5.7 SD, range = 59–67 mm). The specimens were collected in January of 1964 (*n* = 2), July of 1967 (*n* = 12), and August of 1964 (*n* = 11).

The UCM museum numbers are as follows: 23955, 23959, 26274–26276, 26281–26284, 26290, 26297, 26300, 26302, 35231, 35233, 35235, 35237, 35243, 35244, 35246, 35249, 35253, 36266, 35276, and 35278.

I removed the left ovary from females and the left testis from males for histological examination. I embedded the tissues in paraffin, cut into 5 µm sections, mounted them on glass slides, and stained them with Harris' hematoxylin followed by eosin counterstain (Presnell and Schreibman, 1997). I examined the slides to determine the presence of yolk deposition or corpora lutea and counted the oviductal eggs or enlarged ovarian follicles (> 4 mm) but did not examine them histologically, and deposited the histology slides at UCM.

I noted the following three stages in the testis cycle of *U. palmeri* (Table 1): (1) regressed, seminiferous tubules contained spermatogonia and Sertoli cells; germinal epithelium was exhausted during the last period of spermiogenesis (= sperm formation); (2) late recrudescence, secondary spermatocytes dominated in the seminiferous tubules; small quantities of metamorphosing spermatids and sperm were present; and (3) spermiogenesis, lumina of seminiferous tubules were lined by sperm or clusters of metamorphosing spermatids. The smallest reproductively active male (spermiogenesis) measured 68 mm SVL (UCM 26297) and was collected in August. Two smaller males (one from August, UCM 26302, SVL = 59 mm; one from January, UCM 23955, SVL = 67 mm) both contained very small regressed testes, and I considered them as subadults.

Table 1. Stages in the testicular cycle of 13 male *Uta palmeri* from Isla San Pedro Mártir, Sonora, Mexico.

Month	Number	Regressed	Late Recrudescence	Spermiogenesis
January	1	0	1	0
July	9	0	0	9
August	3	1	0	2

I noted the following four stages in the ovarian cycle of *U. palmeri* (Table 2): (1) quiescent, no yolk deposition; (2) early yolk deposition, basophilic vitellogenic granules in ooplasm; (3) enlarged follicles > 4 mm; and (4) oviductal eggs. The mean clutch size (*n* = 5) was 2.8 ± 1.1 SD, range = 2–4, which is within the range (1–5) indicated in Grismer (2002). The smallest reproductively active female (4 follicles > 4 mm) measured 59 mm SVL (UCM 35266), and was collected in July.

Table 2. Stages in the ovarian cycle of 10 adult *Uta palmeri* from Isla San Pedro Mártir, Sonora, Mexico.

Month	Number	Quiescent	Early Yolk Deposition	Enlarged Follicles > 4 mm	Oviductal Eggs
July	2	1	0	1	0
August	8	2	2	2	2

The size data I collected are consistent with the information provided in Grismer (2002), in that females were mature at 54–58 mm SVL and males at 67 mm SVL. My finding of an adult male collected in January in late recrudescence, just prior to full sperm production (spermiogenesis), and an adult male collected in August with exhausted (regressed) testes, suggests that seasonality (likely autumn inactivity) exists in the reproductive cycle of *U. palmeri*. The congener *U. stansburiana* exhibits autumn reproductive inactivity, as it concludes spermiogenesis in August and the next period of spermiogenesis begins in late autumn or winter (Goldberg, 1977). Additional monthly samples of *U. palmeri* need to be examined to ascertain the timing of events in this species' reproductive cycle.

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Internal organ ingestion as an alternative feeding behavior for the Northern Cat-eyed Snake (*Leptodeira septentrionalis*)

Prey size and prey type influence snake predatory behavior (Mori, 1991). Colubrid snakes have evolved two partially separated structural-functional units, a medial swallowing unit and a lateral prey capture unit, and the mandibles and their connecting soft tissues mainly press the prey against the palatopterygoid teeth (Cundall, 1983). Opistoglyphous species like *Leptodeira septentrionalis* bite and hold their prey without releasing it, while their venom affects the prey (Savage, 2002; Solórzano, 2004). Duvernoy glands are specialized structures that produce toxins, located between the postocular and supralabial regions, which according to species develop different degrees and levels of toxicity (Gutiérrez and Sasa, 2002).

Snakes are the main predators of anurans in habitats surrounding bodies of water (Santos-Silva et al., 2014). Numerous individuals of *L. septentrionalis* often gather to feed during breeding aggregations of treefrogs (Solórzano, 2004). Movements by potential prey might be the cue for them to strike (Shine and Sun, 2003). The inflation of a frog's body as a defensive mechanism is solved by the great extensibility of the snake's skin, which is related to the number of scale rows around the neck (Forsman and Lindell, 1993). The frequent consumption of relatively small prey is thought to be a more primitive feature compared to the infrequent consumption of heavy prey (Greene, 1983), an idea supported by molecular phylogeny (Zaher et al., 2009). Detailed observations of predation events are rare due to the difficulties of monitoring animals in the wild (Santos-Silva et al., 2014). Here we report a *L. septentrionalis* performing an alternative feeding behavior while preying on the treefrog *Smilisca phaeota*.

On several occasions from August 2011 to April 2012, we visited Parque Nacional La Cangreja, located ca. 45 km S of Santiago de Puriscal, Provincia de San José, Costa Rica (09º42'12.8"N, 084º23'53.4"W). On 2 September 2011 at 1937h, we found two individuals of *L. septentrionalis* preying on a group of *S. phaeota* in the proximity of Santa Rosa station. One of the snakes was an adult with a snout–vent length of 900 mm and a head length of 40 mm; the other snake, a subadult, had a snout–vent length of 550 mm and a head length of 24 mm.

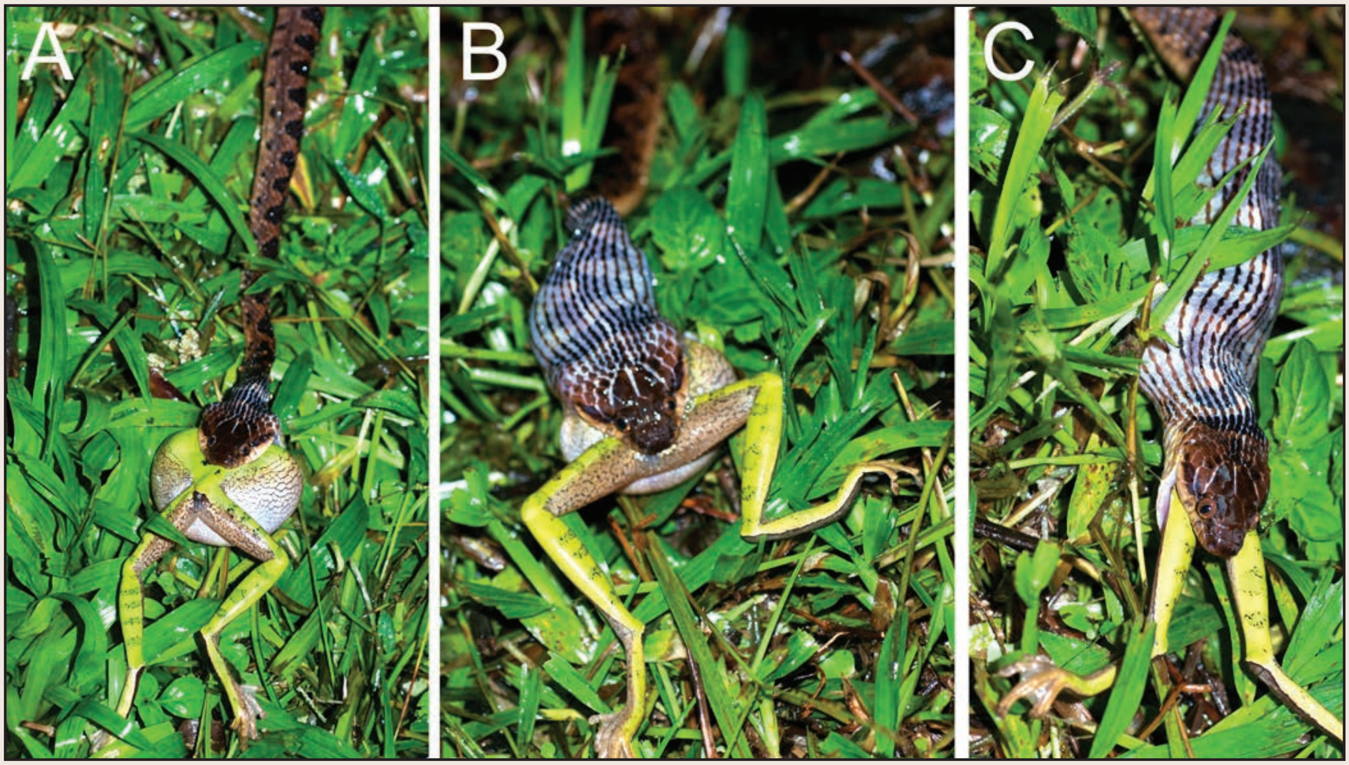

Fig. 1. (A–C) An adult *Leptodeira septentrionalis* captures a *Smilisca phaeota* by the head and swallows it in typical fashion.
📷 © Ignacio Arroyo

The adult snake had captured a treefrog by the head, in typical fashion, and by 2043 h finished ingesting its prey (Fig. 1A–C). At 2005h, the subadult was found coiled and biting a frog on the left side of its neck (Fig. 2A–C), but at ca. 2035 h, due to constant struggling, it released the frog; the snake rapidly struck again, this time on the right side of the frog's neck, and held its prey for nearly two hours. At 2230 h, the snake was able to force its head through the frog's neck and into the body cavity and began feeding on its internal organs (Fig. 2D).

Successful swallowing performances traditionally have been vastly related to head size, as gape-limitation is supposed to favor larger predators. Maximum ingestible prey size likely influences the foraging success and fitness of gape-limited predators (Pough and Groves, 1983; Shine, 1991; Forsman and Lindell, 1993; King, 2002). A calculation of the net energy obtained (and not the prey size), however, is required to evaluate comparative feeding success (Pough and Groves, 1983; Forsman and Lindell, 1993).

The incapacity of properly evaluating the prey's size has been proposed as the reason why snakes attack prey they are unable to ingest by "head-first swallowing" (Shine and Sun, 2003). Some opistoglyphous snakes, however, might take nutritional advantage of prey even though they are unable to swallow the whole item. During development, alternative strategies like the internal organ ingestion described here, are examples of adaptive flexibility in feeding behavior as a way to solve gape-limitation. This example is not the first known evolutionary innovation of snakes to circumvent gape-limitation. Removing and consuming pieces from newly molted crabs that are too large to be swallowed intact also has been reported (Jayne et al., 2002).

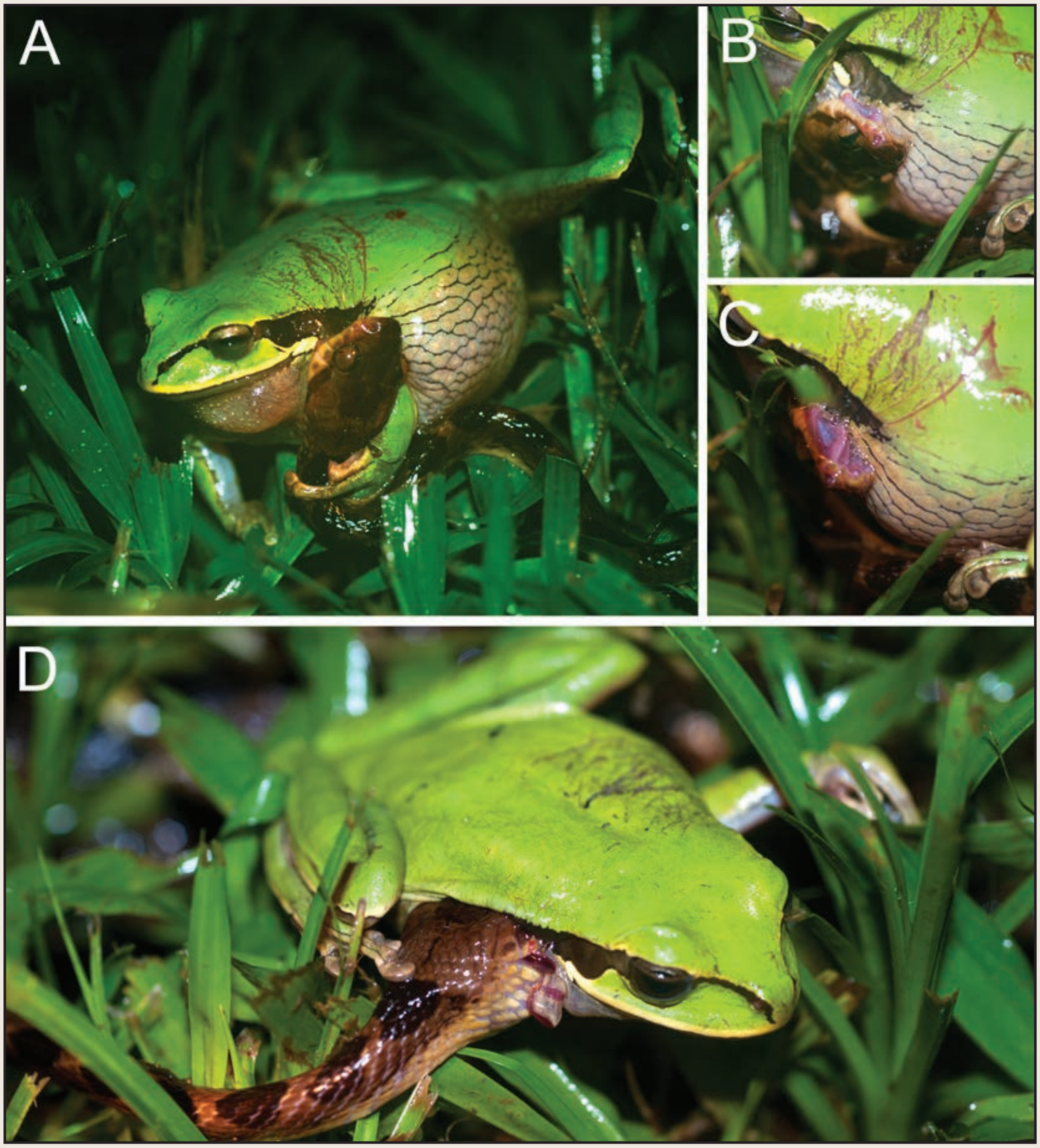

Fig. 2. (A) A subadult *Leptodeira septentrionalis* bites a *Smilisca phaeota* on the neck, while the frog remains inflated; (B, C) the snake continues biting the frog's neck, perhaps injecting venom; and (D) after releasing the frog the snake bites the frog on the other side of the neck and holds it for about two hours, after which it forces its head inside the frog's body cavity and begins ingesting its internal organs. Note that the frog's body no longer is inflated. 📷 © Ignacio Arroyo

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Reptilia: Squamata (snakes)

Porthidium dunni **(Hartweg and Oliver, 1938). Arboreality.** Dunn's Hognosed Pitviper, *Porthidium dunni*, is a small, stout snake with a relatively limited geographic distribution that extends from southwestern Oaxaca to extreme western Chiapas, Mexico; this species is found in the foothills of the Pacific versant and throughout the coastal plain, in tropical deciduous forest, at elevations from near sea level to about 700 m (Campbell and Lamar, 2004). Very little, however, is known about its natural history and behavior.

On 23 June 2013 at 1320 h, two of us (VMS and AR) observed an adult *P. dunni* ca. 3.6 km NNW of La Soledad, Municipio de Villa de Tututepec de Melchor Ocampo, Oaxaca, Mexico (16.051070°N, 97.462168°W; WGS 84; elev. 367 m). The snake was coiled on the main trunk of a large tree, ca. 1m off the ground and ca. 2 m from the inclined base of the tree. The individual was facing down toward the base, with the tip of its rostrum at the edge of its outer coil, possibly indicating ambush behavior (Fig.1). Although *P. dunni* is considered a terrestrial species, apparently arboreal microhabitats occasionally can be utilized when conditions are suitable. Arboreality within the genus *Porthidium* also has been reported in *P. hespere* (Alvarado-Díaz et al., 1997), *P. nasutum* (Taylor, 1954; Medem, 1968; Lee, 1996; Savage, 2002), and recently in *P. ophryomegas* (DeSantis et al., *This issue*).

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Fig. 1. An adult Dunn's Hognosed Pitviper (*Porthidium dunni*) apparently displaying ambush behavior on the main trunk of a tree in Municipio de Villa de Tututepec de Melchor Ocampo, Oaxaca, Mexico. 📷 © Vicente Mata-Silva

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***Porthidium ophryomegas* (Bocourt, 1868). Arboreality.** The Slender Hognosed Pitviper, *Porthidium ophryomegas*, generally is a common inhabitant of lowland dry and moist forests ranging from south-central Guatemala to northwestern and central Costa Rica at elevations from near sea level to 1,095 m (Savage, 2002; Campbell and Lamar, 2004). Although in Guatemala and Honduras its distribution largely is disjunct, as it has been recorded in interior valleys and some Atlantic localities, along the lowlands of the Pacific versant its distribution is more continuous (Köhler, 2008). Individuals often are found active on roads at night or under rocks and logs during the day (Campbell and Lamar, 2004; McCranie, 2011), and to the best of our knowledge arboreal behavior has not been reported in this species.

On 20 July 2010 at 0900 h, one of us (DLD) observed a subadult male *P. oprhyomegas* ca. 2.5 km NNE of the Pacific coastal town of Potrero, Provincia de Guanacaste, Costa Rica (10.4801988°N, 85.7643682°W; WGS 84; elev. 229 m) tightly coiled in vine and shrub vegetation on a disturbed slope in tropical dry forest (Fig. 1). The snake appeared to be in ambush posture, as its body was directed upward toward a small stem, with its head perpendicular to and extended over the edge of its outer coil. It was found ca. 1.5 m above the ground in the tangled vegetation growing over a chain-link fence. Although generally considered to be a terrestrial predator of rodents, lizards, and frogs (Solórzano, 2004; McCranie, 2011), this observation suggests that *P. ophryomegas* occasionally can use arboreal microhabitats as foraging sites. Further illustrating the propensity for *P. ophryomegas* to climb, a separate observation was made in January of 1993 at La Casona, Área de Conservación Guanacaste, Sector Santa Rosa, Provincia de Guanacaste, Costa Rica, where an individual was found ca. 1.2 m high on a rock wall in the environs of the historic hacienda (W. Lamar and L. Porras, pers. comm.).

Fig. 1. A subadult male Slender Hognosed Pitviper (*Porthidium ophryomegas*) apparently displaying arboreal ambush behavior ca. 1.5 m above ground in tangled vegetation at Potrero, Provincia de Guanacaste, Costa Rica. 📷 © Dominic L. DeSantis

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***Salvadora intermedia* (Oaxacan Patch-nosed Snake). Diet.** The Oaxacan Patch-nosed Snake, *Salvadora intermedia*, is a Mexican endemic species found in the Sierra Madre del Sur of Oaxaca, Guerrero, and Puebla (Canseco-Márquez and Gutiérrez-Mayén, 2010). Snakes of the genus *Salvadora* are fast and chiefly diurnal snakes that feed on grasshoppers, lizards, snakes, reptile eggs, birds, and small mammals (Degenhardt et al., 1996; Stebbins, 2003; Lemos-Espinal and Dixon, 2013); relatively few records, however, are are available on the diet of the various species. For example, *Salvadora bairdi* is known to feed on small mammals such as *Baiomys taylori* and *Reithrodontomys* or *Peromyscus* sp. (Setser et al., 2009; Carbajal-Márquez et al., 2014); *S. deserticola* has been reported to feed on grasshoppers, *Aspidoscelis tesselata*, *A. exsanguis*, *A. tigris*, *Sceloporus undulatus*, and the pocket mouse *Perognathus penicillatus* (Barker and Sawyer, 2011; Gatica-Colima and Córdova-Reza, 2012); and *S. grahamiae* is known to include *Sceloporus scalaris* and birds in its diet (Ramírez-Bautista et al., 2000; Lemos-Espinal and Dixon, 2013). Published records on the diet of *S. intermedia*, however, are not available.

On 13 February 2015, Esmeralda Castro-Santos found a dead adult *S. intermedia* (MZFC-30007) on a road in the village of Xocomanatlán, Municipio de Chilpancingo de los Bravo, Guerrero (17°32'40.08"N, 99°37'48.49"W; datum: WGS 84; elev. 1,898 m). The snake measured 311.4 mm in snout–vent length (SVL), with a tail length of109.1 mm. Upon dissection we found an adult *Plestiodon brevirostris* (59.3 mm SVL; incomplete tail; body mass = 6 g) inside of its stomach (MZFC-30008). This is the first record of *P. brevirostris* in the diet of *S. intermedia* (Fig. 1). The specimens were deposited in the Museo de Zoología, Facultad de Ciencias, UNAM.

Fig. 1. A specimen of *Salvadora intermedia* (MZFC-30007) found at Xocomanatlán, Municipio de Chilpancingo de los Bravo, Guerrero, with an adult *Plestiodon brevirostris* MZFC-30008) in its stomach. 📷 © Rufino Santos-Bibianao

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***Trimorphodon paucimaculatus*. Diet and Reproduction.** Little information is available on the diet of the Sinaloan Lyresnake, *Trimorphodon paucimaculatus*. Like other members of its genus, this species is nocturnal and likely consumes lizards, rodents, birds, and bats, and inhabits rocky crevices and tree hollows (García and Ceballos, 1994). Carbajal-Márquez et al. (2014) recently reported a female of *T. paucimaculatus* in Nayarit feeding on Black Vented Oriole (*Icterus wagleri*). No information is available on the reproductive biology of this species, although a related species, *T. biscutatus*, has been reported to deposit clutches of 16–24 eggs that hatch at the start of the rainy season (Ramírez-Bautista, 1994).

On 9 June 2015 at 0710 h, a gravid *T. paucimaculatus* (snout–vent length = 901 mm, tail length = 141 mm) was found dead on the road between La Presa de Aguamilpa and La Presa San Rafael, Municipio de El Nayar, Nayarit, Mexico (21.782017°N, -104.862427°; WGS 84) at an elevation of 122 m in tropical deciduous forest. A photo voucher is deposited in the Colección Fotográfica Digital de Anfibios y Reptiles, at the Museo de Zoología, Unidad Académica de Agricultura, Universidad Autónoma de Nayarit (MZUAN F0004). We examined the stomach contents of the snake and found a partially digested White-bellied Rough Lizard (*Sceloporus albiventris*), the legs, skin, and tail of a Western Mexico Whiptail (*Aspidoscelis costata*), and nine eggs (Fig. 1).

Fig. 1. A *Trimorphodon paucimaculatus* found dead on a road at Municipio El Yayar, Nayrit, Mexico. The stomach contained a *Sceloporus albiventris*, parts of an *Aspidocelis costata*, and nine eggs. 📷 © Jesús Loc-Barragán

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Notes on the diet, foraging behavior, and venom of some snakes in Belize

For a variety of reasons, tropical snakes have received comparatively less study than those found in the temperate zone (Avila et al., 2006). In particular, our understanding of tropical snake ecology is hampered by a lack of dietary data (Vitt, 1987). This situation is unfortunate, because knowledge of the diet of any organism is fundamental to understanding its ecology (Rosenberg and Cooper, 1990), and dietary studies of snakes are important in understanding the role played by these predatory reptiles in ecological systems (Mushinsky, 1987). Moreover, observations of foraging behavior, prey capture, and prey handling can provide useful insights into trophic relationships, hunting strategies, and prey selection (Fitch, 1987b; Arnold, 1992); however, such observations remain poorly documented for most tropical and even many well-studied temperate zone snake species (Fitch, 1987a).

At least 66 species of snakes classified in seven families are known to occur in Belize (Stafford et al., 2010), and for many species in the country basic natural history data, including information on diet and foraging behavior, are lacking or sparse (Lee, 1996). Herein we present dietary records for 15 snake species in Belize. We collected these data opportunistically throughout the country, although the majority of our records originated from three locations: Gold Button Ranch (GBR), Lamanai Outpost Lodge (LOL), and Green Hills Farm (GHF) (see also Platt and Rainwater, 1998; Rainwater and Platt, 1999; Rainwater et al., 2001). GBR (17°05'N; 88°45'W; datum WGS 84) is a 10,526 ha privately owned cattle ranch in Orange Walk District that was stripped of natural forest and converted to open pasture in the mid-1970s, but by the mid- to late 1990s had reverted to dense early successional forest and scrub (Platt et al., 2009); GBR also contains significant areas of natural and anthropogenic wetlands (Platt et al., 2008). LOL (17°45'07.24"N, 88°39'14.58"W; datum WGS 84) lies adjacent to Indian Church Village and the Lamanai Archaeological Site in Orange Walk District, and is located on the western shore of New River Lagoon, an extensive freshwater wetland drained by the New River into Corozal Bay (Rainwater et al., 1998). The vegetation surrounding LOL is a mosaic of Cohune (*Attalea cohune*) forest, and active and abandoned *milpa* fields in various stages of succession. GHF (17°05.52'N; 88°58.27'W; datum WGS 84) is located near Seven Miles Village in Cayo District at an elevation of ca. 240 m above sea level, in karst hills characterized by second-growth moist broadleaf forest (J. Meerman, unpublished). We obtained several additional dietary records from snakes collected in pine forest and savanna along the Western Highway in Belize, Cayo, and Toledo districts, and islands in Turneffe Atoll; these habitats are described in greater detail elsewhere (Platt and Rainwater, 2003; Platt et al., 1999, 2004, 2009). The names of places in the text correspond to topographical maps issued by the Ordnance Survey, Southampton, England, which we obtained from the Department of Lands and Surveys, Belmopan, Belize.

We collected gut contents from a number of snakes found dead on roads (DOR) or killed by laborers; if salvageable, we deposited these specimens in the Campbell Museum (CUSC), Clemson University, Clemson, South Carolina, United States. In two cases we recovered food items from a living snake by applying pressure to the pyloric end of the stomach, thereby causing the animal to regurgitate (Fitch, 1987b). We also collected feces deposited by snakes upon capture; we rinsed each bolus thoroughly, and recovered and dried undigested items before examining them. We observed foraging behaviors during opportunistic encounters with snakes as we engaged in other fieldwork (e.g., Platt, 1996; Rainwater, 2003). For most records, we provide measurements or estimates of the total length (TL) and snout–vent length (SVL) of each snake. We identified prey items to the lowest possible taxon, grouped our dietary records by family and arranged them alphabetically by species within these groupings, and present multiple records for a single species chronologically. Finally, we reviewed the dietary literature for each species, and placed our observations in the context of previously published reports. Our scientific nomenclature follows the Taxonomic List of *Mesoamerican Herpetology* (www.mesoamericanherpetology.com; accessed 10 January 2016); common names follow Stafford and Meyer (2000), with some modification.

Family Boidae

Boa imperator (**Mesoamerican Boa Constrictor**). Hynková et al. (2009) elevated the northern population of *Boa constrictor imperator* to species level, and Reynolds et al. (2014) found support for the recognition of this taxon. The distribution of *B. imperator* extends from northern Mexico to northwestern South America (Hynková et al., 2009). On 3 October 1998, the remains of an unidentified rodent were recovered by palpation from a juvenile female (TL = 580 mm; SVL = 510 mm) captured at LOL. On 20 January 2000, hair from an unidentified mammal was found in the small intestine of a DOR female (TL = 1,790 mm; SVL = 1637 mm) at Indian Church Village. On 10 August 2014, a juvenile (TL = 400 mm) lying on a vine captured a White-necked Jacobin (*Florisuga mellivora*) as the bird fed from an adjacent hummingbird feeder at GHF. Numerous domestic fowl taken by *B. imperator* at GHF include the following: on 20 July 2007, a large subadult (TL = 1,500 mm) was found consuming a domestic chicken (*Gallus gallus*); on 16 June 2014, a large subadult (TL = 1,500 mm) was found consuming a Muscovy Duck (*Cairina moschata*); on 19 October 2014, five Japanese Quail (*Coturnix japonica*) confined in a pen were consumed by a subadult (TL = 1,200 mm); on 4 June 2015, a Muscovy Duck was consumed by a subadult (TL = 1,400 mm); and on 2 January 2016, a large adult (TL = 1,800 mm; body mass = 7.5 kg) was observed consuming a domestic duck (*Anas* sp.), but regurgitated it upon capture.

Other prey items reported for *B. imperator* in Belize include Great-tailed Grackles (*Quiscalus mexicanus*; Green et al., 2003) and Gray-breasted Martins (*Progne chalybea*; Boback, 2005). Few detailed dietary studies based on large samples of *B. imperator* are available (but see Boback, 2005). These studies, however, together with a plethora of anecdotal observations indicate that *B. imperator* is a generalist predator that consumes a diversity of vertebrate prey, including lizards (Greene, 1983; Boback, 2004; Gutsche, 2005; Reed et al., 2006), birds (Greene, 1983; Boback et al., 2000; Boback, 2004; Wasko and Roberts, 2008), and mammals (Greene, 1983; Bakkegard and Timm, 2001; Leenders and Watkins-Colwell, 2003; Sorrell et al., 2011; Sunyer and Galindo-Uribe, 2015).

Family Colubridae

***Drymarchon melanurus* (Black-tailed Cribo)**. On 9 July 1992, the stomach of a DOR male (TL = 1,663 mm; SVL = 1,225 mm) from GBR contained an adult *Eumeces schwartzei* (TL = 140 mm). On 7 June 1993, the stomach of a DOR adult (TL = 1,816 mm; SVL = 1,333 mm) from GBR contained a mass of pin feathers from the Great-tailed Grackle (*Quiscalus mexicanus*), which nest nearby in large numbers in trees at the ranch headquarters. On 13 August 2000, feces collected from an adult (TL = 2,010 mm; SVL = 1,675 mm) captured at GBR contained hair from an unidentified mammal. On 22 October 2000, the stomach of an adult (TL = 1,750 mm; SVL = 1,290 mm) found DOR on Northern Highway (ca. 2 km south of Orange Walk Town, Orange Walk District) contained a partially digested rodent. On 22 October 2000, the stomach of a DOR adult (TL = 1,760 mm; SVL = 1,315 mm) found on a dirt road ca. 1.5 km west of Orange Walk Town contained the remains of a small mammal. On 7 August 2008, a subadult (TL ca. 1,000 mm) was observed entering a burrow in the vertical face of a dirt embankment that contained a brood of Blue-crowned Motmot (*Momotus momota*) chicks. The snake entered the burrow (later determined to be ca. 1.0 m deep) while being mobbed by two adult birds. Vocalizations from the chicks ceased shortly thereafter and the snake emerged about 20 min later, presumably after consuming the brood. On several occasions (dates not recorded), one of us (JCM) encountered a large adult *D. melanurus* (TL ≥ 2,000 mm) consuming eggs from beneath incubating domestic chickens at GHF. The snakes made no attempt to consume the chickens, even pushing their heads beneath the bird to access the clutch.

Our observations are some of the few documenting the consumption of birds by *D. melanurus* (see also Lazcano et al., 2005). Furthermore, the prevalence of mammals among the fecal samples and gut contents we examined (three of five snakes; 60%) suggest these prey are important in the diet of *D. melanurus*. In addition to mammals, other reported prey includes anurans (Henderson and Hoevers, 1977; Leary and Razafindratsita, 1998), hatchling tortoises (Lazcano et al., 2005), lizards (Lee, 1996; Lazcano et al., 2005), snakes (Stuart, 1948; Duellman, 1963; Greene, 1975; Daza-R., 2005; Hernández-Ríos et al., 2013; García-Padilla, 2015), and fish (McCranie, 2011). On occasion, *D. melanurus* is known to consume smaller conspecifics (McCranie, 2011).

***Drymobius margaritiferus* (Speckled Racer).** On 2 July 1994, an adult (TL ca. 600 mm) was observed swallowing an *Incilius valliceps* in a wetland at GBR. On 8 April 1997, an adult (TL ca. 800 mm) was observed making two attempts to capture ranid frogs along the margins of a pond at Mile 30 on the Western Highway. In both instances, the snake moved rapidly toward the motionless frogs and once within range halted and struck at the prey. Neither attempt proved successful, as both frogs quickly retreated onto land. Rather than pursue the frogs, the snake continued moving along the pond margin, presumably in search of other potential prey. On 19 July 1997, a large adult

(TL ca. 1,200 mm) was observed swallowing an unidentified anuran at LOL. On 24 February 1998, an adult (TL = 844 mm; SVL = 555 mm; body mass = 71 g; CUSC 1595) was captured in a snap trap set for small mammals and baited with mixture of peanut butter and oatmeal. The snake triggered the trap when its head depressed the treadle. Although this capture might have been accidental, we speculate the snake likely was attracted by the persistent odor of rodents trapped on preceding days. On 11 November 2002, an adult was observed consuming a *Smilisca baudinii* at GHF. Our observations complement previously published accounts, which indicate anurans are the principal prey of *D. margaritiferus* (Stuart, 1935; Duellman, 1963; Henderson and Hoevers, 1977; Seib, 1984; Lee, 1996; Tellez and Chenot-Rose, 2010; Rodríguez-Canseco et al., 2015). Seib (1984) also recovered a lizard (*Ameiva undulata* [= *Holcosus undulatus*]), reptile eggs, and a neonate rodent from *D. margaritiferus.*

Leptophis ahaetulla **(Green Parrot Snake).** On 31 August 1998, an adult (TL ca. 1,500 mm) was observed swallowing an unidentified hylid frog in a low tree at LOL. When first noticed, the frog was being held midbody by the snake and uttering distress vocalizations; the snake then rapidly repositioned the frog and swallowed it head first. Anurans appear to be the most frequently reported prey of *L. ahaetulla* (Oliver 1948; López et al., 2003; de Albuquerque et al., 2007; Cabrera-Guzmán and Villanueva, 2009; Solé et al., 2010; D'Assunção et al., 2014; de Oliveira et al., 2014), although salamanders (de Albuquerque et al., 2007), lizards (Sexton and Heatwole, 1965; de Albuquerque et al., 2007; Muniz et al., 2013), and birds and their eggs (López et al., 2003; Ribeiro et al., 2014) also are consumed.

Leptophis mexicanus **(Mexican Parrot Snake).** On 23 February 1998, an adult (TL ca. 900 mm) was observed consuming a *Trachycephalus typhonius* at Monkey Bay Wildlife Sanctuary (Mile 32, Western Highway, Cayo District). When we chanced upon the snake, it was ingesting the frog posterior-end first and already had swallowed the rear legs. The frog was secreting copious amounts of integumentary mucous as it was being ingested. Approximately 5 min elapsed before the snake completely swallowed the frog, and we estimated the total handling time about 10 min. After ingesting the frog, the head and mandibles of the snake were caked with a thick layer of mucous, which it attempted to remove by wiping its head vigorously across the substrate (gravel pathway). Before the mucous was completely removed, the snake appeared to become aware of our presence and moved rapidly into high grass. On 26 June 1998, an adult (TL ca. 950 mm) was observed swallowing a *T. typhonius* at LOL. The frog was uttering distress vocalizations (which attracted our attention) and was released by the snake upon our approach. On 11 August 1998, an adult (TL ca. 900 mm) was observed swallowing a *T. typhonius* in a low shrub at LOL. As in our previous observation, the frog was uttering distress vocalizations and released by the snake as we neared. On 2 September 1998, workers at LOL killed an adult (TL = 1,120 mm; SVL = 700 mm); the stomach contained a partially digested anuran. On 20 October 2007, an adult was observed swallowing a *Smilisca baudinii* at GHF. On 17 August 2012, an adult (TL ca. 1,200 mm) on Calabash Cay, Turneffe Atoll, was observed swallowing a neonate *Ctenosaura similis* posterior-end first.

According to Stafford and Meyer (2000), on mainland Belize *L. mexicanus* feeds exclusively on anurans, but on offshore cays where anurans usually are absent (e.g., Platt et al., 1999) the diet consists of lizards. Squamates, however, have been found in the diet of *L. mexicanus* on the mainland (Henderson, 1976; Henderson and Hoevers, 1977), suggesting a greater degree of dietary plasticity than recognized by Stafford and Meyer (2000). Nonetheless, published accounts leave little doubt that anurans are a major component of the diet (Stuart, 1935; Oliver, 1948; Duellman, 1963; Henderson and Hoevers, 1977; Henderson et al., 1977, Henderson, 1982). A salamander (*Bolitoglossa rufescens*) and bird eggs also have been found among the stomach contents of *L. mexicanus* (Stuart, 1935; Meyer, 1966; Henderson, 1982).

Mastigodryas melanolomus **(Lizard Eater).** McCranie (2011) resurrected *Mastigodryas alternatus* (Bocourt) from the synonymy of *M. melanolomus*, and thus the population from eastern Honduras southward no longer applies to this species. On 4 March 1998, the large intestine of a DOR female (TL = 786 mm; SVL = 583 mm; body mass = 55.0 g; CUSC 1605) found at Mile 34 on the Western Highway contained grasshopper (Caelifera) remains. This observation appears to be the first documenting the consumption of insects by *D. melanolomus*. On 23 July 1998, an adult (TL ca. 1,200 mm) was encountered at LOL swallowing a *Holcosus undulatus*, which it released upon our approach. On 8 August 1998, an adult (TL ca. 1,200 mm) was observed at LOL swallowing an unidentified anuran; this observation occurred within 3 m of our previous (23 July 1998) encounter. Given the proximity and similarity in body size, both observations probably are attributable to the same snake. On 19 February 2005, the stomach of a juvenile (TL = 400 mm) found dead at GHF contained a *Sceloporus chrysostictus*; the stomach wall was ruptured by the prey item, which probably caused the death of the snake. Previous reports (Stuart, 1948; Seib, 1984; Lee, 1996) suggested that lizards (*Ameiva undulata* [= *H. undulatus*], *Anolis* [= *Norops*] *limifrons*, *Anolis* [= *Norops*] spp., *Cnemidophorus* [= *Aspidoscelis*] *angusticeps*, *Sceloporus teapensis*, *Sphenomorphus* [= *Scincella*] *incerta*) comprise the bulk of the diet of this species, leading Stafford and Meyer (2000) to conclude that *M. melanolomus* largely is saurophagus. Reptile eggs (Seib, 1984) and small mammals (Seib, 1984) also have been recovered from *M. melanolomus*.

***Spilotes pullatus* (Tiger Ratsnake).** On 30 July 1997, an adult (TL ca. 2,000 mm) was observed swallowing an unidentified rodent in the crown of a Cohune Palm (*Attalea cohune*) at LOL. On 14 August 2000, the stomach of an adult male (TL = 1,990 mm; SVL = 1,405 mm; CUSC 2112) killed by agricultural workers in Indian Church Village contained an unidentified rodent (TL = 225 mm; mass = 52 g). Despite being a large, conspicuous, and fairly common snake, surprisingly little is known regarding the diet of *S. pullatus* (Köhler and Seipp, 1999). The few available reports suggest the diet is largely comprised of small mammals (Sexton and Heatwole, 1965; Henderson and Hoevers, 1977; Köhler and Seipp, 1999; de Mendonça et al., 2011), including chiropterans (de Mendonça et al., 2011), although it also has been reported to feed on birds and their eggs, and lizards (Cadle and Greene, 1993; Solórzano, 2004); da Silva et al. (2013) also described an unsuccessful predation attempt on the eggs of a Rufous-bellied Thrush (*Turdus rufiventris*).

***Tantillita canula* (Yucatan Dwarf Short-tailed Snake).** On 16 July 1997, an adult (TL = 205 mm; SVL = 153 mm) was found crossing a road at Lamanai Archaeological Site; the stomach contained fragments of beetle elytra. On 8 August 1998, an adult (partial specimen = 92 mm; CUSC 2062) was recovered after being killed by a mechanical excavator at LOL; the stomach contained the leg and head of a cockroach (Blattodea), the abdomen of a caterpillar (Lepidoptera), and other unidentified chitinous remains. On 3 September 1998, a DOR adult (TL = 205 mm; SVL = 153 mm) was found at LOL; the stomach contained chitinous remains of insects. To our knowledge, these observations are the only dietary accounts available for *T. canula*. Little is known about the natural history of *T. canula* (Lee, 1996). Stafford and Meyer (2000) speculated that its diet largely is composed of soft-bodied invertebrates.

***Tantillita lintoni* (Linton's Dwarf Short-tailed Snake).** On 15 August 1997, an adult (TL = 173 mm; SVL = 124 mm; CUSC 1613; Platt et al., 2000) was found in secondary forest ca. 3 km NW of Bladen Nature Reserve Headquarters (Toledo District). Chitinous remains were recovered from the distal-most end of intestinal tract. See comments for *T. canula*.

Family Dipsadidae

***Amastridium sapperi* (Rusty-headed Snake).** On 25 October 2015, an adult (TL ca. 750 mm) on the ground was observed consuming a large *Lepidophyma favimaculata* in a commercial butterfly house at GHF; *L. favimaculata* is an abundant species at GHF, occurring in burrows and beneath ground debris in the butterfly house. Little information is available on the natural history of *A. sapperi*, including its diet (Lee, 1996). Our observation is the first report of saurophagy in this species. Other prey items recovered from *A. sapperi* include *Eleutherodactylus* spp. (Martin, 1955), a small, unidentified frog (Lee, 1996), and snake teeth (Lara-Tufiño et al., 2014).

***Coniophanes imperialis* (Garden Snake).** On 12 July 2000, an adult (TL ca. 45 mm) captured at LOL regurgitated an anuran (*Hypopachus variolosus*; SVL = 40 mm). This observation represents a hitherto unreported, but not altogether unexpected prey item given that Lee (1996) observed *C. imperialis* swallowing a *Scinax staufferi*, and other anurans reported in the diet include *Acris crepitans*, *Eleutherodactylus cystignathoides*, *Gastrophryne olivacea*, *Hyla microcephala* [= *Dendrosophus microcephalus*], *Incilius nebulifer*, *Leptodactylus fragilis*, and *Phrynohyas venulosa* [= *Trachycephalus typhonius*] (Campbell, 1998; Lemos-Espinal and Dixon, 2013). Additional items found in the diet include earthworms (Köhler, 2003), insects (Henderson and Hoevers, 1977), salamanders (Köhler, 2003), an adult *Norops lemurinus* and its eggs (Frazier et al., 2007), *Typhylops* [= *Amerotyphlops*] *microstomus* (Campbell, 1998), and bird eggs (Köhler, 2003).

***Coniophanes schmidti* (Garden Snake).** On 28 December 1997, a small, white, hard-shelled egg (diameter = 20 mm; most likely from a cavity-nesting bird) was forced from the stomach of an adult (TL = 581 mm; SVL = 447 mm) captured at LOL. While palpating the snake, at 1415 h SGP was bitten on the left thumb; two puncture wounds were visible, and profuse bleeding immediately followed the bite. Painful swelling developed within 10 min, and by 30 min post-bite the thumb was swollen, rigid, and could not be flexed. By 1650 h the pain had lessened and the digit could be flexed, and 24 hours later SGP had regained full use of the digit, although swelling and pain persisted for several days. On 24 June 2000, an adult was observed consuming an *Incilius valliceps* at GHF. Although Lee (1996) speculated that anurans and lizards are important prey, except for our observations nothing specific is known about the diet of *C. schmidti*. *Coniophanes schmidti* is opisthoglyphous, although presumed harmless to humans (Stafford and Meyer, 2000). Our report apparently is the first documented case of human envenomating by *C. schmidti*.

***Leptodeira septentrionalis* (Central American Cat-eyed Snake).** On 18 August 2005, an adult (TL ca. 800 mm) was seen consuming a *Smilisca baudinii* at GHF. On 15 June 2006, an adult (TL ca. 600 mm) was observed eating an *Agalychnis callidryas* at GHF. On 17 October 2014, an adult (TL ca. 700 mm) was found consuming an egg mass of *A. callidryas* at GHF (see cover of this issue). Similarly, *L. septentrionalis* is known to consume the eggs of *Hyla ebraccata* [= *Dendrosophus ebraccatus*] (Savage, 2002). Most reports suggest anurans are the dietary mainstay of *L. septentrionalis*; those reported in the diet include *Agalychnis callidryas*, *A. moreletii*, *Craugastor loki*, *Hyla* [= *Scinax*] *staufferi*, *Hyla* [= *Tlalocohyla*] *loquax*, *I. valliceps*, *Leptodactylus bolivianus* [= *insularum*], *Rhaebo haematiticus*, and *Smilisca baudinii* (Schmidt and Andrews, 1936; Stuart, 1948; Duellman, 1963; Henderson and Hoevers, 1977; Lee, 1996; Cabrera-Guzmán et al., 2009; Dehling, 2009; Arias et al., 2015; Engeman and Engeman, 2015). Non-anuran prey consumed by *L. septentrionalis* includes *Elaphe flavirufa* (Lee, 1996), and unspecified lizards (Allen and Neill, 1959). In captivity, Ditmars (1939: 238) stated that *L. septentrionalis* "preferred" small lizards, but would also accept small frogs and young mice.

Family Viperidae

***Bothrops asper* (Fer-de-lance).** On 30 November 1994, a juvenile (TL ca. 400 mm) was observed swallowing a *Sceloporus chrysostictus* at Pooks Hill (Cayo District). The feces of a juvenile (TL ca. 760 mm) captured near the intersection of San Felipe and New Hope roads in Orange Walk District on 1 September 1998 contained unidentified mammal hair. On 30 September 1999, a DOR adult female (TL = 951 mm; SVL = 799 mm) was found on the road between LOL and San Carlos Village, Orange Walk District; its stomach contained a partially digested rodent. On 2 May 2005, a juvenile (TL ca. 400 mm) was observed consuming a *Lepidophyma flavimaculatum* at GHF. On 28 March 2009, the stomach of a juvenile (TL = 405 mm; SVL = 350 mm; CUSC 4209) killed by workmen at GHF contained a partially digested *Cryptotis* sp. (probably *C. parva*). The stomach of an adult (TL = 800 mm) killed by workmen at GHF on 28 March 2009 contained a decomposing *Ototylomys phyllotis*; the condition of carcass suggested the rodent was consumed as carrion.

An unidentified small mammal is the only previous dietary record for *B. asper* in Belize (Henderson and Hoevers, 1977). Our record of *Cryptotis* sp. is the first shrew (Soricidae) reported in the diet of *B. asper* from anywhere within its extensive geographic range (Sasa et al., 2009). Sasa et al. (2009) provided an exhaustive review of dietary records, and concluded that *B. asper* exhibits extreme plasticity in the use of prey resources; the most important prey are rodents, birds, and anurans, with centipedes, lizards, snakes, and fish constituting a lesser but important component of the diet, especially for juveniles. Dietary records published post-Sasa et al. (2009) include a fish, an amphisbaenian, and a bird found among stomach contents (Hertz et al., 2009), and observations of *B. asper* capturing a bird (Moody, 2015) and lizard (Urbina-Cardona, 2009), and scavenging an anuran carcass (Logan and Montero, 2009).

***Crotalus tzabcan* (Yucatan Rattlesnake).** Campbell and Lamar (2004) split *Crotalus durissus* into three species (*durissus* [South America], *simus* [Mexico and Central America), and *totonacus* [northeastern Mexico], and regarded *culminatus* (southwestern Mexico) and *tzabcan* (Yucatan Peninsula) as subspecies of *C. simus*. Campbell and Lamar (2004) further noted that isolated populations in northern Guatemala and Belize showed morphological characteristics intermediate between *C. s. simus* and *C s. tzabcan*. Wüster et al. (2005) indicated that *C. simus* (*sensu*

Campbell and Lamar, 2004) is paraphyletic and highly heterogeneous, and that *culminatus* and *tzabcan* form highly distinctive clades that are morphologically distinct, and considered these taxa as separate evolutionary species. Wüster et al (2005), however, recognized the need for additional work on the status of these species. Until additional molecular work is accomplished, we tentatively regard *C. tzabcan* as the species occurring in Belize.

On 21 September 1999, a DOR adult male (TL = 1,530 mm, but missing rattle; SVL = 1,300 mm) was found on the Orange Walk to San Felipe Road at GBR; the stomach contained partially digested remains of a rodent swallowed headfirst. According to Lee (1996), little information is available on the diet of *C. durissus* [= *C. tzabcan*] in the Yucatan Peninsula. Klauber (1956) found mammal remains in the stomachs of 13 specimens from the Yucatan, and noted that captives readily accept mice and rats. A partially digested *Sigmodon hispidus* was recovered from the stomach of a DOR *C. durissus* [= *C. tzabcan*] by Platt and Rainwater (1998).

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DISTRIBUTION NOTES

Amphibia: Anura

Family: Centrolinidae

***Hyalinobatrachium fleischmanni* (Boettger, 1893).** HONDURAS: COLÓN: Municipio de Trujillo, Parque Nacional Capiro y Calentura (15°52'44"N, 85°57'16.50"W; WGS 84); elev. 889 m; 3 December 2011; José Mario Solís. Several males were heard calling from palm trees and other trees along a stream, perched at a height of 3–4 m above the ground. One adult male was photographed, and a voucher is deposited at the University of Texas at Arlington Digital Collection (UTADC-8639; Fig. 1A). This population represents a new departmental record and a range extension for this species, with the closest known locality ca. 79.4 km at Montaña El Corozal, in the department of Atlántida (McCranie and Wilson, 2002; McCranie and Castañeda, 2007).

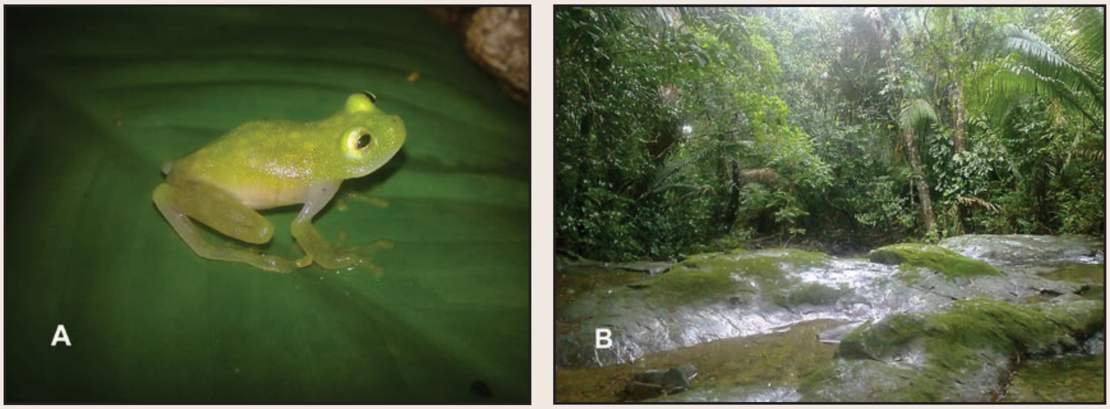

Fig. 1. (A) A male *Hyalinobatrachium fleischmanni* (UTADC-8639) from Parque Nacional Capiro y Calentura, Municipio de Trujillo, Departamento de Colón, Honduras; and (B) the vegetation in Parque Nacional Capiro y Calentura (elev. 889 m) where *H. fleishmanni* were observed.

📷 © José M. Solís

Acknowledgments.—I thank FUCAGUA for their support, and Carl J. Franklin for providing the photo voucher number. I also am indebted to Carlos O'Reilly, German Sandoval, and David Medina for their company during the fieldwork.

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Family Craugastoridae

***Craugastor yucatanensis* (Lynch, 1965).** MEXICO: YUCATÁN: Municipio de Opichén, Calcehtok, (20°32'59.01"N, -89°54'57.41"W; WGS 84), elev. 60 m; 31 July 2015; Javier A. Ortiz-Medina and Daniel E. Chan-Espinoza. Three individuals were found at 1730 h, inside crevices in a cave called "Grutas de Calcehtok." The surrounding habitat is characterized by rocky outcrops surrounded by a combination tropical deciduous forest and secondary vegetation. We deposited a photograph of one of the frogs at the University of Texas at El Paso Biodiversity Digital Collection (Photo Voucher UTEP G-2016.6; Fig. 1); this voucher represents a new municipality record and a range extension of ca. 77 km (airline distance) NE from the nearest locality in a cave named Cueva de Actun Sabaca, located ca. 6 km S of Tekax (Lee, 1996; as Cueva de Sabaca Teca).

Fig. 1. A *Craugastor yucatanensis* (UTEP G-2016.6) from Grutas de Calcehtok, Municipio de Opichén, Yucatán, Mexico.
© Javier A. Ortiz-Medina

Acknowledgments.—A special thanks to Alejandro Cámara-Cortazar for field assistance. Arthur Harris kindly provided the photo voucher number.

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Family: Eleutherodactylidae

***Eleutherodactylus planirostris* (Cope, 1862).** MEXICO: QUINTANA ROO: Municipio de Benito Juárez, Cancun (21. 15741°N, -86.83995°W; WGS 84); elev. 11m. On 30 November 2015 between 2300 and 2400 h, Christian M. García-Balderas found numerous non-native Greenhouse Frogs, *Eleutherodactylus planirostris*, active among leaf litter and grass in an urban garden (Fig. 1). A total of 25 individuals were collected: four adults ($\bar{x}$ = 23.2 mm snout–vent length [SVL], SD = 3.2), eight juveniles ($\bar{x}$ = 16.3 mm SVL, SD = 1.0), and 13 froglets ($\bar{x}$ = 10.3 mm SVL, SD = 1.7). The specimens were deposited in the herpetological collection of El Colegio de la Frontera Sur, Unidad Chetumal (ECO-CH-H3630-3655, Amphibian Collection record number QNR.AN.033.0697). These specimens represent the presence of an established population in the city of Cancun, as well as the second known introduction of this species in the Mexican Caribbean; recently Cedeño-Vázquez et al. (2014) reported the presence of a population in the urban area of Playa del Carmen, Municipio de Solidaridad, Quintana Roo, ca. 63.1 km SW of Cancun. Urgent studies are needed to investigate the possible ecological impact of these new introductions.

Fig. 1. An individual of *Eleutherodactylus planirostris* observed in an urban garden in the city of Cancun.

📷 © Christian M. García-Balderas

***Acknowledgments*.**—We thank Elizabeth Arista de la Rosa for field assistance, and Steven G. Platt for comments that improved the manuscript.

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Family Hylidae

***Ecnomiohyla miotympanum* (Cope, 1863).** MEXICO: PUEBLA: Municipio de Acateno, Paso de las Catrinas (20.128895ºN, -97.221213ºW; WGS 84) elev. 128 m; 31 December 2015; José Carlos Iturbe-Morgado. The frog was found calling on a leaf at night in riparian vegetation along the Río Solteros. A photo voucher (CH-CIB 52; 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 known locality ca. 24.1 km WSW (airline distance) near the vicinity of Xaltzinta, Municipio de Cuetzalan del Progreso, Puebla (Gutiérrez-Mayén, 2000).

Fig. 1. *Ecnomiohyla miotympanum* (CH-CIB 52) from Paso de las Catrinas, Municipio de Acateno, Puebla, Mexico.
📷 © José Carlos Iturbe-Morgado

Acknowledgments.—We thank Leonardo Fernández-Badillo for field assistance, and Irene Goyenechea for providing the photo voucher number.

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Family Hylidae

***Hyla arenicolor* (Cope, 1886).** MEXICO: SAN LUIS POTOSÍ: Peñón Blanco, Salinas Hidalgo, Municipio de Salinas Hidalgo (22°35'5.94"N, -101°39'52.85"W; WGS 84), elev. ca. 2,200 m; 1 October 2007; Emiliano Méndez-Salinas. The frog was found active early in the morning, in an area surrounded by Chihuahuan Desert Scrub. A photo voucher of this individual is deposited at the University of Texas at El Paso Biodiversity Digital Collection (UTEP G-2015.16; Fig. 1); it represents a new municipality record, with the closest known locality ca. 22 km to the S near the vicinity of Guadalupe de los Pozos, Zacatecas (UTEP-H-8190; locality listed as 6 mi [9.6 km] NNW of Pinos [www.vernet.org; accessed 10 December 2015]).

***Acknowledgments*.**—A special thanks to Emiliano Méndez-Salinas for field assistance and providing the photograph of the animal. Arthur Harris kindly provided the photo voucher number.

Fig. 1. A *Hyla arenicolor* (UTEP G-2015.16) from Peñón Blanco, Salinas Hidalgo, Municipio de Salinas Hidalgo, San Luis Potosí, Mexico. 📷 © Emiliano Méndez-Salinas

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Family: Microhylidae

***Gastrophryne elegans* (Boulenger, 1882).** MEXICO: QUINTANA ROO: Municipio de Bacalar, Rancho Santa Lupita (18°46'8.08"N, 88°31'25.07"W; datum WGS 84); elev. 30 m; 17 January 2016; Pablo M. Beutelspacher-García. A specimen (snout–vent lenght = 20 mm) is deposited at the Herpetological Collection of El Colegio de la Frontera Sur, Unidad Chetumal (ECO-CH-H3666, Amphibian Collection record number: QNR.AN.033.0697). The frog was found resting during the day (1020 h) on humid leaf litter along the edge of a banana plantation. This locality represents a new municipality record, and the second record for southern Quintana Roo. This record fills a distributional gap between the two closest reported localities, ca. 65 km SW (airline distance) of a site noted as "ca. 50 km S and 15 km E of Felipe Carrillo Puerto," Quintana Roo, Mexico, by Calderón-Mandujano and Mora-Tembre (2004), and ca. 72 km NE of Albion Island, Orange Walk District, Belize (at the Mexican border bounded by branches of the Río Hondo) (Lee, 1996). According to the distribution maps included in Lee (1996, 2000), and Köhler (2011), this record suggests a continuous distribution for this species in southern Quintana Roo.

***Acknowledgments*.**—We thank Pablo Roberto Salazar-Gómez (owner of Rancho Santa Lupita) for allowing PMBG access to his land, and to Vicente Mata-Silva for comments that improved the manuscript. The collecting permit (SGPA/DGVS/02570/15) was issued by SEMARNAT to Fausto R. Méndez de la Cruz (Instituto de Biología, UNAM), with an extension to JRCV.

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Reptilia: Squamata (lizards)

Family Anguidae

***Abronia mixteca* Bogert and Porter, 1967.** MEXICO: OAXACA: Municipio de San Pedro Tidaá, San Pedro Tidaá (17°20'4.12"N; 97°23'36.1"W; WGS 84), elev. 2,465 m; 20 October 2011; Ciro Rodríguez-Pérez. This lizard (UTEP G-2016.1; Fig.1) was found in pine-oak forest. A second individual (UTEP G-2016.2; Fig. 2), also was found in pine oak forest at Municipio de San Miguel El Grande, San Miguel El Grande (17°3'14.09"N; 97°37'31.29"W) elev. 2,530 m; 5 December 2015; Diana Gabriela Lope-Alzina. Local villagers killed this lizard because of the erroneous belief that this species is venomous and represents a threat to humans. Photographs of both individuals are deposited at the University of Texas at El Paso Biodiversity Digital Collection. Each voucher represents a new municipality record, extending the distributional range ca. 40 km W and 70 km SW, respectively, from the closest known locality in the vicinity of Tejocotes, Municipio de Santiago Tenango (see Bogert and Porter, 1967; Martín-Regalado et al., 2012).

Fig. 1. An *Abronia mixteca* (UTEP G-2016.1) from San Pedro Tidaá, Oaxaca, Mexico.

📷 © Ciro Rodríguez-Pérez

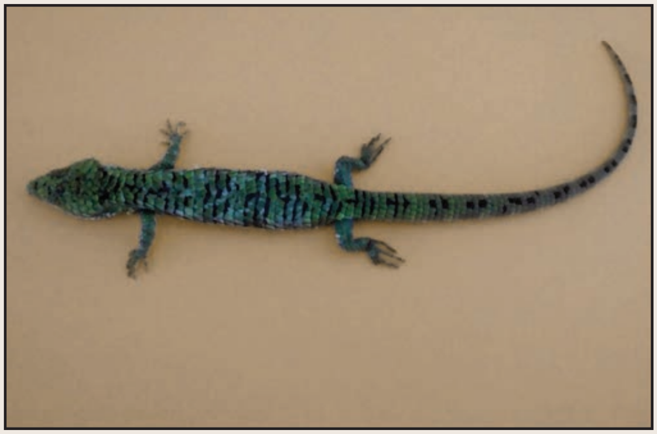

Fig. 2. An *Abronia mixteca* (UTEP G-2016.2) killed by a villager at San Miguel El Grande, Oaxaca, Mexico.

📷 © Diana Gabriela Lope-Alzina

Acknowledgments.—A special thanks to Hermogénes Cruz-Aparicio and his seven-year-old daughter, Nayle, who reside in the Mixtecan highlands, and to biologist Israel Pérez-España for his efforts to save the injured lizard. Arthur Harris kindly provided the photo voucher numbers.

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Family Anguidae

***Abronia mixteca* Bogert and Porter, 1967.** MEXICO: OAXACA: Municipio de Santo Domingo Yanhuitlán, Cruz de Tabla (17°33'13.02"N, -97°20'54.06"W; WGS 84), elev. 2,440 m; 22 April 2012; Clarita Alicia Ibarra-Contreras. The individual was found in oak-forest, in a crevice (Fig. 1) of an oak tree (*Quercus laurina*) covered with bromeliads (*Tillandsia usneoides*). A photo voucher (UTEP G-2016.3) is deposited at the University of Texas at El Paso Biodiversity Digital Collection, which represents a new municipality record that fills a gap between the closest localities, ca. 40 km NW (airline distance) near the vicinity of Yosocuno (Canseco-Márquez and Gutiérrez-Mayén, 2010), and ca. 50 km SE (airline distance) at the type locality of Tejocotes, Municipio de Santiago Tenango (Bogert and Porter, 1967).

Fig. 1. An *Abronia mixteca* (UTEP G-2016.3) from Cruz de Tabla, Municipio de Santo Domingo Yanhuitlán, Oaxaca, Mexico.
📷 © Clarita Alicia Ibarra-Contreras

Acknowledgments.—A special thanks to Leoncio Paz-Cruz for field assistance. Arthur Harris kindly provided the photo voucher number.

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Anelytropsis papillosus Cope, 1885 (Squamata: Dibamidae), an overlooked species in the state of Oaxaca, Mexico

The family Dibamidae is comprised of legless lizards distributed in Mexico, Vietnam, Malaysia, the Philippine Islands, islands of the Sunda Shelf, and New Guinea (Pough et al., 2004). In Mexico, this family is represented by a single species, *Anelytropsis papillosus*. This rare burrowing lizard is small (200–500 mm in total length), limbless, contains vestigial eyes covered with a scale, and lacks external ears openings (Campbell, 1974); small, flaplike hind limbs, however, are present in males, and females are limbless (Pough et al., 2004) (see detailed description in Cope, 1885, 1900; Smith, 1935; Axtell, 1958). Due to the lizard's fossorial habits, little is known about its ecology, including its geographic distribution. This endemic lizard has been reported from central Veracruz (Cope, 1885, 1900; Gadow, 1905), eastern San Luis Potosí (Smith, 1935; Campbell, 1974), southwestern Tamaulipas (Axtell, 1958; Farr et al., 2007; García-Padilla and Farr, 2010), northeastern Querétaro (Campbell, 1974; Thomas, 1974), and Hidalgo (Zaldivar-Riverón et al., 2008) (Fig.1). Because of its ecological versatility, Campbell (1974) expected its geographic distribution to increase farther westward in the states of Hidalgo and Nuevo León, and Axtell (1958) speculated the likely presence of the species as far south as northeastern Oaxaca.

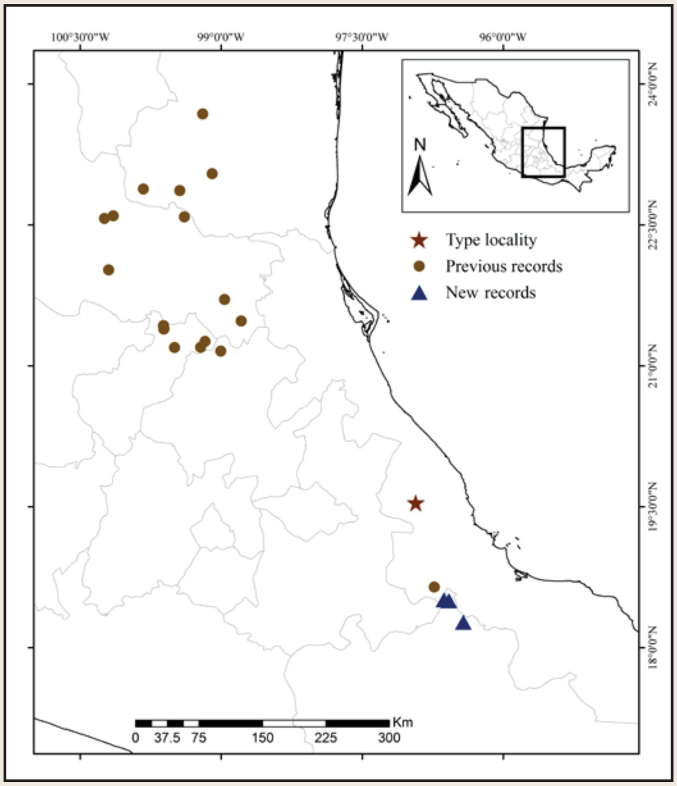

Fig. 1. Distribution of *Anelytropsis papillosus* show-ing the previous records, the type locality, and the new records from the state of Oaxaca, Mexico.

While examining the distribution of legless lizards in Mexico, one of us (JVV) became aware of the existence of three specimens of *A. papillosus* that were collected in northern Oaxaca over two decades ago (Fig. 1). Surprisingly, these specimens remained unreported in the literature, although they were deposited at the Florida Museum of Natural History of the University of Florida. Steven Christman found the first specimen (UF 86705; Fig. 2) on 11 January 1990, under a log on limestone mountain ridge 4.0 km NW of Temascal (= San Miguel Soyaltepec), as well as the second specimen (UF 86706; Fig. 3) on 12 January 1990, 4.0 km SW of Acatlán (= Acatlán de Pérez Figueroa) (microhabitat information not available); Fred Thompson collected the third specimen (UF 86707; Fig. 4) in a limestone ridge on 22 October 1992, 1.0 km SW of Aserradero (= El Aserradero). Thus, these specimens represent the first reports of the species for the state of Oaxaca, and extend the geographic distribution of this species ca. 17.0 (record near Acatlán), 22.0 (record near Aserradero), and 55.0 (record near Temascal) km E from the closest reported locality in Motzorongo, Veracruz (Gadow, 1905). These three localities lie in the Planicie Costera del Golfo (PCG) physiographic province of Oaxaca (Mata-Silva et al., 2015).

With respect to the conservation status of *A. papillosus*, the IUCN system (Canseco-Márquez et al., 2007) regards this species as Least Concern, the SEMARNAT system (2010) as threatened, and the EVS system placed this species in the medium vulnerability category (score = 10) (Wilson et al., 2013). Nonetheless, we believe that the conservation status of *A. papillosus* is subject to change as more specimens are found and more information on the distribution and natural history of this species becomes available.

Acknowledgments.—A special thanks goes to Max A. Nickerson and Kenneth L. Krysko from the Florida Museum of Natural History, University of Florida, who kindly provided the data and photographs of the specimens; and to Aurelio Ramírez-Bautista for verifying the identification of the species. We also thank Anny Peralta-García for constructing the distribution map.

Fig. 2. *Anelytropsis papillosus* (UF 86705) from Temascal (= San Miguel Soyaltepec), Municipio de San Miguel Soyaltepec, Oaxaca, Mexico. 📷 © Kenneth L. Krysko

Fig. 3. *Anelytropsis papillosus* (UF 86706) from Acatlán de Pérez Figueroa, Municipio de Acatlán de Pérez Figueroa, Oaxaca, Mexico. 📷 © Kenneth L. Krysko

Fig. 4. *Anelytropsis papillosus* (UF 86707) from Aserradero, Municipio de Acatlán de Pérez Figueroa Oaxaca. 📷 © Kenneth L. Krysko

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Family Gekkonoidae

***Hemidactylus frenatus* Duméril & Bibron, 1836.** MEXICO: ZACATECAS: Municipio de Valparaiso, Valparaiso (22.769760°N, -103.567070°W; WGS 84); elev. 1,886 m; 21 October 2015; Jorge A. Bañuelos-Alamillo and Ilse Yasareth Trujillo de la Torre. The lizard was found on the wall of a building. A photo voucher is deposited at the San Diego Natural History Museum (SDSNH_HerpPC_05302; Fig. 1). This exotic lizard represents a new state record for Zacatecas, extending the distribution ca. 163.5 km (airline) NW from closest known locality in Aguascalientes, Aguascalientes (Quintero-Díaz et al., 2008).

Acknowledgments.—We thank Bradford Hollingsworth for providing the photo voucher number.

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Fig. 1. A *Hemidactylus frenatus* (SDSNH_HerpPC_05302) observed in Municipio de Valaparaiso, Zacatecas, Mexico.
© Jorge A. Bañuelos Alamillo

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Family Gekkonidae

***Lepidodactylus lugubris* (Duméril & Bibron, 1836)**. PANAMA: PROVINCIA DE BOCAS DEL TORO: Parque Nacional Marino Isla Bastimentos (9.315°N, 82.156°W; WGS 84); elev. 9 m; 12 November 2004; David Hegner. A photo voucher of this individual is deposited at the University of Texas at Arlington Digital Collection (UTADC-8629; Fig. 1A). The single individual of this introduced species was found active at night (ca. 1900 h) on the wall of old wooden house, a few meters away from primary lowland wet forest. The vicinity of the finding was anthropogenically modified, and several other wooden houses were present close to the bay at Bahía Honda (Fig. 1B), near the mangrove forest. This locality represents the first confirmation of this species from Isla Bastimentos, as previous information was unverified (see Sosa-Bartuano and Ramos-Reyes, 2015).

Hoogmoed and Avila-Pires (2015) provided a review of the distribution of *Lepidodactylus lugibris* in the New World, and for Panama included records from the literature and six localities for specimens from the province of Bocas del Toro in museum collections in the United States. The closest locality in Bocas del Toro is ca. 7 km from our record (Lotzkat, 2010), and thus the presence of this species on Isla Bastimentos was not surprising. Jiménez and Abarca (2015) provided several records for the closest localities in Costa Rica, from the province of Limón.

Fig. 1. (A) An individual of *Lepidodactylus lugubris* (UTADC-8629) from Isla Bastimentos, Provincia de Bocas del Toro, Panama; and (B) the location where it was found. 📷 © David Hegner

Acknowledgments.—We thank Carl J. Franklin for providing the photo voucher number.

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Family: Iguanidae

***Iguana iguana* (Linnaeus, 1758).** Lee (1996: 210) noted the distribution of the wide-ranging Green Iguana (*Iguana iguana*) in the Yucatan Peninsula as "from southwestern Campeche, eastern Tabasco, and El Petén to Belize," and documented specimens from Isla Cozumel, Quintana Roo, Mexico. Although Lee (1996; 2000) indicated the range of *I. iguana* in extreme southern Quintana Roo, near the Belize border, no specimens or specific localities were specified. Charruau et al. (2015) reported the presence of *I. iguana* on the Banco Chinchorro atoll, off the southeastern coast of Quintana Roo, near Belize. In this note I report three specimens of *I. iguana* from Quintana Roo that were collected and deposited in the herpetological collection of El Colegio de la Frontera Sur, Unidad Chetumal (Reptile Collection record number: QNR.RE.034.0697).

On 24 November 1992, Humberto Bahena Basave (HBB) collected an adult female (ECO-CH-H0169; snout–vent length [SVL] = 320 mm), 4 km NE of La Unión, along the Río Hondo at the Belizean border, Municipio de Othón P. Blanco (17°54'22"N, 88°51'19"W); elev. 9 m. The following day, HBB collected an adult male (ECO-CH-H0170; SVL = 465 mm), 4.5 km NE of La Unión, also along the Río Hondo and in the same municipality (17°54'35"N, 88°51'15"W); elev. 5 m. Recently, on 27 March 2015, Dariel A. Correa collected a juvenile (ECO-CH-H3451; SVL = 175 mm) in Chetumal, at El Colegio de la Frontera Sur, Municipio de Othón P. Blanco (18°32'36"N, 88°15'47"W); elev. 15 m. These three specimens represent new records for this municipality, and the first verified records for mainland Quintana Roo. These records extend the range of the species ca. 39 km SW and ca. 58 km NE (airline distances) from the closest known locality near Orange Walk town, Belize (Lee, 1996).

During crocodile surveys conducted along the Río Hondo (from La Unión to Chetumal) since 2002, I regularly observed juveniles and adults of *I. iguana* perching on tree branches along the Mexican and Belizan sides of the river. Additionally, during the last three years I noticed the presence of young and adult individuals (Fig. 1) at several sites in the city of Chetumal (e.g., Parque Ecológico Zazil), suggesting that the species is dispersing in disturbed areas.

Acknowledgments.—I thank N. Gabriela Blanco Campos for her help with measuring the specimens mentioned herein. Voucher ECO-CH-H3451 was obtained with collecting permit SGPA/DGVS/02570/15, issued by SEMARNAT to Fausto R. Méndez-de la Cruz (Instituto de Biología, UNAM), with an extension to JRCV.

Fig. 1. An adult male (A) and an young (B) *Iguana iguana* found at Parque Ecológico Zazil (18°30'25"N, 88°19'08"W) in the city of Chetumal, Quintana Roo, Mexico, on 30 September 2014.

📷 © J. Rogelio Cedeño-Vázquez

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Reptilia: Squamata (snakes)

Family Boidae

***Boa imperator* Daudin, 1803.** MEXICO: ZACATECAS: Municipio de Valparaiso, El Charco del Toro, ca. 13.2 km (airline) W of Huejuquilla del Alto (22.624244°N, -104.026067°W; WGS 84); elev.1,012 m; 26 April 2015; Gerardo Rojo-Carrillo and Jorge A. Bañuelos-Alamillo. The snake was found foraging in a stream, in riparian vegetation and xerophytic scrub. Photo vouchers are deposited at the San Diego Natural History Museum (SDSNH_HerpPC_05291–92; Fig. 1). This individual represents a new municipality record, extending the distribution ca. 180 km (airline) NW from closest known locality in Zacatecas, at Alameda Juárez (Santa Rosa), Moyahua de Estrada (Baker et al., 1967).

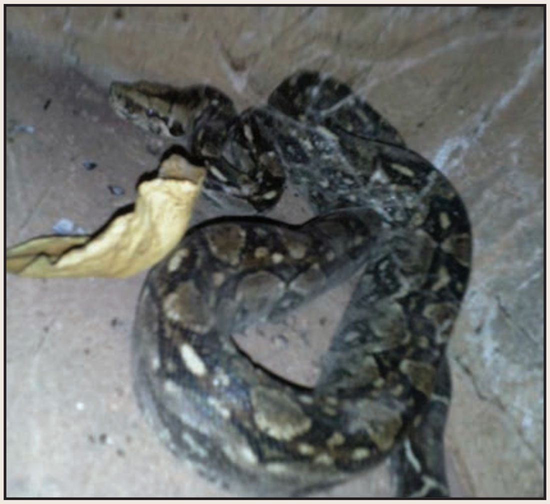

Fig. 1. A *Boa imperator* (SDSNH_HerpPC_05291) observed in Municipio de Valaparaiso, Zacatecas, Mexico.

📷 © Jorge A. Bañuelos-Alamillo

Acknowledgments.—We thank Bradford Hollingsworth for providing the photo voucher numbers.

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Family Boidae

Boa imperator **Daudin, 1803.** MEXICO: SAN LUIS POTOSÍ: Municipio de Tamasopo, Ejido San Nicolás de los Montes (22°7'22.35"N 99°25'23.58"W; WGS 84), elev. 768 m; 12 June 2007; Elí García-Padilla. The snake was found coiled resting in a patch of grass in secondary vegetation, in an area formerly consisting of tropical deciduous forest. A photograph of this individual is deposited at the University of Texas at El Paso Biodiversity Digital Collection (Photo Voucher UTEP G-2016.7). This voucher (Fig. 1) represents a new municipality record, with the closest known locality ca. 44 km ESE in the vicinity of Ciudad Valles (Lemos-Espinal and Dixon, 2013).

Acknowledgments.—A special thanks to Emiliano Méndez-Salinas for field assistance. Arthur Harris kindly provided the photo voucher number.

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Fig. 1. A *Boa imperator* (UTEP G-2016.7) from Ejido San Nicolás de los Montes, Municipio de Tamasopo, San Luis Potosí, Mexico.
📷 © Eli García-Padilla

Masticophis mentovarius (Duméril, Bibron, & Duméril, 1854) (Squamata: Serpentes: Colubridae): an update of records from Panama

Masticophis mentovarius is a large, robust-bodied racer distributed from southern Sonora, in western Mexico, and northern Veracruz, in eastern Mexico, south throughout much of Central America into northern Colombia and eastward along the Caribbean coast to western and north-central Venezuela (Savage, 2002). The species was reviewed last by Johnson (1977). Herein we use the generic name *Masticophis* over *Coluber* for this species, based on the discussion provided in Johnson et al. (2015).

Although recorded primarily from the Pacific versant of all of the countries of Central America (Köhler, 2008), the distribution of *M. mentovarius* appears spotty and apparently is discontinuous, particularly in the southern portion of its range. Savage (2002: map 11.77, as *Coluber mentovarius*) showed no records from the southern half of Costa Rica, and Pérez-Santos and Moreno (1988: map 15) indicated no records from farther west in Colombia than the base of the Península de La Guajira, near the northwest base of the Sierra Nevada de Santa Marta. Johnson (1977: fig. 15) identified the Panamanian sample as *M. mentovarius centralis* (Roze, 1953), and his distribution map illustrated it as isolated from the nearest Colombian population to the east by ca. 900 km, and separated in the west from the nearest Costa Rican population by at least 300 km.

The distribution of *M. mentovarius* in Panama apparently is limited, having been reported only from around the northeastern corner of the Azuero Peninsula. Johnson (1977) reported three records and cited a fourth published record, that of Dunn (1940), for a specimen from Parita. Johnson (1977) included all of these records in the province of Coclé; the town of Parita, however, is in the province of Herrera. All of the collection sites listed by Johnson (1977) are located in a region of relatively dry, grassy savanna interspersed with scrub forest and which, in certain areas, exhibit scattered stands of "Candelaria" cactus (J. Knight and J. Ray, pers. observ.).

Here we add two new records of *M. mentovarius* from Panama, which represent a range extension in the country and a new provincial record. We also provide information on a specimen that to date has been overlooked in publications. The museum abbreviations follow Sabaj Pérez (2014), or are the abbreviations used by Team Snake Panama (TSP). The maps were constructed using ESRI ArcGIS 10.3.1 for Desktop (ESRI, 2015). Specimen TSP 2012-018 was collected with permission from MiAmbiente under collection permit SE/A-22-12.

On 19 January 2012, JW found an individual of *M. mentovarius* (TSP 2012-018; Fig. 1) dead on the road to Altos del María, between the towns of Bejuco and Sorá, Provincia de Panamá Oeste, Panama (8.55N, -79.9167W; WGS 84; elev. 54 m; Fig. 2), along the western base of Cerro Campana. The habitat in this area consists of scattered dry forest interspersed with pastures and grassy, rolling hills. Although the snake was found just after dark, based on the body condition apparently it had been killed during the day. This record represents an eastward range extension of ca. 51 km from the nearest published Panamanian locality at 10 km SW of Penonomé, Provincia de Coclé (Johnson, 1977), and represents a new record for the province of Panamá Oeste (Ray and Ruback, 2015).

The specimen (TSP 2012-018), a male, measured 148.3 cm in total length (snout–vent length = 118.2 cm, tail length = 30.1 cm), with the tail length 20.3% of the total length. The dorsal color pattern of this individual differs from those reported by Johnson (1977) for the holotype (USNM 115107, from Maicao, Guajira, Colombia) and a number of other Colombian specimens in that it does not show "light brown dorsal patterns with many indistinct and irregular stripes and bands." Little pigmentation was present on the dorsum of TSP 2012-018, except for the light grayish-brown ground color. Small black dots were present on the distal ends of the dorsal scales which, when spread, gave the impression of speckling. Anteriorly, a faint dark lateral stripe is present on the top half of the 1st and the lower portion of the 2nd scale rows, and a faint dark stripe also is present on the 3rd. At midbody a faint darker stripe is present on the 2nd and 3rd scale rows. The scalation of TSP 2012-018 is as follows: nasal = divided; supralabials = 7-7; infralabials = 9-9; loreals = 1-1; preoculars = 2-2 (lower one much smaller); postoculars = 2-2; temporals = 2-2-3 (on each side); dorsal scale rows = 17-17-12; ventrals = 192; and subcaudals = 70.

Johnson (1977) indicated that a dorsal scale row count of 19-17-13 is most characteristic for the species, but the dorsal scale row count differed in the above Panamá Oeste specimen. Lancini (1965), however, reported a Venezuelan specimen with a dorsal scale row count of 19-17-12, and Johnson (1977: 304) reported that, "of ten specimens of *M. mentovarius centralis* from Colombia, six, including the holotype, have dorsal scales reduced to 12, whereas four have 13 rows posteriorly." Johnson (1977) did not separate the small Panamanian sample from the larger Colombian/Venezuelan sample,

Fig. 1. A *Masticophis mentovarius* (TSP 2012-018) found dead on a road in the province of Panamá Oeste, which represents a new provincial record. 📷 © Julie M. Ray

and reported no specimens with an anterior scale row count of 17.

Compared to samples of *M. mentovarius* from other portions of its geographic range, several noteworthy differences are evident in TSP 2012-018. Unfortunately, the sample sizes from much of this species' range, and especially from Panama, are too small to develop meaningful hypotheses to account for the morphological variation observed.

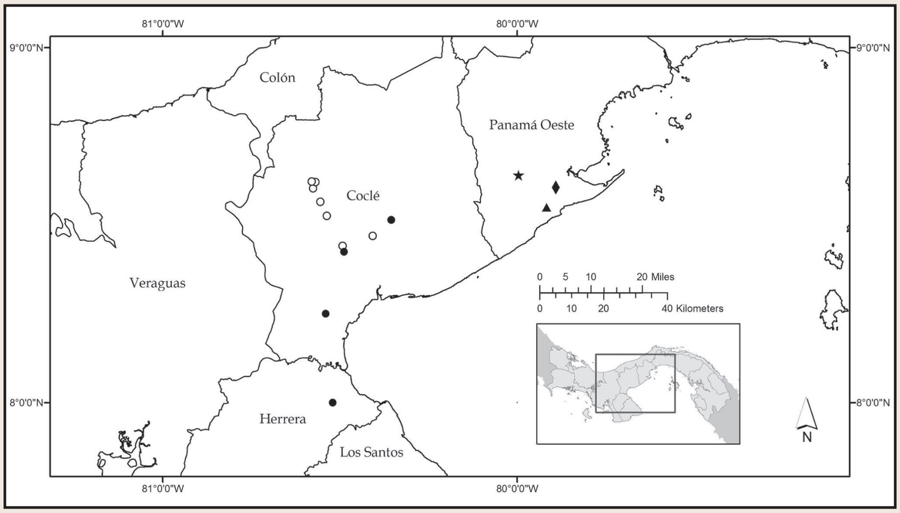

Fig. 2. Map showing the geographic distribution of *Masticophis mentovarius* in the Republic of Panama. Closed circles represent previously published records (Johnson, 1977; Pérez-Santos, 1999), open circles represent records from Coclé Province collected by Team Snake Panama; the triangle represents TSP 2012-018, the star represents TSPDM 014, and the diamond represents TNHC 24237.

On 9 February 2015, another individual of *M. mentovarius* (TSPDM [Team Snake Panama Digital Museum] 014; Fig. 3A, B) was found in Las Lajas de Chame, Provincia de Panamá Oeste, Panama (8.639983N, -79.99535W; WGS 84; elev. 387 m; Fig. 2), but a person who presumed it venomous killed it. A photograph of the snake was sent to JMR for identification. The individual was an adult, but additional information could not be collected from the photograph or the neighbor, Paul Rachner, who sent the photograph. This individual also was found in the province of Panamá Oeste, but came from a location farther east than the previously discussed specimen and represents the easternmost locality for *M. mentovarius* in Panama, 13.2 km SE from TSP 2012-018. It also represents the highest reported elevation for this species in Panama.

While searching for locality records of *M. mentovarius* to include in the map, we found a specimen at the University of Texas at Austin that was not included in Johnson (1977) or Pérez-Santos (1999); Travis LaDuc confirmed the identity of the specimen (TNHC 24237), which was collected by Martin J. Foquette on 19 February 1956 along the "Pan-American Highway about 3.1 mi [5 km] E of the town of Bejuco" (8.60599N, -79.89W; WGS 84; elev. 26 m; Fig. 2), in the province of Panamá Oeste. This locality lies 12.2 km SE from TSP 2012-018 and 6.9 km NE from TSPDM 014, and is the easternmost specimen reported in Panama.

The distribution of *M. mentovarius* in Panama is restricted largely to drier, grassy habitats, and we suspect that this species is not abundant even in suitable habitat. A substantial herpetofauna has been reported from the Cerro

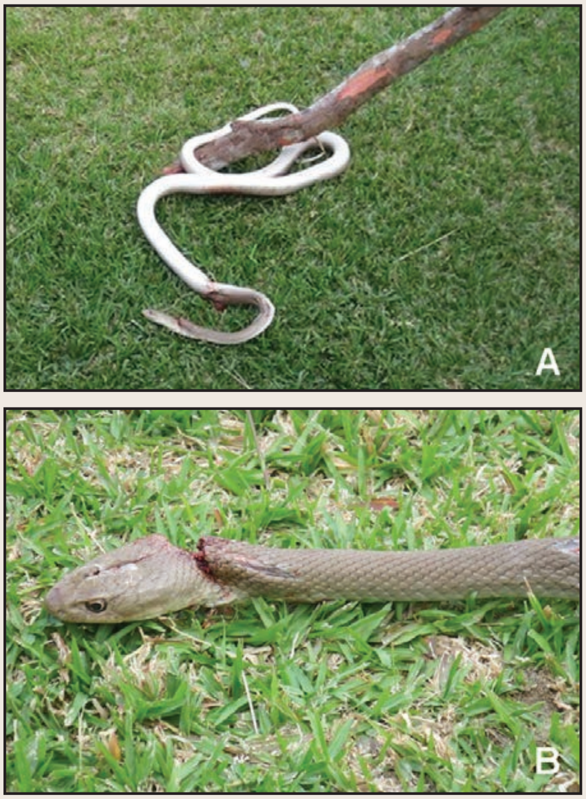

Fig. 3. A *Masticophis mentovarius* killed at Las Lajas de Chame, Provincia de Panamá Oeste, Republic of Panama (A) = ventral surface, and (B) = head view.

📷 © Resident of Las Lajas de Chame

Campana region, including at least 32 species of snakes (Ibáñez et al., 1996; Ray and Ruback, 2015). The discovery of this large snake in this relatively well-known area highlights the need for continued fieldwork in this region.

Acknowledgments.—We thank Jerry D. Johnson for comments on an earlier version of this work, Karin Knight for assistance in the field and in the lab, Travis LaDuc for confirming the identification of TNHC 24237, and Roberto Ibáñez for providing pertinent literature. JW thanks Mario Luis Urriola Hernández for assistance in the field. The ESRI software was obtained through an ESRI Conservation Program grant.

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Family Colubridae

***Phrynonax poecilonotus* (Günther, 1858).** MEXICO: YUCATÁN: Municipio de Tekax, 1.5 km S Tixmehuac (20°13'11.00"N, -89°6'18.30"W; WGS 84), elev. 33 m; 19 June 2012; Javier A. Ortiz-Medina. The snake was found active crawling on rocks in a patch of secondary vegetation and crop fields surrounded by semi-deciduous tropical forest.

We deposited a photograph of this individual at the University of Texas at El Paso Biodiversity Digital Collection (Photo Voucher UTEP G-2016.4). This voucher (Fig. 1) represents a new municipality record, with the closest known reported localities ca. 75 km to the NE in the vicinities of Chichén Itzá and Pisté (Lee, 1996).

Fig. 1. A *Phrynonax poecilonotus* (UTEP G-2016.4) from the vicinity of Tixmehuac, Municipio de Tekax, Yucatán, Mexico.
© Javier A. Ortiz-Medina

Acknowledgments.—A special thanks to Arthur Harris for kindly providing the photo voucher number.

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Family Colubridae

***Pituophis deppei* (Duméril, 1853)**. MEXICO: NAYARIT: Municipio de Huajicori, Ejido Santa María de Picachos (22.705078°N; 105.181327°W; WGS 84); elev. 1,566 m; 25 October 2014; Jesús Loc-Barragán. The snake (Fig. 1) was an adult found active on rocky substrate in oak-pine forest at 1437 h. A photo voucher of the individual was deposited at The University of Texas at Arlington Digital Collection (UTADC-8553). This voucher represents the first record for the state, with the closest known locality ca. 105 km to the NW (airline distance) in the vicinity of Santa Clara, Jalisco (McDiarmid, 1963) and 81 km S of Llano Grande, Durango (Duellman, 1960).

Fig. 1. An adult *Pituophis deppei* (UTADC-8553) from Ejido Santa María de Picachos, Municipio de Huajicori, Nayarit, Mexico. 📷 © Jesús Loc-Barragán

Acknowledgments.—We thank Carl J. Franklin for providing the photo voucher number.

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Family Colubridae

Salvadora bairdi **Jan, 1860.** MEXICO: JALISCO: Municipio de Ojuelos de Jalisco, ca. 3.7 km (airline) NW of Chinampas (21.848434°N, -101.847936°W; WGS 84); elev. 2,378 m; 4 October 2014; Rubén Alonso Carbajal-Márquez. The snake was found basking in oak savanna. A photo voucher is deposited at the San Diego Natural History Museum (SDSNH_HerpPC_05322; Fig. 1). This individual represents a new municipality record, extending the distribution ca. 76.8 km (airline) E from the closest known locality at Mesa Montoro, San José de Gracia, Aguascalientes (Vázquez-Díaz and Quintero-Díaz, 2005).

MEXICO: AGUASCALIENTES: Municipio de El Llano, ca. 8.2 km (airline) E of Palo Alto (21.923892°N, -101.883650°W; WGS 84); elev. 2,437 m; 15 August 2014; Gustavo Ernesto Quintero-Díaz. The snake was found under a rock in oak savanna. A photo voucher is deposited at the San Diego Natural History Museum (SDSNH_HerpPC_ 05323; Fig. 2). This individual represents a new municipality record, extending the distribution ca. 72 km (airline) E from closest known locality at Mesa Montoro, San José de Gracia, Aguascalientes (Vázquez-Díaz and Quintero-Díaz, 2005).

Acknowledgments.—We thank Bradford Hollingsworth for providing the photo voucher numbers.

Fig. 1. A *Salvadora bairdi* (SDSNH_HerpPC_05322) observed in Municipio de Ojuelos de Jalisco, Agua-scalientes, Mexico.
© Gustavo E. Quintero-Díaz

Fig. 2. A *Salvadora bairdi* (SDSNH_HerpPC_ 05323) observed in Municipio de El Llano, Aguascalientes, Mexico.
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Family: Colubridae

***Tantilla cuniculator* Smith, 1939**. MEXICO: QUINTANA ROO: Municipio de Bacalar, Rancho Santa Lupita (18.761832°N, -88.52477°W; datum WGS 84); elev. 30 m; 2 January 2016; Pablo M. Beutelspacher-García. Male (total length = 182 mm, snout–vent length = 143 mm). The snake (Fig. 1) was found dead after a fire had occurred in the area. The specimen is deposited in the herpetological collection of El Colegio de la Frontera Sur, Unidad Chetumal (ECO-CH-H3658, Reptile Collection record number: QNR.RE.034.0697). This individual represents a new municipality record, and the first record for southern Quintana Roo. Following Lee (1996), this record extends the distribution of the species ca. 109 km SW and 80.7 km N (airline distances) of the closest known localities at 3.5 mi (5.6 km) N of Felipe Carrillo Puerto (Mexico), and Tower Hill (Orange Walk, Belize), respectively. According to the distribution maps in Lee (1996, 2000), and Köhler (2008), this record closes the gap between the northern and southern populations of this snake in the eastern portion of the Yucatan Peninsula.

Fig. 1. Dorsal view of *Tantilla cuniculator* (specimen ECO-CH-H3658) found at Rancho Santa Lupita, Bacalar, Quintana Roo, Mexico. © Humberto Bahena-Basave

Acknowledgments.—We thank Pablo Roberto Salazar Gómez (owner of Rancho Santa Lupita) for allowing PMBG access to his land, and Larry David Wilson for verifying the identification of the specimen and comments that improved the manuscript. The collecting permit (SGPA/DGVS/02570/15) 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 Colubridae

***Tantilla cuniculator* Smith, 1939.** MEXICO: YUCATÁN: Municipio de Sinanché, San Crisanto (21°21'9.37"N, -89°10'38.00"W; WGS 84), elev. 1 m; 28 November 2009; Javier A. Ortiz-Medina. The snake was found active at night, on sandy soil in a coconut grove. A photograph of this individual is deposited at the University of Texas at El Paso Biodiversity Digital Collection (Photo Voucher UTEP G-2016.5). This voucher (Fig. 1) represents a new municipality record, with the closest known locality ca. 60 km SW in the vicinity of Merida (Lee, 1996).

Acknowledgments.—A special thanks to Arthur Harris for kindly providing the photo voucher number.

Fig. 1. A *Tantilla cuniculator* (UTEP G-2016.5) from the vicinity of San Crisanto, Municipio de Sinanché, Yucatán, Mexico. 📷 © Javier A. Ortiz-Medina

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Family Dipsadidae

***Coniophanes imperialis* (Baird and Girard, 1859).** MEXICO: HIDALGO: Municipio de San Felipe Orizatlán, El Naranjal (21.194102°N, -98.577538°W; WGS84) elev. 183 m; 11 April 2015; Gonzalo Hernández-Hernández; photo voucher CH-CIB 48 (Fig. 1A). The snake was found dead in a crop field surrounded by deciduous tropical forest. Another individual was found near Mexcarillo, Municipio de San Felipe Orizatlán (21.23409°N, -98.56622°W; WGS 84) elev. 134 m; 29 November 2015; Leonardo Fernández-Badillo; photo voucher CH-CIB 49 (Fig. 1B). This snake was found under a rock in a cattle field.

Photo vouchers of both individuals are deposited in the photographic collection of the Herpetological Collection of the Centro de Investigaciones Biológicas, Universidad Autónoma del Estado de Hidalgo. Both represent new municipality records, with the closest known locality ca. 16.3 km and 17.3 km, respectively, to the NE (airline distance) in the vicinity of San José, Municipio de Huejutla de Reyes, Hidalgo (Ramírez-Bautista et al., 2010).

Fig. 1. (A) A *Coniophanes imperialis* (CH-CIB 48) from El Naranjal, San Felipe Orizatlán, Hidalgo; and (B) a *C. imperialis* (CH-CIB 49) from Mexcarillo, San Felipe Orizatlán, Hidalgo.

📷 © Gonzalo Hernández-Hernández (A), and Leonardo Fernández-Badillo (B)

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Family Dipsadidae

***Coniophanes piceivittis* Cope, 1870.** NICARAGUA: REGIÓN AUTÓNOMA ATLÁNTICO SUR: Isla Grande del Maíz (Big Corn Island), La Loma, Quinn Hill (12.152905°N, 83.063754°W; WGS 84); elev. 45 m; 3 December 2015; Paul Norberg. Photo vouchers are deposited at The University of Texas at Arlington Digital Collection (UTADC-8640; Fig. 1A, B). A local resident found the snake crossing a path early in the morning, and presented it to one of us (PN) the following day. The resident reported that people living in the area regard this species as non-venomous, and call it "doctor snake." The surrounding habitat is a hilly, forested bluff with light residential development. The sex of the individual was not recorded, and because of its length (ca. 50 cm total length [TL]), it was presumed to be an adult; Savage (2002) reported a maximum TL of 57.1 cm. The snake bit PN, who recorded that the bite itched and generated a minor burning sensation, with minor swelling that lasted for a few hours. The snake was released after it was photographed.

The presence of *Coniophanes piceivittis* on Isla Grande del Maíz was surprising, as this locality represents the first record for the island, the Corn Islands, the autonomous region, and for the Atlantic versant of Nicaragua (HerpetoNicas, 2015). It also represents the easternmost record for this species, extending its distribution ca. 287 km E from its closest Nicaraguan locality at Volcán Maderas (SMF 98341/JS 1084; Sunyer, 2009), on Isla de Ometepe in Lago de Nicaragua; this voucher is only the 12th record supported by a specimen or a published photograph for *C. piceivittis* from the country (Harrison, 1992; Vences et al., 1998; Sunyer, 2009; MVZ:Herp:263775). This species occurs on the Atlantic versant in Mexico, but only as far south as Veracruz. Our voucher agrees in coloration, pattern, and all the visible scale counts (Table 1) with the information presented in Bailey (1939) and Savage (2002). Because of the rural location, the relatively poorly sampled herpetofauna of the Corn Islands (Sunyer et al., 2013), the apparent familiarity of the local resident with this species, and the fact that snakes in this genus are not commonly traded or used by humans for any known purpose, we consider it unlikely that this individual was a recent transport to the island.

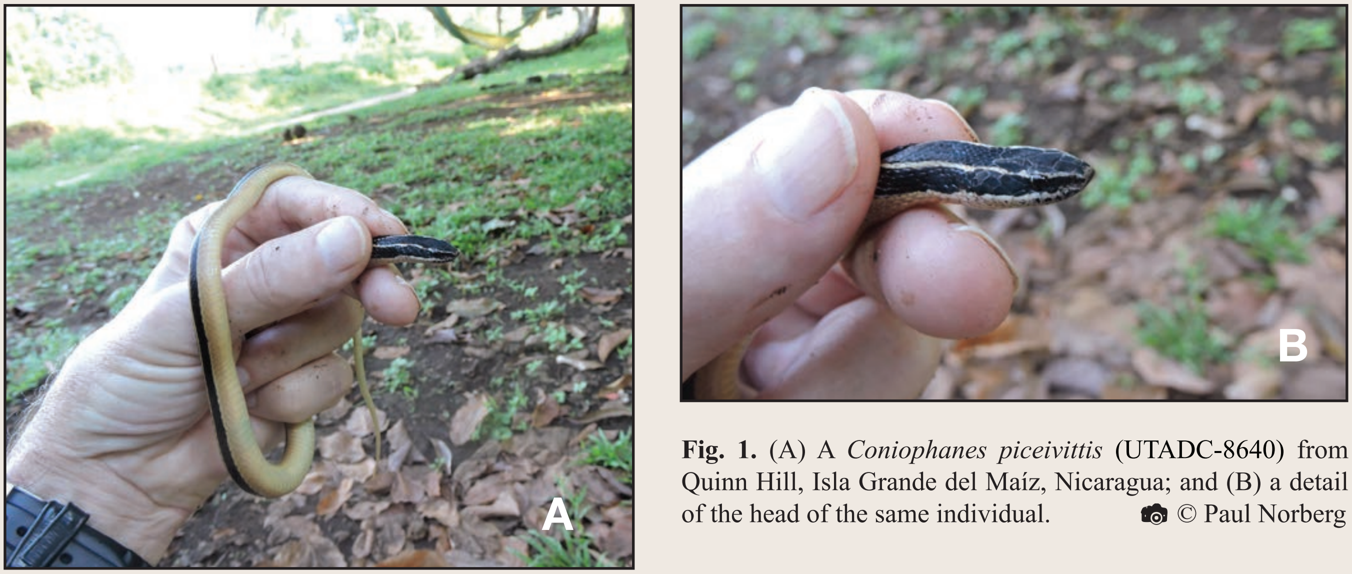

Fig. 1. (A) A *Coniophanes piceivittis* (UTADC-8640) from Quinn Hill, Isla Grande del Maíz, Nicaragua; and (B) a detail of the head of the same individual. © Paul Norberg

To date, no phylogenetic or phylogeographic studies using molecular data have been published on any member of the genus *Coniophanes*, and taxon sampling in large-scale phylogenies has been limited to *C. fissidens* (Mulcahy et al., 2011; Pyron et al., 2013; Pyron et al., 2015); the relationships among *C. piceivittis* and other species of *Coniophanes*, therefore, remain unknown. Of particular interest is *C. andresensis*, a species endemic to Isla San Andrés, 95 km to the NE of Isla Grande del Maíz (McNish, 2011). Harrison (1992) hypothesized that *C. piceivittis* evolved in Nuclear Central America (i.e., the Chortís Block) during the early Tertiary (Miocene-Pliocene). Both the montane ridge that divides present-day Central America (Jordan et al., 2008; Sunyer, 2009; Townsend, 2014) and the Corn Islands (Ruden, 1993; Marshall, 2014) apparently formed around this time, although some sources suggest that the Corn Islands might have formed later, during the Pleistocene (Alvarado et al., 2014). Although the Corn Islands are volcanic in origin, the sea covering the Caribbean continental shelf between present-day mainland Nicaragua and the Corn Islands is so shallow (< 25 m in most places; National Oceanic and Atmospheric Administration, 2015), that evidence from eustatic sea level curves suggests that the two undoubtedly were connected at some point during the Pleistocene, perhaps more than once (Muhs et al., 2004: fig. 6; Sunyer, 2009), and *C. piceivittis* might have colonized the Corn Islands prior to or during this time. Whether it was extirpated on the Atlantic versant of Nicaragua or, more improbable, still is found there, must await more complete sampling of that area.

Table 1. A comparison of available scale counts from photographs of our Isla Grande del Maíz specimen with those published in Bailey (1939) and Savage (2002). *All of the ventral scales were not visible in any one image, but our best estimate from a composite of three images is ~167 (88 countable in Fig. 1A + ~57 countable in one frame from an unpublished video showing most of the ventral region anterior to that visible in Fig. 1A + ~22 rows of dorsal scales countable in another frame from the same video showing the dorsum of the region posterior to that visible in Fig. 1A). †Dorsal scale row count determined by counting the number of rows visible on the right side in Fig. 1B, multiplying by two, and adding one for the middorsal row.

	Bailey (1939)	**Savage (2002)**	**Isla Grande del Maíz Individual**
Total length (mm)	213–544	571 (maximum)	~ 500
Ventrals	158–173	153–174	~ 167 (best estimate*)
Subcaudals	78–91	78–115	Not countable
Upper labials	8 (4–5 contact eye)	7–8	8 (4–5 contact eye)
Lower labials	10	9–10	Not visible
Preoculars	2	(1–)2	2
Postoculars	2	2	2
Temporals	1+2	1+2	1+2 (right)
Dorsal scale rows	23–25 (anterior) 25 (midbody) 17–21 (posterior)	23–25 (anterior) 25 (midbody) 17–21 (posterior)	23 (anterior)† Midbody and posterior not countable

Seven of the eight species of snakes known from the Corn Islands also are found on the adjacent mainland (Villa, 1972), but one, *Pseudelaphe flavirufa*, has a discontinuous and somewhat similar distribution to the one we are documenting for *C. piceivittis*, and has not been found outside of the Pacific versant in Nicaragua (Schulz, 1996; Sunyer et al., 2014). Three specimens of *P. flavirufa* are known from the Corn Islands (AMNH 23887, 97072, 99104; Villa, 1972), and the closest mainland record is 271 km to the NW at Matiguás, Departameto Matagalpa (Gómez et al., 2011; Sunyer et al., 2014). Disjunct distributions are commonplace in Central American herpetofauna, but difficult to verify (Myers et al., 2007). At least two other vertebrates are found on the Corn Islands and on the Pacific, but not on the Atlantic versant of mainland Nicaragua: the Black Spiny-tailed Iguana (*Ctenosaura similis*; Sunyer et al, 2013; Ozturk, 2015: fig. 4), which, perhaps for lack of suitable habitat, is known from only two disjunct Atlantic lowland records in adjacent Honduras (Gutsche and Köhler, 2008) and Costa Rica (Savage, 2002), and the Mangrove Cuckoo (*Coccyzus minor*; Peters, 1929), although Howell (2010) suggested that the cuckoo has been overlooked along the Caribbean coast. The *C. similis* from the Corn Islands represent unique haplotypes that are most closely related to those from western Costa Rica, Panama, and the Yucatán Peninsula (Ozturk, 2015).

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Family Dipsadidae

Hypsiglena affinis **Boulenger, 1894.** MEXICO: ZACATECAS: Municipio de Valparaiso, ca. 13.6 km (airline) W of Huejuquilla El Alto (22.622427°N, -104.030178°W; WGS 84); elev. 1,053 m; 8 October 2015; Jorge A. Bañuelos-Alamillo and Marco Antonio Domínguez de la Riva. The snake was found in xerophytic scrub. Photo vouchers are deposited at the San Diego Natural History Museum (SDSNH_HerpPC_05293–94; Fig. 1). This individual represents a new municipality record, extending the distribution ca. 170.3 km (airline) NW from the closest known locality in Zacatecas, at Mezquital del Oro (Boulenger, 1894).

Fig. 1. A *Hypsiglena affinis* (SDSNH_HerpPC_05293) observed in Municipio de Valaparaiso, Zacatecas, Mexico.
© Jorge A. Bañuelos-Alamillo

Acknowledgments.—We thank Bradford Hollingsworth for providing the photo voucher numbers

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Family Dipsadidae

Rhadinaea (Rhadinella) godmani **(Günther, 1865)**. MEXICO: CHIAPAS: Municipio de Coapilla, ca. 1.1 km (by road) W of Coapilla centro on the road to Ejido Portes Gil (17.13309°N, 93.17004°W; WGS 84); elev. 1,610 m; 23 August 2015; Justin K. Clause and Adam G. Clause. A subadult female with a snout–vent length of 297 mm (Fig. 1) was collected at night (2310 h) while crawling on a dirt road among a matrix of intact *Pinus*/*Quercus* forest and areas of disturbed wooded pasture. The entire snake and a tissue sample are deposited at the Museo de Zoologia "Alfonso L. Herrera" de la Facultad de Ciencias, UNAM (MZFC 29997), which represent the fifth specimen and fourth locality from the state of Chiapas, the first record from the municipality, and the westernmost locality for the species (www.VertNet.org; accessed 30 Aug 2015). The locality lies ca. 107 km NW of the nearest previous record at 6.4 mi (= 10.3 km) E of Teopisca, Mexico Hwy 190, Municipio de Amatenango del Valle (UTA-R 5719). The two remaining localities in Chiapas are 18.9 km NW of Comitán, Municipio de Las Margaritas (TNHC 29667), and "Finca Catarina Dist Libertad" (UMMZ 95155–95156). This last locality, with two specimens, is poorly supported and I was unable ascertain its location with any degree of certainty.

Fig. 1. A subadult female *Rhadinaea (Rhadinella) godmani* (MZFC 2997) from Municipio de Coapilla, Chiapas, Mexico.
📷 © Adam G. Clause

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Family Dipsadidae

***Tretanorhinus nigroluteus* Cope, 1861.** MEXICO: QUINTANA ROO: Municipio de Othón P. Blanco. Two specimens were collected by Pablo M. Beutelspacher-García in a swamp located ca. 5 km W (airline distance) of Chetumal; the first (ECO-CH-H1959) was a juvenile (snout–vent length [SVL] = 243 mm) found on 4 February 2002 (18.526389°N, -88.378056°W; WGS 84), elev. 6 m, and the second (ECO-CH-H3187) was an adult female (SVL = 481 mm) encountered on 8 September 2012 (18.536667°N, -88.382778°W; WGS 84), elev. 2 m. Subsequently, on 12 April 2015 at 2140 h, CMGB and RACM found a juvenile (ECO-CH-H3673; SVL= 270 mm) in leaf litter along the edge of Laguna Guerrero (18.706931°N, -88.255914°W; WGS 84), elev. 2 m (Fig.1). The specimens were deposited in the herpetological collection of El Colegio de la Frontera Sur, Unidad Chetumal (Reptile Collection record number: QNR.RE.034.0697). These individuals close a distributional gap of ca. 192 km (airline distance) between the two known localities in Quintana Roo, La Unión at the Belizean border (Bahena-Basave, 1995), and Sian Ka´an Biosphere Reserve (Calderón-Mandujano et al., 2008).

Fig.1. A juvenile *Tretanorhinus nigroluteus* (ECO-CH-H3673) found at Laguna Guerrero, Municipio de Othón P. Blanco, Quintana Roo, Mexico. © Christian M. García-Balderas

Acknowledgments.—We thank Pablo M. Beutelspacher-García for field assistance. The collecting permit (SGPA/DGVS/02570/15) 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 Dipsadidae

Tropidodipsas sartorii **Cope, 1863.** MEXICO: PUEBLA: Municipio de Acateno, San José Acateno (20.129222°N, -97.221289°W; WGS 84) elev. 125 m; 31 December 2015; José Carlos Iturbe Morgado. The snake was found active at night on a bank of the Río Solteros, in riparian vegetation. A photo voucher of this snake (CH-CIB 51; Fig. 1) was 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 for the species, with the closest known locality ca. 23.4 km to the NE (airline distance) near Paso Real, Municipio de Hueyapan, Puebla (Gutiérrez-Mayén et al., 2011).

Fig 1. A *Tropidodipsas sartorii* (CH-CIB 51) from Municipio de Acateno, Puebla, Mexico.

📷 © José Carlos Iturbe-Morgado

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Family Elapidae

***Micrurus ephippifer* (Cope, 1886).** MEXICO: OAXACA: Municipio de San Bartolo Coyotepec, Presa La Candelaria (16°56'36.6"N 96°40'20.9"W; WGS 84); elev. 1,621 m; 20 January 2016; Pablo R. Simón-Salvador. The specimen, an adult male (Fig. 1), was found active in the morning in tropical deciduous forest dominated mostly by the tree *Pithecellobium dulce*. A photograph of the snake is deposited at the University of Texas at El Paso Digital Collection (Photo voucher UTEP G-2016.8). This individual represents the first published record for this municipality, and fills a gap between the closest known localities, ca. 16.5 km to the N (airline distance) in Cerro de San Felipe del Agua, Municipio de Oaxaca de Juárez (UCM-52511) and ca. 73 km to the SE (airline distance) in the vicinity of San José Lachiguiri Municipio de San José Lachiguiri, Oaxaca (UCM-41230); these two specimens were collected by T.B. McDougall (www.vertnet.org; accessed on 18 February, 2016).

Fig. 1. An adult of *Micrurus ephippifer* (UTEP G-2016.8) found at Presa La Candelaria, Municipio de San Bartolo Coyotepec, Oaxaca, Mexico.

© Pablo R. Simón-Salvador

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Family Natricidae

Thamnophis scaliger **(Jan, 1863).** MEXICO: AGUASCALIENTES: Municipio de El Llano, ca. 8.5 km (airline) E of Palo Alto (21.929819°N, -101.886354°W; WGS 84); elev. 2,438 m; 15 July 2015; Gustavo Ernesto Quintero-Díaz. The snake was found basking in a clump of bunchgrass in oak savanna. A photo voucher is deposited at the San Diego Natural History Museum (SDSNH_HerpPC_05324; Fig. 1). This individual represents a new municipality record, extending the distribution ca. 72 km (airline) E from the closest known locality ca. 1 km NE of Santa Rosa, San José de Gracia, Aguascalientes (Quintero-Díaz et al., 1999).

Fig. 1. A *Thamnophis scaliger* (SDSNH_HerpPC_05324) observed in Municipio de El Llano, Aguascalientes, Mexico.
© Gustavo E. Quintero-Díaz

Acknowledgments.—We thank Bradford Hollings-worth for providing the photo voucher number.

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Family Typhlopidae

***Indotyphlops braminus* (Daudin, 1803).** MEXICO: ZACATECAS: Municipio de Valparaiso, Valparaiso (22.787472°N, -103.555166°W; WGS 84); elev. 1,902 m; 15 October 2015; Jorge A. Bañuelos-Alamillo. The snake was found foraging in a yard after a rainy day. A photo voucher is deposited at the San Diego Natural History Museum (SDSNH_HerpPC_05301; Fig. 1). This exotic snake represent a new state record, extending the distribution ca. 136 km (airline) NW from closest known locality at Jáltiche de Abajo, Calvillo, Aguascalientes (Carbajal-Márquez et al., 2014).

Fig. 1. An *Indotyphlops braminus* (SDSNH_HerpPC_05301) observed in Municipio de Valparaiso, Zacatecas, Mexico.
📷 © Jorge A. Bañuelos-Alamillo

Acknowledgments.—We thank Bradford Hollingsworth for providing the photo voucher number.

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Family Typhlopidae

***Indotyphlops braminus* (Daudin, 1803).** MEXICO: BAJA CALIFORNIA: Municipio de Ensenada, Parque Revolución, Ensenada (31.86976°N, 116.62677°W; WGS 84); elev. 14 m; 9 November 2015; Hector Yee-Pérez. Landscapers found an individual of *Indotyphlops braminus* (a subadult measuring 131 mm in total length; Fig. 1) in a park within the city of Ensenada. The specimen represents the first record of this species in the state of Baja California, with the closest reported locality ca. 95.5 km N (airline) at Norman Park, San Diego, California, United States (Palmer and Fisher, 2010). We deposited the specimen (UABC 2205) in the Herpetological collection of Facultad de Ciencias, Universidad Autónoma de Baja California in Ensenada; additionally, we deposited a photo voucher (SDSNH_HerpPC 5304) in the San Diego Natural History Museum.

Fig. 1. A subadult *Indotyphlops braminus* (UABC 2205; photo voucher SDSNH_HerpPC 5304) found at Parque Revolución, Ensenada, Baja California, Mexico. © Jorge H. Valdez-Villavicencio

Acknowledgements.—We thank Bradford D. Hollingsworth from the San Diego Natural History Museum for verifying the identification of the species, and providing the photo voucher number.

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Family Viperidae

***Bothrops asper* (Garman, 1884).** MEXICO: HIDALGO: Municipio de Tlanchinol, near Temango (21.14979ºN, -98.67115ºW; WGS 84) elev. 171 m; 28 August 2015; Gonzalo Hernández-Hernández. The snake was found inside a mammal burrow, in riparian vegetation. The specimen (CIB 4810; Fig. 1) is deposited in the herpetological collection of the Centro de Investigaciones Biológicas, Universidad Autónoma del Estado de Hidalgo. Mendoza-Quijano et al (2006) commented on the presence of this species in Tlanchinol, but did not provide a specific locality. Thus, this is the first published municipality record with a precise locality. The closest known reported locality is ca. 15 km to the W (airline distance) near the Amatitla–Cuautolol road, Municipio de Tepehuacán de Guerrero (Badillo-Saldaña, 2013).

Fig 1. A *Bothrops asper* (CIB 4810) from Temango, Municipio de Tlanchinol, Hidalgo, Mexico.

📷 © Ferdinand Torres-Angeles

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Family Viperidae

***Crotalus polystictus* (Cope, 1865).** MEXICO: ZACATECAS: Municipio de Valparaiso, ca. 11.8 km (airline) SE of Valparaiso (22.709139°N, -103.475194°W; WGS 84); elev. 2,150 m; 11 October 2015; Jorge A. Bañuelos-Alamillo and Miguel Angel Olvera-Rivera. The snake was found in oak savanna. A photo voucher is deposited at the San Diego Natural History Museum (SDSNH_HerpPC_05300; Fig. 1). This individual represents a new municipality record, extending the distribution ca. 94.2 km (airline) NW from the closest known locality in Zacatecas, at El Plateado de Joaquín Amaro, Sierra Morones (Wilson and McCranie, 1979).

Fig. 1. A female *Crotalus polystictus* (SDSNH_HerpPC_05300) observed in Municipio de Valaparaiso, Zacatecas, Mexico. © Jorge A. Bañuelos-Alamillo

Acknowledgments.—We thank Bradford Hollingsworth for providing the photo voucher number.

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Reptilia: Testudines

Family: Kinosternidae

***Claudius angustatus* Cope, 1865.** MEXICO: QUINTANA ROO: Municipio de Bacalar. Two dead specimens were collected. The first (a female; carapace length = 110 mm) was found by PMBG on 18 May 2015, burned after a fire had occurred in the area, in a banana plantation at Rancho Santa Lupita (18°46'8.08"N, 88°31'25.07"W; datum WGS 84; elev. 30 m). The second (a male; carapace length = 147 mm) was found dead on 20 October 2015 by Jenny Elizabeth Salazar-Méndez, on the road from Bacalar to Reforma (18°42'47.34"N, 88°24'43.07"W; datum WGS 84; elev. 20 m). Both specimens were deposited at the Herpetological Collection of El Colegio de la Frontera Sur, Unidad Chetumal (ECO-CH-H3462-3668, Reptile Collection record number: QNR.RE.034.0697).

These localities represent new municipality records, and the second and third records for the state. Both records extend the distribution of the species ca. 103 km NE (airline distance) from the closest known locality (La Unión) in southern Quintana Roo (at the Belizean border), reported by Cedeño-Vázquez et al. (2003).

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