NATURAL HISTORY NOTES

GYMNOPHIONA — CAECILIANS

CHTHONERPETON INDISTINCTUM **(Argentina Caecilian). PREDATION.** *Chthonerpeton indistinctum* is an atypical caecilian being semiaquatic, viviparous, and having a subtropical distribution. It occurs from northeastern Argentina to southern Brazil, passing through Uruguay, and including the Paraná River in southern Paraguay (Gudynas and Williams 1986. J. Herpetol. 20:250–253; Measey and Di-Bernardo 2003. J. Herpetol. 37:371–373). Despite its capacity to swim, *C. indistinctum* also has fossorial habits, preferring to live burrowed in muddy soil surrounding flooded areas (Gudynas et al. 1988. Zoo. Meded. 62:5–28). Natural predators of neotropical caecilians include snakes, fishes, other amphibians, and birds, including herons (Taylor 1968. The Caecilians of the World: A Taxonomic Review. University of Kansas Press, Lawrence, Kansas. 848 pp.). On 27 July 2016, at 1329 h, in the Municipality of Mostardas, Rio Grande do Sul, Brazil, a *Botaurus pinnatus* (Pinnated Bittern) was observed preying upon an adult *C. indistinctum* in a flooded area (31.1127°S, 50.8477°W; WGS 84). After a few minutes of manipulating the caecilian with its beak (Fig. 1), the *B. pinnatus* swallowed the *C. indistinctum* whole.

Botaurus pinnatus is a large species of Ardeidae known for its solitary habits and secretive behavior, usually hiding among aquatic vegetation and going unnoticed by observers (Schunck et al. 2019. Atual. Ornitol. 209:26–27). The diet of this bird is known to include fishes, amphibians, crustaceans and other aquatic invertebrates, and seeds (Sigrist 2013. Guia de Campo Avis Brasilis: Avifauna Brasileira. Editora Avis Brasilis, São Paulo, Brazil. 592 pp.). In addition to our record, *B. pinnatus* was also recorded feeding on a *Leptodactylus macrosternum* (Miranda's White-lipped Frog) in Piauí, Brazil (Andrade et al. 2013. Herpetol. Notes 6:201–202). On that occasion, the *L. macrosternum* was also swallowed whole by the *B. pinnatus*.

PHOTO BY CLÁUDIO DIAS TIMM

FIG. 1. Adult *Botaurus pinnatus* preying upon a *Chthonerpeton indistinctum* in the Municipality of Mostardas, Rio Grande do Sul, Brazil.

Although ecological interactions between ardeids and caecilians have been superficially mentioned in the literature, this is the first record of a *B. pinnatus* consuming a caecilian. Reports on the natural history of neotropical caecilians are still scarce in the literature (Leitão-Martins *et al*. 2021. Herpetol. Notes 14:945–947). Therefore, our report highlights some aspects of the natural history of these two species which are difficult to observe in nature.

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LUCAS DE SOUZA ALMEIDA, Universidade Estadual Paulista "Júlio de Mesquita Filho", Departamento de Biodiversidade e Centro de Aquicultura, Instituto de Biociências, 13506-900, Rio Claro, São Paulo, Brazil (e-mail: almeidals1994@gmail.com); **CLÁUDIO DIAS TIMM**, Universidade Federal de Pelotas, Departamento de Veterinária Preventiva, Faculdade de Veterinária, 96010-900, Pelotas, Rio Grande do Sul, Brazil (e-mail: timm@ufpel.edu.br).

CAUDATA — SALAMANDERS

AMBYSTOMA MACULATUM **(Spotted Salamander). PREDATION.** We report on *Strix varia* (Barred Owls) exploiting breeding pools of *Ambystoma maculatum* as seasonally abundant prey. *Ambystoma maculatum* is a food source for a wide array of mammalian, avian, and reptilian predators (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, D.C. 587 pp.). Two previous reports also suggest that *A. maculatum* may experience increased predation pressure by fish and an unidentified terrestrial predator(s) during the breeding season, with aggregations of breeding adults representing prey concentrated in time and space (e.g., Beachy 1991. Herpetol. Rev. 22:128; Fernandes and McMeans 2021. Ecology 102:e03202). Several other authors have reported *S. varia* preying on salamanders (e.g., Wiens et al. 2014. Wildlife Monogr. 185:1–50), however, to our knowledge, this is the first report of *S. varia* preying on *A. maculatum* and the first report of avian predation on *Ambystoma* within their breeding pools.

On 30 April 2021, while surveying a vernal pool containing ca. 90 *A. maculatum* egg masses in the town of Mount Desert, Maine, USA (44.3°N, 68.3°W; WGS 84), we found remains of a partially digested *A. maculatum* within 30 cm of an owl pellet (Fig. 1). The pool is located in a mixed softwood forest of *Thuja occidentalis* (Eastern White Cedar), *Picea rubens* (Red Spruce) and *Abies balsamea* (Balsam Fir), bordered by thick mats of *Sphagnum* sp. (sphagnum moss) and generally devoid of emergent aquatic vegetation. Further inspection of the site uncovered a feather floating in the vernal pool within 3 m of the two samples that were later identified as a *Strix varia* contour feather (species

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Fig. 1. Regurgitated remains of *Ambystoma maculatum* and owl pellet consisting primarily of unidentified small mammal bones and fur found within close proximity of one another in Mount Desert, Maine, USA.

PHOTOS BY NOAH CHARNEY

Fig. 2. *Strix varia* with an *Ambystoma* sp. it captured in a pond in Sutherland, Massachusetts, USA.

verified at www.fws.gov; 19 May 2021). Taken together, these findings, while circumstantial in nature, represent the first ever account of *A. maculatum* being eaten by *S. varia*, a raptor known to have a varied diet throughout its range (Hamer et al. 2001. J. Raptor Res. 35:221–227; birdsoftheworld.org, 25 May 2021).

Separately, NDC observed *S. varia* hunting and eating salamanders at a vernal pool in Sunderland, Massachusetts, USA (42.5°N, 72.5°W; WGS 84). The pool is surrounded primarily by *Tsuga canadensis* (Eastern Hemlock), *Pinus strobus* (Eastern White Pine), and *Acer rubrum* (Red Maple), and is largely free of emergent vegetation, except for sparse *Cephalanthus occidentalis* (Buttonbush). In addition to an abundance of *A. maculatum*, *Lithobates sylvaticus* (Wood Frog), and *Notophthalmus viridescens* (Eastern Newt) were also observed in this pool. There were also a small number of egg masses, which were presumed to be from *A. jeffersonianum* (Jefferson Salamander) based on morphology and location.

In 2021, NDC visited the Massachusetts pool weekly throughout the spring and summer for an eDNA study beginning on 17 March 2021, while the surface was still covered in 20 cm of ice. On 24 March 2021, *A. maculatum* were observed migrating nearby during a rain event. On 26 March 2021, during a nighttime visit to the pool, numerous adult *A. maculatum* were observed swimming in the water. *Strix varia* were observed at the pool during five of the six weekly visits between 30 March 2021 and 4 May 2021. Most visits lasted ca. 1 h and occurred between 1930 h and 2130 h. No *S. varia* were observed on 6 April 2021, however, during opportunistic visits that were not part of the regular sampling, *S. varia* were observed on 5 April 2021 (1830 h) and on 17 April 2021 (1130 h) typically perched nearby on branches above the water. On 13 April 2021, I observed and photographed a *S. varia*, perched within 2 m of the water surface, preying upon a salamander in the water. Due to the quality of the photographs, the salamander could only be identified as *Ambystoma* sp. (Fig. 2). The *S. varia* carried the *Ambystoma* sp. to a nearby log where it began picking at it, then flew off with it into the forest. On 20 April 2021, I observed another *S. varia* drop into the water from a perch ca. 5 m above the water, then fly off with what appeared to be another salamander, although no photographs were obtained to confirm the prey's identity.

Of note, both pools where we observed *S. varia* predation had very few emergent shrubs, possibly leaving salamanders exposed to avian predators. In contrast, another pond where NDC performed the same weekly surveys in the same forest ca. 1.6 km away had dense shrub cover. There were both *S. varia* in the vicinity of this pond and an abundance of breeding *A. maculatum*, but *S. varia* were not observed predating salamanders over this shrub-covered pool.

NOAH D. CHARNEY, Department of Wildlife, Fisheries & Conservation Biology, University of Maine, 5755 Nutting Hall, Orono, Maine 04469, USA (e-mail: noah@alumni.amherst.edu); **JUDITH AARSETH TUNSTAD** (e-mail: jtunstad22@coa.edu), **GEORGIA LATTIG** (e-mail: glattig24@coa.edu), **WESTLY REASON** (e-mail: wreason24@coa.edu), and **STEPHEN RESSEL**, College of the Atlantic,105 Eden Street, Bar Harbor, Maine 04609, USA (e-mail: sressel@coa.edu).

***AMBYSTOMA OPACUM* (Marbled Salamander). TAIL BIFURCATION.** Morphological anomalies in amphibians are not only curiosities for herpetologists but may also serve as markers of environmental stressors such as chytrid (Patel et al. 2012. BIOS 83:75–80), chlorofluorocarbon-induced UV overexposure, pollution/pesticide runoff, and parasites (Blaustein and Johnson 2003. Sci. Am. 288:60–65). One example is tail bifurcation, in which the tail of an individual splits into a forked end. Tail bifurcations are rarely observed in amphibians, but have been induced in the laboratory through trauma, such as the injection of tar into the tail bases of *Notophthalmus viridescens* (Eastern Newt; Breedis 1952. Cancer Res. 12:861–866) and the lumbar irradiation of *Ambystoma mexicanum* (Axolotl; Brunst et al. 1951. J. Morphol. 89:111–133). However, causes of tail bifurcations in wild amphibians remain unknown (Henle et al. 2012. J. Herpetol. 46:451–455). Estimates of the frequency of tail bifurcations in wild populations are also scarce. In a sample of 17,935 *Ambystoma talpoideum* (Mole Salamander), only "at least two individuals with forked tails" (≥0.01%) were recorded (Semlitsch et al. 1981. Herpetol. Rev. 12:69). A survey of *Plethodon cinereus* (Eastern

PHOTO BY KEN WANG

Fig. 1. Adult *Ambystoma opacum* from an urban wetland in Fulton County, Georgia, USA, displaying a bifurcated tail.

Red-backed Salamander) estimated a regional frequency of 1:1942 (.05%; Liebgold 2019. Herpetol. Bull. 148:35–36).

Here, I report what I believe to be the first recorded case of tail bifurcation in *A. opacum* (Henle et al. 2012. J. Herpetol. 46:451–455). My observation originates from an urban wetland in Fulton County, Georgia, USA (34.032°N, 84.315°W; WGS 84), where I observed an adult female *A. opacum* with a bifurcated tail (Fig. 1) underneath tree bark on 20 October 2020. Judging from the salamander's size and apparent vigor, her anomalous tail did not appear to pose a significant detriment to her survival. None of the other ca. 200 adult *A. opacum* that I have observed at this site have had a bifurcated tail. Population density at this site is high so I have certainly not found all individuals residing at this site. I therefore estimate a conservative <0.5% *A. opacum* tail bifurcation rate for this site. As individuals were not marked to account for recaptures, the precision of my estimate must not be regarded as exact.

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KEN WANG, Milton High School, Alpharetta, Georgia 30009, USA; e-mail: haotzuw@gmail.com.

***ANEIDES AENEUS* (Green Salamander). BEHAVIOR.** Little information has been published on the behavior of *Aneides aeneus* hatchlings after they disperse from their brood crevices. Most reports indicate that hatchlings seek out moist crevices and ledges that are often moss covered (Gordon 1952. Am. Midl. Nat. 47:666–701; Canterbury 1991. M.S. Thesis, Marshall University, Huntington, West Virginia. 186 pp.). Herein, we report on *A. aeneus* hatchlings use of cover objects on nest rocks at DuPont State Recreational Forest in Henderson and Transylvania counties, North Carolina, USA, from 2012 to 2020 (specific locations are on file with the North Carolina Wildlife Resources Commission and are withheld due to conservation concern). Our observations come from 51 nest rocks that were augmented with bark arrays at some point during the study period to increase the likelihood of detecting hatchlings during surveys. Bark arrays consisted of 4–6 pieces of bark gathered from the site and placed on a flat area on top of the nest rock. Bark pieces varied in size (typically ca. 12 × 30 cm) and were from *Pinus* spp., *Lirodendron tulipifera* (Tulip Poplar), and other trees found locally.

We recorded 152 hatchlings using cover objects. In most cases (97%), a single hatchling occupied a cover object. However, there was one occurrence (<1%) of three hatchlings under the same piece of bark, three occurrences (2%) of two hatchlings under the same piece of bark, and one occurrence (<1%) of two hatchlings under the same piece of *Umbilicaria mammulata* (Rock Tripe). Bark was the most common cover object used by hatchlings (86%; N = 130), followed by *U. mammulata* (8%; N = 12), moss (6%; N = 9), and wet leaves (<1%; N = 1). Of the 130 hatchlings using bark, 94% (N = 122) were found under bark on the surface of the rock, and 6% (N = 8) were found under defoliating bark at the base of stumps (N = 6) and trees (N = 2) on top of the rock. We also recorded several other species of salamanders using cover objects on the nest rocks including adult and juvenile *A. aeneus*, *Plethodon metcalfi* (Southern Gray-cheeked Salamander), *Eurycea wilderae* (Blue Ridge Two-lined Salamander), *Desmognathus carolinensis* (Carolina Dusky Salamander), and *Notophthalmus viridescens viridescens* (Red-spotted Newt). These observations suggest that when *A. aeneus* hatchlings disperse from their brood crevices, they move upward on the nest rock and seek cover that provides suitable microhabitat, and possible protection from predators including larger salamanders.

C. REED ROSSELL, JR. (e-mail: reed.rossell@ncwildlife.org) and **LORI A. WILLIAMS**, North Carolina Wildlife Resources Commission, 1722 Mail Service Center, Raleigh, North Carolina 27699, USA (e-mail: lori.williams@ncwildlife.org); **ALAN D. CAMERON**, 1030 West Blue Ridge Road, Flat Rock, North Carolina 28731, USA (e-mail: adcameron77@bellsouth.net).

***ANEIDES AENEUS* (Green Salamander). INTERSPECIFIC INTERACTIONS.** Interactions between *Aneides aeneus* and phylomycid slugs have long been observed (Gordon 1952. Am. Midl. Nat. 47:666–701) yet are sparsely documented in the literature (Cupp Jr. 2017. Herpetol. Rev. 48:153). Both taxa co-occur in rock outcrops throughout their range, including southwestern North Carolina, USA. The proposed relationship between *A. aeneus* and slugs varies widely. Slugs have been suggested as potential egg predators (Rossell et al. 2019. Am. Midl. Nat. 181:40–52), competitors for space (Cantrell 2012. M.S. Thesis, Tennessee Technological University, Cookeville, Tennessee. 23 pp.), neutral co-inhabitants (Gordon 1952, *op. cit.*), and mutualistic partners (Cupp 2020. Integr. Comp. Biol. Suppl. 1 60:e305).

Interspecific interactions of *A. aeneus* and slugs may be more commonplace than previously thought. As part of a long-term monitoring project, the North Carolina Wildlife Resources Commission (NCWRC) has recorded observations of slugs during *A. aeneus* surveys. However, these data were opportunistically recorded, particularly during the earlier part of the dataset, and as such should be regarded as a conservative estimate of salamander-slug co-occurrences. From 1 January 2011 to 30 July 2021, the NCWRC recorded 15,741 rock outcrop surveys for *A. aeneus*. Out of those, 1.88% (N = 291) surveys contained observations of slugs at known *A. aeneus* rocks. When slugs were present at the survey rock, *A. aeneus* were also present 44.67% (N = 130) of the time. Furthermore, 10.65% (N = 31) of these co-occurrences noted slugs in close proximity to the salamanders (e.g., in brood chamber or other used rock crevice, touching, in front of). Herein, we detail two observations of negative interactions between *A. aeneus* and phylomycid slugs, one of which resulting in the death of an *A. aeneus*.

During routine nest monitoring on 17 September 2013, we observed a *Philomycus* sp. (mantle slug) in a known brood

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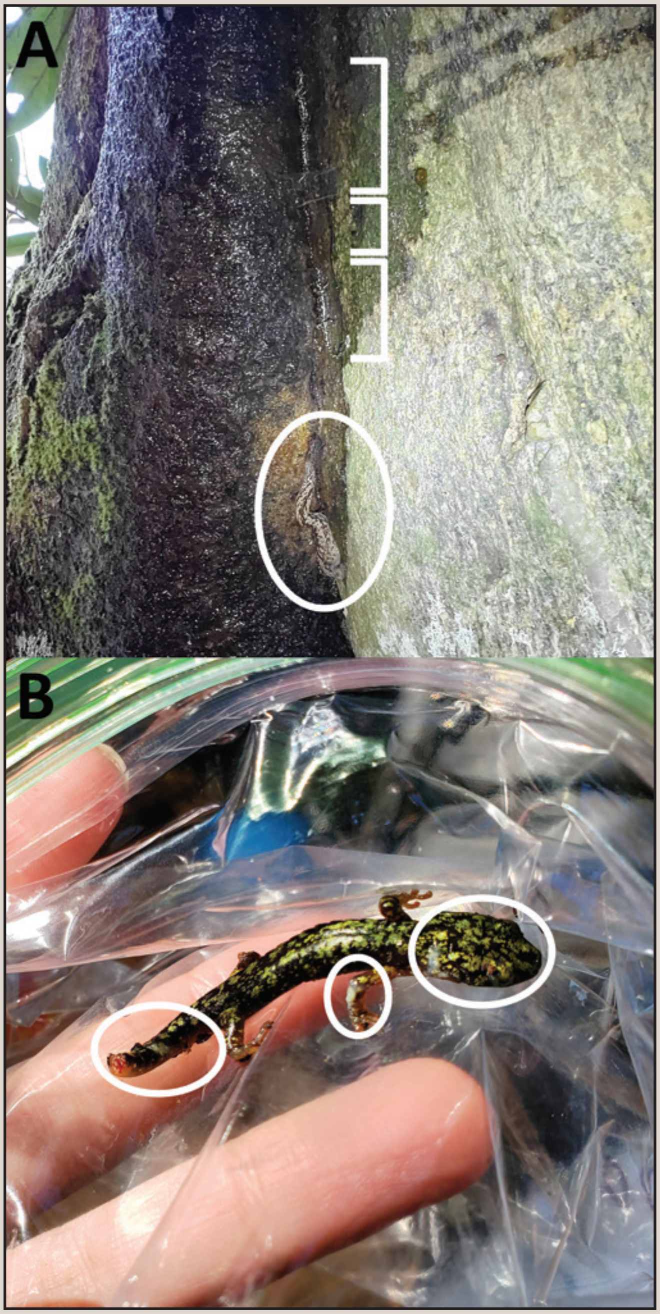

Fig. 1. A) A crevice entrance completely blocked by a *Philomycus* sp. (circled) containing two trapped sub-adult *Aneides aeneus*, with three additional sub-adult *A. aeneus* nearby (brackets); B) The trapped sub-adult *A. aeneus* impeded by the *Philomycus* sp. mucous**.** The left eye is adhered shut, the right eye is glazed over, and organic debris and mucous are stuck to the body.

chamber near several *A. aeneus* hatchlings in DuPont State Recreational Forest, Henderson County, North Carolina, USA (precise locality on file with the North Carolina Wildlife Resources Commission but withheld due to conservation concerns). We again visited the rock on 19 September 2013 to discover one of the hatchlings adhered to the side of the *Philomycus* sp. and covered in mucous. The hatchling was manually removed and gently cleaned in an attempt to remove the mucous, then returned to the brood chamber; the *Philomycus* sp. was removed from the rock. When we returned the following day, the affected hatchling was alive but appeared moribund and had not moved since the previous visit. The next day (21 September 2013) we checked the brood chamber and found the hatchling deceased.

More recently, at 1140 h on 14 October 2020, also located in DuPont State Recreational Forest, we found a *Philomycus* sp. covering what appeared to be a crevice between a tree root and rock, with three sub-adult *A. aeneus* nearby (Fig. 1A). Upon removing the *Philomycus* sp., we found one sub-adult *A. aeneus* missing part of its tail (36.2 cm SVL, 57.3 mm total length) and covered in mucous from the *Philomycus* sp., as if it had been trying to force its way past. The salamander had mucus on several parts of the body including both eyes, head, right foreleg, and tail (Fig. 1B). In addition to missing part of its tail, the salamander's movements appeared lethargic. It was monitored for 45 min as other salamanders were being processed for research purposes, during which there was no apparent improvement in condition. A second unimpaired sub-adult *A. aeneus* was later extracted from the same crevice that the *Philomycus* sp. had been blocking. Our final tally for that rock was six sub-adult *A. aeneus*, two of which were trapped by the slug.

These incidents represent discernable consequences to interspecific interactions between *A. aeneus* and *Philomycus* sp. slugs. Although it may be possible that *A. aeneus* might utilize slugs for water conservation (Cupp Jr. 2020, *op. cit.*), we show that interacting with *Philomycus* sp. in such a way poses a tangible risk, with the highest degree of risk involving physical (and possibly prolonged) contact with the slug. Additionally, these salamanders may be more resilient to warmer and drier conditions than previously thought (Bruce 1968. Herpetologica 24:185–194; Newman et al. 2018. J. Herpetol. 52:437–443; Williams et al. 2020. Herpetol. Conserv. Bio. 15:238–252). If so, these risky interactions may only be necessitated by more drastic environmental conditions. Furthermore, slugs might also constitute a physical barrier and/or occupy limited space in rock crevices that *A. aeneus* use for shelter, foraging, and nesting. Not only does such a barrier impact the salamanders, but it also impacts detection and abundance estimates during surveys. Had we not moved the *Philomycus* sp. on 14 October 2020, we would have missed 33% (N = 2; 6 total) of the *A. aeneus* present. These observations show that *Philomycus* sp. can negatively affect *A. aeneus*, both directly and indirectly, with specific regard to smaller individuals.

JILLIAN C. NEWMAN, Florida Fish and Wildlife Conservation Commission, 5300 High Bridge Road, Quincy, Florida, 32351, USA (e-mail: jcnewma@g.clemson.edu); **BEN DALTON** (e-mail: ben.dalton@ncwildlife.org) and **LORI A. WILLIAMS**, North Carolina Wildlife Resources Commission, 1722 Mail Service Center, Raleigh, North Carolina, 27699, USA (e-mail: lori.williams@ncwildlife.org); **ALAN D. CAMERON**, 1030 West Blue Ridge Road, Flat Rock, North Carolina, 28731, USA (e-mail: adcameron77@bellsouth.net).

***EURYCEA HILLISI* (Hillis's Dwarf Salamander). REPRODUCTION.** *Eurycea hillisi* is a small plethodontid salamander found in seeps and small streams in the southern parts of Alabama, Georgia, and the central Florida, USA, panhandle. The species was recently described as a distinct member of the *E. quadridigitata* complex (Wray et al. 2017. Herpetol. Monogr. 31:18–46), and little is currently known about its natural history and reproduction. The observations reported here represent the first documented occurrences of eggs in the wild. On 5 February 2018, I located a single nest near the type locality for the species in Calhoun County, Florida, USA (30.4344°N, 85.1700°W; WGS

FIG. 1. Adult female *Eurycea hillisi* among an oviposition site in Florida, USA.

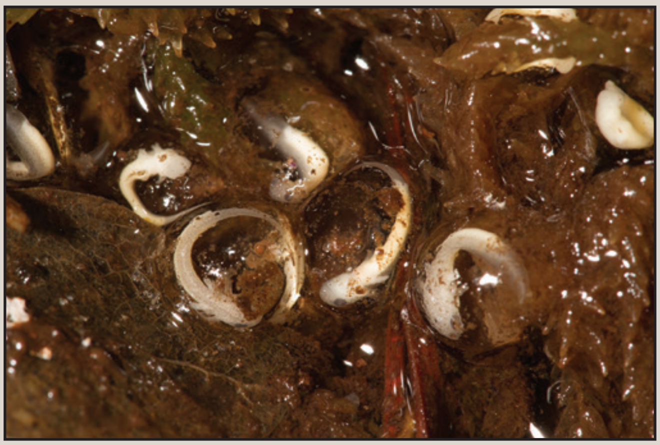

FIG. 2. Eggs of *Eurycea hillisi* uncovered within long fibered sphagnum in Florida, USA.

84). The nest consisted of ca. 8–10 eggs located within a mat of *Thuidium* moss that was clinging to a slightly elevated root mass within a hillside seep. The eggs were tightly clustered and positioned immediately above slowly flowing water. One adult *E. hillisi* was found in association with the nest. Five eggs containing advanced-stage embryos were collected, raised to hatching, and their identification further confirmed by comparison of the larvae with *E. quadridigitata,* which also occurs at the site.

During the morning of 28 February 2021, I uncovered 8–10 nesting sites at a newly discovered population of *E. hillisi* at Lake Talquin State Forest in Gadsden County, Florida, USA (McGrath-Blaser et al. Herpetol. Rev. 52:571). The identity of the nests was confirmed by the presence of three adult *E. hillisi* in their immediate proximity (Fig. 1; 1 male, 2 females). All observed nests were uncovered in three small parallel seepages within 1–3 m of the point where flowing water emanated from the moderately sloping hillside. Each nest was deposited immediately above the edge of seepage flow so that water trickled beneath and among the eggs. The surrounding forest consisted of mixed pine-hardwoods upslope and bottomland hardwoods downslope. Each discrete nest consisted of 10–20 eggs that were loosely deposited within a matrix of long-fibered sphagnum moss and wet leaf litter. Larger assemblages of eggs with embryos at widely different developmental stages were assumed to be two nests deposited in the same location. Individual egg capsules were ca. 5 mm in diameter and completely clear, allowing for easy viewing of the whitish embryos inside (Fig. 2).

E. PIERSON HILL, Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, 1105 S.W. Williston Road, Gainesville, Florida 32601, USA; e-mail: pierson.hill@myfwc.com.

***HYDROMANTES PLATYCEPHALUS* (Mount Lyell Salamander). DIURNAL ACTIVITY.** The plethodontid salamander *Hydromantes platycephalus* is distributed across the Sierra Nevada in California, USA in high-elevation talus fields, seeps, and waterfall spray zones (Stebbins 2003. A Field Guide to Western Reptiles and Amphibians. Third edition, revised. Houghton Mifflin Company, Boston, Massachusetts. 533 pp.; Wake and Papenfuss 2005. *In* Lannoo [ed.], Amphibian Declines: The Conservation Status of United State Species, pp. 783–784. University of California Press, Berkeley, California). Its exceptionally flat head and body facilitate access and movements in cracks and fissures formed in granite boulders within its habitat (Adams 1942. Univ. California Publ. Zool. 46:179–204) and it employs a projectile-like ballistic tongue to capture invertebrate prey (Deban et al. 1997. Nature 389:27–28). Though it can be found under rocks near melting snow and in wet cracks during the day this salamander

FIG. 1. *Hydromantes platycephalus* as found in a fern during the day in Placer County, California, USA.

FIG. 2. The fern that held the first three *Hydromantes platycephalus* with arrows marking salamander locations in Placer County, California, USA.

is considered nocturnal in its habits (Adams 1942, *op. cit.*; Clark and Hagen 2008. Son. Herpetol. 21:122–123; R. W. Hansen, pers. comm.). Here, we report on diurnal activity in *H. platycephalus.*

On 26 July 2021 at 1830 h (ca. 110 min before dark), at the base of a large rock face bordering a talus field in Placer County, California, USA (2488 m elev.), we discovered one adult and one subadult *H. platycephalus* resting on the fronds of a fern ca. 0.7 m off the ground and one small juvenile at the root base (Figs. 1–2). Due to a well below-average rainy season, the local snowpack melted unusually early and the area had not received any recent precipitation until that morning when a brief rain fell in the area. The underside of rocks were still dry and the only moisture present was in the form of small droplets on *Athyrium felix-femina* (Western Lady Ferns) and *Sambucus racemosa* (Red-berried Elders). Seven more juvenile *H. platycephalus* were found at the base of plants in the area, bringing the total to ten *H. platycephalus* exhibiting this behavior. The animals were first detected at 1830 h but had likely been surface active earlier. Just after dark, around 2100 h, it began to lightly rain and several salamanders were observed moving around on the talus and near a large rotting log. Perhaps the diurnal movements were stimulated by the unusually dry conditions with the salamanders capitalizing on the only surface moisture available. It is likely they climbed up through the talus into the plants above that held limited amounts of water.

NOAH MORALES (e-mail: noahmorales01@gmail.com) and **CASEY MOSS**, 1190 Plymouth Ave, Atwater, California 95301, USA (e-mail: hydromantesbrunus@icloud.com).

***NECTURUS MACULOSUS* (Mudpuppy). NEST DESCRIPTION.** *Necturus maculosus* is a rarely seen and poorly understood permanently aquatic salamander of the eastern United States. Little has been published with regards to their life history, and life history data can be used to conserve habitat as well as conduct population viability analyses to understand how changes may negatively impact populations. Very little has been published recently with regards to their reproductive mode, particularly with a focus on nest site characteristics (Eycleshymer 1906. Am. Nat. 40:123–136; Smith 1911. Biol. 20:191–200; Bishop 1926. New York State Mus. Bull. No. 268. 60 pp.; Bishop 1941. New York State Mus. Bull. No. 324. 365 pp.; Fitch 1959. Copeia 1959:339–340; Pfingsten and White 1989. *In* Pfingsten and Downs [eds.], Salamanders of Ohio, pp. 72–77. Ohio Biological Survey Bulletin, Columbus, Ohio; Petranka 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, D.C. 587 pp.). Here, we report descriptions of four *N. maculosus* nests and their habitat in Sand Lake, northwestern Wisconsin, USA.

Sand Lake (45.29718°N, 91.36013°W; WGS 84) is a 272-acre spring-fed, mesotrophic lake located in Chippewa and Rusk counties, Wisconsin, USA. The west side of the lake is heavily developed, while the east side is more wooded. Maximum depth of the lake is estimated at 30.5 m with a mean depth of 8.8 m. The substrate includes sand, gravel, cobble, boulder, and silt.

Nest compound 1 and compound 2 were first discovered in 2010 and have been seen every year since (Table 1). Nest compound 3 and compound 4 were first surveyed in 2021 (Table 1). Eggs in compound 1 and 2 have typically been seen on the same cover objects during early summer. On 26 June 2021, nest compound 1 had unhatched eggs attached to a cement block. In July 2021, data was collected for all four nest compounds by flipping each cover object and noting what species were present, how large the cover object was, distance from the dock, distance from the bank, number and condition of eggs/egg casings, and habitat characteristics (substrate and vegetation type).

Overall, nests were found either under cement or under a log. Cover dimensions ranged from 110–1326 cm^2 with an average of 767 cm^2. Water depth ranged from 38.1–127 cm with an average of 80.7 cm. By 11 July 2021 almost all the eggs had hatched. The

Table 1. Description of four nest compounds and habitat in Sand Lake, Wisconsin, USA from 11 July 2021.

	Nest compound 1	Nest compound 2	Nest compound 3	Nest compound 4
Location (WGS 84):	45.29303°N, 91.36650°W	45.29337°N, 91.36641°W	45.29329°N, 91.36640°W	45.29286°N, 91.36635°W
Cover type:	cement block	log	cement	cement block
Cover dimensions (cm):	51.2 L × 26 W	62 L × 48 W	25.4 L × 27.9 W (triangular)	26 L × 37 W (rectangular)
Water depth (cm):	38.1	127	88.9	68.6
Condition of eggs:	hatched; 1 larvae (ca. 20 mm in nest)	hatched	hatched	30 hatched; 7 unhatched
# eggs or egg casings:	46	egg casings too degraded	ca. 35	37
Distance from bank (m):	2.03	12.5	10.7	7.4
Distance from nearest nest (m):	38.6	3	11.9	3.6
Substrate:	85% sand 15% gravel	40% sand 20% gravel 10% silt	83% sand 3% cobble 10% silt 2% detritus	97% sand 3% gravel
Vegetation type:	100% submergent	100% submergent	100% submergent	100% submergent
Habitat in a 3 m radius:	80% open water 15% macrophytes 5% rock	80% open water 5% macrophytes 13% rock 2% cover object	93% open water 5% macrophytes 2% artificial (dock wheels)	78% open water 15% macrophytes 5% artificial (boat lift) 2% cobble
Habitat notes:	0.61 m from boat dock	2.4 m from boat dock	95% covered above by boat dock	
Guarding female presence:	present	present	present	present
Other species presence:	none	3 crayfish	none	none

number of eggs ranged from ca. 35–46 and averaged 39.3. The distance from the bank ranged from 2.03–12.5 m and averaged 8.16 m. The distance from the nearest nest ranged from 3–38.6 m and averaged 14.3 m. The substrate was mostly composed of sand followed by gravel, silt, cobble, and detritus. All the vegetation near the nests were submergent, and the general habitats were mostly made up of open water, followed by macrophytes, rock, cobble, and boat dock wheels and boat lifts. Guarding females were present at all the nests and only one nest had another species (crawfish) present.

From what can be compared from previous *N. maculosus* nest investigations, there are a few differences worth noting. First, Eycleshymer (1906, *op. cit.*) found *N. maculosus* nests beneath logs, boards, pieces of tin, canvas, and even an old hat. Smith (1911, *op. cit.*) found them under loose flat stones and boards in Lake Monona, Wisconsin, and Bishop (1926, *op. cit.*) documented *N. maculosus* nests under rocks in streams in northwestern Pennsylvania, USA. We describe the first published descriptions of *N. maculosus* nests under concrete blocks, however based on Eycleshymer's (1906, *op. cit.*) observations, *N. maculosus* likely will nest under a wide variety of objects. Second, Bishop (1926, *op. cit.*) reported an average of 107 eggs per nest, Lagler and Goellner (1941. Copeia 1941:96–98) reported an average of 122 eggs from dissections of females from Evan's Lake, Michigan, USA, Smith (1911, *op. cit.*), reported an average of 66 eggs, and Bishop (1926, *op. cit.*) had counts that ranged from 87–140 eggs. Our egg counts per nests average much lower than has been previously documented, however Lagler and Goellner (1941, *op. cit.*) suggested that counting eggs prior to spawning provides a better index of fecundity since guardian females are known to eat some of the eggs they are attending, and there is evidence that more than one female may spawn in the same nest. It also must be taken into consideration that our egg counts were mostly from egg casings left over from hatching. Third, Eycleshmyer (1906, *op. cit.*) stated that nests are often within close proximity to one another, in fact 10 nests were found about 30.5 cm apart from each other on the same 364.8 cm^2 board. Our measurements indicate much greater distances between nests. This could possibly be due to a limited amount of suitable cover objects. Lastly, this note includes the first published descriptions and measurements of distance from the bank, substrate, vegetation type, and general habitat descriptions of *N. maculosus* nests.

This data can be used to better inform population viability analyses to better understand *N. maculosus* fecundity. As well as to help land managers understand, conserve, and restore *N. maculosus* breeding habitat. It was very apparent that proper cover objects were very limited at this site. Wherever there was a cover object bigger than 15 cm, it had a nest, and cover objects were sparsely distributed. Since we describe *N. maculosus* nesting under concrete blocks, those might make excellent additions to areas to increase breeding habitat.

ADRIAN D. MACEDO (e-mail: adrian.macedo@siu.edu) and **HANNAH M. HOLMQUIST**, Southern Illinois University-Carbondale, School of Biological Sciences, Zoology Program, 1125 Lincoln Drive, MC6501 Carbondale, Illinois 62901, USA (e-mail: hannah.holmquist@siu.edu).

***NECTURUS MACULOSUS* (Mudpuppy). NESTING.** *Necturus maculosus maculosus* are the most widespread and well-studied of the Proteidae, ranging from northern Georgia, USA into eastern Canada and west to the Great Plains. Despite this extensive range, most of our knowledge of life history traits for mudpuppies is based on studies occurring in the northern half of its range, specifically the Great Lakes region. Little is known regarding life history traits in the southern portion of its range. In Tennessee, USA, *N. maculosus* is thought to occur statewide in permanent streams, rivers, and likely in reservoirs and lakes. Literature suggests that parturition and nest-guarding in *N. m. maculosus* occurs in late winter through spring, but there are no published observations to verify this in Tennessee (Pasachnik and Niemiller 2011. *In* Niemiller and Reynolds [eds.], The Amphibians of Tennessee, pp. 231–233. University of Tennessee Press, Knoxville, Tennessee). Here, we report four observations of *N. m. maculosus* nests that were discovered while conducting snorkel surveys and lifting cover objects opportunistically for aquatic salamanders from 2011 to 2017, and approximate timing of laying in three river tributaries to the Tennessee River.

Nest number one, containing 22 eggs, was found in a pool of Little River, Blount County, Tennessee, USA (35.6796°N, 83.7221°W; WGS 84) on 2 August 2013. The female (20.2 cm total length, 13.4 cm SVL, 40 g) was with the nest. The nest was attached to the underside of a rock (longest dimension 92.3 cm) underlain by silt, although cobble and gravel were present in other areas under the rock. Water depth was 70.2 cm and the closest bank was 450 cm away. Dissolved oxygen was 11.1 mg/L and water temperature was 21.1°C. The eggs were in the middle stages of development, ca. day 36 and the embryos were active (Storer and Usinger 1957. General Zoology. McGraw-Hill Book Company, Inc., New York, New York. 664 pp.).

Nest number two, containing 42 eggs, was discovered in Citico Creek, Monroe County, Tennessee, USA (35.4763°N, 84.1153°W; WGS 84) on 4 May 2014. The female was still under the nest rock, which was 70 cm in length, 55 cm in width, 4 cm in height. Substrate consisted of approximately 90% sand, and 10% pebble. Water depth to the substrate bottom was 80 cm and the distance from the closest bank to the nest rock was 90 cm. The attending female had a total length of 29.0 cm and a SVL of 19.0 cm. Given the stage of development, little cleavage if any was visible, the nest was laid within the previous 3 d. No additional eggs were visible within the female's body cavity.

Nest number three, containing a single egg, was discovered in the Hiwassee River, Polk County, Tennessee, USA (35.2393°N, 84.5623°W; WGS 84) on 10 May 2015. The female was still under the nest rock, which was 58 cm in length, 30.5 cm in width, 18 cm in height; and had a substrate consisting of ca. 90% silt, 5% cobble, and 5% pebble. The nest rock was 480 cm to the nearest bank. The female tending the nest measured 18.3 cm total length, with a SVL of 12.4 cm. No additional attachment sites were observed, but the female contained numerous eggs visible externally within her body cavity. Based on developmental stage, this nest also was likely laid within the previous 3 d.

Nest number four, containing 40 eggs, was discovered in the Hiwassee River, Polk County, Tennessee, USA (35.2192°N, 84.5176°W; WGS 84) on 17 May 2015. The female was still tending the nest and measured 21.4 cm total length and 15.3 cm SVL. The nest rock was 67 cm in length, 67 cm in width, and 7.6 cm in height. Substrate was ca. 50% sand, 30% silt, and 20% detritus. Additionally, the nest rock was 698 cm from bank. An additional two eggs suffered predation, or otherwise detached, apparent from two attachment sites with remaining partial egg capsules. Like the previous two nests, this nest also was likely laid within the previous 3 d based on stage of development.

Our observations support that, within the southern portion of its range, and specifically the southern Appalachians, oviposition in *N. m. maculosus* occurs in late spring/early summer. Also consistent with previous reports, all eggs were attached singly underneath rocks (Bishop 1926. New York State Mus. Bull. 268:5–60). Eycleshymer (1906. Am. Nat. 40:123–136) suggested that females could lay at least 12 eggs in one day, which would place a window of egg laying from late April to early June for our observations in southern Appalachian streams. This is consistent with previous reports of nesting from April to early June in other parts of the species' range (Bishop 1926, *op. cit.*; Fitch 1959. Copeia 1959:339–440). It is suggested that egg laying is synchronized within local populations, and lasts one week, or less (Smith 1911. Biol. Bull. 20:191–200; Fitch 1959, *op. cit.*). Nest three and four were found several river miles apart, and were discovered within a week of each other. Nest three was discovered with only one egg, which suggests that it had just been laid, while nest four was discovered with 40 eggs. The timing suggests that, at least with these two observed nests, that nesting may have been synchronized. These observations provide insight to the nesting habits of *Necturus* in east Tennessee and should be taken into consideration for conservation implications when conducting aquatic fauna surveys, especially rock flipping and electroshocking, in Tennessee, as well as the southern Appalachians.

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STEPHEN K. NELSON, Zoo Knoxville, 3500 Knoxville Zoo Drive, Knoxville, Tennessee 37914, USA (e-mail: snelson@zooknoxville.org); **EVIN T. CARTER**, University of Tennessee, 569 Dabney Hall, Knoxville, Tennessee 37996, USA (e-mail: ecarte19@vols.utk.edu); **KIRSTEN A. HECHT**, University of Florida, P.O. Box 116455, Gainesville, Florida 32611, USA (e-mail: kirstenhecht@ufl.edu); **LINDSEY HAYTER**, Admiral Veterinary Hospital, 204 N Wyatt Road, Knoxville, Tennessee 37934, USA (e-mail: lehayter28@hotmail.com).

***NOTOPHTHALMUS VIRIDESCENS* (Eastern Newt). ARTIFICIAL BREEDING HABITAT.** *Notophthalmus viridescens* is a common newt species with a wide distribution across eastern North America. The species' range extends from central Texas, USA eastward through the gulf coast states to the southern coast of Florida, USA and northward into southeastern Canada. *Notophthalmus viridescens* is characteristic of wetland and riparian environments that commonly occur throughout this area and many of its life history characteristics reflect the species' association with this habitat type. More specifically, this species is known to prefer wetland habitats with dense submerged vegetation and underwater structure (Behler and King 1996. National Audubon Society Field Guide to North American Reptiles and Amphibians. 12th edition. Alfred A. Knopf, Inc., New York, New York. 744 pp.).

On 16 April 2021, at ca. 2138 h during a herpetofaunal survey, I observed notable breeding activity and abundance of *N. viridescens* in a concrete cattle trough (29.35387°N, 95.97312°W; WGS 84; Fig. 1). In total, ca. 30 individuals were observed near the surface of the water and all appeared to be reproductively active. It appeared that there were more males present than females; however, this could be due to males being more active at the water's surface. Five males were collected and deposited into the herpetology collection at Texas A&M International University (TAMIU-H0038–42). This particular cattle trough is characteristic of ranching practices in this area of Texas, where troughs are maintained via windmills and allowed to remain filled year-round. The trough was host to a substantial amount of submergent aquatic vegetation (e.g., *Ceratophyllum demersum*) and algae (Fig. 1), which was likely an important component of the artificial habitat.

Fig. 1. Daytime photo of artificial breeding habitat (concrete cattle trough) used by *Notophthalmus viridescens* in Texas, USA.

Artificial breeding habitat is an important supplement to native habitats for many amphibians, particularly because breeding habitat for many species is considered limited in many areas (Brand and Snodgrass 2010. Conserv. Biol. 24:295–301). This particular observation is noteworthy because it demonstrates the ability of this species to utilize an artificial habitat. Additionally, this observation provides evidence of a ranching practice that can be beneficial by providing usable habitat for *N. viridescens.* This may be an important consideration for landowners or natural resource managers to consider during times of drought or areas with limited wetland habitat availability.

Specimens and associated data collected under a Texas Parks and Wildlife Department Scientific Permit for Research (SPR-0820-220) and under a Texas A&M International University IACUC protocol (#2018-1).

CORD B. EVERSOLE, Department of Biology and Chemistry, Texas A&M International University, Laredo, Texas 78041, USA; e-mail: cord.eversole@gmail.com.

***PARAMESOTRITON DELOUSTALI* (Vietnam Warty Newt). MALFORMATION.** In salamanders and newts, the most common malformations are polyphalangy, ectrodactyly, and brachydactyly, which occur in both larval and adult stages (Williams et al. 2008. Biol. Lett. 4:549–552). Generally, malformations may be caused by environmental changes, parasites, diseases, prenatal stress, genetic predisposition, or UV radiation (Blaustein and Johnson 2003. Front. Ecol. Environ. 1:87–94). Here, we report a case of polymelia in an adult female *Paramesotriton deloustali.* The specimen was collected on 20 May 1995 by S. Uemo, on Tam Dao Mountain (ca. 950–1000 m elev.), Tam Dao National Park, Vinh Phuc, Vietnam, and stored at the National Museum of Nature and Science, Tokyo, Japan. The *P. deloustali* possesses two right hind limbs, one with five long toes, the other with six short toes (Fig. 1A–C). However, the soft X-ray image shows that there is no metatarsal or phalanges in the fourth toe of the six-toe limb (Fig. 1D). This is the first description of a malformation for the

Fig. 1. The malformation of an adult *Paramesotriton deloustali* from Tam Dao National Park, Vinh Phuc, Vietnam: A) dorsal view of whole body; B) dorsal view of extra hind limb; C) ventral view of extra hind limb; D) soft X-ray image of extra hind limb.

genus *Paramesotriton*. Malformations may negatively impact the survival of natural populations (Sessions and Ruth 1990. J. Exp. Zool. 254:38–47; Williams et al. 2008, *op. cit.*), therefore, further studies on the effects of malformations on Asian newts are warranted.

DUNG VAN TRAN, Graduate School of Global Environmental Studies, Kyoto University, Yoshida-honmachi, Sakyo-ku, Kyoto 606-8501, Japan, and Wildlife Department, Vietnam National University of Forestry, Xuan Mai, Chuong My, Ha Noi, Vietnam (e-mail: trandungfuv@gmail.com); **SOTARO HARA**, Graduate School of Human and Environmental Studies, Kyoto University, Yoshida Nihonmatsu-cho, Sakyo-ku, Kyoto 606-8501, Japan (e-mail: hara.sotaro.47a@st.kyoto-u.ac.jp); **KANTO NISHIKAWA**, Graduate School of Global Environmental Studies, Kyoto University, Yoshida-honmachi, Sakyo-ku, Kyoto 606-8501, Japan and Graduate School of Human and Environmental Studies, Kyoto University, Yoshida Nihonmatsu-cho, Sakyo-ku, Kyoto 606-8501, Japan (e-mail: nishikawa.kanto.8v@kyoto-u.ac.jp)

ANURA — FROGS

ANAXYRUS AMERICANUS CHARLESMITHI **(Dwarf American Toad). SURBURBAN HABITAT USE.** We report intriguing behaviors pertaining to use of human-altered habitat by *Anaxyrus americanus charlesmithi* which provide additional insights into its tolerance of urban and suburban environs, commonality, state-wide distribution in Arkansas, USA (Trauth et al. 2004. The Amphibians and Reptiles of Arkansas. University of Arkansas Press, Fayetteville, Arkansas. 421 pp.), and extensive continental

Fig. 1. Female *Anaxyrus americanus charlesmithi* found on 12 April 2021 self-buried ca. 12.7 cm deep in an gallon plastic container which had been left outside since November after being used for growing plants in 2020 in Fayetteville, Washington County, Arkansas, USA.

distribution in eastern North America (Powell et al. 2016. Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Fourth Edition. Houghton Mifflin Harcourt, Boston Massachusetts, 494 pp.). In the city of Fayetteville, Washington County, in the extreme northwestern part of Arkansas, JMW has occupied a house on a 55 × 55 m suburban lot for >50 years. The suburb was platted on essentially treeless and grass-dominated plains pastureland previously used for livestock. Over that lengthy period the residential lot has transitioned to a tree-dominated setting with a wide variety of low-growing native and horticultural plants with only occasional mowing. It is situated approximately 100 m NE of a concrete lined drainage ditch and 250 m W of a small creek in a narrow heavily vegetated ravine, both of which are conducive to amphibian breeding activities. On the aforementioned residential homeplace, JMW has observed an increasing variety of native vertebrate species as the habitat has transitioned in complexity. Included are numerous species of birds (most recently the first roadrunner and mating hawks), and a surprising assortment of mammals (e.g., feral cats, moles, gray squirrels, foxes, raccoons, rabbits, opossums, armadillos, and deer) for a suburban locale. Reptiles observed on this small parcel of land were reported by Walker et al. (2021. Herpetol. Rev. 52:171–172), which featured the long-term abundance of *Storeria dekayi* (Dekay's Brownsnake). However, the only anurans verified thereon are *Hyla versicolor* (Gray Treefrog), occasionally heard calling from tall trees on the property, and occasional encounters with individuals of *A. americanus* *charlesmithi* (Dwarf American Toad). In the latter case, a small melanistic individual (<2.4 cm) was photographed at ca. 0900 h under dry diurnal conditions on 12 July 2020, which documented a substantial dispersal distance for the species at a small size from one of the two mentioned potential breeding sites.

The nexus for this report occurred at 1430 h on 12 April 2021 as a large number of one gallon plastic containers used for growing a variety of summer plants were being activated for use in that growing season. They had remained unattended on the north side of the house subsequent to freezing temperatures in November of 2020. Activation of the containers involved removing roots and stirring the residual potting mixture in each container by hand. As JMW grasped a handful of the medium near the bottom of one of these the texture of it was immediately noted as being unusual. Upon removal from the container the handful of medium was found to include a large female of *A. americanus charlesmithi*. The animal quickly became active, and it hopped away after being photographed in the container (Fig. 1) and released under a large southern magnolia tree. Although, there is no way of knowing the duration that the animal had sequestered itself in the container, it was recalled that the surface of the potting mixture showed no signs of recent disturbance. Although neither the approximate date the toad buried itself nor how it gained access to the upright gallon container are known, we can state that the pot was located among an accumulation of leaves and that it contained a soft well-drained mixture that could provide a respite from temperature fluctuations, aridity, and predation. That this amphibian is attracted to shelters provided by groups of containers-grown plants was again indicated by an observation of a large adult sheltered among such a display on on the same suburban lot in Fayetteville on 4 May 2022. Upon making the 2021 observation known, SET added that an individual of *A. a. charlesmithi* had once taken refuge in one of his work shoes left outside in suburban Morrilton, Conway County, Arkansas. We offer these as examples of the tolerances and opportunistic behaviors of this euryecious amphibian species which have facilitated its success in urban and suburban environs within its vast continental distribution often well removed from breeding sites.

JAMES M. WALKER, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA (e-mail: jmwalker@uark.edu); **STANLEY E. TRAUTH**, Department of Biological Sciences, Arkansas State University, State University, Arkansas 72467, USA (e-mail: strauth@astate.edu).

***BOANA AGUILARI* AND *SCINAX RUBER* (Common Snouted Treefrog). INTERSPECIFIC AMPLEXUS.** *Boana aguilari* is an endemic species inhabiting the Eastern Andes of Central Peru, in the Pasco and Junín regions, at elevations of 1225–2200 m, while *Scinax ruber* is a species with a widespread distribution in the Amazon basin in South America (Frost 2020. Amphibian Species of the World 6.1, an Online Reference. https://amphibiansoftheworld.amnh.org; 25 Nov 2020). Although examples of interspecific amplexus among frogs are relatively common (Grogan and Grogan 2011. Herpetol. Rev. 42:89–90; Manzano and Corzas 2011. Herpetol. Rev. 42:84), details of the interactions between species with divergent elevational ranges are scarce. Here, we report for the first time, interspecific amplexus between a male *B. aguilari* and a female *S. ruber*.

During a night survey at 2050 h on 17 December 2019 at Quimiri Sur, Chanchamayo Province, Junín region, LAGA observed two male *B. aguilari* in amplexus with the same adult gravid female *S. ruber* on the surface of a small pond (ca. 1.3 km^2) close to a recently burned farm (11.0806°S, 75.3123°W; WGS 84; 1215 m elev.). Both males were on top of the female; one was in axillary amplexus, the other was holding the *S. ruber* around the neck potentially causing asphyxia to the female. The *S. ruber* tried to pull itself away from the male *B. aguilari* around its neck. Once disturbed by our presence, this male released the neck and jumped out of the pond toward nearby shrubs. This left the other male *B. aguilari* in amplexus with the female *S. ruber*, which remained still in the center of the pond. The female *S. ruber* made no attempt to release itself from the amplecting male *B. aguilari* (Fig. 1). Four hours later, this pair was observed in the same position. The voucher specimens of *B. aguilari* (CORBIDI 22212) and *S. ruber* (CORBIDI 22213) are stored in the Colección de Herpetología of the Centro de Ornitología y Biodiversidad (CORBIDI), Lima, Peru.

Fig. 1. Adult male *Boana aguilari* in amplexus with adult female *Scinax ruber* at Quimiri Sur, Chanchamayo Province, Junín region, Peru.

LUIS A. GARCÍA-AYACHI, Instituto Peruano de Herpetología, Lima, Perú / Centro de Ornitología y Biodiversidad, Lima, Perú (e-mail: lgarciaayachi@gmail.com); **ERIKA BERROCAL**, Centro de Ornitología y Biodiversidad, Lima, Perú (e-mail: erika.berrocalrodriguez@gmail.com).

***BUFO BUFO* (Common Toad). ARBOREAL BEHAVIOR.** *Bufo bufo* is a common and terrestrial toad found throughout Europe in a variety of habitats including a range of wetlands, temperate grasslands and forests (Arnold and Ovenden 2002. A Field Guide to the Reptiles and Amphibians of Britain and Europe. Second edition. Collins Publishers, London, U.K. 288 pp.). They are nocturnal outside of the breeding season (Britain's Reptiles and Amphibians. WildGuides Ltd. Hampshire, U.K. 164 pp.) and have been reported to forage exclusively on land (www.amphibiaweb.org; 31 August 2021), using a combination of active searching and sit-and-wait foraging.

There are few published records of the substantial climbing behavior in *B. bufo*. Bringsøe (2016. Mertensiella 24:146–149) reported individuals climbing walls, hedges, a young Norway Spruce (*Picea abies*) at unspecified heights, and 50–60 cm among the flowers of a European Goldenrod (*Solidago virgaurea*) in Denmark. Here, we report observations of arboreal behavior in *B. bufo* while collecting toads as part of an unrelated research project.

During fieldwork at Fairwood Common on the Gower Peninsula, Swansea, Wales, U.K. (51.60181°N, 4.03534°W; WGS 84; 103 m elev.), we observed a young adult *B. bufo* (29 g, ca. 6

PHOTOS BY KEVIN ARBUCKLE

Fig. 1. Four individuals of *Bufo bufo* found climbing up to ca. 120 cm in trees at Fairwood Common on the Gower Peninsula, Swansea, Wales, U.K.

cm SVL) resting ca. 120 cm high in a tree fork at 2208 h on 2 June 2021, 30 min after sunset (Fig. 1A). Since then, we have observed an additional six separate instances of *B. bufo* climbing into trees at the same site. On the nights of 23 and 24 June 2021, there were a total of 13 *B. bufo* found, five of which were located at heights between 30–120 cm in trees. Figure 1B and 1C show a juvenile and adult respectively, exhibiting this arboreal behavior. On 6 July 2021 at 2257 h, another juvenile (Fig. 1D) was found climbing a tree at a steep angle (ca. 70°) ca. 90 cm off the ground.

The conditions have varied when this behavior has been observed, with high humidity (ca. 80%) and temperatures ranging from 14–18°C. The sightings all occurred within an hour of sunset, with damp ground conditions. The available routes by which the *B. bufo* could have reached the locations where we observed them involved climbs ranging from 45 to nearly 90°, and the behavior was not limited to adult *B. bufo*.

Bufo bufo is an opportunistic and generalist predator of small invertebrates (Gittins 1987. Amphibia-Reptilia 8:13–17; Vignoli et al. 2009. Life Environ. 59:47–57; Mallov and Stojanova 2010. Biotechnol. Biotechnol. Eq. 24(Supp1):263–269; Crnobrnja-Isailovi et al. 2012. J. Herpetol. 46:562–567) and these prey items were commonly found on tree trunks in the area, including those which toads had climbed. However, as they were also common at ground level, it is difficult to conclude that arboreal behavior in *B. bufo* provides specific advantages for feeding compared to foraging at ground level. We suggest that general exploratory activity, perhaps largely consisting of active foraging, leads *B. bufo* to move around any part of the environment it can feasibly access, including tree trunks.

The paucity of previous published records of arboreal activity in *B. bufo*, and the consideration of it as a firmly terrestrial species (Arnold and Ovenden 2002, *op. cit.*), are perhaps more to do with human search patterns than toad activity. Herpetologists searching for *B. bufo* (particularly in the U.K. where no arboreal reptiles or amphibians are native) typically search on the ground. Our observations suggest that researchers may benefit from expanding active searches for *B. bufo* to include tree trunks in suitable habitats, particularly where forks and cavities provide opportunities to securely rest. Although arboreal behavior has been documented in *B. bufo* previously (Bringsøe 2016, *op. cit.*), published observations remain rare and the species is still considered firmly terrestrial. Our observations add, to our knowledge, the first records of arboreality for *B. bufo* in the U.K. and suggest that it may be an under-reported but common behavioral strategy in this well-studied species.

JOE ROBERTS, Civil Engineering Department, College of Engineering, Swansea University, Bay Campus, Swansea, United Kingdom, SA1 8EN (e-mail: 654516@swansea.ac.uk); **KEVIN ARBUCKLE** Department of Biosciences, College of Science, Swansea University, Swansea, United Kingdom, SA4 3PB (e-mail: kevin.arbuckle@swansea.ac.uk).

***BUFO SPINOSUS* (Spined Toad). PREDATION.** Bufonids are well known for their ability to produce steroid toxins (bufadienolides) mainly from their parotoid glands, but also from their dorsal tegument (Chen et al. 2017. Ecol. Evol. 7:8950–8957). These toxins are associated with a bitter taste and inhibit Na+/K+ -ATPase activity with effects ranging from nausea to heart failure. They are mainly used as an antipredator defense to repel or kill potential predators. Despite their potent skin toxins, many bufonids are preyed upon by reptilian (Costa and Trevelin 2020. Herpetol. Notes 13:649–660), avian (Bordignon et al. 2018. PLoS ONE 13:e0193551; Blancas-Calva and Castro-Torreblanca 2021. Reptil. Amphib. 28:227–228) and mammalian species (Cabrera-Guzmán et al. 2014. J. Pest Sci. 88:143–153). In Europe, mammalian predators of *Bufo* spp. (mainly mustelids: Smiroldo et al. 2019. Mammal Rev. 49:240–255) have evolved specialized behaviors to avoid intoxication by bufadienolides: most species aim at the ventral surface (which contains fewer toxins (Bringsøe and Holden 2021. Herpetozoa 34:57–59) and peel the skin of individuals to have access to toxin-free viscera and muscles (Henry 1984. Rev. Ecol. 39:291–296).

While monitoring the reproduction of *Bufo spinosus* in western France, we noticed remains of male and female individuals at one of our study sites (46.17313°N, 0.46059°W; WGS 84). Most carcasses were characterized by open abdomens and evisceration as well as skinned legs and missing muscles (Fig. 1A, B). When predation involved reproductive females,

PHOTOS BY MATTHIAS RENOIRT

Fig. 1. A male (A) and a female (B) *Bufo spinosus* preyed upon by a *Rattus norvegicus* in western France: A) the male has been eviscerated (1), another wound is visible in the pelvic area (2) and muscles of the right hind limb are missing (3); B) The female has been wounded in the ventral area (4) with non-consumed eggs clearly visible, the gular area (5), and eviscerated at the pelvic area (6), muscles of the left hind limb are missing (7) and both forelimbs (which bones are visible – 8) are missing.

Fig. 2. Predation of *Bufo spinosus* by *Rattus norvegicus* in western France. Screenshot taken from the video footage referenced in the text.

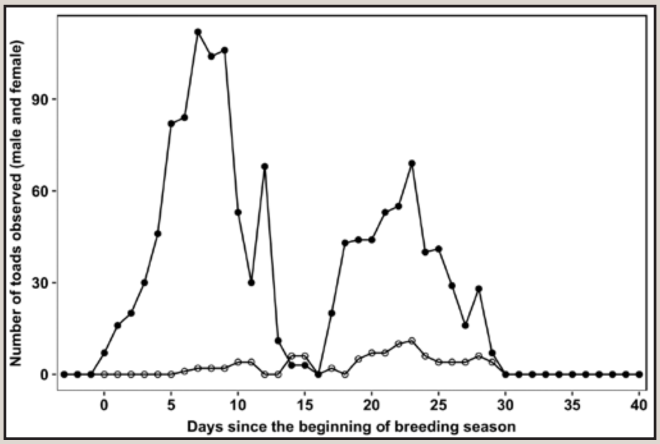

Fig. 3. Number of toads observed on the site in western France since the beginning of the breeding season (28 January 2021). Black dots represent live individuals and white dots represent carcasses of toads preyed upon by *Rattus norvegicus.*

eggs were not consumed (Fig. 1B), presumably because toad eggs also contain bufadienolides (Zhou et al. 2021. J. Nat. Prod. 84:1425–1433). Concomitantly, we observed a *Rattus norvegicus* (Brown Rat) swimming across the breeding pond with a live *B. spinosus* in its mouth. We set up camera traps (WiMius invisible trail camera) where toad remains have been found in order to validate our visual observation. One of our camera traps recorded a predation event of a male *B. spinosus* (Fig. 2): a brown rat actively tried to turn a *B. spinosus* on its back in order to access its ventral surface (video available at: http://dx.doi.org/10.26153/tsw/41042). During the course of our monitoring, the maximum number of carcasses observed in one night was 11, but these predation events likely occurred during the whole reproductive period (Fig. 3). *Rattus norvegicus* density appeared to be low, as most footage recorded only one individual, except for a single occasion when two rats could be observed simultaneously (video available at: http://dx.doi.org/10.26153/tsw/41042). Although we have monitored several (N = 8) breeding sites of *B. spinosus* since 2015, we interestingly only recorded 5 carcasses of toads on other sites and these remnants were characteristic of mustelid predation (i.e., entirely peeled skin, Henry 1984. Rev. Ecol. 39:291–296).

Rats are opportunist omnivores known to prey on amphibians (Watts 1981. The Rodents of Australia. Angus and Robertson, Sydney, New South Wales, Australia. 321 pp.; Breed and Ford 2007. Native Mice and Rats. Clayton: CSIRO Publishing, Collingwood, Victoria, Australia. 185 pp.; Velo-Antón and Cordero-Rivera 2011. Herpetol. Notes 4:299–301) including toxic bufonids (Shine 2010. Q. Rev. Biol. 85:253–291; Cabrera-Guzmán et al. 2014. J. Pest Sci. 88:143–153). Yet, to our knowledge, rodent predation on toxic toads has not been described previously in Europe. Given the number of dead *B. spinosus* observed during the course of our observations, the potential impact on the breeding population might be substantial (Lodé 1996. Ethol. Ecol. Evol. 8:115–124).

MATTHIAS RENOIRT (e-mail: matthias.renoirt@gmail.com), **MARION CHERON** (e-mail: cheron.marion@gmail.com), **SABRINA TARTU** (e-mail: tartu.sabrina@gmail.com), **FREDERIC ANGELIER** (e-mail: frederic.angelier@cebc.cnrs.fr), and **FRANÇOIS BRISCHOUX**, Centre d'Etudes Biologiques de Chizé, CEBC UMR 7372 CNRS-La Rochelle Université, 79360 Villiers en Bois, France (e-mail: francois.brischoux@cebc.cnrs.fr).

ELACHISTOCLEIS CESARII. **DERMATOPHAGY.** *Elachistocleis cesarii* is a microhylid with a wide geographic distribution occurring in the Caatinga, Cerrado, Pantanal, and Atlantic Forest domains in Brazil (Toledo et al. 2010. Zootaxa 2418:50–60). Dermatophagy is observed in several species of amphibians and reptiles, which either consume their own shed epidermis or that of conspecifics (Weldon et al. 1993. J. Herpetol. 27:219–228). In amphibians, shedding or molting of the skin of adults can last from a few days to several weeks, and the shed skin is frequently consumed (Vitt and Caldwell 2013. Herpetology: An Introductory Biology of Amphibians and Reptiles. Fourth edition. Academic Press, San Diego, California. 776 pp.). Dermatophagy may be associated with reclaiming proteins lost in the molting process (Bustard and Maderson 1965. Herpetologica 21:306–308). It may also help regulate cutaneous microorganisms, like fungi and bacteria, and in some species, it may even reduce *Batrachochytrium*

Fig. 1. A) *Elachistocleis cesarii* from the Municipality of Trairí, Ceará, Brazil; B) pulling the shed skin from its left forelimb (red arrow); C) the shed skin stretched between the forelimbs and the mouth (yellow arrows).

dendrobatidis infections (Meyer et al. 2012. Dis. Aquat. Organ. 101:235–242; Ohmer et al. 2017. Sci. Rep. 7:1–10).

Herein, we report the first observation of dermatophagy by *E. cesarii*. On 21 February 2021, at 0605 h, an *E. cesarii* (Fig. 1A) was encountered and collected in a pitfall trap, in a coastal region of the municipality of Trairí, Ceará, Brazil (3.2667°S, 39.3512°W; WGS 84), in vegetation characterized as shrubs and herbs. At 1940 h of the same day, the *E. cesarii* was measured and photographed. After it remained still for 20 sec, it opened its mouth and bit the fingertips of the left forelimb (Fig. 1B). The forelimb was pulled back and the shed skin was removed from the fingers and stretched between the mouth and the forelimb (Fig. 1C). This action was repeated 7 or 8 times. The entire process was repeated for the right forelimb (Fig. 1C). Dermatophagy in amphibians is rarely seen in nature and is mostly observed in captivity (Weldon et al. 1993, *op. cit.*). Some records of dermatophagy in amphibians are documented by analyzing stomach contents of individuals (e.g., Sas et al. 2005. An. tiin. Univ. "Al.I. Cuza" Iai, Biol. Anim. 51:169–177; Kovács et al. 2010. Biharean Biol. 4:169–177), while others come from direct observations such as what we report here (e.g., Jairam et al. 2016. IRCF Rept. Amphib. 23:173–174).

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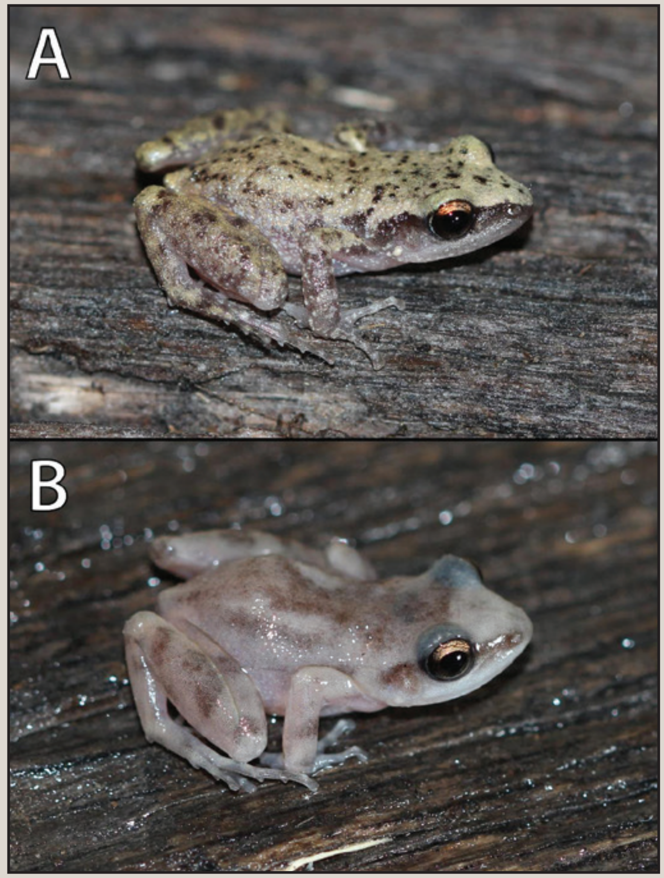
LUCAS LIMA BEZERRA, Universidade Estadual do Ceará, 60714-903, Fortaleza, Ceará, Brazil (e-mail: herpeto.bezerra@gmail.com); **LUCAS DE SOUZA ALMEIDA**, Universidade Estadual Paulista "Júlio de Mesquita Filho", Departamento de Biodiversidade, Instituto de Biociências, 13506-900, Rio Claro, São Paulo, Brazil (e-mail: almeidals1994@gmail.com).

ELEUTHERODACTYLUS CYSTIGNATHOIDES **(Rio Grande Chirping Frog). ABERRANT COLORATION and POLYDACTYLY.** *Eleutherodactylus cystignathoides* (Eleutherodactylidae) is a small, direct developing anuran that is distributed from extreme southern Texas, USA south through the Mexican states of Tamaulipas, Nuevo León, San Luis Potosí, and Veracruz (Dodd 2013. Frogs of the United States and Canada. Volume 1. The Johns Hopkins University Press, Baltimore, Maryland. 982 pp.). Additionally, introduced populations are widespread across large parts of Texas (Dixon 2013. Amphibians and Reptiles of Texas: with Keys, Taxonomic Synopses, Bibliography, and Distribution Maps. Third Edition Revised and Updated. Texas A&M University Press, College Station, Texas. viii + 447 pp.) and Louisiana (Boundy and Carr 2017. Amphibians & Reptiles of Louisiana. An Identification and Reference Guide. Louisiana State University Press, Baton Rouge, Louisiana. xi + 386 pp.), with introduced populations reported as early as 1973 (Mather and Dixon 1976. Herpetol. Rev. 7:127) and new introduced populations continuing to be reported (e.g., Guadiana et al. 2020. Herpetol. Rev. 51:799–803). *Eleutherodactylus cystignathoides* has a brownish gray to green body coloration with irregular flecking, small black spots, and a prominent dark bar that extends from the tympanum to the snout (Dodd 2013, *op. cit.*). Though variation in dorsal coloration and patterning are well documented within some species of *Eleutherodactylus* (e.g., *E. coqui*: Woolbright and Stewart 2008. Copeia 2008:431–437), little information exists on variation within *E. cystignathoides* outside of slight phenotypic differences discussed between previously identified subspecies (Lynch 1970. Univ. Kansas Publ. Mus. Nat. Hist. 20:1–45). Here, I present instances of aberrant coloration and morphology in an introduced population of *E. cystignathoides* in east Texas, USA.



PHOTOS BY DREW R. DAVIS

Fig. 1. Adult *Eleutherodactylus cystignathoides* from an introduced population in Fort Bend County, Texas, USA, displaying typical (A) and aberrant coloration (B).

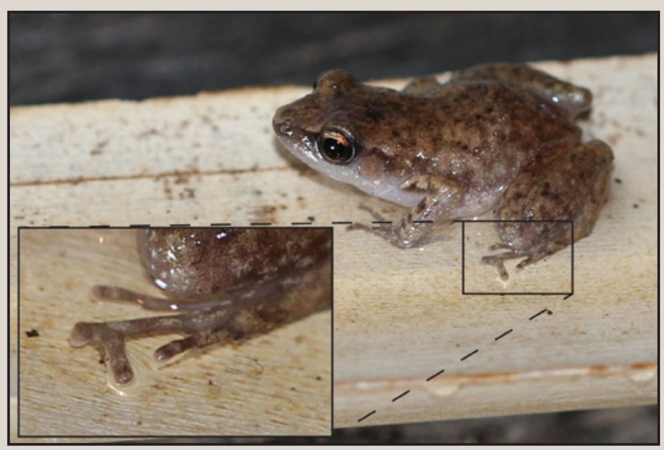


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Fig. 2. Adult *Eleutherodactylus cystignathoides* exhibiting polydactyly from an introduced population in Fort Bend County, Texas, USA.

On 17 January 2021, at ca. 1230 h, four adult *E. cystignathoides* (Biodiversity Collections, Th University of Texas at Austin [TNHC] 115321–115324 [DRD 7309–7312]) were collected near the Co Rd 1093 bridge over the Brazos River, Fort Bend County, Texas, USA (ca. 29.67209°N, 96.01944°W; WGS 84). This site was a deciduous forest along the Brazos River, with abundant discarded trash (e.g., household waste, construction materials), though none of it appeared recent, which may explain how *E. cystignathoides* was first introduced at this location. Three of the four collected individuals expressed coloration and patterning that is typical for this species (Fig. 1A), as did an additional two individuals that were captured, observed, and released. The fourth individual (TNHC 115324 [DRD 7312]: 20 mm SVL, 0.5 g) had reduced pigmentation across the entire body, possibly exhibiting leucism (Fig. 1B). Faint dark stippling was present across much of the dorsum and formed bars on the hind limbs and through the eye (Fig. 1B). As with other instances of leucism, the eyes of this individual appear normal. Despite the aberrant coloration, the individual appeared outwardly healthy. Aberrant coloration has been reported in other *Eleutherodactylus* (e.g., *E. planirostris*: Petrovic 1973. J. Herpetol. 7:49–51), but to the best of my knowledge, no instances of atypical coloration have been reported in the literature for *E. cystignathoides*.

A separate, normally colored individual collected as part of this series (TNHC 115323 [DRD 7311]: 22 mm SVL, 0.7 g) displayed polydactyly (Fig. 2). An instance of polydactyly occurred on the fourth digit of the left hindlimb, likely occurring between the terminal and proximal phalanges. The supernumerary phalange appeared shorter (ca. 1.4 mm) than the normal phalange (ca. 1.8 mm) and resulted in the normal phalange being angled ca. 90° to the left. The three other individuals collected in this series, as well as two individuals not collected, displayed normal digitation. The cause of this condition is not immediately known without radiographic or histologic evidence. Numerous factors can influence bone development in amphibians, including hormonal disruption, nutritional deficiencies, injuries, or genetic abnormalities (Sessions and Ruth 1990. J. Exp. Zool. 254:38–47). Though polydactyly may be due to genetic mutation, which may be heritable (Uehlinger 1969. J. Embryol. Exp. Morphol. 21:207–218), the resulting malformations are expected to be symmetric and bilateral as has been seen in other anurans (e.g., Kreiser et al. 2016. Herpetol. Rev. 47:105–106). Given the asymmetric nature of this malformation, this may be the result of hyper-regeneration due to a previous injury. This condition could also be called schizodactyly following the definition in Henle et al. (2017. Mertensiella 25:9–48) or polyphalangy following Meteyer (2000. Biological Science Report USGS/BRD/BSR–2000–0005. 16 + [2] pp.). Here, I chose to use the inclusive term polydactyly as described by Henle et al. (2017, *op. cit.*) to mean the "duplication of digit(s) or parts thereof" due to the inconsistent alternative terminology and because more specific radiographs are lacking. Despite this aberrant morphology, this individual appeared outwardly healthy.

All specimens were collected under a Texas Parks and Wildlife Scientific Permit for Research (SPR-1018-294) issued to DRD and under an approved University of Texas Rio Grande Valley IACUC protocol (AUP #18-28). I thank T. LaDuc and T. Devitt for helpful comments on this note.

DREW R. DAVIS, School of Earth, Environmental, and Marine Sciences, The University of Texas Rio Grande Valley, 1 W University Boulevard, Brownsville, Texas 78520, USA and Biodiversity Collections, Department of Integrative Biology, The University of Texas at Austin, Austin, Texas 78712, USA; e-mail: drew.davis@utrgv.edu.

***EUPHLYCTIS CYANOPHLYCTIS* (Indian Skipper Frog) and *DUTTAPHRYNUS MELANOSTICTUS* (Common Asian Toad). INTERSPECIFIC AMPLEXUS.** Interspecific amplexus, an uncommon phenomenon, can occur when the reproductive activities of two species overlap in both space and time (Hobel 2005. Herpetol. Rev. 36:439–440). Herein, we report a case of interspecific amplexus between two sympatric species belonging to two distinct families: *Euphlyctis cyanophlyctis* and *Duttaphrynus melanostictus*. *Euphlyctis cyanophlyctis* is a common dicroglossid of South Asia and *D. melanostictus* is a common bufonid of South and Southeast Asia (Frost 2021. Amphibian Species of the World 6.1, an Online Reference. https://amphibiansoftheworld.amnh.org; 18 July 2021).

At ca. 2330 h on 20 May 2019, during an anuran survey near a forest trail in Saputara, Gujarat, India (20.5763°N, 73.7491°E; WGS 84), we heard calls of *E. cyanophlyctis* from a small artificial pond. On inspection, we noticed many male *E. cyanophlyctis* calling from the pond. We observed a few pairs of *E. cyanophlyctis* in conspecific amplexus in the pond. Courtship initiated when a female approached the calling male and made physical contact, after which the male stopped calling and grasped the female in axillary amplexus (Fig. 1A). During this survey, a male *E. cyanophlyctis* was seen in axillary amplexus with a female *D. melanostictus* (Fig. 1B). The male *E. cyanophlyctis* was calling intermittently during the ten minutes we observed the pair, after which they both disappeared under the aquatic vegetation. During the period of observation, the female *D. melanostictus* tried to remove the male a few times by moving its back but was unsuccessful. We did not observe any other cases of heterospecific amplexus at the site. To our knowledge, this is the first report of interspecific amplexus between *E. cyanophlyctis* and *D. melanostictus* in the wild.

HARSHIL PATEL, Department of Biosciences, Veer Narmad South Gujarat University, Surat 395007, India (e-mail: harshilpatel121@gmail.com); **RAJU VYAS**, 1 - Shashwat Apartment, 23 Anandnagar Society, BPC Road, Alkapuri, Vadodara 390007, Gujarat, India (e-mail: razoovyas@hotmail.com); **VAIBHAV NAIK**, Valsad Pardi, Gopi Street, Valsad, 396001, Gujarat, India (e-mail: vaibhavdesai09@gmail.com).

***GASTROPHRYNE CAROLINENSIS* (Eastern Narrow-mouthed Toad). HABITAT USE.** Crocodilian mound nests are known to host a variety of reptilian species, particularly those that utilize them as egg deposition and nesting sites (Kushlan and Kushlan 1980. Copeia. 1980:930–932; Merchant et al. 2014. Herpetol. Rev. 45:201–203). Particularly in *Alligator mississippiensis* (American Alligator) nests, past studies have documented reptiles such as *Anolis carolinensis*, *Kinosternon baurii*, *Pseudemys nelsoni*, *Apalone ferox*, *Sternotherus odoratus*, *Trachemys scripta*, *Nerodia erythrogaster*, and *Farancia abacura* utilizing nests as microhabitats in relation to life and natural history related behaviors such as nesting and basking. In addition to reptiles, numerous mammalian and avian species also have been documented as microhabitat associates of *A. mississippiensis* nests (Merchant et al. 2014, *op. cit.*). However, little information exists in the scientific literature on the use of crocodilian mound nests by amphibian species.

On 28 June 2021, at ca. 1806 h during an *A. mississippiensis* nest survey, I observed and recorded an individual juvenile *Gastrophryne carolinensis* burrowed in an *A. mississippiensis* nest. This observation occurred at Brazos Bend State Park, Fort Bend County, Texas, USA (29.37276°N, 95.62729°W; WGS 84). The individual was discovered 7.62 cm under the surface of the nest. This particular nest had an internal temperature of 30.0°C, a surface temperature of 28.3°C, and internal moisture was 14.4%. The nest measured 45.7 cm tall, 127.0 cm wide, and was 124.5 cm from the water's edge. Fire ants were present in the nest and the nest was constructed primarily of dirt, decaying wood, and decaying vegetation (e.g., *Rubus trivialis* [Southern Dewberry], and *Polygonum* sp. [Smartweed]). The female *A. mississippiensis* was not present at the time of the observation.

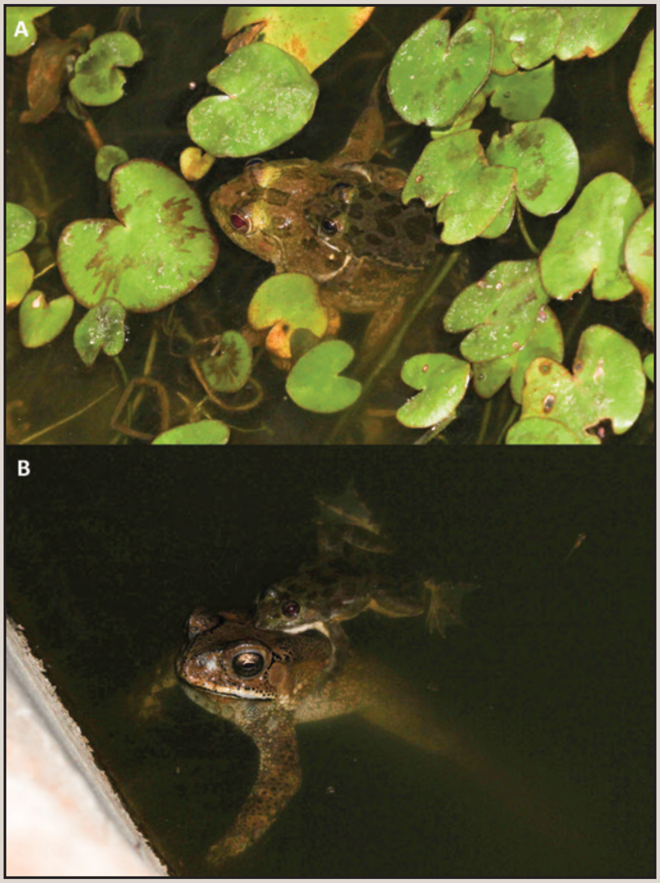

Fig. 1. A) A pair of *Euphlyctis cyanophlyctis* in axillary amplexus in Saputara, Gujarat, India; B) male *E. cyanophlyctis* in axillary amplexus with a female *Duttaphrynus melanostictus* in Saputara, Gujarat, India.

Gastrophryne carolinensis is a common microhylid with a wide distribution across southeastern and southcentral North America. *Gastrophryne carolinensis* can be considered a habitat generalist, but is often found in course woody debris, decaying vegetation, and heavy cover that occurs in many of the habitat types that are characteristic of its range. The microhabitat use of *G. carolinensis* is likely influenced by dietary preference, which is primarily termites, ants, and other invertebrates.

It is well known that amphibian species utilize microhabitats to maintain suitable thermal and water balance (Tracey et al. 2014. Physiol. Biochem. Zool. 87:197–202; Guevara-Molina et al. 2020. J. Therm. Biol. 93:102721). Because decaying vegetation of *A. mississippiensis* nests creates heat and remains moist throughout the nesting season, it is likely that the individual *G. carolinensis* observed was utilizing the nest as habitat for proper thermoregulation and water balance. Additionally, it is probable that the nest provided habitat conducive to many of the aforementioned preferred diet items (e.g., ants, termites, and other invertebrates) of *G. carolinensis*, as invertebrates are commonly associated with *A. mississippiensis* nests (pers. obs.). Therefore, *A. mississippiensis* nests may also provide foraging habitat for *G. carolinensis*. This observation provides information on the natural history and habitat use of *G. carolinensis* and provides interesting insight into the interactions between two herpetofaunal species that, to my knowledge, has not been previously documented.

This work was conducted under Texas Parks and Wildlife Department Scientific Permit for Research (SPR-0820-220) and under a Texas A&M International University IACUC protocol (#2018-1).

CORD B. EVERSOLE, Department of Biology and Chemistry, Texas A&M International University, Laredo, Texas, 78041, USA; e-mail: cord.eversole@gmail.com.

HOPLOBATRACHUS TIGERINUS **(Indian Bullfrog). DIET.** *Hoplobatrachus tigerinus* is a large species of dicroglossid that feeds on invertebrates, small mammals, and birds (Padhye et al. 2008. The IUCN Red List of Threatened Species 2008:e. T58301A11760496; 16 Jan 2021). *Polypedates maculatus* (Chunam Frog) is a rhacophorid that is sympatric with *H. tigerinus* and is distributed in the Terai region and midlands of Nepal (Kästle et al. 2013. Field Guide to Amphibians and Reptiles of Nepal, Arco-Nepal e.V., München, Germany. 339 pp.). Frogs are considered to be generalist predators and anurophagy has been documented in 228 species (Measey et al. 2015. PeerJ 3:e1204). Here, I report on the predation of *P. maculatus* by *H. tigerinus*.

At 2000 h on 18 August 2021, in Buttabari (26.65511°N, 88.00473°E; WGS 84; 138 m elev.), Arjundhara Municipality-11 of Jhapa District, Nepal, I heard a frog distress call and upon investigation, I observed a *H. tigerinus* preying upon a *P. maculatus* (Fig. 1). The *H. tigerinus* grasped the right hind limb of its prey and attempted to swallow the *P. maculatus*. On sensing my presence, the *H. tigerinus* leaped into the thick bushes holding the *P. maculatus* in its mouth. To the best of my knowledge, this is the first report of *H. tigerinus* predating on *P. maculatus*.

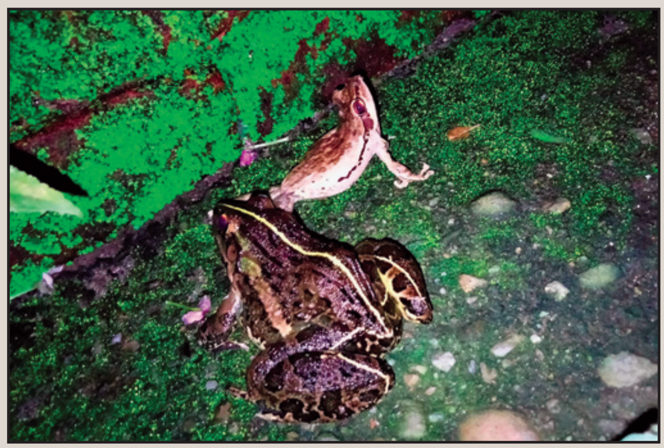

Fig. 1. *Hoplobatrachus tigerinus* grasping *Polypedates maculatus* in Arjundhara Municipality, Jhapa, Nepal.

TAPIL PRAKASH RAI, Department of Environmental Science, Mechi Multiple Campus (Tribhuvan University), Bhadrapur-8, Jhapa, Nepal; Turtle Rescue and Conservation Centre (ARCO-Nepal & SUMMEF), Arjundhara-9, Jhapa, Nepal (e-mail: tapilprai19@gmail.com).

HYLA FEMORALIS **(Pine Woods Treefrog). PREDATION.** Large spiders from families Ctenidae, Lycosidae, Pisauridae, Theraphosidae, and Trechaleidae are known predators of anurans, with most records occurring in the tropics (e.g., Acevedo et al. 2018. Herpetol. Rev. 49:728–729; Pina–Silva and Neuhas. 2018 Herpetol. Rev. 48:100–101; Palhares et al. 2020. Herpetol. Rev. 51:571). Here, I report an incidence of predation by a *Dolomedes triton* (Six-spotted Fishing Spider, Pisauridae) on an adult *Hyla femoralis*. This observation took place at a breeding aggregation of *H. femoralis* in Big Woods Wildlife Management Area, Sussex County, Virginia, USA (36.95942°N, 77.06048°W; WGS 84) at 2343 h on 17 May 2019. For ca. 5 min, I observed a large *D. triton*

PHOTO BY MICHAEL PATRIKEEV

Fig. 1. *Dolomedes triton* with captured *Hyla femoralis* in Big Woods Wildlife Management Area, Sussex County, Virginia, USA.

carrying an adult *H. femoralis* through a flooded patch of grass. The frog was subdued and likely dead; breakdown of dorsal tissues was visible (Fig. 1). *Hyla femoralis* (25–38 mm SVL) occurs in the southeastern Coastal Plain of the United States (Conant and Collins 1991. A Field Guide to Reptiles and Amphibians. Eastern and Central North America. Houghton Mifflin, Boston, Massachusetts. 450 pp.). *Dolomedes triton* is a common spider closely associated with standing or slow-moving bodies of water throughout most of temperate and subtropical North America. Large females may exceed 30 mm in body length. *Dolomedes triton* hunts aquatic and terrestrial invertebrates, small fish, tadpoles, and small salamander larvae. Its venom is very effective in both immobilizing and killing ectothermic vertebrates 4–5 times the spider's size (Bleckmann and Lotz. 1987. Anim. Behav. 35:641–651; Guarisco. 2010. Trans. Kansas Acad. Sci. 113:35–43). Mitchell (1990. Herpetol. Rev. 21:89–90) documented predation on *Pseudacris feriarum* by *D. triton*, but to the best of my knowledge, this is the first report of predation on *H. femoralis* by *D. triton*.

I would like to thank D. C. Currie, J. C. Eitniear, and D. Sutherland for assistance with finding literature on arachnids.

MICHAEL PATRIKEEV, 567 Clemency Crescent, Nepean, Ontario K2J 6R8 Canada; e-mail: mpatrikeev@hotmail.com.

***HYLA VERSICOLOR* (Gray Treefrog). SUSTAINED SOMNOLENCE.** Both *Hyla versicolor* (4N = 48**,** tetraploid) and *H. chrysoscelis* (Cope's Gray Treefrog; 2N = 24, diploid) are present in Arkansas based on Chaffin and Trauth (1987. Proc. Arkansas Acad. Sci. 41:20–23**)** and Trauth et al. (2004. The Amphibians and Reptiles of Arkansas**.** University of Arkansas Press, Fayetteville, Arkansas. 421 pp.), though details of their distributional association and biology therein require further study. The loud and distinctive call of males of *H. versicolor*, usually from high in trees, occasionally can be heard during the daytime even in urban and suburban parts of central and northwestern Arkansas; however, these frogs are seldom observed outside of the breeding season. For example, for over >50 years JMW has lived on a suburban residential lot ca. 100 and 250 m from potential amphibian breeding sites in Fayetteville, Washington County, Arkansas, USA, and although calls of *H. versicolor* have often been heard on the property, none have been seen on the property (JMW, pers. obser.).

We report an unusual behavioral sequence in a frog, confirmed by SET to have been a large adult of *H. versicolor* based on a previous study these species (Chaffin and Trauth 1987, *op. cit.*). The frog appeared to exhibit sustained somnolence (Libourel and Herrel 2015. Biol. Rev. 2015:1–34), located in plain sight, on an unshaded manmade structure on a well vegetated residential property which has been variously inhabited since the 1950s in urban Little Rock, Pulaski County, Arkansas. On 29 May 2021 at ca. 0800 h under cloudy skies, JRM observed an apparent somnolescent individual of *H. versicolor* which remained in the same location, or less likely, returned to the same location after nocturnal activity, through 30 May. It had climbed 1.524 m above ground level to a horizontal railing of a black Mets fence which was located <1 m from a potential breeding site in a large outdoor concrete fish tank. The daily high/low temperatures on these days were ca. 24/18°C and 26/15°C, respectively. We could not be certain of the sex of the frog; however, based on body size and configuration it appeared to be an adult female (Fig. 1). Although the total behavioral functionality of the frog's unusual extended state of exposed somnolence at the same site could not be readily explained (see Libourel and Herrel 2015, *op. cit.*) it was positioned near a potential breeding site. In the days subsequent to the observation, vocalizations from one or more males of *H. versicolor* could be heard on the property (e.g., between 1815 and 1915 h on 2 June 2021). We could find no records of *H. versicolor* remaining for such a long in the same location during the breeding season. *Hyla chrysoscelis* does not begin breeding activities in central Arkansas until much later than the May dates reported herein for *H. versicolor* (Trauth et al. 2004, *op. cit.*).

JAMES M. WALKER, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA (e-mail: jmwalker@uark.edu); **JEANNE R. MCLACHLIN**, College of Medicine, University of Arkansas for Medical Sciences, 430.1 W Markham Street, #551, Little Rock, Arkansas 72205, USA (e-mail: jrmclachlin@uams.edu); **STANLEY E. TRAUTH**, Department of Biological Sciences, Arkansas State University, State University, Arkansas 72467, USA (e-mail: strauth@astate.edu).

***HYLA WRIGHTORUM* (Arizona Treefrog). PREDATION.** *Hyla wrightorum* is a species endemic to northern Mexico and the US states of Arizona and New Mexico (Gergus et al. 2005. *In* Lannoo [ed.], Amphibian Declines: The Conservation Status of United States Species, pp. 461–463. University of California Press. Berkeley, California). While there are many suspected predators of adult *H. wrightorum* (Gergus et al. 2005, *op. cit.*), actual reported predation events in the literature are scarce. This scarcity is likely due to their short breeding season (Gergus et al. 2005, *op. cit.*) and the difficulty in observing them outside of the breeding season. One observed predator is *Thamnophis eques* (Mexican Gartersnake; Holm and Lowe 1995. Status and conservation of sensitive herpetofauna in the Madrean riparian habitats of Scotia Canyon, Huachuca Mountains, Arizona. Final report to the Arizona Game and Fish Department. 66 pp.). Due to this confirmed predator, there is a presumption that other *Thamnophis* species which share the range of *H. wrightorum*, including *T. cyrtopsis* (Black-Necked Gartersnake) and *T. elegans* (Terrestrial Gartersnake), also likely predate adult *H. wrightorum* (Gergus et al. 2005, *op. cit.*). However, to the best of my knowledge, there are no records in the literature of predation on *H. wrightorum* by additional *Thamnophis* species. Herein, I believe I report the first recorded instance of *T. elegans* predating *H. wrightorum*. Specifically, predation on *H. wrightorum* by the subspecies *T. e. vagrans* (Wandering Gartersnake), the subspecies which co-occurs with *H. wrightorum*.

At 2140 h on 11 July 2021, I observed a successful predation event by *T. e. vagrans* on *H. wrightorum* at East Clear Creek on

Fig. 1. *Thamnophis elegans vagrans* predating a male *Hyla wrightorum* in Coconino County, Arizona.

the Mogollon Rim, Coconino County, Arizona, USA (34.46867°N, 111.33666°W; WGS 84; 2200 m elev.). Most likely due to the concurrent drought, the creek was mostly dry except for a few pools along the creek bottom due to recent rain. At one of these pools, I was observing a chorus of at least 8 male *H. wrightorum* when a *T. elegans* arrived at the pool. After arriving, the *T. e. vagrans* held its head and neck above the water and oriented itself behind a male *H. wrightorum* which was producing advertisement calls. Facing away from the snake and toward the bank of the pool, the calling *H. wrightorum* appeared unaware of the snake and made no attempt to flee. After a period of time in wait, the snake made a quick strike at the frog. Having successfully bitten into the frog's head, the *T. e. vagrans* slowly wrestled the frog into more of its mouth while moving backwards to a rock in the pool. Once at the rock, the snake proceeded to swallow the male *H. wrightorum* (Fig. 1).

In addition to confirming a suspected predator of *H. wrightorum*, this observation demonstrates the predation risk associated with reproductive behavior in anurans. The predated calling male *H. wrightorum* may have been able to avoid predation if it had not been calling and thus unaware or unresponsive to the approaching *T. e. vagrans*. Studies have suggested the formation of anuran choruses may be in part to dilute predation risk during this vulnerable moment in their life cycle (Ryan et al. 1981. Behav. Ecol. Sociobiol. 8:273–278). The vulnerability of calling male anurans (and the females attracted to their choruses) may be important to consider in conservation of anuran populations.

E. GRIFFIN NICHOLSON, Ecology and Evolutionary Biology Program, Texas A&M University, College Station, Texas 77843, USA; e-mail: gnicholson@tamu.edu.

HYPOPACHUS VARIOLOSUS **(Sheep Frog). ARBOREAL BEHAVIOR.** *Hypopachus variolosus* is a small sized frog distributed from sea level to moderate elevations (1610 m elev.) from southern Texas, USA and Sonora, Mexico to Costa Rica (Lee 1996. The Amphibians and Reptiles of the Yucatán Peninsula. Cornell University Press, Ithaca, New York. 500 pp.; Köhler 2011. Amphibians of Central America. Herpeton, Verlag Elke Köhler, Offenbach, Germany. 376 pp.). This terrestrial anuran has strong legs specialized for digging and is mostly fossorial or semifossorial

PHOTOS BY PABLO M. BEUTELSPACHER-GARCÍA

Fig. 1. A). Adult *Hypopachus variolosus* found inside a dry branch of an *Enterolobium cyclocarpum* at Rancho Santa Lupita, Municipality of Bacalar, Quintana Roo, México, ca. 2.5 m height; B) view of the *E. cyclocarpum* showing the branch (arrow) where the *H. variolosus* was found.

(Vitt and Cadwell 2013. Herpetology: An Introductory Biology of Amphibians and Reptiles. Fourth edition. Elsevier Ltd, Oxford, England. 757 pp.). *Hypopachus variolosus* commonly uses temporary, ground-level water bodies for breeding, such as marshes and flooded grasslands (Lee 1996, *op. cit.*). However, McDiarmid and Foster (1975. J. Herpetol. 9:264–265) reported an unusual case of a *H. variolosus* tadpole they found in a tree cavity almost entirely filled with water (87 cm above the ground). They could not explain the presence of the tadpole because the species is considered terrestrial. Herein, we report an unusual case of scansorial behavior of *H. variolosus*.

At 1530 h on 7 August 2021 at Rancho Santa Lupita, located between Bacalar and Reforma, Municipality of Bacalar, Quintana Roo, México (18.76116°N, 88.52602°W; WGS 84; 27 m elev.), one of us (PMBG) found an adult *H. variolosus* inside a dry branch (Fig. 1A) of an Earpod Tree (*Enterolobium cyclocarpum*) ca. 2.5 m above the ground. The tree was surrounded by secondary vegetation (Fig. 1B) in a seasonally flooded zone. The trunk was hollow, thus the frog likely climbed inside from the ground up to the tree branch searching for shelter. To our knowledge, this is the first record of scansorial behavior for *H. variolosus*. This finding may explain the presence of the tadpole observed by McDiarmid and Foster (1975, *op. cit.*), suggesting that this species not only uses water bodies at ground level to reproduce, but may also search for water bodies in elevated situations to deposit eggs. In addition, this observation of an elevated shelter site suggests a possibly broader ecological niche for the genus *Hypopachus*.

JOSÉ ROGELIO CEDEÑO-VÁZQUEZ, El Colegio de la Frontera Sur, Departamento de Sistemática y Ecología Acuática, Av. Centenario Km 5.5, C.P. 77014, Chetumal, Quintana Roo, México (e-mail: rcedenov@ecosur.mx); **PABLO M. BEUTELSPACHER-GARCÍA**, 16-A esquina con 31, Colonia Nueva Generación, Bacalar, Quintana Roo, México (e-mail: beutelspacher-pacher@gmail.com); **LUIS FRANCISCO NIETO-TOSCANO**, El Colegio de la Frontera Sur, Av. Centenario Km 5.5, C.P. 77014, Chetumal, Quintana Roo, México (e-mail: luisnietotoscano913@gmail.com).

***LEPTODACTYLUS LATRANS* (Butter Frog) and *PHYSALAEMUS CROMBIEI* (Crombie's Dwarf Frog). ANTIPREDATOR MECHANISMS.** Anurans are exposed to constant predatory pressure and have evolved several anti-predator mechanisms in order to survive (Toledo et al. 2007. J. Zool. 271:170–177; Mailho-Fontana et al. 2014. J. Exp. Zool. A. 321:65–77). *Leptodactylus latrans* is distributed throughout the Brazilian coastal zone from Pernambuco to the states of São Paulo and Minas Gerais, while *Physalaemus crombiei* occurs in the states of Espírito Santo and Bahia (Frost 2021. Amphibian Species of the World 6.1, an Online Reference. https://amphibiansoftheworld.amnh.org; 20 Aug 2021). Both are leptodactylids associated with wetlands and humid environments, however *P. crombiei* mostly occurs in forest environments with dense leaf litter and *L. latrans* demonstrates a tolerance to anthropogenic environments (Peixoto and Pimenta 2004. The IUCN Red List of Threatened Species 2004:e.T57248A11608727; 1 June 2022; Solé et al. 2009. Herpetol. Notes 2:9–15; Pupin et al. 2010. Herpetol. J., 20:147–156).


PHOTO BY BRYAN MARTINS

Fig. 1. *Leptodactylus latrans* from Cariacica, Espírito Santo state, Brazil, displaying limbs interweave defense mechanism.


PHOTO BY RAFAEL MATHIELO

Fig. 2. *Physalaemus crombiei* displaying limbs interweave defense mechanism.

On 16 July 2020 at 1460 h, we observed two juvenile *L. latrans* on the wet ground in Cariacica, Espírito Santo, Brazil (20.31528°S, 40.37639°W; WGS 84; 32 m elev.). When captured, the individuals released slippery secretions from their skin and exhibited death feigning. When released onto the substrate, one individual jumped and hid immediately, while the other intertwined the hind limbs, a behavior known as limbs interweave (Fig. 1). The release of slippery secretions and death feigning have been reported for *L. latrans* as defense mechanisms (Toledo et al. 2010. J. Nat. Hist. 44:1979–1988), but limbs interweave has not been reported. On 9 July 2021 at 1847 h, we observed a *P. crombiei* jumping over the leaf litter in Nova Almeida, Espírito Santo, Brazil (20.04772°S, 40.21306°W; WGS 84; 8 m elev.). Upon noticing us, the *P. crombiei* stopped and remained immobile. We tried to capture it, but it jumped away and displayed the limbs interweave defense mechanism (Fig. 2). The limbs interweave defense mechanism has been reported for *L. chaquensis* (Ferreira et al. 2019. Ecol. Sociobiol. 73:1–21), however, this is the first record of the limbs interweave defense mechanism for both *L. latrans* and *P. crombiei*.

RAFAEL SCHERRER MATHIELO (e-mail: rsmathielo@gmail.com), **JÚLIA SACRAMENTO BARBOSA** (e-mail: juliabarbosa790@gmail.com), **MATEUS SANDRINI** (e-mail: sandrinimateus@gmail.com), and **BRYAN DA CUNHA MARTINS**, Programa de pós-graduação em Zoologia, Instituto de Ciências Biológicas, Universidade Federal do Amazonas, 68067-005, Manaus, Brasil (e-mail: bryancmartins@hotmail.com).

***LEPTODACTYLUS MACROSTERNUM* (Miranda's White-lipped Frog). HABITAT USE.** *Leptodactylus macrosternum* is a leptodactylid widely distributed in the Neotropical region, occurring predominantly across the open diagonal formations in South America (Cerrado, Chaco, Pantanal, Caatinga) and parts of the Amazonian and Atlantic Rainforests (Magalhães et al. 2020. Herpetol. Monogr. 34:131–177). It is a medium-sized species (males: 48.7–98.9 mm SVL; females: 55.9–90.8 mm SVL; Magalhães et al. 2020, *op. cit.*) and is considered a generalist in terms of habitat use, occurring from forest edges and open areas to anthropized regions (Costa et al. 2016. Rev. Verde Agroecol. Sust. Dev. 11:123–128; Chaves et al. 2017. Zoologia 34:e20782). Their diet consists predominantly of small terrestrial arthropods, such

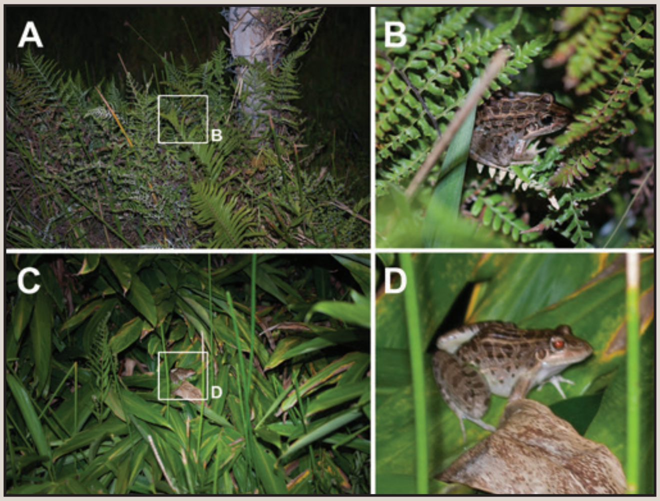

Fig. 1. Examples of *Leptodactylus macrosternum* perched at 70 cm (A, B) and 1 m (C, D) above the soil at Reserva Biológica de Pedra Talhada, Municipality of Quebrangulo, Alagoas, Brazil.

as coleopterans and hymenopterans, and they are commonly found in the soil or at the edges of water bodies (Teles et al. 2018. Herpetol. Notes 11:223–226).

Here, we provide the first record of vertical substrate utilization by *L. macrosternum* in an ecotone between the Caatinga and Atlantic Rainforest in northeastern Brazil. This observation occurred on 21 December 2019 at 1900 h during an expedition to the Reserva Biológica de Pedra Talhada, Municipality of Quebrangulo, Alagoas, Brazil (9.25945°S, 36.44094°W; WGS 84; 537 m elev.). We recorded ca. 10 *L. macrosternum* adults perched on shrubs, ferns, and *Heliconia* sp. on the banks of an artificial dam (Fig. 1). Individuals were at heights ranging from 15 cm to 1 m above soil level.

In general, leptodactylids have terrestrial or semi-aquatic habits (de-Sá et al. 2014. S. Am. J. Herpetol. 9:1–128) and these habits are reinforced by morphological characteristics, such as discless non-adhesive digits or interdigital membranes (de-Sá et al. 2014, *op. cit.*; Magalhães et al. 2020, *op. cit.*). As far as we know, this is the first record of a leptodactylid utilizing vertical substrates, indicating that the absence of adhesive discs does not exclude the use of vertical substrates by this species. Further investigations are required to test whether *L. macrosternum* are able to climb, as observed for some medium and large sized frogs (Dubeux et al. 2019. Herpetol. Rev. 50:764) or if they simply landed on the vegetation after jumping.

UBIRATÃ F. SOUZA, Laboratório de Estudo Herpetológicos e Paleoherpetolóco, Universidade Federal Rural de Pernambuco, 52171-900, Recife, Pernambuco, Brazil (e-mail: ubirataferreirasouza@gmail.com); **JOÃO PEDRO S. OLIVEIRA,** Departamento de Ciências Biológicas, Universidade Estadual de Alagoas, 57312-000, Arapiraca, Alagoas, Brazil (e-mail: jpoliveira875@gmail.com); **MARCOS J. M. DUBEUX**, Laboratório de Herpetologia, Universidade Federal de Pernambuco, 50740-550, Recife, Pernambuco, Brazil (e-mail: marcosdubeux.bio@gmail.com).

LIMNONECTES FINCHI **(Finch's Wart Frog). ENDOPARASITE.** *Limnonectes finchi* lives in mature and old secondary forests and is known from Sabah and adjacent areas of Kalimantan, Borneo (Inger et al. 2017. A Field Guide to The Frogs of Borneo. Third edition. Natural History Publications, Borneo, Kota Kinabalu. 228 pp.). We know of no helminth records for *L. finchi* and herein establish the known helminth list for this species. We examined 8 *L. finchi* collected in Sabah, Malaysia, (mean SVL = 38.5 mm ± 3.9 SD; range: 33–44 mm) and deposited in the Amphibians and Reptiles Collection, Field Museum of Natural History (FMNH), Chicago, Illinois, USA (FMNH 230706, 230707, 230709, 230726, 245717–245719, 245721).

The specimens had been preserved in 10% formalin and stored in 70% ethanol. The body cavity was opened by a longitudinal incision and the digestive tract was removed and opened. The esophagus, stomach, small intestine and large intestine were examined for helminths under a dissecting microscope. Of the 8 specimens of *L. finchi* examined, two (FMNH 230726, collected 1986 and FMNH 245719, collected 1990), from the Lahad Datu District, Sabah, Malaysia (5.2°N, 117.83333°E; WGS 84) each harbored one female nematode in the intestine. They were placed in a drop of lactophenol on a glass slide, a cover slip was added, and identification was made after study under a compound microscope.

We assigned the nematodes to *Cosmocerca ornata* after comparisons with the description of the female of this species in Bala (2016. J. Environ. Appl. Biores. 4:49–51). *Cosmocerca ornata* is widespread having been reported from Europe (Baker 1987. Occas. Pap. Biol. 11:1–325), Africa (Aisen et al. 2003. Acta. Parasitol. 48:47–54), and Asia (Goldberg et al. 2017. Pac. Sci. 71:229–235). *Cosmocera ornata* has previously been reported in anurans from Borneo (see Goldberg and Bursey 2020. Comp. Parasitol. 87:1–3.). The *C. ornata* were deposited in the Harold W. Manter Parasitology Laboratory (HWML), The University of Nebraska, Lincoln, Nebraska, USA as HWML 112252. *Cosmocerca ornata* in *L. finchi* is a new host record.

We thank Alan Resetar for permission to examine *L. finchi* and Joshua Mata for facilitating the loan.

STEPHEN R. GOLDBERG, Whittier College, Department of Biology, Whittier, California 90608, USA (e-mail: sgoldberg@whittier.edu); **CHARLES R. BURSEY**, Pennsylvania State University, Shenango Campus, Department of Biology, Sharon, Pennsylvania 16146, USA (e-mail: cxb13@psu.edu).

LIMNONECTES PALAVANENSIS **(Smooth Guardian Frog). ENDOPARASITE.** *Limnonectes palavanensis* lives on the floor of old growth and secondary forests and is known from Brunei, Kalimantan, Sabah and Sarawak, Borneo and also occurs on Palawan Island in the Philippines (Inger et al. 2017. A Field Guide to The Frogs of Borneo. Third edition. Natural History Publications, Borneo, Kota Kinabalu. 228 pp.). We know of no helminth records for *L. palavanensis* and herein establish the known helminth list for this species. We examined 10 *L. palavanensis* (mean SVL = 32.2 mm ± 3.8 SD; range: 28–38 mm) collected in Sabah, Malaysia, and deposited in the Amphibians and Reptiles Collection, Field Museum of Natural History (FMNH), Chicago, Illinois, USA (FMNH 230811, 230814, 230816, 230825, 238787, 238801, 238805, 238812, 238821, 238832).

The specimens had been preserved in 10% formalin and stored in 70% ethanol. The body cavity was opened by a longitudinal incision and the digestive tract was removed and opened. The esophagus, stomach, small intestine, and large intestine were examined for helminths under a dissecting microscope. Of the 10 specimens of *L. palavanensis* examined, one (FMNH 238787, Tambunan District, 5.8°N, 116.3667°E; WGS 84; collected 1989) harbored one female nematode in the small intestine. It was placed in a drop of lactophenol on a glass slide, a cover slip was added, and identification was made after study under a compound microscope.

We have assigned this nematode to *Moaciria* based upon our experience with *Moaciria moraveci*, a species described from *Hylophorbus* cf. *rufencens* (Red Mawatta Frog) collected in Papua New Guinea (Bursey et al. 2007. Acta Parasitol. 52:233–237). Although our current specimen is somewhat larger (5.1 mm in length, 0.51 mm width at vulva level vs. 3.64 mm length, 0.38 width for *M. moraveci*), a similar body morphology was noted: narrow alae extend from base of lips to near middle of tail; cuticle is thick, distinctly annulated with fine transverse striations, and equally spaced somatic papillae present. The only key characters present (per Anderson et al. 2009. Keys to The Nematode Parasites of Vertebrates. Archival Volume. CABI, Oxfordshire, UK. 463 pp.) are mouth with three lips offset from body and lips rounded, which are used to define the Spinicaudinae. To our knowledge, only *M. komodoensis* has been reported from Indonesia (Pinnell and Schmidt 1977. J. Parasitol. 67:337–340.); however, five additional species are known from the Australo-Papuan region. The *Moaciria* sp. was deposited in the Harold W. Manter Parasitology Laboratory (HWML), The University of Nebraska, Lincoln, Nebraska, USA as HWML 112256. *Moaciria* sp. in *L. palavanensis* is a new host record.

We thank Alan Resetar for permission to examine *L. palavanensis* and Joshua Mata for facilitating the loan.

STEPHEN R. GOLDBERG, Whittier College, Department of Biology, Whittier, California 90608, USA (e-mail: sgoldberg@whittier.edu); **CHARLES R. BURSEY,** Pennsylvania State University, Shenango Campus, Department of Biology, Sharon, Pennsylvania 16146, USA (e-mail: cxb13@psu.edu).

***LIMNONECTES PARAMACRODON* (Lesser Swamp Frog). ENDOPARASITES.** *Limnonectes paramacrodon* has been found in clay and gravel banks of small streams in primary or selectively logged forests, heath forests, and coastal peat swamps. It is known from Brunei, Kalimantan, Sabah and Sarawak, Borneo and also has been found in Peninsular Malaysia and Singapore (Inger et al. 2017. A Field Guide to The Frogs of Borneo. Third edition. Natural History Publications, Borneo, Kota Kinabalu. 228 pp.). The digenean *Glypthelmins staffordi* and the acanthocephalans *Macranthorhynchus* spp. have previously been reported in *L. paramacrodon* from Penang Island, Peninsular Malaysia (Rahman and Shakinah 2015. J. Vet. Sci. Technol. 6:1–5). In this note we add to the helminth list of *L. paramacrodon.* We examined 6 *L. paramacrodon* collected March 2006 in Sarawak, Malaysia (2.9°N, 113.4°E; WGS 84; mean SVL = 47.5 mm ± 5.1 SD; range: 38–53 mm) deposited in the Amphibians and Reptiles Collection, Field Museum of Natural History (FMNH), Chicago, Illinois, USA (FMNH 269826, 269830, 269833, 269837 269839, 269843).

The following nematodes were identified: two *Aplectana macintoshii* in the small intestine of FMNH 269837, three and one *Cosmocerca ornata* in the small intestine of FMNH 269833 and large intestine of FMNH 269843, respectively. Two and one acanthocephalan cystacanths were identified in the body cavities of FMNH 269826 and FMNH 269833, respectively.

Aplectana macintoshii was identified after comparison with morphological characteristics of this species given in Sou and Sow (2018. Proc. Zool. Soc. 72:313–317). *Aplectana macintoshii* is a widely distributed nematode with representatives in the following biogeographical regions: Afrotropical, Neotropical, Oceanian, Oriental, Palearctic (*sensu* Holt et al. 2013. Science 339:74–78.). It has recently been reported in ranid, bufonid, and dicroglossid anurans from Southeast Asia (Goldberg et al. 2017a. Pac. Sci. 71:229–235; Goldberg et al. 2017b. Pac. Sci. 71:367–375; Goldberg et al. 2017c. Pac. Sci. 71:535–540).

Cosmocerca ornata was identified after comparisons with the description of the female of this species in Bala (2016. J. Environ. Appl. Biores. 4:49–51). *Cosmocerca ornata* is widespread having been reported from Europe (Baker 1987. Occas. Pap. Biol. 11:1–325), Africa (Aisen et al. 2003. Acta. Parasitol. 48:47–54), and Asia (Goldberg et al. 2017a, *op. cit.*). *Cosmocera ornata* has previously been reported in anurans from Borneo (see Goldberg and Bursey 2020. Comp. Parasitol. 87:1–3).

Rahman and Shakinah (2015, *op. cit.*) reported the acanthocephalans, *Macracanthorynchus* spp. in several species of frogs. The acanthocephalans were abundant in the intestine of the host; most individuals were in the larval stage. Because we found so few individuals and the location (body cavity) was different, we are inclined to believe our cystacanths would be assigned to a different species. We are not able to compare our specimens visually to those of Rahman and Shakinalh (2015, *op. cit.*). Helminths were deposited in the Harold W. Manter Parasitology Laboratory (HWML), The University of Nebraska, Lincoln, Nebraska, USA as *A. macintoshii* (HWML 112254), *C. ornata* (HWML 112255), and acanthocephalan cystacanths (HWML 112253). *Aplectana macintoshii, C. ornata* and acanthocephalan cystacanths in *L. paramacrodon* are new host records.

We thank Alan Resetar for permission to examine *L. paramacrodon* and Joshua Mata for facilitating the loan.

STEPHEN R. GOLDBERG, Whittier College, Department of Biology, Whittier, California 90608, USA (e-mail: sgoldberg@whittier.edu); **CHARLES R. BURSEY**, Pennsylvania State University, Shenango Campus, Department of Biology, Sharon, Pennsylvania 16146, USA (e-mail: cxb13@psu.edu).

***LITHOBATES CATESBEIANUS* (American Bullfrog). DIET.** *Lithobates catesbeianus* is a widespread invasive species that has had devastating impacts to native herpetofauna (Kraus 2009. Alien Reptiles and Amphibians: A Scientific Compendium and Analysis. Invading Nature: Springer Series in Invasion Ecology, Vol. 4. Springer, Dordrecht, Netherlands. 563 pp.). Though there are a myriad of ecological interactions between *L. catesbeianus* and native herpetofauna which may cause declines of native species (Kupferberg 1997. Ecology 78:1736–1751; Both and Grant 2012. Biol. Lett. 8:714–716; Yap et al. 2018. PLoS ONE 13:e0188384), predation by invasive *L. catesbeianus* is a clear threat to native herpetofauna since it is a generalist with a gape-limited diet (Jancowski and Orchard 2013. NeoBiota 16:17–37). In Maryland, within the native range of the species, *L. catesbeianus* has been recorded on one occasion as a predator of *Diadophis punctatus* (Ring-necked Snake; Ernst 1962. Turtox News. 40:266–267). In the invasive range of *L. catesbeianus*, there is one record from Oregon of a *D. punctatus* taken from the stomach of an invasive *L. catesbeianus* (Graf et al. 1939. Copeia. 2:101–104). However, to the best of my knowledge, there are no other records of predation of *D. punctatus* by *L. catesbeianus.* Here, I report what I believe is the first record of predation of the subspecies *Diadophis punctatus regalis* (Regal Ring-necked Snake) by *L. catesbeianus* in the state of New Mexico, USA.

At 2202 h on 21 June 2021, I was capturing *L. catesbeianus* along the Gila River in Grant County, ca. 2.37 mi SE of Cliff, New Mexico, USA (32.92903°N, 108.6011°W; WGS 84; 1358 m elev.). To euthanize *L. catesbeianus* for the purposes of collection as museum specimens, I put *L. catesbeianus* in a bucket with a clove oil mixture where they soaked in the mixture and were euthanized within 20 min. On rare occasion, the euthanization

FIG. 1. A *Diadophis punctatus regalis* which had been inside of a *Lithobates catesbeianus* (right side of photo) in Grant County, New Mexico, USA.

resulted in the regurgitation of stomach or mouth contents. In this particular instance, after inserting a *L. catesbeianus* into the bucket, I found a *D. p. regalis* (8 g, 330 mm SVL, 57 mm tail length) in the bucket (Fig. 1). Along with a few deceased crayfish, the snake clearly came from this particular *L. catesbeianus* since the bucket had been previously empty except for another *L. catesbeianus* which had already been euthanized much earlier that night at 2114 h. The *D. p. regalis* was still alive, indicating recent predation by the *L. catesbeianus*, and may have been in the mouth of the *L. catesbeianus* when I captured it. I released the *D. p. regalis* but collected the *L. catesbeianus* and deposited it at the Biodiversity Research and Teaching Collections, Texas A&M University (TCWC; presently uncatalogued; EGN 19515).

Though other subspecies of *D. punctatus* have been identified in the diet of *L. catesbeianus*, the addition of another subspecies and geographic region indicates *D. punctatus* are likely consumed by *L. catesbeianus* wherever the two species are sympatric. In the invasive range of *L. catesbeianus* in the western USA, native *D. punctatus* may be naive to this predation threat. Impacts to populations of native *D. punctatus* are possible and further investigation into the amount of predation and impacts from *L. catesbeianus* is warranted along with continuing management of this invasive species to protect native herpetofauna such as *D. p. regalis*.

Collection of specimens was authorized through a New Mexico Department of Game and Fish Scientific Collecting Permit (NMDGF Sci #3809) issued to EGN and was conducted under a Texas A&M University animal care permit (2021-0099).

E. GRIFFIN NICHOLSON, Ecology and Evolutionary Biology Program, Texas A&M University, College Station, Texas 77843, USA; e-mail: gnicholson@tamu.edu.

***LITHOBATES SYLVATICUS* (Wood Frog). POST-BREEDING VOCALIZATION.** Male *Lithobates sylvaticus* may call for several days after oviposition (Waldman 1982. Behav. Ecol. Sociobiol. 10:169–174; Davis and Folkerts 1986. Brimleyana 12:29–50) but calling long after breeding is rarely documented. We heard a male *L. sylvaticus* calling adjacent to a small suburban garden pond in Thunder Bay, Ontario, Canada (48.4358°N, 89.2719°W; WGS 84; 228 m elev.) on 10 July 2021 which was 55 d after *L. sylvaticus* ceased breeding calls in the area (11 April–16 May 2021). The individual made a series of one and two note calls just before sunrise from 0450–0500 h. Conditions were 9°C air temperature (third consecutive night with a single digit low), 80% relative humidity, clear sky, 0 km/h wind speed.

Post-breeding or "rain calls" in *L. sylvaticus* have been documented as occurring in mid-June in northeastern Ontario (Schueler 1973. Can. Field-Nat. 87:409–418), November and December in New Brunswick, Canada (Gorham 1964. Can. Field-Nat. 78:154–160), and December in New York, USA (Burroughs 1914. The Writings of John Burroughs VII.: Signs and Seasons. Houghton Mifflin Co., Boston, Massachusetts. 290 pp.). Zweifel (1989 J. Herpetol. 23:185–186) reported non-reproductive "terrestrial calls" of *L. sylvaticus* from the end of August until mid-March (most in October and November) in New Jersey, USA. The reasons for anurans calling after their breeding seasons or beyond breeding sites remain poorly understood, but rising humidity, rainfall, or territoriality have been suggested (Miller 2021. Archives Natl. Hist. 48:42–61). Our record occurred 11 d since the last rainfall with no humidity trend, 3 d prior to the next rainfall, and on the third consecutive night with single digit low temperatures. However, the individual called ca. 2 m from an *L. sylvaticus* hibernation site (Hecnar and Hecnar 2017. Herpetol. Rev. 48:165–166).

STEPHEN J. HECNAR (e-mail: shecnar@lakeheadu.ca) and **DARLENE R. HECNAR**, Department of Biology, Lakehead University, 955 Oliver Road, Thunder Bay, Ontario P7B 6H9, Canada (e-mail: drhecnar@lakeheadu.ca).

***LITHOBATES SPHENOCEPHALUS* (Southern Leopard Frog). HATCHING SUCCESS IN WASTEWATER.** Wastewater treatment (WWT) wetlands are being applied globally with poorly understood consequences for the wildlife that choose to occupy them. The ability of frog populations to successfully inhabit WWT wetlands requires successful egg deposition and hatching and tadpole development and metamorphosis. Recent studies have documented successful tadpole development and metamorphosis in WWT wetlands (Zeitler et al. 2019. J. Freshw. Ecol. 33:475–488.; Zeitler et al. 2021. J. Environ. Manage. 289:112571). These results imply that eggs are both being deposited and hatching in WWT wetlands, but it is unknown whether they hatch at similar rates to egg clutches deposited in rain-filled ponds and wetlands.

On 17 March 2019, we visited a calling population of *Lithobates sphenocephalus* in a local pond and collected 10 recently deposited clutches of eggs. We placed each clutch individually in a 5 L container with a bubbler. We collected water from the pond where egg clutches were collected and from a local WWT wetland (described in Zeitler et al. 2021, *op. cit.*). Half of the collected clutches were exposed to water from the WWT wetland and half to the local pondwater. We observed the clutches daily for 14 d until we observed that all eggs either hatched or exhibited signs of death (i.e., cloudy or undeveloped). At that point, we counted all the tadpoles that emerged from the clutch and the number of dead or non-viable eggs and compared the proportion of dead and non-viable eggs between the two water sources. All tadpoles were released at their collection location. We determined that egg hatching success was equivalent between the two water sources. The mean clutch size of all clutches was 430 ± 22. The hatching success of clutches from pond water was 21.7 ± 1% and from WWT wetlands was 19.8 ± 2%. A t-test confirmed these were similar (t = 0.79, p = 0.472). Although WWT wetlands contain a suite of pharmaceuticals and personal care products that have the potential to affect the development of vertebrates (Zeitler et al. 2021, *op. cit.*), that was not the case here, since we did not observe a significant difference in hatching success for the egg clutches that developed in treated effluent.

KRISTEN K. CECALA (e-mail: kkcecala@sewanee.edu), **ELI H. WALKER**, and **EMMA F. ZEITLER**, Department of Biology, University of the South, Sewanee, Tennessee 37383 USA.

***ODONTOPHRYNUS OCCIDENTALIS* (Cururu Lesser Escuerzo). PARASITISM.** Predation and parasitism have been considered important elements in shaping the life histories of amphibians (Beebee 1996. Ecology and Conservation of Amphibians. Springer Netherlands, Dordrecht, Netherlands. 214 pp.). The ecological relationships between amphibians and leeches are very complex, with leeches potentially acting as predators or parasites on all life stages of amphibians, including their eggs (Romano and Di Cerbo 2007. Acta Zool. Sin. 53:750–754; Bach et al. 2018. Herpetol. Rev. 49:309), larvae (Gunzburger and Travis 2005. J. Herpetol. 39:547–571), and adults (Merilä and Sterner 2002. Ann. Zool. Fenn. 39:343–346; Velazco et al. 2016. Cuad. Herpetol. 30:17–19). Freshwater leeches, including temporary ectoparasites and predatory species, may affect amphibian physiology and anatomy, causing damage and reducing fecundity or survival, directly or indirectly (Chivers et al. 2001. Oikos 92:135–142). Leeches can affect amphibians in a direct way by preying on eggs and hatchlings at different stages of development (Chivers et al. 2001, *op. cit.*), and by parasitizing adults (Merilä and Sterner 2002, *op. cit.*). Additionally, leeches may contribute to the spread of pathogens (Raffel et al. 2006. J. Parasitol. 92:1256–1264) and secondary parasites (Sawyer 1986. Leech Biology and Behaviour. II. Feeding Biology, Ecology and Evolution. Clarendon Press, Oxford, England. 374 pp.).

Odontophrynus occidentalis (Odontophrynidae) is an anuran distributed in a latitudinal range from 42°S in the Chubut Province to 27.5°S in the north of the Catamarca Province, Argentina (Peiretti et al. 2002. Herpetol. Rev. 33:221; Rosset et al. 2007. South Am. J. Herpetol. 2:97–106). The corresponding altitudinal range is from a few meters above sea level in Monte Hermoso to 2149 m in the Sierra de Achala (Barrio 1964. Physics-Tomo. 24:385–110; Martino et al. 2019. PeerJ 7:e6480). It is typically found in arid or semi-arid zones in western Argentina, living close to clear streams or springs (Cei 1980. Amphibians of Argentina. Monitore Zoologico Italiano, Firenze, Italia. 597 pp.). Terrestrial habitats include pastureland, montane grassland, shrubs, forests, and rock outcrops (Martino et al. 2019, *op. cit.*).

Haementeria depressa (Glossiphoniidae) is a leech distributed in the subtropical and pampasic areas in Argentina and is frequently found in stagnant waters, among the vegetation or at the bottom of ponds. It has blood-sucking habits and its temporary hosts are mostly vertebrates (Ringuelet 1985. Fauna de agua dulce de la República Argentina: Annulata. Hirudinea. Fundación Para La Educación, La Ciencia y La Cultura, Buenos Aires, Argentina, 275 pp.). It is endemic to the neotropical region in Argentina and is distributed in the following provinces: Misiones, Corrientes, Entre Ríos, Jujuy, Tucumán, La Rioja, San Luis, Santiago del Estero, Córdoba, Santa Fe, Buenos Aires, La Pampa y Río Negro (Gullo 2015. Nat. Neotrop. Tomo. 46:25–40). The identification at the species level was performed using both external and internal features: size, the subdivision of the rings, number and arrangement of the tubers, shape and arrangement of the sensillas, position of the eyes, and separation of the gonopores.

Fig. 1. Parasitism of *Haementeria depressa* on *Odontophrynus occidentalis* in Neuquén, Argentina.

During an evening survey (2200 h) on 27 October 2019, in a permanent pond located near the El Chocón (Neuquén, Argentina; location: 39.24630°S, 68.73383°W; WGS 84), we observed a *H. depressa* parasitizing an *O. occidentalis*. The *H. depressa* was attached to the upper part of the left forelimb of the *O. occidentalis* (Fig. 1). When we retired the leech, we could observe a little circle of damaged tissue in this place. The *O. occidentalis* was a male (5.82 cm SVL, 22 g) and at the time of the observation was vocalizing in the pond a few meters from the Limay River. This is the first record of *H. depressa* in Neuquén Province and the first record of *O. occidentalis* as a host of *H. depressa*. The *H. depressa* was collected and deposited in the collection of the Museum of La Plata (MLP-Oi 4201).

Considering the scarce information published about the impact of parasitic infections on amphibian fitness (Goater and Ward 1992. Oecologia 89:161–165; Tocque 1993. J. Anim. Ecol. 62:683–693) or the impact on population dynamics and persistence (Merilä and Sterner 2002, *op. cit.*), it is important to document this type of interaction. The direct effects of ectoparasites on the health and condition of individuals is unknown, as well as the possible indirect effects of disease transmission in native amphibian populations.

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JORGELINA L. VILLANOVA (e-mail: jorgelinalv@gmail.com) and **ANDRÉS VENTURINO**, Centro de Investigaciones en Toxicología Ambiental y Agrobiotecnología del Comahue, Universidad Nacional del Comahue - CONICET, Neuquén 8300, Neuquén, Argentina; **BETTINA GULLO**, Cátedra Zoología Invertebrados I, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, La Plata 1900, Buenos Aires, Argentina; **EVELINA BARRETO** and **GUILLERMO S. NATALE**, Centro de Investigaciones del Medioambiente, Facultad de Ciencias Exactas, Universidad Nacional de La Plata - CONICET, La Plata 1900, Buenos Aires, Argentina.

***OSTEOCEPHALUS TAURINUS* (Manaus Slender-legged Treefrog). PREDATION.** Although the size of a chorus of frogs and predation risk are often negatively correlated, there is a risk that synchronized calling can attract predators to reproduction sites (Ryan et al. 1981. Behav. Ecol. Sociobiol. 8:273–278). Calling *Osteocephalus taurinus* congregate in groups in low vegetation or in small water bodies. Reproduction usually commences at the beginning of the rainy season but may occur throughout the year after sporadic rains. Egg masses of 550–2000 black eggs are deposited as a film on the surface of temporary ponds (Bokermann 1965. Herpetologica 20:252–255; Duellman 1978. The Biology of an Equatorial Herpetofauna in Amazonian Ecuador. Univ. Kansas Mus. Nat. Hist. Misc. Publ. 65:1–352). Adult and juvenile *Osteocephalus* sp. are preyed upon by vertebrates and arthropods (e.g., praying mantis and spiders), while tadpoles are typically predated by fish and dragonfly larvae (Cintra and Sanaiotti 1990. Herpetol. Rev. 21:59; Gascon 1992. Ecology 73:971–980; Amezquita and Hodl 2004. Herpetologica 60:420–429; Costa-Pereira et al. 2010. Biota Neotrop. 10:469–472.). An ongoing study of the diet of *Atelocynus microtis* (Short-eared Dogs) indicate that they are omnivorous generalists and scavengers that prey upon vertebrates including rodents, fish and frogs (RLP and Williams, unpubl. data). *Atelocynus microtis* have been reported to consume amphibians such as caecilians (Parker and Bailey [eds.] 1990. A biological assessment of the Alto Madidi Region and adjacent areas of northwest Bolivia, May 18–June 15, Conservation International, Washington DC, USA. 25 pp.; Cisneros-Heredia and Mosquera 2010. Reptilia 24:5–6; O'Donnell 2020. Canid Biol. Conserv. 22:25–28). Here, we report a predation event on *O. taurinus* during a breeding congregation by an *A. microtis* in the Amazon of southeastern Peru. This observation was briefly mentioned in an *A. microtis* conservation action plan (Leite-Pitman and Williams 2004. *In* Sillero-Zubiri et al. [eds.], Canids: Foxes, Wolves, Jackals and Dogs. Status Survey and Conservation Action Plan, pp. 26–31. IUCN SSC Canid Specialist Group, Gland, Switzerland and Cambridge, UK.), but here we offer more details.

PHOTO BY RENATA LEITE PITMAN

Fig. 1. A dead *Osteocephalus taurinus* next to the tracks of an *Atelocynus microtis* in the Amazon of southeastern Peru.

On 16 October 2000, during an ecological study of *A. microtis* near the Cocha Cashu Biological Station in Manu National Park, researchers were alerted to the chorus of a mass reproduction event of *O. taurinus* (11.84611°S, 71.39056°W; WGS 84; ca. 360 m elev.) in a seasonally flooded forest near the intersection of trail 27 with the stream Playa Bonita. An estimated 30 pairs of *O. taurinus* were found in amplexus in trees next to a peccary wallow that was about a meter in diameter. The wallow contained hundreds of dark eggs floating over the entire surface of the water. The wallow was bare of immediate surrounding vegetation and was located in a *Heliconia* sp. patch, 400 m from the stream. One dead adult *O. taurinus* was found surrounded by tracks of *A. microtis*. The tracks and puncture wounds on the back of the head indicated that the frog had been mauled (Fig. 1). The wallow was surrounded by tracks of *A. microtis*. No signs of other species were evident. This observation provides additional insight into the risks associated with reproductive modes of neotropical anurans, as well as the dietary composition and predation behavior of a poorly studied canid species.

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RENATA LEITE PITMAN, Duke University, Durham, North Carolina 27708 USA (e-mail: renata.leite@duke.edu); **PATRICK S. CHAMPAGNE**, Acadia University Biology Department, 33 Westwood Avenue, Wolfville, Nova Scotia, Canada, B4P 2R6 (e-mail: patrickchampgne@gmail.com).

***PHYSALAEMUS CUVIERI* (Barker Frog) and *SCINAX X-SIGNATUS* (Venezuelan Snouted Treefrog). HETEROSPECIFIC AMPLEXUS.** Successful reproduction in anurans is facilitated by intraspecific signals that depend on specific aspects for each species, such as morphology, courtship posture, chemical signs, call, and sexual dimorphism (Bowcock et al. 2008. Anim. Behav. 75:1571–1579). However, the use of sexual signals between different species is not completely efficient, resulting in abnormal amplexus (Haddad et al. 1990. Rev. Bras. Biol. 50:739–744) and frequently heterospecific amplexus (e.g., Melo-Sampaio et al. 2017. Herpetol. Rev. 48:3; Pedro and Nali 2020. Herpetol. Notes 13:791–793).

During fieldwork on 1 May 2021 at 2040 h in the Pequís community, rural zone of the Pedro II Municipality, Piauí, Brazil (4.50947°S, 41.48925°W; WGS 84; 418 m elev.), we observed heterospecific amplexus between a male *Physalaemus cuvieri* (Leptodactylidae) and a male *Scinax x-signatus* (Hylidae) in a disabled fish tank, filled with emergent vegetation. While the *P.*

Fig. 1. Heterspecific amplexus between a male *Physalaemus cuvieri* and a male *Scinax x-signatus* in northeastern Brazil.

cuvieri vocalized near the edge of the tank, the male *S. x-signatus* approached the *P. cuvieri* which then clasped the *S. x-signatus* by the inguinal region (Fig. 1). The *S. x-signatus* swam frantically and tried to climb the emergent vegetation, while the *P. cuvieri* tried to stimulate it by shaking its hind legs. No release calls were emitted and after ca. 2 min the *S. x-signatus* managed to break free and both individuals swam away in different directions. Other species exhibiting reproductive activity in the area included: *Pithecopus gonzagai*, *Dermatonotus muelleri* (Muller's Termite Frog), *Elachistocleis piauiensis* (Piaui Oval Frog), *Dendropsophus soaresi* (Picos Treefrog), and *Trachycephalus typhonius* (Pepper Treefrog). There is only one record of heterospecific amplexus for *P. cuvieri* which was observed in amplexus with a female *P. gonzagai* (Ribeiro et al. 2014. Herpetol. Rev. 45:479–480). Therefore, this is the second record of heterospecific amplexus involving *P. cuvieri* and the first between *P. cuvieri* and a hylid.

FELIPE P. SENA, Programa de Pós-Graduação em Zoologia, Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais, 31270-901, Belo Horizonte, Minas Gerais, Brazil; **CLAYLTON A. COSTA**, Programa de Pós-graduação em Zoologia, Departamento de Ciências Biológicas, Universidade Estadual de Santa Cruz, Rodovia Jorge Amado, km 16, 45662-900, Ilhéus, Bahia, Brazil; **LUCAS R. UCHÔA**, Programa de Pós-graduação em Biodiversidade, Ambiente e Saúde, Universidade Estadual do Maranhão, Centro de Estudos Superiores de Caxias, 65604-380, Caxias, Maranhão, Brazil; **ETIELLE B. ANDRADE**, Grupo de Pesquisa em Biodiversidade e Biotecnologia do Centro-Norte Piauiense - BIOTECPI, Instituto Federal de Educação, Ciência e Tecnologia do Piauí , 64255-000, Pedro II, Piauí, Brazil (e-mail: etlandrade@hotmail.com).

***PHYSALAEMUS LISEI* (Braun's Dwarf Frog). ECTROMELIA.** Anomalies such as ectromelia, characterized by an absent or partially absent limb (Meteyer 2000. Field Guide to Malformations of Frogs and Toads. Biological Science Report USGS/BRD/BSR, Madison, Wisconsin. 20 pp.), can be caused by environmental factors, such as pesticides and traumatic injuries, or by hereditary mechanisms (Ouellet et al. 1997. J. Wildl. Dis. 33:95–104). On 24 January 2021 at 1657 h, during an active search, we found an adult *Physalaemus lisei* with ectromelia of the right femur (Fig. 1) characterized by an absent or partially absent limb. In this case, the femur was present but there was no evidence of a stifle joint. This record occurred in an araucaria forest in Gramado City, Rio Grande do Sul, Brazil (29.35863°S, 50.86469°W; WGS 84). The individual was not collected. Ectromelia has been reported for *Physalaemus cuvieri*, *P.* aff. *gracilis* (Ascoli-Morrete 2019. Austral Ecol. 44:1025–1029) and *P. moreirae* (Trevine 2011. M.S. Thesis, Universidade Estadual Paulista Júlio de Mesquita Filho, Brazil. 213 pp.), but this is the first report for *P. lisei*. We recommend more studies of the local anurans to assess the frequency and effects of ectromelia in this population.

PHOTO BY PEDRO HOFFMANN

Fig. 1. *Physalaemus lisei* with ectromelia of the right femur from Rio Grande do Sul, Brazil.

PEDRO HENRIQUE DE OLIVEIRA HOFFMANN, Laboratório de Ecologia e Conservação de Ecossistemas Aquáticos, Universidade do Vale do Rio dos Sinos, Rio Grande do Sul, Brazil (e-mail: hoffmann.paleo@gmail.com); **ANDRESSA ADOLFO**, Laboratório de Ecologia Espacial, Universidade do Vale do Rio dos Sinos, Rio Grande do Sul, Brazil (e-mail: andressadolfo@gmail.com); **FERNANDA RODRIGUES DE AVILA**, Laboratório de Genética e Biologia Molecular, Universidade do Vale do Rio dos Sinos, Rio Grande do Sul, Brazil (e-mail:fernandar.avila@gmail.com); **MATEUS OLIVEIRA**, Sintrópica Consultoria Ambiental, Rio Grande do Sul, Brazil (e-mail: mateoliveirabio@gmail.com).

***POLYPEDATES TERAIENSIS* (Terai Tree Frog). MALACOPHAGY.** Malacophagy (consuming molluscs) in Indian anurans occurs in several bufonids, dicroglossids, and ranids (Dutta et al. 2009. Amphibians and Reptiles of Similipal Biosphere Reserve. Regional Plant Resource Centre, Nayapalli, Bhubaneswar 751015, Orissa, India. 170 pp.; Mohapatra et al. 2013. Amphibians of Nandankanan. Nandankanan Biological Park, Forest Department, Odisha, India. 58 pp.; Chowdhury et al. 2016. Proc. Zool. Soc. 71:114–120; Deuti 2021. Amphibians of West Bengal. Nature Books India, New Delhi, India. 152 pp.). *Polypedates teraiensis* is a rhacophorid occurring in Nepal, India, Bangladesh, Myanmar and possibly China (Frost 2021. Amphibian Species of the World 6.1, an Online Reference.

1A) PHOTO BY NABANITA RAY; 1B) PHOTO BY PRAJJWAL RAY

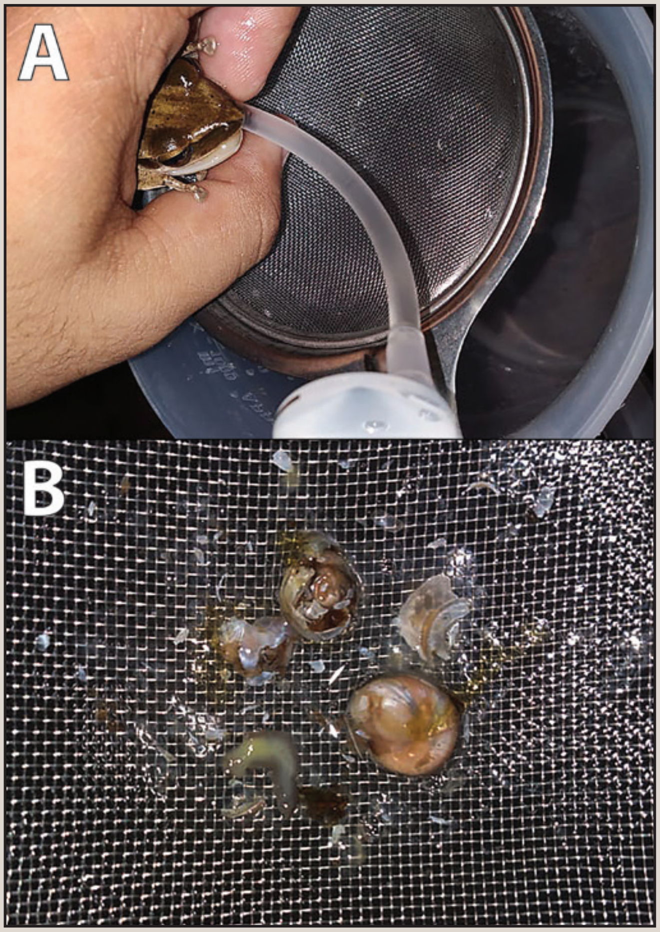


Fig. 1. A) *Polypedates teraiensis* (ZRC[IMG] 1.235a) from Jalpaiguri, West Bengal, India being stomach-flushed; B) freshly flushed stomach contents (ZRC[IMG] 1.23ba) collected on a metal sieve.

https://amphibiansoftheworld.amnh.org; 11 Sept 2021). *Polypedates teraiensis* has been documented feeding on plankton (Lalramdinfeli 2017. M.Phil. Thesis, Mizoram University, Mizoram, India. 95 pp.) and fruit as tadpoles (Gautam and Bhattarai 2020. J. Anim. Div. 2:42–45), various insects (Chanda 1993. Rec. Zool. Surv. India 93:15–29), and other frogs and lizards as adults (Dutta et al. 2009, *op. cit.*; Mohapatra et al. 2013, *op. cit.*; Deuti 2021, *op. cit.*). Here, I report the first case of malacophagy in *P. teraiensis* based on stomach content examination of live specimens from Jalpaiguri, West Bengal, India.

Between 1924 h to 2040 h on 30 July 2021, seven *P. teraiensis* were captured by hand from the Sen Para region, Jalpaiguri (between 26.53167°N, 88.72953°E and 26.53128°N, 88.72981°E; WGS 84) and stomach-flushed (Sole et al. 2005. Stud. Neotrop. Fauna E. 40:23–28; Fig. 1A). Stomach contents were collected on a sieve and later preserved in 70% ethanol (separately for each *P. teraiensis*). All relevant photographs were deposited to the image component of the Zoological Reference Collection of the Lee Kong Chian Natural History Museum, National University of Singapore (ZRC[IMG]). All frogs were later released, unharmed, at the location of their capture.

Six of the seven individuals provided at least some stomach contents (ca. 4–12 mm) including partially digested remains of snails along with some unidentified debris (Fig. 1B). Although species identification was not possible without proper equipment, the size and shape of the snail remains were consistent with *Macrochlamys* sp., pulmonate snails in the family Ariophantidae (verified by N. A. Aravind Madhyastha) which seemed very abundant in and around the collection site. As this observation might be influenced by the abundance of snails as prey, I recommend more dietary studies to be carried out in different regions to see if *P. teraiensis* only preys on snails opportunistically or if snails are indeed preferred by these frogs.

PRAJJWAL RAY, Department of Environmental Biology & Wildlife Sciences, Cotton University, Guwahati 781001, Assam, India; e-mail: prajjwalray066@gmail.com.

PRISTIMANTIS THECTOPTERNUS **(Northern Cordilleras Robber Frog). PREDATION.** *Pristimantis thectopternus* is an Andean endemic species of Colombia, distributed both along the western flank of the Central Cordillera and western and eastern flanks of the Occidental Cordillera, from the departments of Cordoba to Cauca, at elevations between 750–2540 m (Ruiz-Carranza et al. 1996. Rev. Acad. Colomb. Cienc. 20:365–415; Acosta 2000. Biota Colomb. 1:289–319; Romero-Martínez et al. 2008. Caldasia 30:209–229.). *Pristimantis thectopternus* is a leaf litter species, that occasionally can be found in shrubs between 0.3–1.7 m high, and along the edges of roads and rivers (Lynch 1975. Los Angeles Co. Mus. Contrib. Sci. 272:1–19; Páez et al. 2002. Guía de Campo de Algunas Especies de Anfibios y Reptiles de Antioquia. Multimpresos Ltda. Medellín, Colombia. 136 pp.). In Manizales, Caldas Department, Colombia, *P. thectopternus* is sympatric with other leaf litter craugastorids, including *Pristimantis achatinus*, and *Pristimantis w-nigrum*, and with the dendrobatid, *Leucostethus fraterdanieli*. Herein, we present the first record of predation of *P. thectopternus* by *L. fraterdanieli*.

From 8–10 November 2016, between 1000 and 1500 h, 27 *L. fraterdanieli* individuals from the Recinto del Pensamiento Park (5.0393ºN, 75.4465ºW; WGS 84; 2154 m elev.) in Manizales, were sampled in leaf litter and their stomach contents were examined by stomach-flushing. In one of the frogs (a female, 24 mm SVL)

Fig. 1. Ventral (left) and dorsal (right) views of *Pristimantis thectopternus* consumed by a *Leucostethus fraterdanieli* at Recinto del Pensamiento Park, Manizales, Caldas Department, Columbia.

we found a juvenile *P. thectopternus* (9 mm SVL; Fig. 1) ingested headfirst, along with some arthropods. This is the second report of anurophagy for *L. fraterdanieli* (Cárdenas-Ortega and Herrera-Lopera 2016. Herpetol. Rev. 47:438) and the first record of predation of *P. thectopternus* by a dendrobatid.

We thank Juan Mateo Rivera for taking the photographs and Laura Maria Barajas Rebolledo for editing the image.

MARÍA SILVANA CÁRDENAS-ORTEGA, Grupo de Ecología y Diversidad de Anfibios y Reptiles, Facultad de Ciencias Exactas y Naturales, Universidad de Caldas, Calle 65 # 26-10, A.A. 275, Manizales, Colombia (e-mail: silvana9420@gmail.com); **JORGE MARIO HERRERA-LOPERA**, Semillero de Investigación en Biodiversidad y Conservación de paisajes Urbanos (OIKOS), Red de Biología y Conservación de Vertebrados and Red de Diversidad Biológica del Occidente Mexicano, Instituto de Ecología, A. C. Centro Regional del Bajío, Av. Lázaro Cárdenas No. 253, Col. Centro, 61600 Pátzcuaro, Michoacán, México (e-mail: mario.herreralopera@gmail.com).

***PSEUDACRIS CRUCIFER* (Spring Peeper). COLORATION.** Occasionally, observations of color phenotypes such as albinism, leucism, or other atypical colorations are reported in amphibians (e.g., Dyrkacz 1981. SSAR Herpetol. Circ. 11:1–31; Larson and Muller 2011. Herpetol. Rev. 42:406; Hall et al. 2018. Herpetol. Notes 11:601–602; Hartzell 2020. Herpetol. Rev. 51:558–559). Erythrism, defined as the predominance of abnormal redness, is considered to be rare in amphibians (McAlpine and Gilhen 2018. Can. Field-Nat. 132:43–45). However, reports of this condition are common in some populations of *Plethodon cinereus* (Moore and Ouellet 2014. Can. Field-Nat. 128:250–259) and this condition has been noted sporadically in some frog species (McAlpine and Gilhen 2018, *op. cit.*; West and Allain 2020. IRCF Rept. Amphib. 27:331–332). *Pseudacris crucifer* are small frogs native to eastern North America which are typified by light to dark brown dorsal coloration with a dark "x-shaped" marking and lighter ventral coloration (Hulse et al. 2001. Amphibians and Reptiles of Pennsylvania and the Northeast. Cornell University Press, Ithaca, New York. 419 pp.). Recently, McAlphine and Gilhen (2018, *op. cit.*) documented the first known instances of erythrism in *P. crucifer* in North America, consisting of three observations from populations in Maritime Canada. Herein, I report an additional observation of an erythristic *P. crucifer* from Pennsylvania, USA.

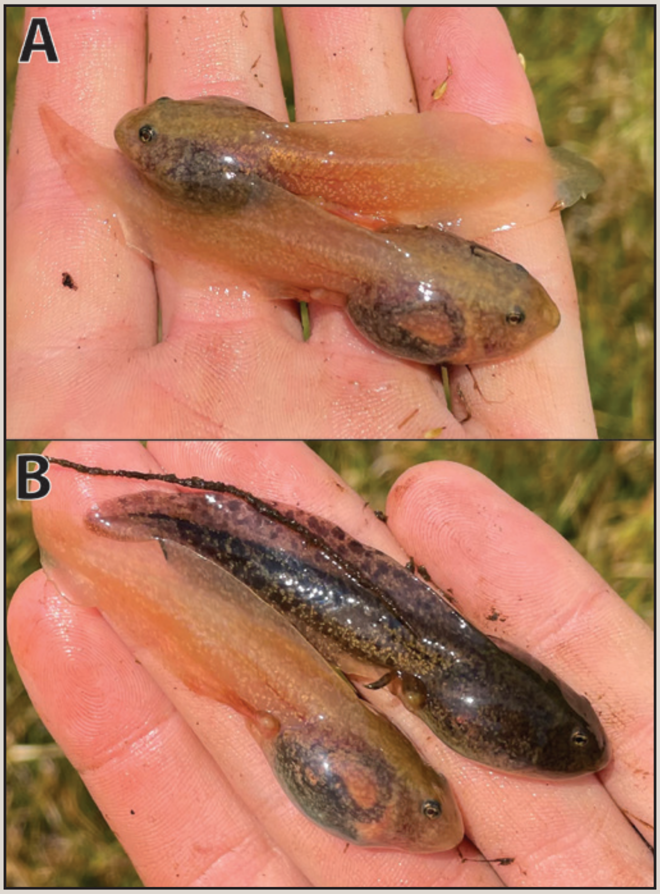
Fig. 1. Erythristic *Pseudacris crucifer* from Pennsylvania, USA.

On 29 September 2021 at 1400 h, I observed an adult erythristic *P. crucifer* (Fig. 1) of unknown sex at a private residence adjacent to a wetland complex in Mifflinville, Columbia County, Pennsylvania, USA (41.0307°N, 76.3041°W; WGS 84). The frog was initially observed sheltering within a patch of grass and subsequently captured, identified, observed, and released. The frog displayed coloration similar to erythristic *P. crucifer* pictured within McAlpine and Gilhen (2018, *op. cit.*) and the "x-shaped" marking was faint but visible (Fig. 1). Although *P. crucifer* are known to change shades from darker to lighter to match background substratum (Kats and Van Dragt 1986. Copeia 1986:109–115), it appears unlikely that the individual's coloration was majorly influenced by the surrounding environment as the frog was initially observed sheltering among green plant material and did not appear to change in coloration during ca. 15 min of observation.

I thank Brittney Hartzell for assistance with this observation. The findings and conclusions in this note are those of the author and may not necessarily reflect those of the Pennsylvania Fish and Boat Commission.

SEAN M. HARTZELL, Division of Environmental Services, Pennsylvania Fish and Boat Commission, 595 East Rolling Ridge Drive, Bellefonte, Pennsylvania 16823, USA; e-mail: seanhartzell77@gmail.com.

***RANA CASCADAE* (Cascades Frog). LEUCISTIC LARVAE.** Color polymorphism, including albinism and leucism, has been observed in larval and metamorphosed amphibians for several



PHOTOS BY RYAN J. ABERG

Fig. 1. A) Two leucistic *Rana cascadae* larvae from the Russian Wilderness, Siskiyou County, California, USA. Note pigmentation in the eyes and internal organs; B) comparison between leucistic and standard *R, cascadae* larvae found at the same location.

species (Dyrkacz 1981. Herpetol. Circ. 11:1–31). While albino animals lack skin pigmentation and have red eyes (Brassaloti and Bertoluci 2009. Herpetol. Bull. 106:31–33), leucistic animals lack skin pigmentation but retain normal eye coloration (Hughes et al. 2019. Herpetol. Rev. 50:115). On 13 July 2021, while searching a meadow pond in the Russian Wilderness, Klamath Mountain Range, Siskiyou County, California, USA (41.37569°S, 122.95879°W; 1886 m elev.), we captured two leucistic *Rana cascadae* tadpoles (gosner stages 37–40; Gosner 1960. Herpetologica 16:183–190; Fig. 1A) within a group of ca. 30 normally colored tadpoles. The eyes were pigmented, but they lacked the skin pigmentation observed in the standard *R. cascadae* larvae found in the same meadow pond (Fig. 1B). The larvae were transparent yellow in body color with light gold flecking throughout their bodies and tail tissues, while their caudal fin margins were a lighter shade of transparent yellow (Fig. 1A, B). Although albino *R. cascadae* larvae have been previously observed in the central Cascade Range of Oregon, USA (Altig and Brodie 1968. Wasmann J. Biol. 26:241), this is the first record of leucistic larvae for *R. cascadae*.

RYAN J. ABERG (e-mail: ryan.aberg@wildlife.ca.gov) and **JUSTIN M. GARWOOD**, California Department of Fish and Wildlife, 5341 Ericson Way, Arcata, California 95521, USA (e-mail: justin.garwood@wildlife.ca.gov).

***RAORCHESTES SHILLONGENSIS* (Shillong Bush Frog). POLYMORPHISM.** *Raorchestes shillongensis* is a critically endangered species of bush frog (Dutta et al. 2004. IUCN Red List of Threatened Species 2004:e.T58902A11852580; Baruah et al. 2018. Phyllomedusa 17:3–20), which is endemic to Shillong and its suburbs in the state of Meghalaya, India. It is a small sized frog with a SVL ranging from 10.0–21.3 mm (BS, pers. obs.). The species was described based on eight specimens which were found hibernating in the soil (Pillai and Chanda 1973. Proc. Indian Acad. Sci, Ser. B. 78:30–36). One of the diagnostic characters in the species description is the presence of a light V-shaped mark on the dorsum near the occiput. However, this V-shaped mark is not a consistent distinguishing character of this species as over the years other workers have reported 'H'-shaped or ')-('-shaped markings (Mathew and Sen 2003. Cobra 53:9–12; Ahmed et al. 2009. Amphibians and Reptiles of Northeast India: A Photographic Guide. Aranyak, Guwahati, India. 168 pp.) In addition, four color morphs of this species were reported recently (Baruah et al. 2018, *op. cit.*).

During a field study on the population diversity of *R. shillongensis* from April 2018 to March 2019, we have encountered several vibrant color morphs of this species, which we are reporting here. The following major morphological variations were observed during the course of our study; however, the white color on the supra-tympanic folds and the dark inter-orbital mark were consistent in all the morphs observed, though in some individuals, the latter was missing:

1. Grey dorsum with ')-(' shaped or ') (' mark (Fig. 1A, C, F, H, I)
2. Dark brown dorsum with no distinct markings (Fig. 1B)
3. Black dorsum with no distinct markings (Fig. 1D)
4. Irregular dorsal markings (Fig. 1E, N)
5. Hour-glass marking on dorsum (Fig. 1G, K–M)
6. Grey or slaty dorsum with sharp '> <' shaped mark (Fig. 1J, O)

Fig. 1. Various color morphs of *Raorchestes shillongensis* from Shillong, Meghalaya, India: grey dorsum with ')-(' shaped or ') (' mark (A, C, F, H, I); dark brown dorsum with no distinct markings (B); black dorsum with no distinct markings (D); irregular dorsal markings (E, N); hour-glass marking on dorsum (G, K–M); grey or slaty dorsum with sharp '> <' shaped mark (J, O).

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BHASKAR SAIKIA, Northeastern Regional Centre, Zoological Survey of India, Shillong 793 003, Meghalaya, India (e-mail: bhaskarsaikia7@gmail.com); **ILONA JACINTA KHARKONGOR**, Arunachal Pradesh Regional Centre, Zoological Survey of India, Itanagar 791113, Arunachal Pradesh, India (e-mail: ilona.kharkongor@ymail.com).

***RHINELLA DORBIGNYI* (Dorbigny's Toad). DEFENSIVE BEHAVIOR.** *Rhinella dorbignyi* belongs to the *Rhinella granulosa* species group, which is composed of small to medium-sized species that present rough skin, well-developed and keratinized cranial crests, and small parotoid glands, and is distributed in open areas in southeastern Brazil, Uruguay, and northeastern Argentina, being a rather common species in grasslands of the Pampas region in Argentina (Pereyra et al. 2016. Cladistics 32:36–53). During fieldwork, we observed stiff-legged behavior in adult male and female *R. dorbignyi* from two different populations separated by ca. 400 km in the southeastern and

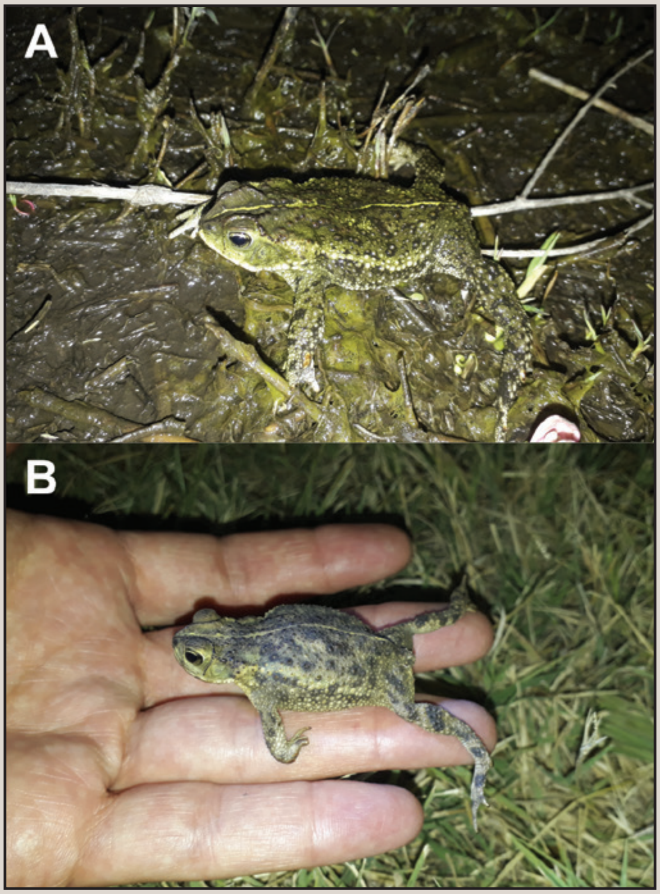

Fig. 1. Stiff-legged behavior in *Rhinella dorbignyi* in Buenos Aires Province, Argentina: A) adult female (77.5 mm SVL) with limbs stretched laterally and body ventrally flattened; B) adult female (56 mm SVL) with limbs stretched posteriorly with inflated lungs.

northwestern parts of Buenos Aires Province, Argentina. The first site was a flooded area located between Provincial Route 88 and agricultural crops in the district of Lobería, Buenos Aires, Argentina (38.4746°S, 58.5763°W; WGS 84; 28 m elev.). Between 2000 and 2200 h on 10 November 2020, we traversed the margins of a semi-permanent body of water and located two female (71.2, 77.5 mm SVL) and one male (58.1 mm SVL) *R. dorbignyi*. When holding them to take photographs, they stretched their limbs laterally and flattened the trunk of the body ventrally, maintaining a rigid posture (Fig. 1A). When the specimens were left on the ground, this stiff-legged behavior ceased almost immediately, or after a few seconds.

The second site was a semi-natural area located in the Municipal Park of Alberti, Buenos Aires, Argentina (35.0274°S, 60.2842°W; WGS 84; 72 m elev.). Between 2100 h and 2300 h on 23 December 2020, we located three female *R. dorbignyi* (64.4, 56, and 62.4 mm SVL) feeding in an open grassy area. Before capturing them, we disturbed them first with gentle touches and later with more intense touches. The animals tried to escape, but in no case did they display the stiff-legged posture during the disturbance, rather this posture was only observed when we grabbed the animals. One of the females stretched her hind legs posteriorly and inflated her lungs, increasing her body volume notably (Fig. 1B). As before, this rigid posture ceased within seconds after releasing the animals.

Stiff-legged behavior was originally described in two unrelated frog species (*Stereocyclops parkeri* and *Proceratophrys appendiculata*) that live in the leaf-litter of coastal rainforests in southeastern Brazil (Sazima 1978. Biotropica 10:158). This behavior has been previously reported in other leaf-litter species (de Mira-Mendes et al. 2016. Herpetol. Notes 9:91–94). It is suggested that by displaying this behavior frogs could mimic fallen leaves, confusing visually oriented predators (Sazima 1978, *op. cit.*). Nevertheless, *R. dorbignyi* inhabits open grasslands, an environment where resembling a fallen leaf is likely to provide little advantage. In addition, adults spend most of the time underground or are frequently observed on the margins of temporary ponds. The stiff-legged behavior has been reported in other species that inhabit open phytophysiognomies, including *R. granulosa* (Mângia and Santana 2013. Herpetol. Notes 6:45–46), *R. pygmea* (Figueiredo-De-Andrade and Da Silveira 2018. Herpetol. Notes 11:205–207), *Odontophrynus americanus* (Maffeid and Ubaid 2016. Neotrop. Biol. Conserv. 11:195–197), and *Pleurodema bibroni* (Kolenc et al. 2009. Zootaxa 1969:1–35, reported as death feigning), suggesting that more studies are necessary to better understand the adaptive role of this postural defense in anurans.

LUCAS DAVID JUNGBLUT (e-mail: lucasjungblut@yahoo.com.ar) and **ANDREA GABRIELA POZZI**, Universidad de Buenos Aires, Facultad de Ciencias Exactas y Naturales, Dpto. de Biodiversidad y Biología Experimental, and Instituto de Biodiversidad y Biología Experimental y Aplicada (IBBEA) CONICET-UBA, Intendente Güiraldes 2160, Ciudad Universitaria, (1428) CABA, Argentina.

***RHINELLA HORRIBILIS* (Mesoamerican Cane Toad). DIET.** *Rhinella horribilis* is naturally distributed throughout the Neotropics, except the arid Andean areas and the Austral Temperate Forest region (Pereyra et al. 2021. Bull. Am. Mus. Nat. Hist. 447:1–155). The diet of this opportunistic toad in its native range is composed of a wide variety of terrestrial insects, chilopods, diplopods, crustaceans, arachnids, mollusks, annelids, and other anurans (Zug and Zug 1979. Smithson. Contr. Zool. 284:1–57; Carrasco-Fuentes 1989. B.S. Thesis, Escuela Nacional de Estudios Profesionales “Iztacala”, UNAM, México. 51 pp.; Cabrera Peña et al. 1997. Rev. Biol. Trop. 44/45:702–703; Torres-Quintero et al. 2008. Entomol. Mex. 7:136–141; Sampeiro-Marí et al. 2011. Caldasia 33:495–505). However, some of the above-referenced studies have not identified the food items to genus or species

Fig. 1. *Rhinella horribilis* carcass from Puerto Vallarta, Jalisco, Mexico and stomach contents consisting of 147 undigested third instar maggots of *Lucilia* sp. Scale bar = 10 mm.

level. Here, we report blowfly maggots in the genus *Lucilia* (Diptera: Calliphoridae) as prey of *R. horribilis.*

On 14 May 2021, we collected and dissected a road killed *R. horribilis* (115 mm SVL) from an urban area of Puerto Vallarta, Jalisco, Mexico (20.68027°N, 105.21944°W; WGS 84; 5 m elev.). We removed the stomach contents and examined them under an Optika optical microscope. We observed and quantified one juvenile earwig (Hexapoda: Dermaptera), one juvenile cricket (Hexapoda: Orthoptera) and one juvenile cockroach (Hexapoda: Blattodea), food items previously reported as prey for *R. horribilis* (Sampeiro-Marí et al. 2011, *op. cit.*). In addition, we observed 147 undigested third instar maggots of *Lucilia* sp. Blowfly maggots are known to feed on a wide variety of decaying organic material, including carcasses (Wall and Shearer 1997. Veterinary Entomology: Arthropod Ectoparasites of Veterinary Importance. Champman & Hall, London. 439 pp.; Jaume-Schinkel and Ibáñez-Bernal 2020. Acta Zool. Mex. [n.s.] 36:1–20) and the *R. horribilis* probably preyed upon them as they fed on decaying organic matter. The *Lucilia* sp. maggots were identified using Florez and Wolff (2009. Neotrop. Entomol. 38:418–429), based on peritreme shape, oral sclerite pigmentation and spine shape of thoracic segments.

FABIO G. CUPUL-MAGAÑA (e-mail: fabiocupul@gmail.com) and **ARMANDO H. ESCOBEDO-GALVÁN**, Centro Universitario de la Costa, Universidad de Guadalajara, Av. Universidad 203, 48280 Puerto Vallarta, Jalisco 48280, México.

***RHINELLA ICTERICA* (Yellow Cururu Toad). AMPLEXUS DISPLACEMENT ATTEMPT.** Some studies on sexual selection in amphibians have highlighted the importance of the relationship between reproductive success and body size (e.g., Howard and Kluge 1985. Evolution 39:260–277), and the importance of nonrandom reproductive behaviors such as amplexus displacement—when one male dislodges or attempts to dislodge another already amplectant male (e.g., Lamb 1984. Copeia 1984:1023–1025). Bufonids are widely distributed and there are several reports of amplexus displacement (e.g., Lamb 1984, *op. cit.*). This species-rich family comprises more than 600 species in over 50 genera, and includes the Neotropical genus *Rhinella* (Frost 2021. Amphibian Species of the World: 6.1, an Online Reference. amphibiansoftheworld.amnh.org; 21 July 2021).

Rhinella icterica is a large-sized, widespread bufonid, ranging from central-Eastern Brazil to Uruguay (Kwet and Di-Bernardo 1999. Pro-Mata–Anfibios, EDIPUCRS, Porto Alegre, Brazil. 107 pp.; Frost 2021, *op. cit.*). Reproduction in *R. icterica* is explosive and occurs from August to January in temporary ponds and puddles (Haddad et al. 1990. Rev. Bras. Biol. 50:739–744). Despite being widely distributed and conspicuous, *R. icterica* still lacks detailed studies on its reproduction. Here, we report the first observation of an amplexus displacement attempt on an amplectant pair of of *R. icterica* by a nearby conspecific male.

On 19 November 2020 at 2100, in Monte Verde, Camanducaia, Minas Gerais, Brazil (22.85°S, 46.0333°W; WGS 84; 1250 m elev.), we observed a pair of *R. icterica* in amplexus in a pond (male: ca. 130 mm SVL; female: ca. 150 mm SVL), with a second male nearby (ca. 125 mm SVL) occasionally attempting to dislodge the amplectant male (Fig. 1A). The satellite male initially grasped the amplectant male at various points and eventually assumed an inguinal grasp on the female while attempting to dislodge the original male by moving above the pair. With each dislodgement attempt, the amplectant male pressed its venter tightly against the female's dorsum and kicked the satellite male with its hind

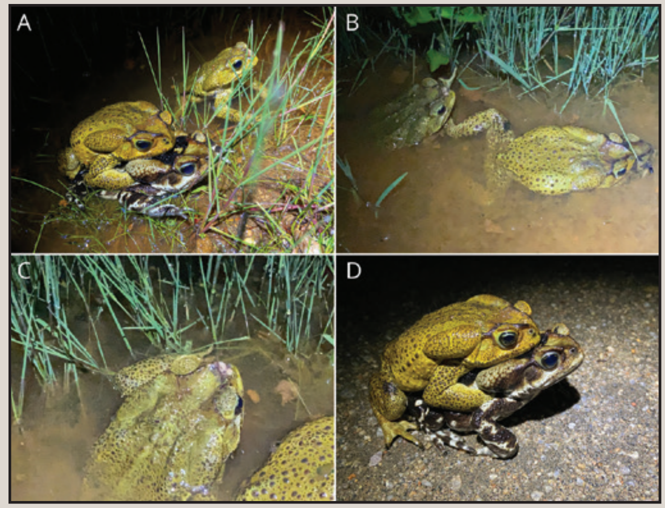

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Fig. 1. A) Amplectant pair of *Rhinella icterica* with an intruding conspecific male in the Municipality of Camanducaia, Minas Gerais, Brazil; B) displacement attempt by the intruding male; C) wounds on the face of the intruding male caused by the amplectant male; D) amplectant pair after moving to the road to avoid the intruding male.

limbs vigorously (Fig. 1B). After at least four attempts to remove the amplectant male, the satellite male withdrew from the site with some wounds on its face (Fig. 1C). This event lasted ca. 10 min, with the amplectant pair eventually moving to the road in an attempt to avoid the satellite male (Fig. 1D). Our observation shows that in addition to an energetic cost (Leary et al. 2004. Behav. Ecol. 15:313–320), physical damage might be an additional cost for satellite males. We hope this work offers a baseline for studies on the reproductive behavior of Neotropical bufonids, and we encourage researchers to report detailed observations to better understand this process and its potential costs at the individual and population levels.

We thank Melhoramentos Florestal for logistical support and authorization to work in the study area, and Gabriela Leal for helping in the field surveys. We additionally thank Marcio Martins for facilitating fieldwork and financial support. This study was partly financed by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior—Brazil (CAPES)—Finance Code 001" and by Fundação de Amparo à Pesquisa do Estado de São Paulo (Grant #2018/140918).

JUAN C. DÍAZ-RICAURTE (e-mail: juan.diaz@usp.br) and **FILIPE C. SERRANO**, Laboratório de Ecologia, Evolução e Conservação de Anfíbios e Répteis, Departamento de Ecologia, Instituto de Biociências, Universidade de São Paulo, Rua do Matão, 05508-090 São Paulo, Brazil.

***RHINELLA JUSTINIANOI* (El Chape Toad). ARBOREAL BEHAVIOR.** *Rhinella justinianoi* (Bufonidae) is a highly terrestrial ground-dwelling and threatened endemic toad from the departments of Cochabamba and Santa Cruz in the Bolivian Yungas (Harvey and Smith 1994. Herpetologica 50:32–38; Reichel and Aguayo 2006. Guía de Anfibios en la ruta "Caminando en las Nubes" Parque Nacional Carrasco. Conservación Internacional, Santa Cruz, Bolivia; Aguayo 2009. *In* Aguirre et al. [eds.], Libro Rojo de la fauna sylvestre de Vertebrados de Bolivia, pp. 91–224. Ministerio de Medio Ambiente y Agua, La Paz, Bolivia; IUCN SSC Amphibian Specialist Group 2020. The IUCN Red List of Threatened Species 2020:e.T54675A154330739; 27 Feb 2021). During a field trip on 16 February 2021, two juvenile *R. justinianoi* were found

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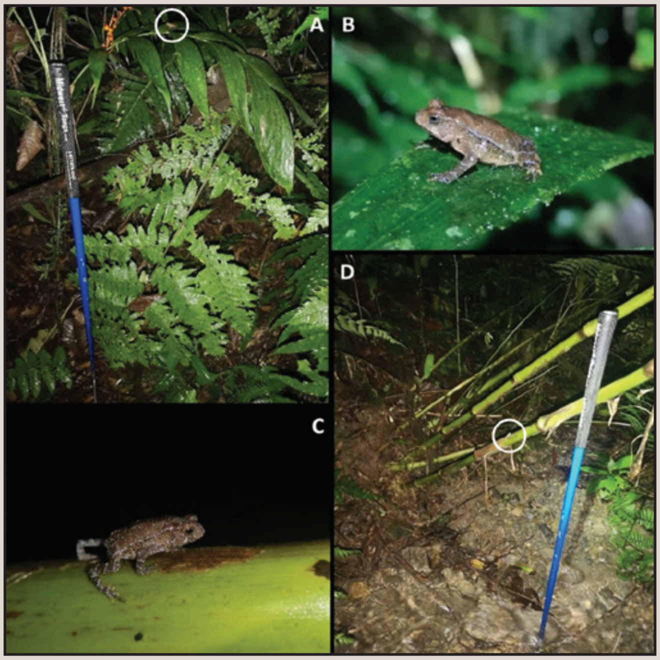

Fig. 1. Two juvenile *Rhinella justinianoi* from Carrrasco National Park, Cochabamba Department, Bolivia exhibiting arboreal behavior.

exhibiting arboreal behavior near a water course at Chaquisacha, in Carrrasco National Park, Cochabamba Department, Bolivia (17.41691°S, 65.24468°W; WGS 84; 1585 m elev.). The first one was observed perched on the leaf of a palm (*Bactris* sp.), 1.25 m above the ground (Fig. 1A, B). The second one was observed climbing a bamboo stem, 0.89 m above the ground (Fig. 1C, D).

Most of the members of the *R. veraguensis* group exhibit arboreal behavior (Duellman and Schulte 1992. Copeia 1992:162–172; Padial et al. 2006. Zootaxa 1278:57–68; Pereyra et al. 2021. Bull. Am. Mus. Nat. Hist. 447:1–156.). According to Harvey and Smith (1994, *op. cit.*) and Reichel and Aguayo (2006, *op. cit.*), *R. justinianoi* was the only species considered completely terrestrial and not exhibiting arboreal behavior. Terrestrial bufonids do not have specialized structures (adhesive discs) for adherence and climbing (Hanna and Barnes 1991. J. Exp. Biol. 155:103–125). Therefore, this climbing behavior or arboreal behavior may be related to the selection of arboreal sites as a defense strategy (Lindquist et al. 2007. Phyllomedusa 6:37–44; Gosá 2008. Naturzale, Cuad. C. Nat. 19:131–148; Noronha et al. 2013. Herpetol. Bull. 124:22–23).

Previous to this record, several juveniles and sub-adults were found perching on fern leaves at a height between 20 to 30 cm (OQ-M, pers. obs.). To the best of our knowledge, this is the first report of arboreal behavior in the wild for *R. justinianoi.* The juvenile *R. justinianoi* were not collected and were identified by coloration and other external characters using Harvey and Smith (1994, *op. cit.*) and Aguayo (2009, *op. cit.*).

OLIVER QUINTEROS-MUÑOZ, Museo de Historia Natural Alcide d'Orbigny, Casilla 843, Cochabamba, Bolivia (e-mail: ohlisin@gmail.com); **RODRIGO AGUAYO**, Centro de Biodiversidad y Genética, Universidad Mayor de San Simón, Casilla 538, Cochabamba, Bolivia (e-mail: phrynopus@gmail.com).

***SMILISCA BAUDINII* (Common Mexican Treefrog). ENDOPARASITES.** *Smilisca baudinii* is a species of hylid frog that has a wide geographic distribution, ranging from extreme southern Texas in the USA, south to Costa Rica (Dodd 2013. Frogs of the United States and Canada. Johns Hopkins University Press, Baltimore, Maryland. 1032 pp.). On 24 May 2021, at ca. 0000 h during a light rain, two adult *S. baudinii* were found dead on the road next to the Centro Interpretativo Ecológico of the Municipality of Gómes Farías, Tamaulipas, Mexico, in a semi-deciduous tropical forest. These frogs, a male and a female, were found ca. 1 m apart. They were dissected for prey items and parasites and each housed a polystomatid fluke (Monogenea) in the urinary bladder. The polystomatids were fixed in AFA solution between microscope slides, washed for several hours in distilled water, dyed in Semichon's acetic carmine, dehydrated in a series of ethanol (70, 80, 90 and 96%), cleared in a series of ethanol and xylene solutions (1:3, 2:2, 3:1) as well as pure xylene, and mounted on microscope slides, using a xylene based synthetic resin as a mounting medium. Another adult male *S. baudinii* was found dead on 6 July 2021, at ca. 2200 h during heavy rain, in the same location as the two previous specimens; it held three polystomatids in its urinary bladder, which were prepared as detailed above. The five polystomatids were identified as *Polystoma naevius* (Fig. 1) by comparing them with the description found in the literature (Caballero y Cerecero 1941 An. Ins. Biol. Univ. Nac. Autón. Méx., Ser. Zool. 12:615–621). *Polystoma naevius* has been reported in *S. baudinii* and *Trachycephalus* cf. *vermiculatus* in the Mexican state of Quintana Roo (Terán-Juárez 2011. B.S. Thesis, Instituto Tecnológico de Chetumal, Chetumal, Quintana Roo. 125 pp.) and in *S. baudinii* and *S. cyanosticta* in Veracruz (Goldberg et al. 2002 Southwest. Nat. 47:293–299). Our observation represents the first record of *P. naevius* in *S. baudinii* from the state of Tamaulipas, making it the northernmost record. The first pair of *S. baudinii* were deposited in the Herpetological Collection of the Facultad de Ciencias Biológicas of the Universidad Autonoma de Nuevo Léon (voucher number: UANL 8541a, b); the lone male was not preserved. The five polystomatids were deposited in the Facultad de Ciencias Forestales of the same university (voucher codes: PARAS032-036).

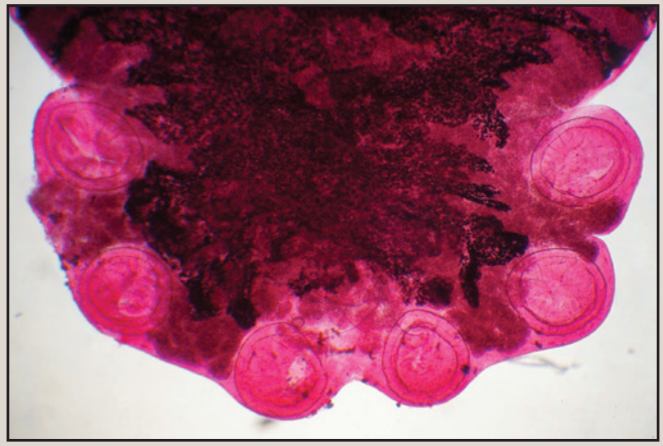

Fig. 1. Close up of the opishaptor of the mounted polystome *Polystoma naevius* found in the urinary bladder of *Smilisca baudinii* from Gómez Farías, Tamaulipas, Mexico.

MANUEL DE LUNA, Facultad de Ciencias Forestales, Universidad Autónoma de Nuevo León, Nuevo León, México (e-mail: scolopendra94@gmail.com); **ROBERTO GARCIA-BARRIOS** (e-mail: roberto.garciab98@gmail.com), **GERARDO GUAJARDO- MARTÍNEZ** (e-mail: geguajardo@yahoo.com.mx), and **DAVID LAZCANO**, Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León, Nuevo León, México (e-mail: imantodes52@hotmail.com).

XENOPHRYS MEGACEPHALA **(Big Headed Horned Frog). HABITAT.** *Xenophrys megacephala* is a low elevation frog species endemic to the northeastern Indian states of Meghalaya and Assam. The known habitats of this species are forest floor leaf litter, on rocks along narrow cascade streams, and shrubs with a height of ca. 1 m (Mahony et al. 2011. Zootaxa 3059:36–46). Previous distribution records are from two disjunct populations: an eastern population from the northern Ri-Bhoi District of Meghalaya and the bordering southern Kamrup District of Assam, and a western population from Tura Municipality in the West Garo Hills District of Meghalaya (Mahony et al. 2020. J. Nat. Hist. London 54:119–194).

A specimen of *X. megacephala* (deposited at the National Zoological Collection, Zoological Survey of India, Shillong under the Registration Number V/A/NERC/ZSI/1501) was collected from Siju Cave, South Garo Hills District of the state of Meghalaya, India (25.35089°N; 90.68333°E; WGS 84; 92 m elev.; Fig. 1) on 22 March 2018. This is the first report of *X. megacephala* inhabiting a cave environment. The collection was made from the dark zone of Siju Cave, ca. 400 m from the cave entrance. Our specimen was found in the main cave passage on the rock wall near the stream flowing out from the cave (Fig. 2).

Interestingly, Siju Cave was reported to harbor tadpoles of *Megalophrys* (*Xenophrys*) sp., which were found up to ca. 105 m from the cave entrance (Kemp and Chopra 1924. Rec. Ind. Mus. Calcutta 26:3–22). Although an unlikely habitat for megophrid frogs, surprisingly, there have been two reports of their occurrence, about a century apart, from this cave. This new locality record extends the known distributional range of the species ca. 50 km south from Tura and thus forms the southernmost distribution for *X. megacephala*.

PHOTO BY BHASKAR SAIKIA

Fig. 1. Cave entrance of Siju Cave, South Garo Hills, Meghalaya, India.

PHOTO BY UTTAM SAIKIA

Fig. 2. *Ex-situ* photograph of a *Xenophrys megacephala* collected from Siju Cave, South Garo Hills, Meghalaya, India.

BHASKAR SAIKIA, Northeastern Regional Centre, Zoological Survey of India, Shillong 793 003, Meghalaya, India (e-mail: bhaskarsaikia7@gmail.com); **SAMRAT SENGUPTA**, Department of Zoology, D.R. College, Golaghat 785621, Assam, India (e-mail: samrat_sengupta1@yahoo.com); **UTTAM SAIKIA**, Northeastern Regional Centre, Zoological Survey of India, Shillong 793 003, Meghalaya, India (e-mail: uttamzsi@gmail.com).

TESTUDINES — TURTLES

BATAGUR TRIVITTATA **(Burmese Roofed Turtle). FEMALE AGE AT FIRST REPRODUCTION.** *Batagur trivittata* is a large aquatic turtle endemic to the major river systems of Myanmar (Ernst and Barbour 1989. Turtles of the World. Smithsonian Institution Press, Washington, D.C. 313 pp.) where it was historically described as common to abundant (Smith 1931. The Fauna of British India, including Ceylon and Burma. Vol. 1. Loricata and Testudines. Taylor and Francis, London. 185 pp.). However, by the late 1990s, *B. trivittata* was feared extinct (Bhupathy et al. 2000. Chelon. Res. Monogr. 2:156–164) until two small remnant populations (one of which has since been extirpated; Platt et al., unpubl. data) were "rediscovered" in the early 2000s (Platt et al. 2005. Chelon. Conserv. Biol. 4:929–939; Kuchling et al. 2006. Oryx 40:176–182). Fewer than 10 reproductively mature females are known to survive in the wild (Çilingir et al. 2018. Conserv. Biol. 31:1469–1476) and hence, *B. trivittata* is now ranked as one of the most critically endangered turtles in the world (Stanford et al. 2018. Turtles in Trouble: The World's 25+ Most Endangered Tortoises and Freshwater Turtles - 2018. IUCN Tortoise and Freshwater Turtle Specialist Group, Ojai, California. 79 pp.).

Shortly after *B. trivittata* was rediscovered, assurance colonies (*sensu* Platt et al. 2017a. Herpetol. Rev. 48:570–575) were established, first at the Yadanabon Zoological Garden (Kuchling and Tint Lwin 2004. Marginata 1:44–50), and later at Lawkanandar Wildlife Park, Htamanthi Wildlife Sanctuary, and Yangon Zoological Garden (Platt et al. 2013. Assurance Colonies of *Batagur trivittata* in Myanmar. Report to Wildlife Conservation Society, Bronx, New York, USA. 36 pp.; Platt and Platt 2019. Turtle Survival 2019:30–35). The mission of these assurance colonies is two-fold: 1) serve as a hedge against biological extinction and 2) produce offspring for head-starting and translocation into the wild (Platt et al. 2013, *op. cit.*). Importantly (Conway 1995. Biodiver. Conserv. 4:573–594), the assurance colonies are all located within the known historic geographic range of *B. trivittata* (Smith 1931, *op. cit.*). At the time of this writing (February 2022), the captive population numbers >1000 individuals and with 150–200 hatchlings being produced each year, *B. trivittata* appears at little risk of biological extinction (Platt and Platt 2021. Turtle Survival 2021:46–49). That said, the survival of *B. trivittata* is contingent on the continued success of ex situ conservation-breeding in the assurance colonies.

Although a knowledge of species biology is critical when crafting effective conservation measures (Dayton. 2003. Amer. Nat. 162:1–13), many aspects of the life history of *B. trivittata* remain poorly known (Platt et al. 2021. Herpetol. Rev. 52:625–626). In particular, the age at which female *B. trivittata* become sexually mature and begin to reproduce has yet to be determined (Platt et al. 2017. Herpetol. Rev. 48:616–618). Age at sexual maturity is a key demographic variable that ultimately determines the rate of population increase and knowing when females begin to reproduce is critical when designing and managing conservation-breeding programs for endangered species (Bury 1979. *In* Harless, M. and H. Morlock [eds.]. Turtles: Perspectives and Research, pp. 571–602. Robert E. Krieger Publishing Company, Malabar, Florida; Larriera et al. 2006. Herpetol. Rev. 37:26–28). We here provide novel data on the age at sexual maturity of female *B. trivittata* in an assurance colony in Myanmar.

Our data were collected at Lawkanandar Wildlife Park (LWP) in Bagan, where an assurance colony is maintained in a 1-ha natural lake on the banks of the Ayeyarwady River. The assurance colony was established in May 2011 with 100 *B. trivittata* (40 males and 60 females) originally hatched from eggs collected along the upper Chindwin River in 2007, 2008, and 2009 (Platt et al. 2013, o*p. cit.*). These eggs were incubated under natural conditions at a protected sandbank near Limpha Village (Platt et al. 2017b. Herpetol. Rev. 48:420–423) and the hatchlings transported to Yadanabon Zoological Garden (Mandalay) for head-starting. The assurance colony at LWP was later reduced to 74 turtles (20 males and 54 females) when individuals were transferred to other assurance colonies or reintroduced into the Chindwin River.

The natural lake housing the assurance colony at LWP is surrounded by a chain link fence to prevent turtles from escaping, and an artificial sandbank (12 × 12 m; sand depth ca. 90 cm) along the shore is available for nesting. Curatorial staff began making daily inspections of the sandbank in December 2019 to search for signs of nesting (e.g., trackways, holes, unburied eggs). After nesting activity was detected in 2021 (see below), the sandbank was enclosed by a low (ca. 45 cm) wire-mesh (mesh size = 2.5 cm) fence in late March (conclusion of the nesting season) to contain the hatchlings after emergence. Once hatching was underway, staff inspected the sandbank twice daily (early morning and late afternoon), collected any hatchlings that had emerged since the previous inspection, and transferred these to a specialized rearing facility in the park.

Trackways, body pits, and holes began to appear on the sandbank in mid-January 2021, and the first hatchling emerged on 14 April 2021. Ultimately, 34 eggs successfully hatched between mid-April and mid-June. On 24 June 2021, we excavated the sandbank and recovered 14 unhatched eggs and six dead hatchlings; the latter had been unable to successfully exit the nest. The combined total of living hatchlings, dead hatchlings, and unhatched eggs indicated that 54 eggs were deposited by female *B. trivittata* during the 2021 nesting season. Because female *B. trivittata* typically deposit a single clutch in multiple nest holes (Platt et al., unpubl. data), we were unable to determine how many females actually nested. However, given that an average clutch deposited by wild females along the Chindwin River consists of 20–25 eggs, we estimate the 54 eggs deposited at LWP represent the reproductive efforts of at least three, or perhaps four female *B. trivittata.* Since the oldest females hatched in 2007, the maximum age at first reproduction for female *B. trivittata* in the assurance colony at LWP was 14 y-old.

Our observations constitute the only report describing the age at which female *B. trivittata* are capable of reproduction, and comparable data from congeners are likewise sparse. Moll (1980. Malay. J. Sci. 6(A):23–62) speculated that female *B. affinis* (Southern River Terrapin) attain sexual maturity in about 25 years. Similarly, Chen et al. (cited in Moll et al. 2015. Chelon. Res. Monogr. 5:090.1–17) used recapture data fitted to a von Bertalanffy Growth Model to predict that female *B. affinis* would begin reproducing when about 22 y-old. In comparison, our results indicate that at least in captivity, female *B. trivittata* begin reproducing at a relatively young age. However, considering that growth is undoubtedly accelerated in captivity, sexual maturity among wild female *B. trivittata* probably occurs at >20 years of age.

We earlier predicted (Platt et al. 2017c. Herpetol. Rev. 48:616–618) that female *B. trivittata* would reach sexual maturity at a carapace length (CL) ≥ 406 mm or about 70% of maximum female body size (see Shine and Iverson 1995. Oikos 72:343–348). Although we lack recent morphometric measurements, the mean (±1 SD) CL of 10 female *B. trivittata* measured at LWP during a health assessment in 2018 (Calle et al. 2021. J. Zoo Wildl. Med. 52:1270–1274) was 369 ± 40 mm. Of this sample, the CL of two females (20%) exceeded 406 mm, and another measured 399 mm. Given that additional growth likely occurred during the three years that elapsed between the health assessment and nesting, our earlier prediction seems to be a reasonable approximation of the body size of female *B. trivittata* at sexual maturity. That said, because the CL of many female *B. trivittata* (hatched in 2008 and 2009) in the assurance colony at Htamanthi Wildlife Sanctuary exceeds 406 mm (Platt et al. 2019. Herpetol. Rev. 50:553–555), and yet these turtles have not begun reproducing, we consider it likely that a body size × age interaction exists in *B. trivittata* whereby females must reach a threshold age before reproduction can occur, regardless of body size (e.g., Joanen and McNease 1987. *In* Webb et al. [eds.], Wildlife Management: Crocodiles and Alligators, pp. 329–340. Surrey Beatty & Sons, Pty. Ltd., Chipping Norton, NSW).

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STEVEN G. PLATT (e-mail: sgplatt@gmail.com) and **TINT LWIN**, Wildlife Conservation Society - Myanmar Program, No. 12 Nanrattaw Street, Kamayut Township, Yangon, Myanmar (e-mail: tintlwin.2010@gmail.com); **SHWE HTAY AUNG**, Lawkanandar Wildlife Park, Bagan, Myanmar (e-mail: shakuushakuu@gmail.com); **KALYAR PLATT**, Turtle Survival Alliance – Myanmar Program, No. 12 Nanrattaw Street, Kamayut Township, Yangon, Myanmar (e-mail: kalyarplatt@gmail.com); **THOMAS R. RAINWATER**, Tom Yawkey Wildlife Center & Belle W. Baruch Institute of Coastal Ecology and Forest Science, Clemson University, P.O. Box 596, Georgetown, South Carolina 29442, USA (e-mail: trrainwater@gmail.com).

***CHELYDRA SERPENTINA* (Snapping Turtle). DIET.** *Chelydra serpentina* is a freshwater turtle with an omnivorous diet consisting of a variety of plants and animals, although amphibian eggs were not listed among the many items by (Punzo 1975. J. Herpetol. 9:207–210) in an extensive dietary study. At 1020 h on 30 April 2017 an adult *C. serpentina* was observed in shallow water, consuming *Lithobates sylvaticus* (Wood Frog) eggs in Shawano County, Wisconsin, USA (44.8928°N, 88.7725°W; WGS 84; 320 m

Fig. 1. *Chelydra serpentina* from Wisconsin, USA, with algae-covered jelly and developing *Lithobates sylvaticus* embryos.

PHOTO BY RYNE D. RUTHERFORD.

Fig. 1. Adult *Chelydra serpentina* from Michigan, USA, killed by *Lontra canadensis*, four days after it was discovered dead.

elev.). The eggs were a couple of weeks old, and the masses contained some algae growth. The globular gelatinous masses with developing black embryos 1–2 mm in length, numbering over one hundred eggs per mass, and surrounded by a thin jelly layer were easily recognizable as *L. sylvaticus* eggs (Casper et al. 2020. Field Guide to Amphibian Eggs and Larvae of the Western Great Lakes. Amphibian and Reptile Conservancy, Inc., Louisville, Kentucky. 91 pp.). At least twenty egg masses were laid together in about 0.5-m deep water in a canopy opening of a mostly shaded pond. The weather was cool, 9°C and cloudy, and the *C. serpentina* was observed in a mostly stationary position biting off chunks of the egg masses at intervals ranging from a few seconds to over a minute. Both jelly and embryos were consumed (Fig. 1). *Lithobates sylvaticus* egg predators are few, but overwintering *L. clamitans* (Green Frog; Vasconcelos and Calhoun 2006. Wetlands 26:992–1003) and *Notophthalmus viridescens* (Eastern Newt; Pitt et al. 2011. Herpetol. Rev. 42:263) have both been found to be significant predators on *L. sylvaticus* eggs. The only other egg predator I have observed in twelve years of amphibian egg surveys in northern Wisconsin and Michigan are giant casemaker caddisflies (Family Phryganeidae).

RYNE D. RUTHERFORD, U.J. Noblet Forestry Building 1400 Townsend Drive Houghton, Michigan 49931-1295, USA; e-mail: rdruther@mtu.edu.

***CHELYDRA SERPENTINA* (Snapping Turtle). PREDATION.** *Chelydra serpentina* is a long-lived species that experiences high juvenile mortality and high adult survivorship. Adult *C. serpentina* have few predators and mortality can have a lasting impact on populations (Harding. 1997. Amphibians and Reptiles of the Great Lakes Region. University of Michigan Press, Ann Arbor, Michigan. 378 pp.). At 1500 h on 12 March 2013, three adult *C. serpentina* were observed dead and upside down on the snow adjacent to a stream where it flowed out of a lake in Delta County, Michigan, USA (45.77839°N, 86.83127°W; WGS 84, 187 m elev.; Fig. 1). Fresh *Lontra canadensis* tracks were found around the turtles and evidence of feeding inside the carcasses was apparent. The skin in front of the hind legs had been ripped open and some internal organs were removed and presumably eaten, but the intestines were avoided and left on the snow. Drag marks where the turtles had been removed from the stream were also seen. This site was revisited in the following weeks and during the winters of 2014–2018, but no additional evidence of predation on *C. serpentina* was observed. *Lontra canadensis* predation on *C. serpentina* appears to be uncommon. In an extensive *L. canadensis* diet study in Wisconsin, USA, no turtles were discovered as prey items (Knudsen and Hale 1968. J. Wildlife Manage. 32:89–93). However (Brooks et al. 1991. Can. J. Zool. 69:1314–1320), found that winter predation by *L. canadensis* caused a sudden and significant population decline at a long-term study site where predation on adult *C. serpentina* had not been previously noted. *Lontra canadensis* predation on *C. serpentina* may be a sporadic, yet potentially significant source of adult mortality in the Great Lakes Region and perhaps elsewhere in its range.

RYNE D. RUTHERFORD, U.J. Noblet Forestry Building 1400 Townsend Drive Houghton, Michigan 49931-1295, USA; e-mail: rdruther@mtu.edu.

***CHELYDRA SERPENTINA* (Snapping Turtle). STAIR CLIMBING.** The turtle body plan is seemingly more awkward than ideal for the ascension of vertical structures. As a result, steep slopes and vertical barriers are often impassable for most turtles (Claussen et al. 2002. Copeia 2002:411–418; Kornilev et al. 2006. Herpetol. Rev. 37:145–148). Nevertheless, several species of turtles have been observed to ascend vertical structures. Diamondback Terrapins (*Malaclemys terrapin*) are known to climb vertical walls (Coker 1906. The Natural History and Cultivation of the Diamond-back Terrapin. E. M. Uzzell, Raleigh, North Carolina. 69 pp.), and Wood Turtles (*Glyptemys insculpta*) can climb chain-link fences (Howell 2015. Pocket Guide to the Reptiles and Amphibians of North America. National Geographic, Washington, D.C. 176 pp.). Pancake Tortoises (*Malacochersus tornieri*) occupy and climb rocky outcrops (called kopjes) in east Africa (Bonin et al. 2006. Turtles of the World. Johns Hopkins University Press, Baltimore. 416 pp.), and captives reportedly can climb over low walls (Kirkpatrick 1993. Rept. Amph. Mag. 1993:2–9). Asian Big-headed Turtles (*Platysternon megacephalum*) can climb steep, rocky waterfalls, using their long stiff tails and enlarged heads (Bonin et al. 2006, *op. cit.*), and are also said to climb bushes and trees (Kirkpatrick 1995. Rept. Amph. Mag. 1995:40–47). Additionally, documented examples exist of box turtles (*Terrapene carolina* and *T. ornata*) scaling a 77 cm high wire mesh fence (Wilbern 1982. Bull. Maryl. Herpetol. Soc. 18:170–171), a European Pond Turtle (*Emys orbicularis*) ascending the inner surface of an automobile wheel (Golubovi and Popovi 2016. Hyla Herpetol. Bull. 2016:24–25), a Spiny Softshell Turtle (*Apalone spinifera*) scaling all but the last four inches (ca. 10 cm) of a nearly vertical 12-foot (ca. 3.66 m) dam with small, built-in "steps" every two inches (Cox 1894. Science 23:50), and another *A. spinifera* climbing a staircase of 14 stairs, with the height of each stair 54–58% the length of its carapace (Engelman 2006. J. Kans. Herpetol. 19:9–10). Here, I report an instance of stair climbing in a Snapping Turtle (*Chelydra serpentina*).

On May 20, 2013, the squeaking sound of claws on the glass of a storm door alerted me to the presence of a *C. serpentina* on the porch of a residence in Raeford, North Carolina, USA. To make it to the door, the turtle had to have climbed three brick-and-mortar stairs: a bottom stair 16.5 cm high and 29 cm horizontally deep, a second stair 16.5 cm high and 33.5 cm deep, and a top stair 17 cm high. The height of the top stair was 61% of the length of the turtle's carapace (30 cm). After the top stair, the turtle had horizontally traversed 190 cm of concrete porch to reach the storm door.

In the case of the aforementioned *A. spinifera* that ascended a staircase, Engelman (2006, *op. cit.*) hypothesized that the turtle was attracted by olfactory cues to an upstairs aquarium that contained a Bluegill (*Lepomis macrochirus*) and a crayfish (*Orconectes virilis*). No such explanation is plausible for the case described here. The residence housed no aquaria or terraria, and its only indoor resident animals were three domestic cats (*Felis catus*). When it was discovered, the turtle was scratching at the storm door in an apparent attempt to keep moving forward. Surmising that it may have been more interested in continuing in a particular direction than in pursuing something within the house, I carried the turtle by hand to the other side of the house and released it into the swamp that bordered the far end of the back yard. The residents of the house had not previously seen this or any other Snapping Turtle on their property, nor have they seen it again in the nine and a half years since this incident, which further suggests that the turtle's motivation for the stair-climbing and porch traversing was less about gaining access to something in the house than about continuing to move in the same direction.

This incident demonstrates that a *C. serpentina* is capable of climbing a staircase in which the vertical height of each stair is around 60% of its carapace length. As Engelman (2006, *op. cit.*) noted, the same is the case for *A. spinifera*. Whether the same is the case for turtles of other taxa, and whether any turtle species is capable of climbing stairs that are taller relative to its carapace length, are questions that await further data.

PHILIP J. SENTER, Department of Biological and Forensic Sciences, Fayetteville State University, Fayetteville, North Carolina, USA; e-mail: psenter@uncfsu.edu.

***CHRYSEMYS DORSALIS* (Southern Painted Turtle). REPRODUCTIVE OUTPUT.** Although geographic variation in reproduction in *Chrysemys picta* (Painted Turtle) has been well-studied (Iverson and Smith 1993 Copeia 1993:1–21, among others), output in *Chrysemys dorsalis* (formerly considered a subspecies of *C. picta*) has only been reported by Moll (1973. Herpetologica 27:307–318). This note expands our knowledge of reproduction in this species.

Two adult female Southern Painted Turtles (*Chrysemys dorsalis*) were captured on the Joe Hogan Fish Hatchery in Lonoke, Lonoke County, Arkansas, USA (34.78°N, 91.90°W; WGS 84) on 1 May 1999 and removed at the request of fisheries personnel (due to competition with their fish stocks). Each was measured (maximum carapace length, CL, in mm; maximum plastron length, PL, in mm), and weighed (body mass, BM, in grams), humanely euthanized, and its reproductive tract removed for examination. Eggs and enlarged follicles (>10 mm diameter; Moll 1973, *op. cit.*) were counted and measured, and the latter were grouped by size cohort. Data for the two females were: 135 mm CL, 125 mm PL, 345 g BM, no oviducal eggs, seven fresh corpora lutea, six follicles 18–19 mm, five follicles 16–17 mm, and four follicles 12–15 mm; and 138 mm CL, 132 mm PL, 358 g, six oviducal eggs (mean: 31.55 mm egg length, 17.02 mm egg width, 5.64 g egg mass), six fresh corpora lutea, five follicles 15–16 mm, six follicles 13–14 mm, and four follicles 11–12 mm. Confirmed clutch size averaged 6.50 (6–7; N = 2); however, estimated clutch size including sets of follicles that potentially could be ovulated was 5.38 (4–7; N = 8). Sets of enlarged follicles along with the presence of only one set of corpora lutea suggest that nesting began in late April and that each female might produce four clutches in the year of capture.

Moll (1973, *op. cit.*) published the only comparative data for *C. dorsalis* with a sample from west Tennessee, USA and a combined sample from Arkansas, USA and Louisiana, USA (Table 1). Based on these data, clutch size appears to increase with body size across populations, as is typical of *Chrysemys* (Iverson and Smith 1993, *op. cit.*). Egg size exhibits a potential trend toward an increase with latitude, but the data are too few to test statistically. Reproductive output (as measured by RCM = clutch mass/gravid body mass) varies little across the range from Tennessee to Louisiana. The available data confirm that *C. dorsalis* has the potential to produce an average of 3–4 clutches

TABLE 1. Summary of reproductive data for *Chrysemys dorsalis*. Abbreviations are: N (sample size), CL (maximum carapace length in mm), BM (body mass in g), CS (clutch size), EL (egg length in mm), EW (egg width in mm), EM (egg mass in g), RCM (relative clutch mass: CM/[BM-CM] in %), and CF (clutch frequency in clutches per year).

State	Latitude	N	CL	PL	BM	CS	EL	EW	EM	% RCM	CF	Source
Tennessee	36.5	19	133[a]	125	326[b]	4.8	31.78[c]	18.21[c]	6.39[c]	9.41 (1–5)	3.07	Moll 1973
Arkansas	34.8	2	137	129	352	6.5	31.55	17.02	5.64	9.46	4.0	This study
Arkansas/Louisiana	35.7/31.5	8/29	121[a]	114	256[b]	4.1	29.57[d]	16.85[d]	5.48[d]	8.78 (2–5)	3.15	Moll 1973

[a]estimated from the PL/CL ratio from Arkansas (0.940).
[b]estimated from CL-BM equation for 166 female *Chrysemys picta* in Zweifel (1989. Am. Mus. Novit. 2952:1–55): BM = $0.0010 * PL^{2.629}$ (mm and g).
[c]calculated from 45 eggs measured by E. O. Moll (pers. comm.).
[d]calculated from 51 eggs measured by E. O. Moll (pers. comm.).

per year (Moll 1973, *op. cit.*). Additional data are necessary to test these preliminary reproductive patterns, especially from populations in Mississippi and Alabama.

Ed Moll generously provided the raw (unpublished) egg size data from his 1973 paper. Scientific collecting permits were provided by the Arkansas State Game and Fish Commission, and Barry Beavers permitted our access to the Joe Hogan Fish Hatchery.

JOHN B. IVERSON, Department of Biology, Earlham College, 801 National Road West, Richmond, Indiana 47374, USA; e-mail johni@earlham.edu.

***CHRYSEMYS PICTA MARGINATA* (Midland Painted Turtle). NOVEL RAILWAY MORTALITY.** While surveying a 3.5-km section of railway at Shawanaga First Nation, Ontario, Canada, we observed a *Chrysemys picta marginata* mortality putatively caused by entrapment in creosote-tar leached from a railway tie. Here, we report on this novel cause of mortality for a freshwater turtle. Wildlife-railway mortality data were collected from 21 May 2019 to 13 October 2021 and are being used for a broader study investigating wildlife mortalities on railways. This study was initiated by Shawanaga First Nation and Magnetawan First Nation based on community concerns about impacts to wildlife caused by railways.

Railway-related mortality is known to occur for turtles, often caused by direct collisions with trains, or entrapment between the parallel rails of railbeds; subsequently leading to death caused by heat stress (Dorsey et al. 2015. *In* van der Ree et al. [eds.], Handbook of Road Ecology, pp. 219-227. John Wiley & Sons, Ltd, Chichester, UK). A combination of small body size and a general lack of shell flexibility have been identified as likely causes of turtle railway entrapment, as these morphological traits restrict the ability of turtles to escape over the rails after entering the railbed (Kornilev et al. 2006. Herpetol. Rev. 37:145–148).

While conducting weekly surveys, at 1635 h on 17 June 2019, we encountered a dead adult male *C. picta marginata* (13.63 cm midline carapace length) in the center of the railway tracks (45.5228°N, 80.2892°W; WGS 84; 219 m elev.) resting on its plastron with three desiccated limbs extended from the leg pockets. The carcass was found directly on top of a railway tie surrounded by a pool of leached creosote-tar. We observed that the turtle was adhered directly to the tie by tar when we attempted to flip the carcass over, which required substantial force, to remove it from the tracks. Once fully overturned, much of the tar remained on the turtle, covering ca. two thirds of the plastron, primarily on the pectoral, abdominal, and femoral scutes (Fig. 1).

The carcass showed no signs of physical trauma as would be expected from a direct collision with a train or hi-rail truck. We suspect the turtle likely entered the railbed through a gap between railway ties (areas where railway ballast has shifted, leaving openings under the rails), several of which exist along the survey route (pers. obs.; Fig. 2.). The individual likely became trapped in the tar while walking down the length of the tracks after getting entrapped between the rails. At the time of observation, we measured the temperature of the air at 28.5°C, the railbed at 38.0°C, and the rail tie at 52.0°C using a probe thermometer (accuracy ± 1°C). Based on the high temperature of the railway tie in comparison to the ambient air temperature, it is likely that the turtle, once immobilized in tar, would have quickly succumbed to heat stress, as suggested for general turtle-railway entrapment (Kornilev et al. 2006, *op. cit.*).

PHOTO BY STEVEN KELL

Fig. 1. Male *Chrysemys picta marginata* (Midland Painted Turtle) found entrapped in creosote-tar leached from a railway tie, that putatively died from heat stress, at Shawanaga First Nation, Ontario, Canada.

PHOTO BY KYLE VINCENT

Fig. 2. Example of the pre-existing gaps between railway ties along the railway corridor at Shawanaga First Nation, Ontario, Canada. We suspect these gaps may allow turtles entry into the railway bed where they then become trapped.

To our knowledge, this is the first documented observation of turtle mortality caused by entrapment in railway-tar. Over the course of three years of weekly surveys, no other tar-entrapment mortalities were observed. However, two other *C. picta marginata* mortalities found in the center of the rails showed evidence of tar accumulation on their plastrons. A community member from Shawanaga First Nation also reported seeing turtles with tar on them after finding them trapped between the rails. This suggests that although this may be a rare occurrence, railway-tar entrapment might present a previously unreported threat to freshwater turtles.

All research was carried out under an approved Laurentian University Animal Care Committee protocol and was authorized by Laurentian University and Shawanaga First Nation. We would not have made this observation without the initiation

of the broader study by both Shawanaga First Nation and Magnetawan First Nation, and the Indigenous Knowledge shared by both communities. Financial support for this project was provided by the Natural Sciences and Engineering Research Council (NSERC), an Ontario Graduate Scholarship (OGS), the Laurentian University Advancing Indigenous Research Fund, and the Canada Research Chair Program.

KYLE D. VINCENT, School of Natural Sciences, Laurentian University, Sudbury, Ontario, Canada, P3E 2C6 (e-mail: kvincent1@laurentian.ca); **JESSE N. POPP**, School of Environmental Sciences, University of Guelph, Guelph, Ontario, Canada, N1G 2W1 (e-mail: poppj@uoguelph.ca); **STEVEN J. KELL**, Lands & Resources Department, Shawanaga First Nation, Nobel, Ontario, Canada P0G 1G0; **ANGELA BELLEAU**, Department of Geography and Environment, Mount Allison University, Sackville, New Brunswick, Canada; **JACQUELINE D. LITZGUS**, School of Natural Sciences, Laurentian University, Sudbury, Ontario, Canada, P3E 2C6 (e-mail: jlitzgus@laurentian.ca).

***CHRYSEMYS PICTA* (Painted Turtle). EGG MORTALITY.** At 0703 h on 24 June 2013, a Thirteen-lined Ground Squirrel (*Ictidomys tridecemlineatus*) was observed adjacent to a Painted Turtle (*Chrysemys picta*) nest made on a gravel pathway near a pond in Brown County, Wisconsin, USA (44.59855°N, 88.03692°W; WGS 84; 177 m elev.). The nest had been recently excavated and the ground squirrel was observed feeding on a turtle egg over a period of several minutes. The ground squirrel maintained an upright posture with the egg held in its two front feet. Only the albumen was consumed; the yolk fell to the ground and was ignored (Fig. 1). No additional eggs were removed from the nest during 10 min of observation and no other nests were found that had been dug up. Ernst and Lovich (2009. Turtles of the United States and Canada. Second Edition. The Johns Hopkins University Press, Baltimore, Maryland. 827 pp.) include *I. tridecemlineatus* on an extensive list of known predators of *C. picta* eggs and hatchlings, but whether *I. tridecemlineatus* was included on the list because of egg or hatching predation is unclear in that reference. Since no other references were found which include *I. tridecemlineatus* as a predator of *C. picta*, this observation likely represents the first documentation of *C. picta* egg predation by *I. tridecemlineatus*.

PHOTO BY RYNE D. RUTHERFORD.

Fig. 1. *Ictidomys tridecemlineatus* consuming a *Chrysemys picta* egg in Brown County, Wisconsin, USA.

RYNE D. RUTHERFORD, U.J. Noblet Forestry Building 1400 Townsend Drive, Houghton, Michigan 49931-1295, USA; e-mail: rdruther@mtu.edu.

***CLEMMYS GUTTATA* (Spotted Turtle). ATTEMPTED PREDATION.** *Clemmys guttata* is a small (ca. 120–140 mm adult carapace length [CL]) aquatic turtle occurring in a variety of shallow wetland habitats from southern Ontario, Canada and Maine, USA southwards on the Atlantic Coast to northern Florida, USA and from Ontario westward along the southern shore of the Great Lakes to Illinois, USA (Ernst and Lovich 2009. Turtles of the United States and Canada. Second edition. Johns Hopkins University Press, Baltimore, Maryland. 827 pp.). Because most populations are small, isolated, and apparently declining, *C. guttata* is ranked as endangered by the IUCN (Rhodin et al. 2018. Chelon. Conserv. Biol. 17:135–161). The drivers of this range-wide population decline are complex, but include habitat destruction and fragmentation, illegal harvesting for the pet trade, pollution, and predation (Litzgus and Mousseau 2004. Southeast. Nat. 3:391–400). Most predation is attributed to subsidized predators such as raccoons (*Procyon lotor*), although large frogs (DeGraaf and Nein. 2010. Northeast. Nat. 17:667–670) and a variety of reptiles (snakes and turtles), birds, and mammals, including River Otters (*Lontra canadensis*) are thought to prey on *C. guttata* (Ernst and Lovich 2009, *op. cit.*). That said, we are unaware of any specific reports of predation or attempted predation on *C. guttata* by *L. canadensis*. In recognition of this knowledge gap, we here describe the attempted predation of an adult *C. guttata* by *L. canadensis* as recorded in a series of trail camera images.

Our trail camera images were taken at a wetland in the Francis Marion National Forest (specific location withheld for conservation purposes), Berkeley County, South Carolina, USA. The wetland is a 1.2-ha pond dominated by Water Tupelo (*Nyssa aquatica*) with little emergent vegetation other than scattered clumps of sedges (*Carex* sp.). In >3 years of monitoring, water depth never exceeded 90 cm and twice during this period the pond dried completely; maximum water depth at the time of our observation was 71 cm. We confirmed the presence of *C. guttata* and identified several basking sites during visits to the pond in 2020. On 1 February 2021, we returned and attached a Browning Strike Force HD Trail Camera (Model BTC-5HD-850) to a small tree about 2 m from a log known to be used for basking by *C. guttata*. The log was angled about 45° from the horizontal and the surrounding water was ca. 50 cm deep. The trail camera was programed to take a single photograph at 10-min intervals, unless triggered by the motion sensor, in which case the camera took a single photograph every 60 s in response to disturbance. We recovered the trail camera on 19 April 2021.

On 28 February 2021, our trail camera recorded a series of eight consecutive images over a period of 16 min (1122–1138 h) that clearly show an unsuccessful predation attempt by *L. canadensis* on *C. guttata* (digital images SP.0019–SP.0025 archived in Campbell Museum, Clemson University). In the first image (1122 h), an adult *C. guttata* is visible basking in full sunlight (tree canopy had yet to leaf out) atop the log and parallel to the camera. The air temperature recorded by the camera was 26°C in the first image and increases to 27°C in subsequent images. At 1132 h a swimming otter was visible at the base of the log; the turtle had pivoted to a position perpendicular to the camera and appeared ready to drop into the water below (Fig. 1A). In the following image (1133 h), the otter was standing at the base of the log and had captured the turtle, holding it ventral side-up and biting the posterior region (Fig. 1B). The otter continued biting the underside of the turtle in the next image (1133 h), probably attempting to extract the head and legs from the shell (Fig. 1C). One minute later (1134 h), the otter can be seen turning away from the camera after having released the turtle, which remains in view, plastron-up, and just below the water's surface. The otter then climbs to the apex of the log with the turtle still visible below the surface (1134 h; Fig. 1D).

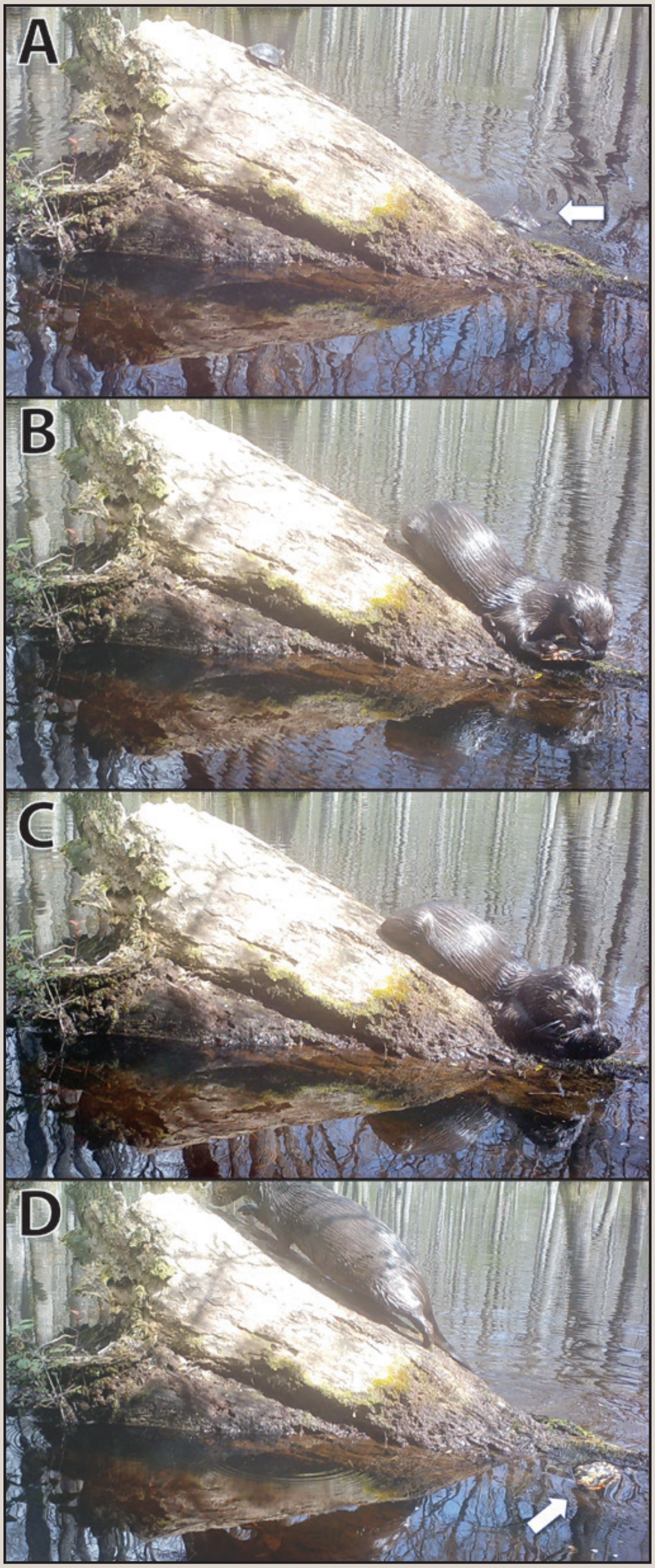

FIG. 1. Trail camera images showing the attempted predation of an adult Spotted Turtle (*Clemmys guttata*) by a River Otter (*Lontra canadensis*) in Berkeley County, South Carolina, USA. The basking *C. guttata* attempts to flee as the otter (white arrow) approaches the log (A). After capturing the turtle, the otter unsuccessfully attempts to breach the shell (B–C), and then abandons the effort, and climbs atop the log leaving the turtle (white arrow) in the water (D). The turtle is not seen in subsequent images and presumably escaped.

At 1137 h the otter appears to be resting on the log and the turtle is no longer visible, presumably having departed the scene. In the final image (1138 h), the otter had reentered the water and was not recorded in any subsequent images.

To briefly summarize, our camera trap imagery shows an otter successfully capturing, but failing to kill a *C. guttata* basking on a partially submerged log. The otter briefly (at least one minute) attempted to kill the turtle before abandoning the effort and climbing atop the log, providing an opportunity for the turtle to escape. The brevity of the encounter and failure to kill the turtle are somewhat surprising given that otters are known to successfully prey on turtles comparable in size or larger than *C. guttata* (Brooks et al. 1991. Can. J. Zool. 69:1314–1320; Ligon and Reasor. 2007. Southwest. Nat. 52:608–610; Stacey et al. 2014. J. Wildl. Dis. 50:906–910). To our knowledge, this series of images represent the first report confirming the potential for *L. canadensis* predation on *C. guttata*.

In general, turtles appear to be a minor dietary component in most studies of *L. canadensis* food habits (e.g., Roberts et al. 2008. Can. Field-Nat. 122:303–311; Day et al. 2015. Can. J. Zool. 93:197–205; Fretueg et al. 2015. Amer. Midl. Nat. 173:294–304). Nevertheless, predation by *L. canadensis* on numerous species of turtles is well-documented (reviewed by Platt and Rainwater. 2011. IUCN Otter Special. Group Bull. 28:4–10; Stacy et al. 2014, *op. cit.*) and under certain conditions (e.g., during the winter when turtles are sluggish or periods of low water in droughts) can be a significant source of mortality. *Lontra canadensis* typically kill turtles by evisceration after breaching the shell or severing the head from the neck; amputations of multiple appendages are also common (Stacy et al. 2014, *op. cit.*). The impact of *L. canadensis* predation on turtle populations can range from low, to moderate or even high depending on a variety of factors (Jones 2017. Chelon. Conserv. Biol. 16:215–228, and references therein). Given that most *C. guttata* populations are small, isolated, and declining (Litzgus and Mousseau 2004, *op. cit.*), predation of the demographically important adult size-class by *L. canadensis* could represent a source of additive mortality (Zimmer-Shaffer et al. 2014. Chelon. Conserv. Biol. 13:227–236), and possibly accelerate population declines. However, while otter predation is certainly a cause for concern, any such conclusion is premature until further evidence of otter predation on *C. guttata* is forthcoming.

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BENJAMIN R. MORRISON, Amphibian and Reptile Conservancy, 640 Dupre Road, McClellanville, South Carolina 29458, USA (e-mail: bmorrison@arcprotects.org); **STEVEN G. PLATT**, Wildlife Conservation Society - Myanmar Program, No. 12, Nanrattaw St., Kamayut Township, Yangon, Myanmar (e-mail: sgplatt@gmail.com); **THOMAS R. RAINWATER**, Tom Yawkey Wildlife Center & Belle W. Baruch Institute of Coastal Ecology and Forest Science, Clemson University, P.O. Box 596, Georgetown, South Carolina 29442, USA (e-mail: trrainwater@gmail.com).

***KINOSTERNON FLAVESCENS* (Yellow Mud Turtle). ALLERGIC REACTION TO MUSK.** Rathke's glands are known to occur in both extinct and extant turtle species and in both chelonian suborders, Pleurodira and Cryptodira, and are thought to be homologous in all turtles (Webb 2010. M.S. Thesis, Arkansas State University, Jonesboro, Arkansas. 37 pp.). Turtles in the family Kinosternidae possess Rathke's glands, which produce a distinctively odiferous chemical secretion. *Kinosternon flavescens* is generally shy and seldom bites but does expel a pungent musk (Ernst and Lovich 2009. Turtles of the United States and Canada. Second Edition. The Johns Hopkins University Press, Baltimore, Maryland. 827 pp.). On 26 May 2020, on Co Rd 4677 in Frio County, Texas, USA (28.7008°N, 99.2292°W; WGS 84) at 0900 h, an adult male *K. flavescens* was found sitting in a roadside puddle following heavy thunderstorms. The turtle was briefly handled (<5 min) to obtain photographs. The senior author used her left hand to move the turtle while holding her camera with her right. Being aware of the location of Rathke's glands in the shell, care was taken to minimize direct contact with secreted musk. While it was being held, the turtle exuded musk from glands in the shell and a clear viscous fluid from the cloaca. At 0905 h she used her left index finger and thumb to touch the inner orbital area of her left eye and scratched her right forearm. In a matter of seconds, she felt an itching sensation near her eye, so she rubbed the area. This initiated a burning sensation, so she stopped and tried unsuccessfully to alleviate the discomfort by rinsing her eye with water. Subsequently a rash also appeared on the inside of her right forearm. By 0907 h the affected area on her face and forearm turned reddish, and by 0908 h, the left eyelid had become swollen and the eye was bloodshot, with tears freely flowing. By 0910 h the eyelid had swollen shut and her discomfort level was high. At this time, she took a 180 mg antihistamine tablet (Allegra) containing the active ingredient Fexofenadine HCL. At 1000 h, swelling of her eyelids had subsided enough for her to open the eye. Twenty-four h later most of the swelling had subsided but considerable discomfort persisted in the ocular region. Though we cannot rule out the potential of the introduction of other foreign material, care should be taken to prevent Rathke's gland secretions from entering the eye.

VIVIANA RICARDEZ, **CARL J. FRANKLIN**, and **SAL SCIBETTA**, Texas Turtles, 1001 Denmark Drive, Grand Prairie, Texas 75050, USA (e-mail: turtlesoftexas@gmail.com).

***KINOSTERNON STEINDACHNERI* (Florida Mud Turtle). REPRODUCTIVE OUTPUT.** The Florida Mud Turtle has only recently been elevated from a subspecies of *Kinosternon subrubrum* to a full species (Turtle Taxonomy Working Group 2021. Chelonian Res. Monogr. 8:1–472). Although reproduction in *K. subrubrum* has been well-studied (Meshaka et al. 2017. Chelonian Res. Monogr. 5:101.1–101.16), very little is known for *K. steindachneri*. Hofer (2004. Emys 11:23–31) reported a single captive female that laid two eggs in 2000 and four eggs in 2001, and Ernst et al. (1973. Herpetologica 29:247–250) examined growth based on plastral annuli but could not estimate size or age at maturity.

Between 1971 and 1978 colleagues and I opportunistically collected *K. steindachneri* on roads in north Florida (ca. 29–31°N latitude) and prepared them for skeletal study. Those dissections provided preliminary reproductive data for females, some of which were published in 1978 (Iverson 1978. Herpetologica 33:205–212). However, because no subsequent field reproductive data have been published, those early data are supplemented here with additional samples as well as further reproductive details from the earlier sample.

TABLE 1. Reproductive data for 18 subadult and adult female *Kinosternon steindachneri* from northern Florida, USA. Females are listed in chronologically through the hypothesized reproductive season (October to June). Abbreviations are CL (maximum carapace length in mm), PL (maximum plastron length in mm), est BM (body mass in g, estimated from CL-BM data for 36 *K. subrubrum*: $BM = 0.002032 \times CL^{2.4917}$; CL in mm; r = 0.91; P < 0.0001; Iverson, unpubl. data), age (age at maturity); CS (clutch size based on oviducal egg counts; I = immature; N = not gravid), EL (mean clutch egg length in mm), EW (mean clutch egg width in mm), est EM (mean clutch egg mass in g, estimated from data for 269 eggs of *K. subrubrum*: EM = 0.162EL + 0.485EW – 7.843; r = 0.95; P < 0.0001; Iverson and Ewert, unpubl. data), CM (clutch mass in g; CS × EM), RCM (relative clutch mass, CM/BM), and EF (groups of enlarged follicles 10–15 mm in diameter; NR = not recorded). Means are for adults only.

Date	County	CL	PL	PL/CL	age	est BM	CS	EL	EW	est EM	CM	RCM	EF
27-Aug	Alachua	94.7	84.85	0.896	–	170.76	N	–	–	–	–	–	1
30-Aug	Alachua	91.5	76.25	0.833	4	156.75	I	–	–	–	–	–	0
20-Oct	Levy	104.6	91.5	0.875	–	218.77	3	26.43	16.43	4.41	13.22	0.060	3+2+3
27-Oct	Brevard	100.25	88.9	0.887	–	196.80	3	29.4	15.85	4.61	13.82	0.070	2
28-Nov	Columbia	108.05	94.0	0.870	–	237.20	3	–	–	–	–	–	4
19-Dec	Marion	93.7	83.2	0.888	–	166.31	4	27.95	17.44	5.14	20.57	0.124	3+3
27-Jan	Alachua	103.8	89.5	0.862	–	214.63	4	26.175	15.95	4.13	16.53	0.077	2
13-Mar	Alachua	69.2	60.4	–	4	–	I	–	–	–	–	–	–
15-Mar	Alachua	90.8	76.25	0.840	5	153.78	5	25	15.27	3.61	18.06	0.117	4+2
23-Mar	Alachua	106.0	88.6	0.836	–	226.14	5	24.61	15.77	3.79	18.96	0.084	5+2
23-Mar	Columbia	97.8	86.5	0.884	8	185.03	N	–	–	–	–	–	0
4-Apr	Alachua	98.65	78.7	0.798	7	189.07	2	28.6	15.45	4.28	8.57	0.045	NR
27-May	Alachua	112.0	97.4	0.870	–	366.74	4	–	–	–	–	–	NR
11-Jun	Levy	93.0	80.6	0.867	–	163.23	N	–	–	–	–	–	0
12-Jun	Alachua	98.05	85.55	0.873	–	186.21	5	25.58	16.31	4.21	21.06	0.113	NR
14-Jun	Baker	97.4	90.5	0.929	–	183.15	3	28.775	16.7	4.92	14.75	0.081	0
14-Jun	Baker	96.75	88.7	0.917	–	180.12	2	26.5	16	4.21	8.42	0.047	1
21-Jun	Alachua	65.1	48.45	–	3	–	I	–	–	–	–	–	–
	MEAN	**99.70**	**86.98**	**0.873**		**195.37**	**3.58**	**26.90**	**16.12**	**4.33**	**15.40**	**0.0818**	

Gravid females were found from October to June, but not in July to September (Table 1). Except in June most females also had enlarged preovulatory follicles suggesting the production of another 1–2 clutches during the on-going reproductive season. However, females in June either had no enlarged follicles or fewer than would typically constitute a clutch. These data suggest a reproductive season lasting at least nine months, with a late summer period of ovarian recrudescence. Confirmation of this hypothetical annual cycle will require additional study, since it seems to differ from that of *K. subrubrum*, which is a spring-early summer nester (January to July with season length declining with increased latitude; Meshaka et al. 2017, *op. cit.*). I consider the anecdotal reports for *K. subrubrum* of an egg found in the field in late November in Louisiana (Anderson and Horne 2009. Southeast. Nat. 8:563–565), and a captive in Texas that deposited an egg in late September (Lardie 1975. J. Herpetol. 9:260–264) to be anomalous.

Based on counts of enlarged ovarian follicles (Table 1), females are apparently capable of producing multiple clutches per reproductive season. However, I was unable to identify multiple sets of corpora lutea in any dissected female. This could reflect my inability to detect them, or the possibility that they regress fully before a subsequent clutch is ovulated. Given the length of the reproductive season and multiple sets of large follicles, annual clutch frequency is likely three or more.

Adult females averaged 99.7 mm maximum carapace length (CL) and ranged from 90.8 to 112.0 mm (Table 1). Two females aged by annuli at 4 years old were immature, whereas the smallest adult female (90.8 mm CL) was aged at 5 years. All larger females were mature, suggesting that reproduction begins in the fifth year, at ca. 90 mm CL (ca. 75 mm maximum plastron length [PL]). Based on the plastral growth curve for *K. steindachneri* in Ernst et al. (1973, *op. cit.*), 75 mm PL would be reached at an average age of 8 years, although some of their females reached that size by age six. Apparently female *K. steindachneri* mature at larger sizes than *K. subrubrum* (70–85 mm CL; Meshaka et al. 2017, *op. cit.*), but at similar ages (4–9 years; Meshaka et al. 2017, *op. cit.*).

Clutch size in my sample averaged 3.58, and ranged from 2 to 5, but was not correlated with CL (r^2 = 0.0008). Eggs averaged 29.60 mm in length, 16.12 mm in width, and weighed 4.33 g (N = 36), but neither mean clutch egg length (r^2 = 0.020) nor mean clutch egg width (r^2 = 0.008) nor estimated mean clutch egg mass (r^2 = 0.021) were correlated with CL. Clutch size was not correlated with estimated egg mass (r = -0.40; P = 0.25). Clutch size in *K. steindachneri* is larger than in *K. subrubrum* (2–3; Gibbons 1983. Herpetologica 39: 254–271), but egg size is nearly identical (Meshaka et al. 2017, *op. cit.*). In the only contrast to the patterns for *K. steindachneri*, CS is apparently correlated with body size in *K. subrubrum* (Iverson 1979. J. Herpetol. 13:105–111).

Estimated relative clutch mass (RCM = clutch mass/gravid body mass) averaged 8.18% (range: 4.5–12.3) and was also not correlated with CL (r^2 = 0.234; P > 0.10). RCM in *K. steindachneri* is nearly identical to that of *K. subrubrum* in South Carolina (9.3%; Congdon and Gibbons 1985. Herpetologica 41:194–205), Texas (7.1%; Houseal and Carr 1983. Southwest. Nat. 28:237–238), and Arkansas (estimated at 7.2%; Iverson 1979. J. Herpetol. 13:105–111). It is also close to the average RCM (7.65%) for 23 populations (16 species) of kinosternids reviewed by Iverson et al. (1993. Can. J. Zool. 71:2448–2461). Given how few life history data are available for *K. steindachneri*, future field research on the species is needed.

JOHN B. IVERSON, Department of Biology, Earlham College, 801 National Road West, Richmond, Indiana 47374, USA; e-mail johni@earlham.edu.

***MACROCHELYS APALACHICOLAE* (Apalachicola Alligator Snapping Turtle). UNUSUAL JUVENILE MOVEMENT.** Live and dead *Macrochelys apalachicolae* of all sizes have been observed on beaches of barrier islands or bays along the Gulf of Mexico in Franklin, Gulf, and Bay counties, Florida, USA (Lewis and Irwin 2001. Herpetol. Rev. 32:274; Enge et al. 2021. Florida Field Nat. 49:138147). Enge et al. (2021, *op. cit.*) confirmed the presence of a reproducing population of *M. apalachicolae* on the 5056-ha St. Vincent Island, which is located 10.5 km from the mouth of the Apalachicola River. This island has six permanent, freshwater coastal dune lakes, five of which are connected and drain into Apalachicola Bay via a small stream with an outlet near West Pass on the eastern end of the island. Most outflow from Apalachicola Bay into the Gulf of Mexico occurs through West Pass (Sun and Koch 2001. J. Hydraulic Eng. 127:718727), where a dead adult *M. apalachicolae* was found by Lewis and Irwin (2001, *op. cit.*). Enge et al. (2021, *op. cit.*) speculated that *M. apalachicolae* observed in estuarine areas represented larger turtles that voluntarily entered bays to forage and smaller turtles that were flushed from

Fig. 1. Juvenile *Macrochelys apalachicolae* leaving Apalachicola Bay (A) and entering the mouth of a small stream (B) on St. Vincent Island near West Pass, Franklin County, Florida, USA.

mainland rivers during periods of high discharge. Reduced salinity levels in the bay after heavy rainfall events may encourage turtles to enter the bay to forage, and they crawl ashore after becoming osmotically stressed (Enge et al. 2021, *op. cit.*). Surface salinity in Apalachicola Bay varies from about 5 ppt near the mouth of the Apalachicola River to about 30 ppt at the eastern end of the bay; bottom salinity is generally higher because of vertical stratification (Huang and Spaulding 2002. Hydrol. Processes 16:30513064).

On 24 March 2022 at 1500 h, MT observed a partially submerged, juvenile *M. apalachicolae* in the mouth of the small stream near West Pass on St. Vincent Island, Franklin County (29.64223°N, 85.09409°W; WGS 84). The turtle was leaving the surf in Apalachicola Bay and crawling upstream in shallow water (Fig. 1) after a period of heavy rainfall. We assume this turtle did not come from the Apalachicola River but instead was part of the island population and had been foraging in the bay during reduced salinity levels. The velocity and volume of this stream are insufficient to have washed the turtle into the bay. This observation suggests that both juvenile and adult *M. apalachicolae* voluntarily enter brackish Apalachicola Bay.

MILES THREADGILL, U.S. Department of Agriculture, Milton, Florida 32570, USA (e-mail: mthreadgill22@gmail.com); **KEVIN M. ENGE**, Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, 1105 S.W. Willison Road, Gainesville, Florida 32601, USA (e-mail: kevin.enge@myfwc.com).

***PSEUDEMYS TEXANA* (Texas Cooter). EPIBIONTIC HOST.** Caddisflies are insects belonging to the order Trichoptera. They have an amphibious life cycle with an aquatic larval stage lasting up to two years and an adult lifespan up to three months (Voelz 1983. M.A. Thesis, St. Cloud State University, St. Cloud, Minnesota. vii + 42 pp.). On 13 June 2021 at 1236 h three adult *Pseudemys texana* were hand captured in the Guadalupe River at Louis Hays Park in Kerrville, Texas, USA. Each specimen had a cluster of eggs on its plastron from the caddisfly family Hydropsychidae (Fig. 1). The clusters measured ca. 7 × 17 mm. Photo images were deposited into the Texas Turtles Digital Collection (TTDC 218–222). Caddisflies belonging to the family Hydropsychidae emerge from the water during the spring but return during their brief adult lifespan to dive below the surface and deposit their eggs on rocks, vegetation or other items on the bottom (Badcock 1952. Nature 170:40–41). It seems likely that the *Hyperphyches* were able to deposit their eggs onto the turtle plastrons while the turtles were asleep. This is apparently the first documentation of tricopterans utilizing turtle shells as a surface on which to deposit eggs.

Fig. 1. Caddisfly eggs on the plastron of *Pseudemys texana* (TTDC 220) from Kerrville, Texas, USA.

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CARL J. FRANKLIN, **VIVIANA RICARDEZ**, and **SAL SCIBETTA**, Texas Turtles. 1001 Denmark Drive. Grand Prairie, Texas 75050, USA (e-mail: turtlesoftexas@gmail.com); **JOSEPH FIORENZA**, 1407 Bowden Chase Court, Spring, Texas 77379, USA; **GRAHAM DERZON-SUPPLEE**, 10140 NE Roberts Road, Bainbridge Island, Washington 98110, USA; **JESSE M. MEIK**, Department of Biological Sciences Tarleton State University, Stephenville, Texas 76402, USA; **ANDRÉS BETTER**, 4684 S Hampton Circle, Boulder, Colorado 80301, USA (e-mail: andybetter00@gmail.com).

***STERNOTHERUS CARINATUS* (Razor-backed Musk Turtle). POTENTIAL MORTALITY.** Razor-backed Musk Turtles are known for basking on emergent limbs and branches, usually at an angle of 30–60° (Lindeman 1996. Herpetol. Nat. Hist. 4:23–34). On 24 April 2020 at 1300 h in Mill Creek, Shelby County, Texas, USA along Highway 96 (31.7241°N, 94.1707°W; WGS 84), we witnessed an adult female basking on a branch ca. 40 cm above the surface of the water. Upon detecting our presence, she dropped from her basking site and became wedged into the "Y" of the branch below her. In this condition neither her front nor rear legs could gain purchase to achieve freedom. Asides from the obvious risk of predation, there was the added potential for desiccation as *S. carinatus* are known to experience a high rate of transdermal evaporative loss (Constanzo et al. 2001. Physiol. Biochem. Zool. 74:519–519). The turtle was removed from the branch, photographed, and released. This instance provides a tangible example of how natural environmental factors can influence turtle mortality in the wild.

CARL J. FRANKLIN, **VIVIANA RICARDEZ**, and **SAL SCIBETTA**, Texas Turtles, 1001 Denmark Drive, Grand Prairie, Texas 75050, USA (e-mail: turtlesoftexas@gmail.com).

***TERRAPENE CAROLINA TRIUNGUIS* (Three-toed Box Turtle). SUSTAINED AQUATIC BEHAVIOR.** Trauth et al. (2004. The Amphibians and Reptiles of Arkansas. University of Arkansas Press, Fayetteville, Arkansas. 421 pp.) briefly mentioned aquatic behavior in *Terrapene carolina triunguis*, based on observations in a neighboring state, there being no direct observations of such behavior in Arkansas, USA. That reference (McDowell et al. 2004. Herpetol. Rev. 35:265–266) recorded four dates on which *T. c. triunguis* was observed in aquatic habitats in Missouri, USA: 4 June 2004 (Current River, Carter County), 23 June 2002 (ephemeral pond in Wilson's Creek National Battlefield, Greene County), 23 July 2002 (Current River, Shannon County), and 21 October 2002 (North Fork of the White River, Ozark County). More recently Pitt et al. (2020. Herpetol. Rev. 51:839–840) reported three observations associated with a seventh order stream, the North Fork of White River in Ozark County, Missouri. We consider the riverine observations by McDowell et al. (2004, *op. cit.*) and Pitt et al. (2020, *op. cit.*) to be relevant to understanding the significance of the present report.

Walker and Trauth (2020. Herpetol. Rev. 51:115–116) provided the first report of aquatic behavior in *T. c. triunguis* in Arkansas which involved the entry and exit of an adult in the shallows of Beaver Lake, though swimming was not observed. The part of this 11331-ha lake at full pool (i.e., 341.68 m elev.) featured in the previous and present reports is in Benton County in

Fig. 1. Adult of *Terrapene carolina triunguis* photographed on 24 May 2019 at ca. 0955 h making landfall on riprap bordering Big Hickory Creek Cove of Beaver Lake, Benton County, Arkansas, USA.

the northwestern corner of Arkansas near the Hickory Creek Marina (36.23765°N, 94.03805°W; WGS 84; ca. 342 m elev.). The southwest–northeast entry road to the marina has two elevated roadbed components of ca. 40–50 m stabilized by riprap which transformed two potential islands into a peninsula tipped by the marina. The previous report of aquatic behavior in *T. c. triunguis* (Walker and Trauth 2020, *op. cit.*) was on the northwest side of the riprap component bordering Little Hickory Creek Cove nearest the entry to the park, whereas this report refers to the opposite northeast side of the riprap bordering Big Hickory Creek Cove (= BHCC).

On Thursday 24 May 2021, while fishing from the shoreline of BHCC, JMW noticed the head of a turtle moving diagonally across a part of the cove ca. 15 m from the shoreline. It was immediately noted, as a cell phone was activated for images, that it was not one of the many aquatic turtles in Beaver Lake which always immediately submerge on detection of the slightest movement of a human. As the moving head did not submerge and the dome of the carapace occasionally became visible, it was obvious that the animal was an individual of *T. c. triunguis* swimming diagonally across the cove. The campground component on this part of BHCC is extensively used by humans in spring and summer; however, during the morning of 24 May 2021 JMW was the only person present in campground as well as the surrounding area. Thus, the swimming *T. c. triunguis* was not flushed into the cove by human causation. The individual entered the cove (water temperature ca. 16.7C) an estimated 15–20 m up the shoreline and was noticed as it crossed in front of JMW. It was moving in the general direction of the wind creating moderate wave action which was unfortunately in the direction of the riprap on the elevated area supporting the road. In no part of the transit across the cove did *T. c. triunguis* completely submerge and the dome of the carapace only occasionally bobbed above the surface of the water. The turtle appeared to be an effective swimmer with steady speed which could have sustained a much longer transit. After walking along the cove to the road and then down the road to the vicinity of the oncoming turtle, which was carefully observed from an inobtrusive distance, it made several unsuccessful attempts to emerge from the lake before finding sufficiently flat rocks to make the landing (Fig. 1). As the animal struggled to climb up the riprap toward the busy roadway, human intervention seemed appropriate; JMW relocated it to a nearby forested area.

Leading up to the observation on aquatic behavior that day, three individuals of *T. c. triunguis* were seen either crossing or on roads in the vicinity of Beaver Lake suggesting that the species was on the move. The previously cited riverine sightings of *T. c. triunguis* in Missouri coupled with the present observation in Arkansas suggest that Three-toed Box Turtle does not react to water as a barrier to significant dispersal across, rivers, ponds, and lakes or to local activities.

JAMES M. WALKER, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA (e-mail: jmwalker@uark.edu); **STANLEY E. TRAUTH**, Department of Biological Sciences, Arkansas State University, State University, Arkansas 72467, USA (e-mail: strauth@astate.edu).

TRACHEMYS DORBIGNI **(D'Orbigny's Slider Turtle). PREDATION.** *Trachemys dorbigni* is a small freshwater turtle inhabiting aquatic environments such as lagoons, rivers, swamps, lakes, and weirs with an abundance of vegetation (Bujes 2008. Herpetol. Rev. 40:347–438). It is known to occur in Argentina (Buenos Aires, Chaco, Corrientes, Entre Rios, Santa Fe), Uruguay, and Brazil, in the states of Rio Grande do Sul and Santa Catarina (Rhodin et al. 2021. Turtles of the World. Chelon. Res. Monogr. No. 8. 471 pp.). As with many Brazilian freshwater turtle species, much of the species' natural history remains unknown (Cunha et al. 2021. Chelon. Conserv. Biol. 20:109–115). Here we report the predation of a *T. dorbigni* by *Ardea cocoi* (Cocoi Heron). The event took place between the municipalities of Bagé and Bom Pedrito (31.18045°S, 54.34399°W; WGS 84; 299 m elev.), Rio Grande do Sul, Brazil. The region is part of the Pampas biome, with vegetation composed of grassy-woody steppe along with the presence of gallery forests. The observation took place on 3 April 2021 at 1503 h through a camera trap (Scoutguard SG565) set up for the study of local mammals. The image obtained shows an adult individual of *A. cocoi* preying on a juvenile *T. dorbigni* (Fig. 1). This is apparently the first record of predation of this turtle species by a bird. The impact of bird predation on the natural turtle population is unknown but is likely to be less important for the conservation of the species than the destruction of riparian habitat for rice production and collecting for pet markets.

Fig. 1. Predation of juvenile *Trachemys dorbigni* by *Ardea cocoi*, in Rio Grande do Sul, Brazil.

FABIO ANDREW G. CUNHA, Programa de Pós-Graduação Ecologia Aquática e Pesca, Universidade Federal do Pará, Belém, Pará, Brasil, Rua Augusto Corrêa, 01, Cep.: 66.075-110 (e-mail: fabioagcunha@gmail.com); **FELIPE BORTOLOTTO PETERS**, Programa de Pós-Graduação em Biologia Animal, Universidade Federal do Rio Grande do Sul, Porto Alegre, Rio

Grande do Sul, Brasil, Avenida Bento Gonçalves, 9500, Cep.: 91501-970 (e-mail: felipebortolottopeters@gmail.com).

TRACHEMYS SCRIPTA SCRIPTA **(Yellow-bellied Slider). KYPHOSCOLIOSIS.** Kyphosis is a dorsal-ventral curvature of the spine resulting in an exaggerated doming of the carapace in chelonians (Rothschild et al. 2013. *In* Brinkman et al. [eds.], Morphology and Evolution of Turtles, pp. 501–534. Springer, New York, New York). Instances of kyphosis in numerous freshwater and marine turtle species have been summarized by several authors (Plymale 1978. Southwest. Nat. 23:457461; Rhodin et al. 1984. Brit. J. Herpetol. 6:369–373; Stuart 1996. Bull. Chicago Herpetol. Soc. 31:60–61; Selman and Jones 2012. Chelon. Conserv. Biol. 11:259261; Rothschild et al. 2013, *op. cit.*). According to Tucker et al. (2007. Herpetol. Rev. 38:337–338), 0.06% of 21,786 specimens of *Trachemys scripta elegans* (Red-eared Slider) exhibited kyphosis. Scoliosis, a lateral curvature of the spine in the frontal plane, has been rarely reported in chelonians (Rhodin et al. 1984, *op. cit.*). Kyphoscoliosis, a condition that includes both dorsoventral and lateral undulations of the spine (Rhodin et al. 1984, *op. cit.*), is even less common (Stuart and Painter 2008. Herpetol. Rev. 39:218219; Bennett and Litzgus 2014. J. Herpetol. 48:262–266; Mitchell and Johnston 2014. Herpetol. Rev. 45:312; Mitchell and Johnston 2016. Herpetol. Rev. 47:127–128; Elsey et al. 2017. Herpetol. Rev. 48:837838; Schachner et al. 2017. J. Anat. 231:835848; Turner 2018. Queensland Nat. 56:1217; Jackson and Zappalorti 2020. Herpetol. Rev. 51:113114).

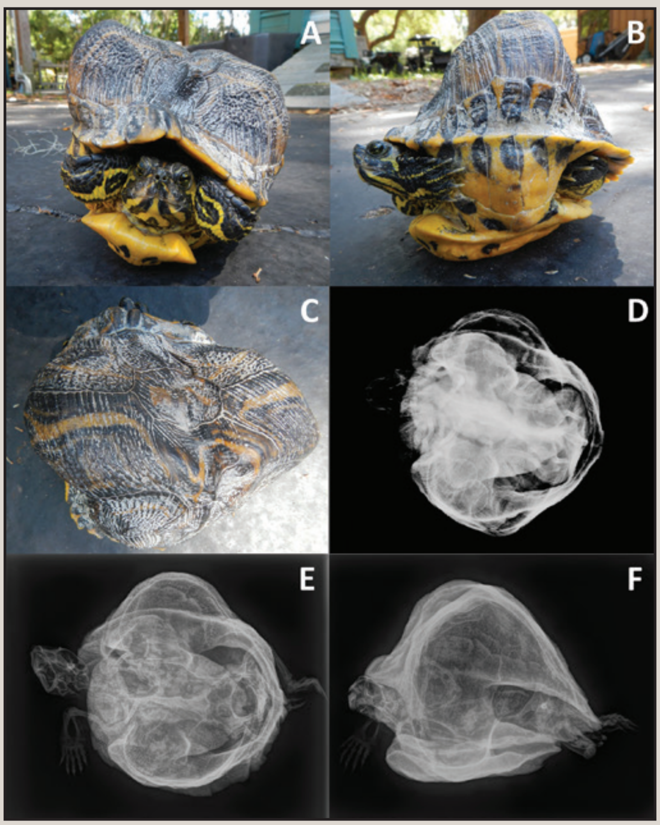

Fig. 1. Kyphoscoliotic female *Trachemys scripta scripta* from Alachua County, Florida, USA, showing anterior view (A), lateral view (B), dorsal view with head facing up (C), antemortem ventrodorsal radiograph with head facing left showing seven eggs (D), postmortem dorsoventral radiograph showing scoliosis (E), and postmortem lateral radiograph showing kyphosis (F).

In May 2017, an adult female *T. s. scripta* was found near High Springs, Alachua County, Florida, USA, with an extremely deformed shell that apparently represented severe kyphoscoliosis. Measurements were 147 mm straight midline carapace length (CL), 147 mm maximum carapace width (CW), 140 mm maximum shell height (HT), 119 mm straight midline plastron length (PL), and 1441 g mass. Her head, limbs, and tail appeared to be normal. Eight female *T. s. scripta* from northern Florida with masses (14371450 g) comparable to the kyphoscoliotic female averaged 205 mm CL, 167 mm CW, 91 mm HT, and 194 mm PL. Females with normal dimensions are typically ca. 2.25 times longer than they are high, whereas the kyphoscoliotic female was only 1.05 times longer than high. The dorsolateral protuberance on the right side of the carapace was more prominent than on the left side (Fig. 1A), causing significant lateral distortion of carapacial scutes (Fig. 1B). A keel on the slightly convex plastron (Fig. 1C) caused the turtle to tip to the side (Fig. 1A), preventing limbs on both sides from contacting the ground simultaneously while on a firm surface. Despite compromised terrestrial mobility, this gravid turtle was found on land, probably searching for a nest site. A radiograph showed at least seven eggs (Fig. 1D), but she was no longer gravid when she died in captivity after progressively declining. Postmortem radiographs showed both scoliosis (Fig. 1E), and kyphosis (Fig. 1F) of the spine. Halfway distal to the nuchal scute, the spine curved to the right and then back to the left, but this curvature did not conform to the shape of the dorsolateral protuberances (Fig. 1E). The turtle was skeletonized for educational purposes. She resembled an adult female *T. s. elegans* from Louisiana, USA with kyphoscoliosis and multiple spinal deformities that measured 113 mm CL, 107 mm CW, and 103 mm HT (1.10 times longer than high) and had a mass of 845 g, two prominent dorsal protuberances, and a slightly convex plastron (Elsey et al. 2017, *op. cit.*). These shell abnormalities in *T. scripta* probably represent congenital defects and illustrate the amazing adaptability of turtles to survive severe shell malformations and injuries.

KEVIN M. ENGE (e-mail: kevin.enge@myfwc.com), **BAMBI CLEMONS**, and **MCKENZIE KEIGTLEY**, Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, 1105 SW Williston Road, Gainesville, Florida 32601, USA; **GERALD R. JOHNSTON**, Department of Natural Sciences, Santa Fe College, Gainesville, Florida 32606, USA; **LESLIE STRAUB**, Florida Wildlife Care, Gainesville, Florida 32641, USA.

CROACODYLIA — CROCODILIANS

CROCODYLUS ACUTUS **(American Crocodile). DIET.** Reported prey items of *Crocodylus acutus* include insects, crustaceans, fish, and large reptiles such as *Caiman crocodilus*, boas, and iguanas (Medem 1981. Los Crocodylia de Sur America. Volumen I. Los Crocodylia de Colombia. Colciencias. Bogota, Colombia. 354 pp.; Platt et al. 2002. Herpetol. Rev. 33:202–203; Platt et al. 2013. J. Herpetol. 47:1–10; Balaguera-Reina et al. 2018. Ecosphere 9:e02393). However, *Arius felis* (Hardhead Catfish) has not been reported as a prey item despite its distributional overlap with *C. acutus* in south Florida. This record provides evidence for *A. felis* as a potential *C. acutus* diet item in south Florida.

At 1936 h on 9 February 2021, we observed a *C. acutus* (152.7 cm total length) with an *A. felis* pectoral spine lodged in its tongue in the West Lake Complex of Everglades National Park, Miami-Dade County, Florida, USA (25.19047°N, 80.78421°W; WGS 84; 1 m elev.; Fig. 1). The *C. acutus* was captured for research purposes, and we were able to extract the pectoral spine (42 mm)

PHOTO BY NICOLE JENNINGS

Fig. 1. Adult *Crocodylus acutus* with an *Arius felis* pectoral spine in its tongue at Everglades National Park, Florida, USA.

PHOTO BY SIDNEY GODFREY

Fig. 2. A reference photo of an *Arius felis* pectoral spine taken from the tongue of a *Crocodylus acutus* at Everglades National Park, Florida, USA.

with a pair of tongs for further examination (Fig. 2). The pectoral spine was photographed and submitted to the Florida Museum of Natural History to attain species identification. The pectoral spine's presence in the crocodile's tongue is evidence that *A. felis* could be an unreported prey item for *C. acutus* in south Florida. However, we could not confirm the presence of *A. felis* in either the stomach or gastrointestinal tract since we could not extract stomach contents or feces.

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SIDNEY T. GODFREY (e-mail: sgodfrey1@ufl.edu), **NICOLE D. JENNINGS** (e-mail: nicole.jennings@ufl.edu), and **FRANK J. MAZZOTTI**, University of Florida IFAS Fort Lauderdale Research & Education Center, Davie, Florida, USA 33314 (e-mail: fjma@ufl.edu).

SQUAMATA — LIZARDS

***ANOLIS CAROLINENSIS* (Green Anole). HABITAT USE.** The native range of *Anolis carolinensis* includes the most northern latitudes of any species in the diverse and primarily tropical lizard genus *Anolis* (Williams 1969. Quart. Rev. Biol. 44:345–389). Throughout most of the year, *A. carolinensis* is considered a habitat generalist that uses grasses, stems, leaves, branches, tree trunks, and signs/fence posts as perching sites (Irschick et al. 2005. Biol. J. Linn. Soc. 85:223–234). However, unlike many of its tropical congeners, *A. carolinensis* faces high seasonal temperature variation and must behaviorally thermoregulate in order to survive the colder months. During the winter, these lizards are generally active but may seek refuge in rock crevices when temperatures drop at night or when it is particularly cold or overcast during the day (Bishop and Echternacht 2004. Herpetologica 60:168–177). In this report, we describe late-fall novel refuge use by *A. carolinensis*.

On 22 November 2021, at 1124 h, we observed an adult female *A. carolinensis* inhabiting an inactive hornet nest in Oconee

Fig. 1. Adult female *Anolis carolinensis* positioned (as found) within the aperture of an inactive hornet nest in Oconee County, South Carolina, USA.

Fig. 2. Adult female *Anolis carolinensis* positioned on the outside of the inactive hornet nest in Oconee County, South Carolina, USA. This was how we encountered the lizard when we returned ca. 20 min after our initial observation.

County, South Carolina, USA (34.59868°N, 82.92664°W; WGS 84; 230 m elev.). The nest was hanging ca. 2.5 m above the ground in a large cedar tree and was partially obscured by branches and foliage. The lizard was positioned in the nest aperture with only her head sticking out (Fig. 1), which is consistent with *A. carolinensis* basking behavior just before emergence from rock crevices in winter (Bishop and Echternacht 2004. Herpetologica 60:168–177). She remained in the nest's opening while we took several photos from a distance of 5 m for ca. five min. We then left and returned at 1151 h to take more photos. Upon our return, the lizard was clinging to the outside of the nest (Fig. 2) and had climbed ca. 30 cm up from the aperture.

Given the shape, size, and placement of the nest, we determined that it was most likely constructed by the regionally common *Dolichovespula maculata* (Bald-faced Hornet). We first observed this nest on 15 August 2021 but did not approach due to the abundance of hornets in and around it. However, during our visit on 22 November 2021, no hornets were seen anywhere nearby. In addition, we tapped on the nest on 23 November 2021 and did not hear any buzzing or any other response, suggesting that the nest was empty. The anole was no longer present in the nest at this time either.

To our knowledge, this is the first published report of *A. carolinensis* or any anole species occupying an abandoned hymenopteran nest. While interesting, the purpose for doing so remains unclear. Female *A. carolinensis* have been documented to use active nests of trap jaw ants as oviposition sites (Kwapich 2021. Southeast. Nat. 20:N119–N124), but it seems highly unlikely that the female we observed was using the hornet nest for egg-laying simply due to the fact that late November is well outside the reproductive season for this species (Licht 1973. Copeia 1973:465–472). Alternatively, we suspect that *A. carolinensis* may use hornet nests as well-insulated thermal refugia during the colder months of the year. Indeed, the very same type of nest in which we observed an anole is known to regularly provide roosting sites for overwintering Carolina Wrens in the southeastern United States (Elliott and Elliott 2017. The Chat 81:97–100).

JOHN DAVID CURLIS (e-mail: curlisjd@umich.edu) and **MOLLY A. HIRST**, Department of Ecology and Evolutionary Biology and Museum of Zoology, University of Michigan, 3600 Varsity Drive, Ann Arbor, Michigan 48108, USA; **ANNE CURLIS** and **DAVID CURLIS**, 9322 Lear Court, Huntersville, North Carolina 28078, USA.

***ANOLIS SCHIEDII* (Schiede´s Anole). MAXIMUM ELEVATION.** *Anolis schiedii* is endemic to Mexico and is restricted to the central part of the state of Veracruz, occurring from 1340 to 2012 m in cloud forest, oak forest, and pine-oak forest (Nieto-Montes de Oca 1994. Herpetologica 50:325–335; Vásquez-Cruz and Peralta-Hernández 2020. Herpetol. Rev. 51:773–774.). Here, we report a new maximum elevation record for *A. schiedii*.

On 12 September 2021, ca. 1800 h, we found an adult female *A. schiedii* active among the litter in an ecotone between an oak forest and cloud forest at an elevation of 2325 m in the Municipality of Huiloapan de Cuautémoc, Veracruz, México (18.80602°N, 97.12987°W; WGS 84; 2325 m elev.). We did not collect the lizard, but instead caught and photographed it, and then released it back to the leaf litter (Fig.1). The photo voucher is deposited in the Digital Collection of Natural History Museum of Los Angeles County (LACM PC 2820). The maximum elevational extent previously reported for *A. schiedii* was 2012 m from northwest of Tepetlaxitla in the Municipality of Magdalena, Mexico (Vásquez-Cruz and Peralta-Hernández 2020, *op. cit.*) and our observation increases the known elevation of *A. schiedii* by 313 m.

We thank N. Camacho for cataloging the photograph and Luis Canseco-Márquez for confirming the species identity.

PHOTO BY RAFAEL PERALTA-HERNÁNDEZ

Fig. 1. An adult female *Anolis schiedii* from Cerro de Huiloapan, Huiloapan de Cuauhtémoc, Veracruz, México.

RAFAEL PERALTA-HERNÁNDEZ, Museo de Zoología, Facultad de estudios superiores Zaragoza, Universidad Nacional Autónoma de México, Batalla 5 de Mayo s/n, Col. Ejército de Oriente, 09230, Ciudad de México, México (e-mail: phrafa4@gmail.com), **VÍCTOR VÁSQUEZ-CRUZ** (e-mail: victorbiolvc@gmail.com), **JORGE LUIS CASTILLO-JUÁREZ** (e-mail: joorgeluiscj@gmail.com), **ALFONSO KELLY-HERNÁNDEZ** (e-mail: alfonsokellyh@hotmail.com), and **DANIELA ALEGRÍA SÁNCHEZ** PIMVS Herpetario Palancoatl, Avenida 19 número 5525, Colonia Nueva Esperanza, Córdoba, Veracruz, México (e-mail: luciferi999@outlook.com); **PEDRO E. NAHUAT-CERVERA** Ekuneil Península de Yucatán. Calle 52, por 89 y 93, Colonia Centro. C.P. 97000. Mérida, Yucatán, México (e-mail: pedro.nahuat4@gmail.com).

***ASPIDOSCELIS LABIALIS* (Baja California Whiptail). BODY SIZE and REPRODUCTION.** *Aspidoscelis labialis* is a monotypic species endemic to the west coast of Baja California Norte, México. This species is the least studied, most morphologically distinctive (Walker 1966. Copeia 1966:644–650; Lowe et al. 1966. J. Arizona Acad. Sci. 4:121–127), and genetically divergent member (Barley et al. 2019. Mol. Phylogenet. Evol.132:284–295) within a subgroup of small-bodied, striped, and unspotted gonochoristic taxa in the

Table 1. Data for samples with adults of *Aspidoscelis labialis* from Baja California Norte, México, and adults of *A. inornatus* from Santa Fe County, New Mexico, USA, in the University of Colorado Museum of Natural History (UCM) utilized in this study. Data for GPS (WGS 84) and elevations (m) were not recorded at the time of collection of specimens and are approximations for the collecting sites.

Species	Date	Collection Site	Coordinates	Elevation	UCM #s	Habitat Type	Sympatric Congeners
A. labialis	30 March 1965	MX: Baja California Norte: east side of Bahía de San Quintín	30.4464°N, 116.0218°W	7.3	29344–29375 (N = 32)	Peninsular Coastal Plain	None observed
A. labialis	31 March 1965	MX: Baja California Norte: west side of Bahía de San Quintín	30.4448°N 115.9896°W	19.5	29299–29343 (N = 45)	Peninsular Coastal Plain	None observed
A. inornatus	18 July 1965	USA: New Mexico: 14.4 km south of Santa Fe	35.6047°N, 106.0343°W	1963	29480–29537 (N = 58)	Inland Shrubby Arroyo	*A. velox* (N = 8)

Aspidoscelis sexlineatus group. Also included in the subgroup are the polytypic *Aspidoscelis inornatus* complex (Little Striped Whiptail) of the southwestern USA and northern México (Wright and Lowe 1993. J. Arizona-Nevada Acad. Sci. 27:129–157) and polytypic *A. sexlineatus* (Six-lined Racerunner) essentially distributed east of the Rocky Mountains in much of the USA (Trauth 1980. Ph.D. Dissertation, Auburn University, Auburn, Alabama. 212 pp.; Trauth 1992. Texas J. Sci. 44:437–443; Trauth 1995. Bull. Chicago Herpetol. Soc. 30:68) and extreme northeastern México (Pérez-Ramos et al. 2010. Southwest. Nat. 55:419–425). The relatively small range of *A. labialis*, at great distances west of the *A. inornatus* complex and *A. sexlineatus*, is restricted to a remote and seldom visited narrow and patchy band of habitat along the Pacific coast from south of Ensenada, Baja California Norte, México, to SE of Guerrero Negro, Baja California Sur, México (Grismer 2002. Amphibians and Reptiles of Baja California Including its Pacific Islands and the Islands in the Sea of Cortés. Univ. Calif. Press, Berkeley. 399 pp). Unlike taxonomically challenging variation in the *A. inornatus* complex (Collins 1997. Herpetol. Cir. 25:1–40; Reeder et al. 2002. Am. Mus. Novitat. 3365:1–64; Walker et al. 2012. Herpetol. Conserv. Biol. 7:265275; Crother 2017. SSAR Herpetol. Cir. 43:1–102; Barley et al. 2021. Am. Nat. 198:195–209) and *A. sexlineatus* in México (Pérez-Ramos et al. 2010, *op. cit.*), there is no current taxonomic controversy pertaining to the diminutive species *A. labialis* (see Lovich et al. 2009. Herpetol. Conserv. Biol. 4:358–378). I visited the range of *A. labialis* in March 1965 to determine its mode of reproduction (i.e., either parthenogenetic or gonochoristic) and collected a large sample of this locally abundant species on both the east and west sides of Bahía de San Quintín, Baja California Norte (Table 1). Specimens from among these series were subsequently used to voucher a publication pertaining to morphological variation, habitat, behavior, and relative abundance in *A. labialis* (Walker 1966, *op. cit.*).

I dissected female *A. labialis* from the 2-d early spring period to obtain reproductive data. The continuing dearth of information on the reproductive biology of this species has prompted me to use data from the two consecutive dates (Table 1) to supplement a report by Goldberg (2012. Herpetol. Rev. 43:643) who examined 20 *A. labialis* specimens collected over a 5-y period between 1964 and 1982 which are deposited in the Natural History Museum of Los Angeles County (LACM) and Museum of Vertebrate Zoology (MVZ). In this study I also used a large comparative sample of adult *A. inornatus* (sensu Wright and Lowe 1993, *op. cit.*) from Santa Fe County, New Mexico, USA collected with T. P. Maslin and H. L. Taylor for SVL comparisons with *A. labialis* (Table 1). I used JMP v13.0.0 (SAS Institute Inc., Cary, North Carolina) to obtain ranges of variation, means ± SE, and significance (Tukey HSD; = 0.05).

The largest adult female *A. labialis* in the UCM samples (N = 27) from March 1965 was 61 mm SVL, whereas the largest adult female *A. inornatus* from New Mexico collected in July 1965 (N = 32) was 69 mm SVL; the largest adult male *A. labialis* (N = 45) was 59 mm SVL, whereas the largest adult male *A. inornatus* (N = 23) was 66 mm SVL. Neither intraspecific SVL means for female (mean SVL = 54.0 ± 0.63 SE; SVL range: 47–61 mm) and male (mean SVL = 53.0 ± 0.82 SE; SVL range: 46–59 mm) *A. labialis* ($P = 0.7637$), nor SVL means for female (mean SVL = 58.6 ± 0.75, SVL range = 49–69 mm) and male (mean SVL = 56.4 ± 0.88 SE; SVL range: 48–66 mm) *A. inornatus* were significantly different ($P = 0.2623$). There was a significant interspecific difference of mean SVL between females of *A. labialis* and both sexes of *A. inornatus* ($P = 0.0001$), which may have resulted from the dates of collection, namely late March and middle July, rather than a biological difference.

Only ten of 27 female *A. labialis* collected 30–31 March 1965 (mean SVL = 52.5 ± 0.76 SE; SVL range: 47–55 mm) had yolked ovarian follicles, five from the east side Bahía de San Quintín and five from west of Bahía de San Quintín. Although these individuals established an early spring onset of first clutch production in some individuals of the species, the size difference between 10 gravid and seventeen females that possessed neither yolked follicles nor oviducal eggs (mean SVL = 53.3 ± 1.03 SE; SVL range: 47–61 mm) was not significant ($P = 0.9869$). Based on the presence of yolked ovarian follicles in 10 lizards with bilateral clutch development the following data obtained: left ovary (mean eggs = 1.3 ± 0.15, egg count range = 1–2); right ovary (mean eggs = 1.5 ± 0.17 SE; egg count range: 1–2); size of yolked ovarian follicles (mean size = 2.8 ± 0.11 SE; range: 2.5–3.5 mm); and clutch size (mean = 2.8 ± 0.13 SE; range: 2–3). Goldberg (2012, *op. cit.*) reported a significantly smaller mean clutch size for *A. labialis* (mean = 1.71 ± 0.95 SE; range = 1–3) based on seven specimens pooled from five years (i.e., 1964, 1967, 1968, 1971, and 1982). The smallest female of 47 mm SVL in my samples indicated that females hatched in the previous summer became sexually mature in less than 12 months. It was also apparent that development of clutches of ca. three eggs began so early in the year as to likely result in production of multiple yearly clutches in females.

The unusual abundance of *A. labialis* at the collection sites east and west of Bahía de San Quintín was noteworthy (Walker 1966, *op. cit.*). I hypothesize that this was related to a combination of an extended activity cycle, early sexual maturity, multiple clutches per activity cycle, and allopatry to another small-bodied gonochoristic congener, namely *A. hyperythrus*, which has an extensive distribution on the peninsula and on islands in the Gulf of California (Radtkey et al. 1997. Proc. Natl. Acad. Sci. U.S.A. 94:9740–9745; Taylor and Walker 2014. Southwest. Nat. 221–227; Taylor and Walker 2014. J. Herpetol. 48:355–362).

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JAMES M. WALKER, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA; e-mail: jmwalker@uark.edu.

***ASPIDOSCELIS LAREDOENSIS* (Laredo Striped Whiptail). TAIL AUTOTOMY and PREDATOR ESCAPE.** Numerous publications reviewed by Bateman and Fleming (2009. J. Zool. 277:1–14) concluded that tail autotomy in lizards is an adaptation that reduces the success rate of predator attacks. We describe attempted predation on an adult diploid parthenogenetic *Aspidoscelis laredoensis* (Laredo Striped Whiptail; clonal complex A sensu Walker 1987. Texas J. Sci. 39:313–334) by the ophidian *Masticophis schotti ruthveni* (Ruthven's Whipsnake; Fig. 2; sensu Camper and Dixon 1994. Ann. Carnegie Mus. 63:1–48). The attack occurred on a lizard of an estimated SVL of ca. 75 mm in which the tail was detached (Fig. 1) and the lizard escaped. We use the term autotomy to cover tail breakage by force as well as when sufficiently stressed whether by intervertebral or intravertebral means.

We observed the lizard and ophidian along a section of the Rio Grande pedestrian trail of ca. 2.88 km in Bentsen-Rio Grande Valley State Park (BRGVSP) near Mission, Hidalgo County, Texas, USA (26.17305°N, 98.3825°W; WGS 84; ca. 39.6 m elev.). *Aspidoscelis laredoensis* A has become abundant in this park since its discovery there in 1984 (Walker 1987, *op. cit.*; Walker et. al. 1996. Southwest. Nat. 41:64–67; Paulissen 2000. Herpetol. Nat. Hist. 7:41–57), and *M. s. ruthveni* is the most frequently observed snake here as well. The trail and tramway systems in BRGVSP meander through one of the few extant enclaves of riparian woodland in Texas in the vast extent of the Rio Grande Valley between Val Verde County and the Gulf of Mexico. The loamy soil along the Rio Grande trail supports relatively thick seasonal growth of two introduced grass species, low-growing Buffelgrass (*Cenchrus ciliaris*) and tall-growing Guinea Grass (*Megathyrsus maximus*) which makes observation of reptiles challenging. These trails provide anthropogenic corridors that are extensively used by individuals of *Aspidoscelis gularis gularis* (Texas Spotted Whiptail) and *A. laredoensis*, both of which are apparently frequent prey for *M. s. ruthveni.*

On 21 August 2021, at ca. 1430 h, from a distance of ca. 5 m along the Rio Grande trail system in BRGVSP, we observed an adult *M. s. ruthveni*, ca. 1 m in length, attack a large adult *A. laredoensis.* About 15 min prior to the predation attempt, we observed an adult male and female of *A. g. gularis* engaged in courtship behaviors, while an adult *A. laredoensis* was within a meter of the two lizards actively foraging on grasshoppers. Suddenly, the *M. s. ruthveni* emerged from a trail-side mesquite tree with its head elevated. The two *A. g. gularis* apparently detected the presence of the snake and rapidly ran down the trail for a distance of ca. 10 m, whereas the less wary *A. laredoensis* erred by inadvertently circling back in the general direction of the snake, the presence of which was apparently obscured by grasses. The lizard's movement was detected by the *M. s. ruthveni* and the snake rapidly moved across the trail and seized the lizard. After a brief struggle the lizard was observed to escape, but not before the tail detached leaving it with a bloody stub with a jagged wound posterior to the 17th scale whorl (Fig. 1). The autotomized tail was not found and perhaps it was consumed by the snake. We offer this as a rarely observed example of tail loss in a lizard that allowed it to escape predation by a marauding whipsnake, which is a well-known lizard predator. The observation is consistent with the generality that tail autotomy in *A. laredoensis* improves survivorship (e.g., Bateman and Fleming 2009, *op. cit.*) and that whipsnakes typically employ foraging tactics to encounter prey (Ernst and Ernst 2003. Snakes of the United States and Canada. Smithsonian Institution Press, Washington D.C., 661 pp.).

Fig. 1. Large adult of diploid parthenogenetic *Aspidoscelis laredoensis* (Laredo Striped Whiptail clonal complex A) with caudal detachment posterior to the 17th scale whorl following seizure by *Masticophis schotti ruthveni* (Ruthven's Whipsnake) in Bentsen-Rio Grande Valley State Park, Hidalgo County, Texas, USA.

Research on and collection of whiptail lizards in BRGVSP were conducted under authority of permits issued by the state of Texas to JEC (State Park Scientific Study Permit 51-21 and Scientific Permit SPR-1090-298) and MAP (State Park Scientific Study Permits 8-94, 3-95, and 96-95; Scientific Permit SPR-0691-408). We thank BRGVSP Superintendent Orlando Carranco and his staff for numerous courtesies in 2021. Partial funding for field research was provided to JEC in 2021 by an Endowed Professorship through the Louisiana State University Eunice Foundation and Opelousas General Hospital, and separately by the Walker Family Trust.

JAMES E. CORDES, Division of Sciences and Mathematics, Louisiana State University Eunice, Eunice, Louisiana 70535, USA (e-mail: jcordes1@live.com); **JAMES M. WALKER**, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA (e-mail: jmwalker@uark.edu); **BRIAN K. SULLIVAN**, School of Mathematical and Natural Sciences, PO Box 37100, Arizona State University, Phoenix, Arizona 85069, USA (e-mail: bsullivan@asu.edu); **MARK A. PAULISSEN**, Department of Natural Sciences, Northeastern State University, Tahlequah, Oklahoma 74464, USA; (e-mail: paulisse@nsuok.edu); **TOBY J. HIBBITTS**, Biodiversity Research and Teaching Collection, Department of Ecology and Conservation Biology, College Station, Texas 77843, USA (e-mail: thibbitts@tamu.edu).

***ASPRONEMA DORSIVITTATUM.* PREDATION.** *Aspronema dorsivittatum* (Squamata: Mabuyidae) is a widely distributed Brazilian lizard inhabiting Atlantic Forest savanna and more humid formations in the Cerrado (Recorder and Nogueira 2007. Biota Neotrop. 7:267–278; Novelli et al. 2012. Biota Neotrop. 12:147–153). *Akodon montensis* (Rodentia: Cricetidae) is a small terrestrial rodent. In Brazil, it is found from Rio de Janeiro through Minas Gerais and extending to Rio Grande do Sul (Bonvicino 2008. Guia dos Roedores do Brasil, com Chaves para Gêneros Baseadas em Caracteres Externos. Rio de Janeiro: Centro Pan-Americano de Febre Aftosa - OPAS/OMS. 122 pp.). It is an insectivorous–omnivorous species with a diet consisting of fungi, vegetable matter, insects, and spiders (Vieira et al. 2006. Acta Theriol. 51:311–318). Here, we report an apparent predation of *As. dorsivittatum* by *Ak. montensis.*

At 0900 h on 3 October 2008, during a pitfall trap survey in an area of Cerrado in Reserva Biológica Unilavras-Boqueirão, Ingaí,

Fig. 1. Specimen of *Aspronema dorsivittatum* being preyed by *Akodon montanensis* inside a pitfall trap in Minas Gerais, Brazil.

Minas Gerais, Brazil (21.34639°S, 44.99083°W; WGS 84), an adult *Ak. montensis* was observed feeding on an adult *As. dorsivittatum* (Fig. 1). The lizard was dead and had rodent bites across the dorsal region, along the head, and near the anterior and posterior appendages. The specimen of *As. dorsivittatum* was deposited in the Reptile Collection of Universidade Federal de Juiz de Fora, MG (CHUFJF 1125). This is the first report of predation of *As. dorsivittatum* by *Ak. montensis*.

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IARA ALVES NOVELLI (e-mail: iaranovelli27@gmail.com), **ÁLVARO FRANCISCO BATISTA JUNQUEIRA** (e-mail: junqueiraalvaro@yahoo.com), and **BERNADETE MARIA DE SOUSA**. Laboratório de Herpetologia, Universidade Federal de Juiz de Fora, Campus Universitário, Bairro Martelos, CEP 36036-330, Juiz de Fora, Minas Gerais, Brazil (e-mail: bernadete.sousa@gmail.com).

BARISIA IMBRICATA **(Transvolcanic Alligator Lizard). ARBOREAL HABITAT USE.** *Barisia imbricata* is a terrestrial lizard endemic to temperate conifer forests between 2200 and 3800 m elevation of the Transmexican Volcanic Belt in Mexico where it is found in muhly grass, crevices, and open meadows (Guillete and Smith 1982. Trans. Kansas Acad. Sci. 85:13–33; Ramírez-Bautista 2009. Herpetofauna del Valle de México: Diversidad y Conservación. Universidad Autónoma del Estado de Hidalgo, Pachuca, Hidalgo. 70 pp.). Generally, the genus is considered to have mainly terrestrial habits, although *B. rudicollis* is suspected to be arboreal based off morphology and anecdotal observations (McCoy and Fox 1996. Southwest. Nat. 41:359–364). Here, we report an observation arboreality in a wild *B. imbricata*.

On 28 October 2021, at 1327 h, we observed a neonate *B. imbricata* (ca. 5.0 cm SVL) perched on an invasive eucalyptus tree (*Eucalyptus* sp.) in San Cayetano de Morelos, México, México (19.41250°N, 99.70162°W; WGS 84; 2607 m elev.). The lizard was ca. 140 cm above the ground and was initially observed sitting still on a crevice in the trunk with its head facing up. After 12 min, it climbed higher (ca. 40 cm) where it took refuge under loose tree bark, at which time we lost sight of it.

To our knowledge this is the first report of climbing and arboreal habitat use by *B. imbricata*, although they are known to climb small bushes or bunch grasses (McCoy and Fox 1996, *op. cit.*). Furthermore, the McCoy and Fox (1996, *op. cit.*) morphological comparison among *B. imbricata, B. rudicollis,* and *Abronia depii*

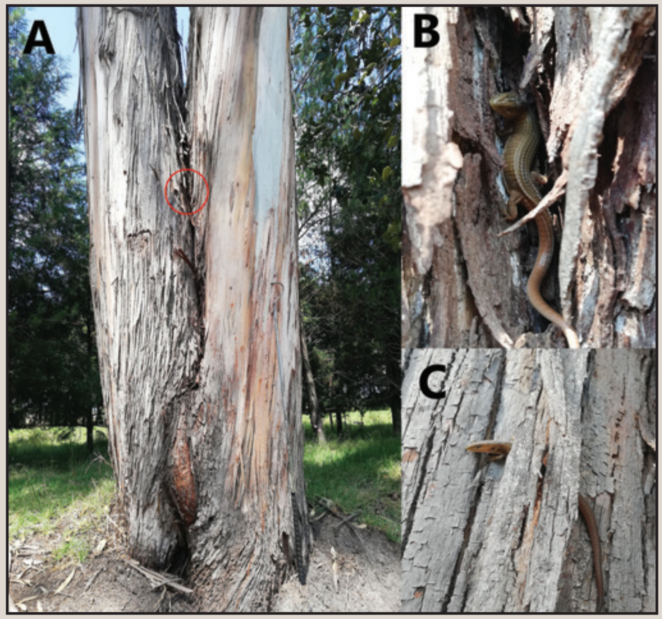

Fig. 1. A) Eucalyptus tree (*Eucalyptus* sp.) with a red circle showing the location of *Barisia imbricata* when it was found; B) neonate *B. imbricata* inside the tree crevice; C) neonate *B. imbricata* under the tree bark.

suggested that the former species is not as arboreal as related taxa. Our observation provides evidence that at least young of *B. imbricata* are arboreal, but it remains to be determined if adults do the same.

LAURA S. ARZATE-GARAY (e-mail: larzate.bioscienciasc@gmail.com) and **JOSELE R. FLORES-SANTIN**, Laboratorio de Ecofisiología Animal, Facultad de Ciencias, Universidad Autónoma del Estado de México, Km 14.5 carretera Toluca–Ixtlahuaca, San Cayetano, Toluca, Estado de México 50200, México (e-mail: jfloress538@profesor.uaemex.mx); **G. PAMELA HERNANDEZ-LOPEZ** Universidad Autónoma del Estado de México, Km 14.5 carretera Toluca–Ixtlahuaca, San Cayetano, Toluca, Estado de México 50200, México (e-mail: gpamelahernandez99@gmail.com); **CHARLES M. WATSON**, Department of Life Sciences, Texas A&M University San Antonio, One University Way, San Antonio 78224, Texas, USA. (e-mail: charles.watson@tamusa.edu)

CNEMASPIS LITTORALIS **(Coastal Day Gecko). DIET and FEEDING BEHAVIOR.** *Cnemaspis littoralis* is a diurnal gecko that inhabits human habitations as well as forests in the dry, coastal regions of the northernmost districts of Kozhikode and Kannur, and the southernmost district of Trivandrum, Kerala State, India to Ponmudi, the southernmost district of Kerala (Cyriac and Umesh 2013. J. Asian Biodiv 5:36–43). Little is known about the species diet and feeding behaviors, although ant eggs and adult ants have been found in their stomachs (Cyriac and Umesh 2013, *op. cit.*). Here, we report on *C. littoralis* feeding on a novel prey item from India.

At 1100 h, on 26 May 2020, we observed an adult male *C. littoralis* (ca. 31.6 mm SVL) foraging on the trunk of Jackfruit Tree (*Artocarpus heterophyllus*) in Iringole-kavu-sacred Grove, Ernakulum District, Kerala, India (10.06847°N, 76.3011°E; WGS 84; 70 m elev.). The *C. littoralis* was positioned on the trunk with its head facing the ground as winged termites were in flight near the tree. There were many termite mounds around the sacred grove with reproductive termites, with a body length ca. 8–12 mm, taking flight. We watched the lizard for over 20 min. During

PHOTO BY NEETHU M U

FIG. 1. Adult male *Cnemaspis littoralis* (31.6 mm SVL) feeding on a flying termite in Iringole-kavu-sacred Grove, Ernakulum District, Kerala, India.

this time, it made slight postural adjustments according to the termite movements before it lunged and caught a termite out of the air (Fig. 1). Once secured in its mouth, the lizard shook the termite, made chewing movements, and re-positioned the termite in its mouth before swallowing. After eating the termite, the lizard moved to the upper parts of the tree out of view. The elapsed time from initial strike to complete ingestion was 132 s. To our knowledge, this is the first report of *C. littoralis* feeding on termites and hunting for flying prey. In this area of India, winged termites emerge early in the monsoon season and on this day, termites were in high abundance, likely emerging after a large morning pre-monsoon rain shower.

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NEETHU M U (e-mail: krishnanidhi1992@gmail.com) and **JOYCE JOSE**, Department of Zoology, St. Thomas College, Thrissur-1, Kerala State, India (e-mail joyceofthejungle@gmail.com).

***FOJIA BUMUI* (Fojia Skink). AQUATIC BEHAVIOR.** The monotypic *Fojia bumui* is known from a small area in the southeastern Huon Peninsula and adjacent Papuan Peninsula, Morobe Province, Papua New Guinea (Greer and Simon 1982. J. Herpetol. 16:131–139). Greer and Simon (1982, *op. cit.*) noted this species to be largely restricted to within 3 m of small streams, to have a sit-and-wait feeding strategy that involves perching on vertical rock faces near small waterfalls, and to sleep at night along the mid-rib of broad leaves hanging 1–2 m over or very near to streams. I extend these observations of their aquatic predilections by noting two further behaviors of this species from a population on the north side of Mt. Shungol (6.82ºS, 146.69ºE; AGD 66; 750 m elev.), Morobe Province, Papua New Guinea.

First, on 21 and 23 October 2003, I collected a series of *F. bumui* (Bernice Pauahi Bishop Museum, Hawai'i State Museum of Natural and Cultural History [BPBM] 18829–18855) at night, when they are easily collected sleeping on leafy perches alongside rapidly flowing streams. On these two nights, I found 40 of 41 lizards sleeping directly above the water, and I conducted a small experiment on two of them by gently nudging their perches to gauge their responses to being disturbed. Once awakened, the lizards immediately dove into the water and swam downstream with the current, quickly taking them away from danger, making such escape an easy matter.

Second, during the day of 16 October 2003 (BPBM 18820–18822; SVL range: 37.5–59.5 mm) my team obtained one adult under a rock at streamside and two juveniles under submerged rocks in the stream, similar to *Desmognathus* salamanders in North America. The two juveniles were collected by one of my porters who, once he saw that we were searching for lizards under rocks alongside the stream, immediately strode into the middle of the stream and began turning submerged rocks that were under ca. 10–20 cm of water. How long these animals can maintain themselves submerged underwater is unknown, but their secretive location in an undisturbed location suggests that they were likely sleeping and can remain submerged for a considerable period of time. That the porter immediately and purposively strode to the middle of the stream to search for submerged animals suggests that this aquatic behavior is not a fluke but is a known behavior by local people, who used to eat these lizards (Greer and Simon 1982, *op. cit.*).

Several lizard species show escape behaviors that involve diving into water (e.g., Heatwole and Torres 1963. Herpetologica 19:223; Howland et al. 1990. Can. J. Zool. 68:1366–1373; Morato et al. 2015. Herpetol. Notes 8:571–573), including at night (Zuluasa-Isaza et al. 2022. Rept. Amph. 29:52–54), and a few have been found sleeping at night completely submerged (Thompson 1993. Wildl. Res. 20:613–619; Olmos 1995. Herpetol. Rev. 26:37; Barrio-Amoros 2020. Herpetol. Rev. 51:594–595), and *F. bumui* does both. Whether *F. bumui* forms a dorsal plastron of air from which to breathe underwater, as seen in several *Anolis* (Boccia et al. 2021. Curr. Biol. 31:2957–2954) is a topic worthy of future investigation, but the granular and tuberculate dorsal scales in this species suggest it is likely.

FRED KRAUS, Department of Ecology and Evolutionary Biology, University of Michigan, Ann Arbor, Michigan, USA; e-mail: fkraus@umich.edu.

***GAMBELIA WISLIZENII* (Long-nosed Leopard Lizard). BEHAVIORAL DISPLAY.** Tollestrup (1983. Z. Tierpsychol. 62:307–320) stated "*Gambelia wislizenii* is an unusual iguanid because it displays infrequently…" While this statement generally refers to social interactions with conspecifics, there are relatively few published reports of any stylized behavioral displays for this species. Tollestrop (1983, *op. cit.*) recorded only occasional intraspecific interactions, including head bob, pushup, slow pushup, rocking, and stiff-legged stance. This paucity of intraspecific postures is attributed to the notion that *G. wislizenii* demonstrates little territorial defense (Tollestrup 1983, *op. cit.*). Reproductive behavior

Fig. 1. This radiocollared *G. wislizenii* from Pima County, Arizona, USA, moved its tail nearly perpendicular to the axis of the body on both sides and undulated the distal, contrastingly banded one-third. The angle of the distal third of the tail was not always in line with the rest of the tail, as shown in this image.

has only occasionally been reported (Montanucci 1967. Herpetologica 23:119–126; Parker and Pianka 1976. Herpetologica 32:95–114; Tollestrup 1983, *op. cit.*). Threat or defense displays are more commonly reported for this species and may include flight, vocalization, and aggressive defense (lunge, gape, bite), depending on the animal's body temperature and distance to threat (Crowley and Pietruskza 1983. Anim. Behav. 31:1055–1060), or lizards may simply avoid detection via cryptic immobility (McCoy 1967. Amer. Midl. Natur. 77:138–146; Tanner and Krogh 1974. Herpetologica 30:63–72).

On 3 July 2021, I watched an adult male *G. wislizenii* from Saguaro National Park (Tucson Mountains District), Pima County, Arizona, USA, go through a complex array of stylized posturing that involved the head, torso, legs, tail, and gait, often simultaneously. I assume these were displays, although I do not know the recipient of the visual postures. This individual had been consistently tolerant of my approach and presence during radio-tracking. On this occasion, however, I watched it for 38 min from a distance of ca. 3–5 m (except as noted below), while it repeatedly went through a repertoire of displays starting at 0819 h. After this time, I left to continue radio-tracking other lizards, so do not know if the animal was displaying before or after my observation period. The lizard was already warmed up by that time of day, with an air temperature of 31.1°C and surface temperature of 40.9°C. Also, it had the lighter coloration of an active lizard.

I videotaped the event for 169 s to isolate and document the various display components. Postures and movement patterns were mostly similar to those described by Carpenter and Ferguson (1977. Biol. Reptilia 7:355–544), so I used their numeric codes and brief descriptions to assign to the following observed behaviors:

Head: 64-lick; 60-head turn or 76 for various head movements, but more precisely described as head shift or turn. The head turn may have been in response to something nearby, but it was not directed at me. There was also 75-head bob, but "slight" head bob is more accurate, rather than that described by Tollestrup (1983, *op. cit.*) for *Gambelia* spp. during intraspecific interaction.

Legs: Displays of the forelegs were frequent and are best described as an alternating partial circumduction, such as 85-stamp or 142-submissive wave. The hind legs were moved as well, but I could not determine if these were postures or merely adjustments to accommodate tail movements.

Torso: During most of the displays when the animal was not walking, its torso was essentially prostrate. In one instance during the video, it raised the forebody, with the torso lifted and tail flat on the ground. My prior observations suggest this was not a basking posture.

Tail: The movements of the tail were pronounced and are described below in greater detail but might be considered to include 89-tail move, 90-tail display, and 95-tail wave. The tail was moved side to side and at times the base was lifted.

Gait: This individual sometimes had a slow walk that could best be described as "shuddering," with a rapid, spasmodic, net-forward motion; I found no close analog with Carpenter and Ferguson (1977, *op. cit.*).

Most of these displays were novel for *G. wislizenii*, although head bob is essentially universal in iguanines and many of the other displays are also common in other species, including *G. silus* (Tollestrop 1983, *op. cit.*). The most conspicuous displays involved the tail. During most of the observation period, the lizard was actively moving its tail. The tail moved to the right and left at nearly right angles to the axis (Fig. 1) and also straight back. In some cases, the entire tail was wriggled in an undulating motion. In addition to these broad movements, there was fine wriggling of the distal one-half to one-third of the tail. Many authors have noted the especially cryptic coloration of *G. wislizenii* (Montanucci 1978. J. Herpetol. 12:73–81). However, the tail is about twice the length of the head and torso, and the distal portion is slender and contrastingly banded in all pattern classes (see photographs in Montanucci 1978, *op. cit.*), and the banding is especially conspicuous when the tail is wriggled.

The most logical explanation for the displays was that the lizard was reacting to my presence with a threat or defensive display. Numerous researchers suggest that humans serve as a surrogate for a predator merely by their proximal presence (Crowley and Pietruskza 1983, *op. cit.*; Cooper and Sherbrooke 2016. Ethology 122:1–10). Many lizard species use their tail to distract the predator away from the head (Carpenter and Ferguson 1977, *op. cit.*). However, this does not appear to explain the behavior in this case, because I only observed the behavior once with radio-telemetered *G. wislizenii* (N = 174 encounters). Also, this individual never showed any "typical" defensive displays (sensu Crowley and Pietruskza 1983, *op. cit.*) upon my approach at other times (N = 36 encounters). On this occasion, I moved to within about 1 m of it twice to see its reaction. In both cases, it stopped displaying and showed no antipredator behavior other than immobility. I do not completely discount the idea that this behavior was defensive, but other hypotheses are also possible. My first impression was that the distal tail undulations seemed like caudal luring or prey distraction, as observed in some other reptiles (Heatwole and Davison 1976. Herpetologica 32:332–336), including a few species of lizards (Murray et al. 1991. Copeia 1991:509–519; Foster and Martin 2008. West. N. Am. Nat. 68:257–259). *Gambelia wislizenii* is often saurophagous, sometimes consuming lizards of its own size (Hollingsworth 2009. *In* Jones and Lovich [eds.] Lizards of the American Southwest, pp. 124–127. Rio Nuevo Publishers, Tucson, Arizona). The broad movements of the tail appeared reminiscent of a writhing, banded snake. If it was mimicking a banded snake (e.g., the sympatric Sonoran Coralsnake [*Micruroides euryxanthus*]), then that would imply it was a threat or warning display. I did not detect any other *G. wislizenii* or predators in the vicinity, although at one point an

Aspidoscelis tigris (Tiger Whiptail, a known prey species) came within 2 m of the leopard lizard but seemed to go unnoticed. It is also possible that the concomitant displays each had different functions.

I have often seen two sympatric species doing tail displays in the study area. The banded tail waving behavior of *Callisaurus draconoides* (Zebra-tailed Lizard) is well studied (e.g., Cooper 2011. Behav. Ecol. Sociobiol. 65:1833–1840; Eifler and Eifler 2020. Southwest. Nat. 55:104–109) and is often attributed to predator deterrence. I also frequently observe *Dipsosaurus dorsalis* (Desert Iguana) doing circumduction (Jones 2020. Herpetol. Rev. 51:848) simultaneously with tail undulation, but this not only happens when I am close, but also when I am observing with binoculars from >20 m away. If the caudal behavior of *G. wislizenii* is analogous to that of these other species, it is apparently far less frequently observed. These observations suggest that *G. wislizenii* has a greater repertoire of stereotypical movements than generally believed.

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LAWRENCE L. C. JONES, Southwest Zoologists' League, 3975 S Wolf Spider Way, Tucson, Arizona, USA; e-mail: gilaman@comcast.net.

***HEMIDACTYLUS MABOUIA*. (Tropical House Gecko). DIET.** *Hemidactylus mabouia* is a nocturnal gecko invasive exotic species in Brazil that is originally from Africa (Vanzolini et al. 1980. Acad. Bras. Ciênc. 1:161; Carranza and Arnold 2006. Mol. Phylogenet. Evol. 38:531–545). This species can be found in urban and natural environments (Rocha et al. 2011. Zoology 28:747–754) and is a generalist and opportunistic forager known to eat a wide variety of terrestrial invertebrates, including gastropods (Vitt 1995. Mus. Nat. Hist. 1:1–29; Zamprogno and Teixeira 1998 Braz. J. Biol. 1:143–150; Rocha and Anjos 2007. Braz. J. Biol. 67:485–491). Here we report a new species of gastropod in the diet of *H. mabouia* from coastal mangrove habitat in Brazil.

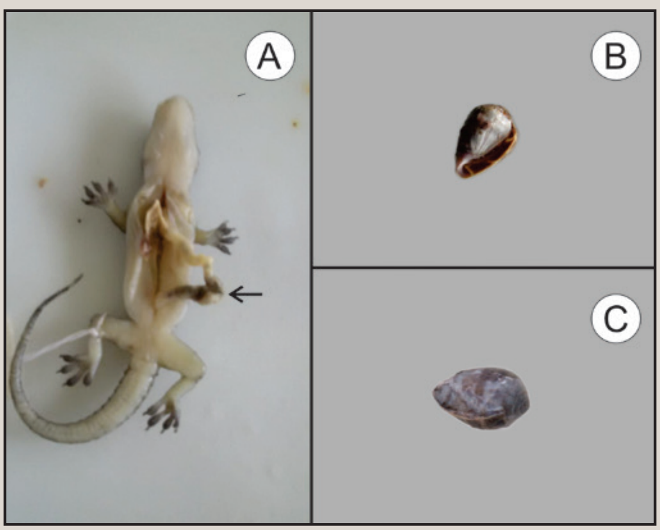

Fig. 1. A) *Hemidactylus mabouia* (stomach identified with a black arrow) from a mangrove stand in Manguezal de Arpoeiras in Acaraú, Ceará, northeastern Brazil; B) *Melampus coffeus* removed from the stomach of *H. mabouia*; C) *Melampus* sp. removed from the stomach of *H. mabouia*.

During a survey on the feeding ecology of lizards in a mangrove stand in Manguezal de Arpoeiras in Acaraú, Ceará, northeastern Brazil (2.83613°S, 40.08411°W; WGS 84; 4 m elev.), we found two adult female *H. mabouia* with snails in their stomachs (Fig. 1A). The first (4.77 cm SVL) was collected on 15 February 2019, at 1915 h, and the second (5.22 cm SVL) was collected on 28 March 2019, at 1853 h. When the lizards were dissected, we found specimens of the snail *Melampus coffeus* (0.75 cm long, 0.49 cm wide; Fig. 1B) in the stomach of the first lizard collected, and we found a specimen from the genus *Melampus* sp. (0.92 cm long, 0.57 cm wide; Fig. 1C) in the stomach of the second lizard collected. Both lizards and the snails were deposited in the zoological collection of the Instituto Federal de Educação, Ciência e Tecnologia do Ceará Campus Acaraú (FBA 553, FJM 565) and were collected under ICMBio collect permit (SISBIO 67376-1).

Gastropods have already been recorded in the diet of *H. mabouia* (Rocha and Anjos 2007, *op. cit.*), but to our knowledge this is the first record of a mangrove *Melampus* sp. snail in the diet of this species, which are common snails in mangroves and often feed among the roots and branches at the intertidal zone. Our observations of this snail in the diet of *H. mabouia* suggests the lizards were foraging in the mangroves, possibly near the water line, a habitat type not commonly reported in this lizard.

We would like to thank the malacologist Rafaela Camargo Maia for making this work easier and for allowing us to use her house to carry out collections in the mangroves.

FRANCISCA BEATRIZ ARAÚJO, Universidade Federal do Oeste do Pará, CEP: 68040-070, Santarém, Pará, Brazil (e-mail: fbeatrizaraujo@gmail.com); **PAULO MATEUS CRUZ SANTOS** (e-mail: paulomateuscss@gmail.com) and **FRANCISCO JOSÉ MARIANO VASCONCELOS**, Universidade Federal do Amazonas, CEP: 69067-005, Manaus, Amazonas, Brazil (e-mail: fjmv1994@gmail.com); **ROBÉRIO MIRES DE FREITAS**, Universidade Federal do Ceará, CEP: 60440-900, Fortaleza, Ceará, Brazil (e-mail: roberiodw20@gmail.com); **AMAURÍCIO LOPES ROCHA BRANDÃO**, Instituto Federal de Educação, Ciência e Tecnologia do Ceará, CEP: 62.680-000, Paracuru, Ceará, Brazil (e-mail: amauricio.brandao@gmail.com).

***HEMIDACTYLUS MABOUIA* (Tropical House Gecko). PREDATION.** *Hemidactylus mabouia* is native to sub-Saharan Africa and has been introduced to the new world tropics and subtropical regions where it is most abundant in urban, but also occurs in natural environments (Rocha et al. 2011. Zoologia 28:747–754). Among these environments, *H. mabouia* are also found in coastal regions such as beaches and mangroves and are preyed upon by a diverse set of predators including snakes such as *Tropidophis pardalis* (Armas et al. 2017. Novitates Caribaea, 11:99–102) and birds such as *Guira guira* (Andrade et al. 2015. Bol. Mus. Biol. Mello. Leitão. 37:201–206). Here we report on a novel predator, a crab inhabiting on mangrove from Brazil.

During a night survey on 25 May 2019 in the Praia de Arpoeiras Mangrove in Acaraú, Ceará, northeastern Brazil (2.83614°S, 40.08411°W; WGS 84; 4 m elev.) we observed a crab (*Goniopsis cruentata*) preying on an adult *H. mabouia* (Fig. 1). When we found the *G. cruentata*, it was already holding the *H. mabouia* in its chelipeds while perched on a dead mangrove trunk 1.5 m above the water. We watched the crab hold the gecko for a few minutes and then it entered a hole in the dead trunk and went out of view. Other *H. mabouia* were found at the same area and at least one was missing a limb. *Goniopsis cruentata* has

Fig. 1. *Goniopsis cruentata* holding a *Hemidactylus mabouia* with its chelipeds in the Praia de Arpoeiras Mangrove in Acaraú, Ceará, northeastern Brazil.

an opportunistic, generalist diet and feeds mainly on detritus (Lima-Gomes et al. 2011. Crustaceana 84:735–747), and to our knowledge this is the first record of this crab preying on a lizard and the first record of crab predation on *H. mabouia*.

We would like to thank the malacologist Rafaela Camargo Maia for making this work easier and for allowing us to use her house to carry out the collections in the mangroves.

PAULO MATEUS CRUZ SANTOS (e-mail: paulomateuscss@gmail.com), **FRANCISCO JOSÉ MARIANO VASCONCELOS** (e-mail: fjmv1994@gmail.com), **FRANCISCA BEATRIZ ARAÚJO** (e-mail: fbeatrizaraujo@gmail.com), **LARISSA FLÁVIA FONTELES DOS SANTOS** (e-mail: larissafontelesbio@gmail.com), and **AMAURÍCIO LOPES ROCHA BRANDÃO**, Instituto Federal de Educação, Ciência e Tecnologia do Ceará, CEP: 62.680-000, Acaraú, Ceará, Brazil (e-mail: amauricio.brandao@gmail.com).

***KENTROPYX ALTAMAZONICA* (Cocha Whiptail). PREDATION.** *Kentropyx altamazonica* has a wide distribution in the Amazon basin and is found in open environments, such as forest edges, secondary growth and river margins, including seasonally flooded forests, or varzea (Ávila-Pires 1995. Zool. Verhand. 299:1–706). Within the varzea forests, it is one of the most abundant lizards often found climbing on vegetation at the water's edge (Debien et al. 2019. Herpetol. Notes 12:1051–1065). A common fish of varzea forests is the Silver Arowana, *Osteoglossum bicirrhosum* (Fig. 1A), which is well known for its habit of jumping out of the water to capture terrestrial prey (Goulding 1980. The Fishes and the Forest. University of California Press, Berkeley, California. 280 pp.). Here we report on the predation of *K. altamazonica* by a silver arowana from Brazil.

On April 2021, we removed an adult of *K. altamazonica* (73.4 cm SVL) from the stomach of an adult *O. bicirrhosum* (66 cm total length; Fig. 1B) from a varzea forest in Comunidade Boca do

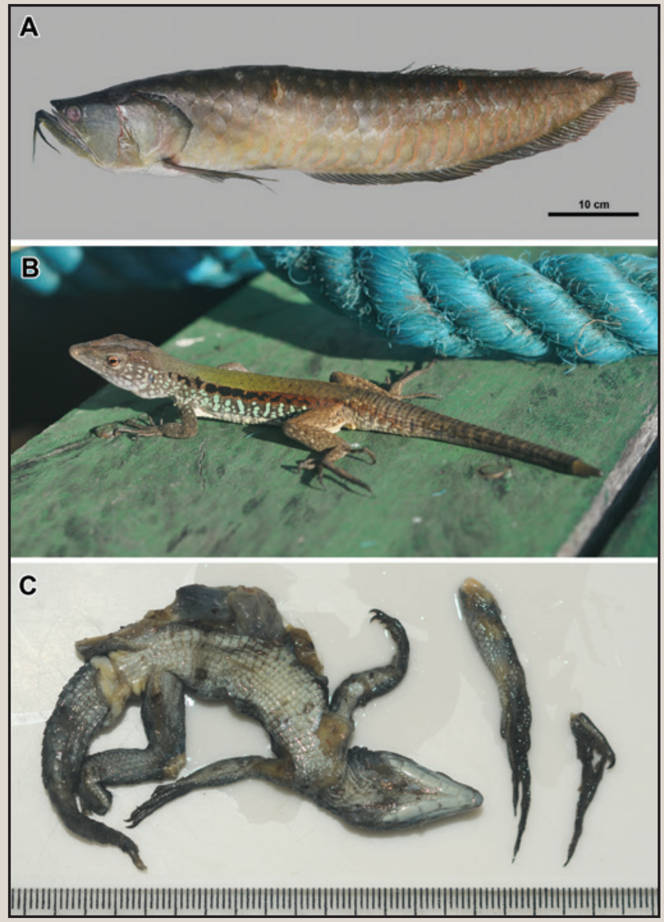

Fig. 1. A) Silver Arowana (*Osteoglossum bicirrhosum*); B) *Kentropyx altamazonica* found from the stomach of *O. bicirrhosum* in Uarini, Amazonas, Brazil.

Mamirauá, Reserva de Desenvolvimento Sustentável Mamirauá, Uarini Municipality, Amazonas, Brazil (3.11789°S, 64.79452°W; WGS 84; 37 m elev.). During this time of year, the rivers flood the forest for several months with no dry land for several kilometers around the capture site. It is unclear if the fish caught the *K. altamazonica* by capturing it from a perch over the water or if it was caught while swimming or running across the water (Dixon and Soini 1986. The Reptiles of the Upper Amazon Basin, Iquitos Region, Peru. Milwaukee Public Museum, Milwakuee, Wisconsin. 78 pp.; Ávila-Pires 1995, *op. cit.*) and either scenario is feasible. There are few records of *O. bicirrhosum* preying on vertebrates, but examples include small birds, bats, and reptiles (Goulding 1980, *op. cit.*). To our knowledge this is the first predation record of a *K. altamazonica* by *O. bicirrhosum*.

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DIEGO M. M. MENDES (e-mail: diego.mello.mendes@gmail.com), **GLEICIELY ALMEIDA CABRAL** (e-mail: gleiciely.cabral17gmail.com), **CAROLINA GOMES SARMENTO** (e-mail: carolinagsarmento@gmail.com), **JONAS ALVES DE OLIVEIRA** (e-mail: jonas.alves@mamiraua.org.br), and **ALEXANDRE PUCCI HERCOS**, Grupo de Pesquisa em Ecologia e

Biologia de Peixes, Instituto de Desenvolvimento Sustentável Mamirauá, Caixa Postal 38, 69553-225, Tefé, Amazonas, Brazil (e-mail: alexandre.hercos@mamiraua.org.br).

OPHISAURUS VENTRALIS **(Eastern Glass Lizard). HABITAT.** Few ecological studies have been conducted on glass lizards (genus *Ophisaurus*) and many aspects of their biology remain incompletely known. Captures are usually too few to assess even general habitat associations, even when much effort is expended (e.g., Baxley and Qualls 2009. Herpetol. Conserv. Biol. 4:295–305; Schlimm 2013. M.S. Thesis, University of Georgia, Athens, Georgia. 146 pp.). McConkey (1954. Am. Midl. Nat. 51:133–171) characterized the habitat of *O. ventralis* as "damp grassy situations" and more recent resources describe habitat using similar short, general phrases. Although glass lizards can be common in some urban areas (Neill 1950. Herpetol. 6:113–116), almost no detailed data on habitat have been published.

Between July 2020 and August 2021, we made 12 observations of at least eight individual *O. ventralis* (seven alive, five dead) in a ca. 2 km^2 area centered around Edgewood Avenue, Ft. Myers, Lee County, Florida, USA (26.66189°N, 81.8447°W; WGS 84; 2 m elev.), indicating a robust urban population. This neighborhood lies between Florida Hwy 80 and the south bank of the Caloosahatchee River. Most homes were built in the 1940s, before which the area was a fruit orchard. Mature trees include *Quercus virginiana*, *Sabal palmetto*, *Delonix regia*, *Tabebuia pallida*, *Spathodea campanulata*, *Mangifera indica*, *Cupaniopsis anacardioides*, *Citrus* spp., and *Ficus* spp., and most lots have grassy yards that are mowed every few weeks.

At 1944 h on 12 July 2021, we observed a juvenile *O. ventralis* (ca. 7 cm SVL, ca. 13 cm unbroken tail length; iNaturalist 86801066) under a small hardwood log (64 cm long × 20 cm diameter). The log was at the edge of a shallow depression that might have once been a tree stump, surrounded by dense herbaceous vegetation (predominantly *Salvia misella*, but also including *Asparagus setaceus*, *Bidens alba*, *Cyperus croceus*, *Desmodium incanum*, and *Phyllanthus tenellus*) growing to a height of ca. 30 cm. The same individual or another of similar size was seen again under that log on 21 July (0745 h), 6 August (0730 h), 12 August (0815 h), and 14 August (0745 h). On 6 August 2021, a subadult *O. ventralis* (ca. 20 cm SVL) was under a second nearby log of similar size. Canopy cover (average of 4 measurements taken facing cardinal directions using a spherical densiometer) was 39% when all trees were fully leafed. Other organisms regularly found under these logs included *Indotyphlops braminus* (Brahminy Blindsnake), millipedes (*Anadenobolus monilicornis* and *Trigoniulus corallinus*), and other soft- and hard-bodied invertebrates.

Three Thermochron iButton loggers were deployed near the log, one under the log, one next to the log but in the shade of herbaceous vegetation, and one in the nearest unshaded area, and were set to record temperature every 5 min from 14 to 27 August 2021. During this period, the log was overturned to check for the presence of *O. ventralis* at 1500 h on 19 August, 0855 h on 21 August, and 1700 h on 23 August. We did not find any lizards during these checks and, according to the iButton readings, temperatures under the log were not affected by flipping. Mean temperature was 27.5°C for all three microhabitats. Over the 14-d period, the mean (± SD), maximum, and minimum temperatures varied among the three microhabitats (Fig. 1). Maximum temperature under the log was 28.6 ± 1.0°C, compared to 31.2 ± 2.8°C next to the log in the shade and 34.9 ± 5.0°C in the nearest unshaded area; whereas mean (± SD) minimum temperature under the log was 26.9 ± 0.7°C, compared to 25.6 ± 0.9°C next to the log in the shade and 24.6 ± 0.9°C in the nearest unshaded area. The highest maximum temperature over the 14-d period was 29.6°C under the log, 36.3°C next to the log in the shade, and 44.8°C in the nearest unshaded area (Fig. 2). The highest temperatures measured in the two more exposed microhabitats meet or exceed field body temperatures measured for *O. attenuatus* in Kansas (Fitch 1956. Univ. Kansas Pub. Mus. Natur.

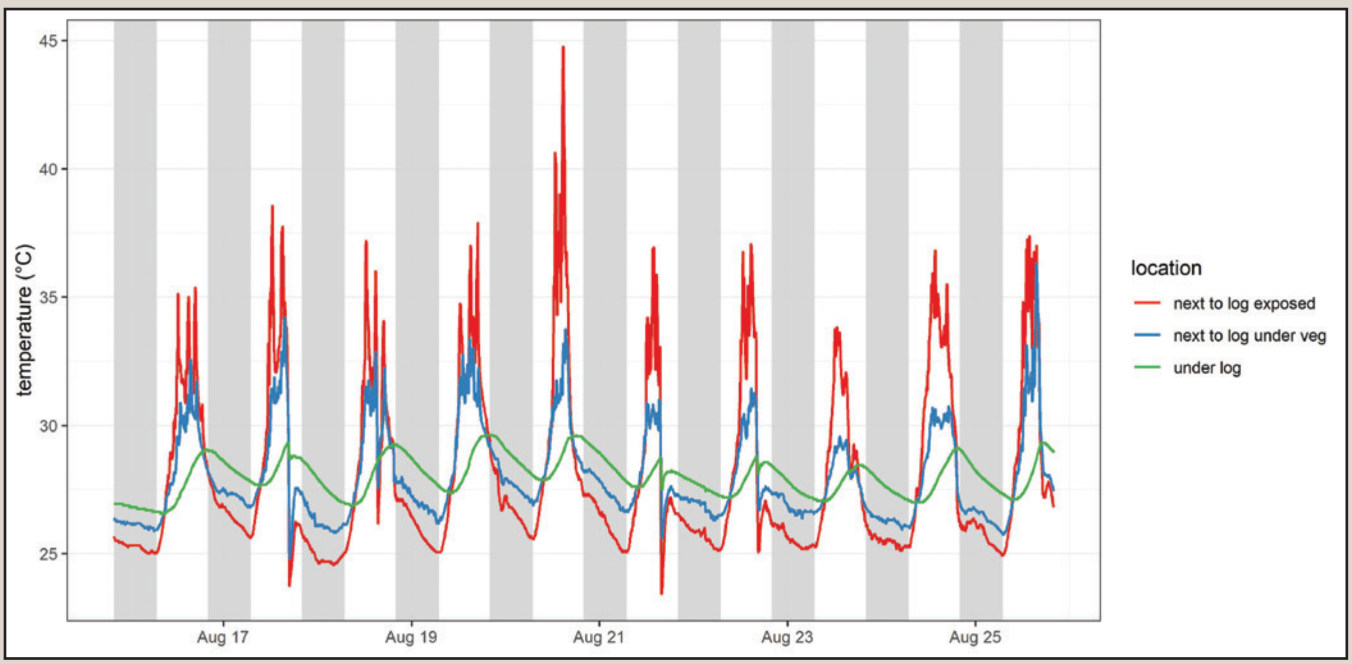

Fig. 1. Temperature (°C) in three *Ophisaurus ventralis* microhabitats in Florida, USA (green = under log; blue = next to log, beneath vegetation; red = next to log, exposed) over 12 d in August 2021. Sudden dips on 17, 18, 21, and 22 August are afternoon thunderstorms.

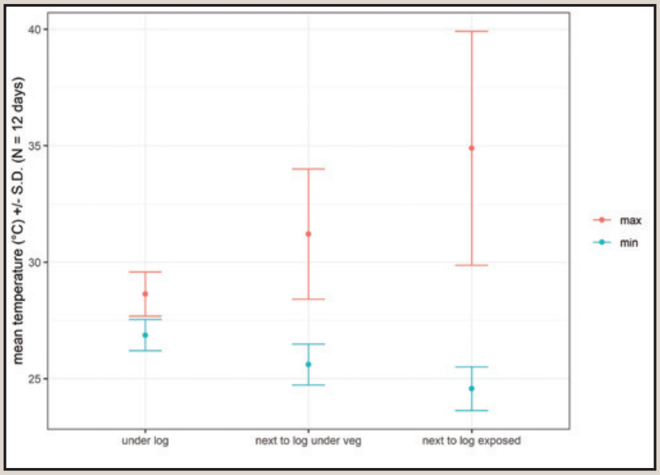

Fig. 2. Average maximum (pink) and minimum (blue) temperature (°C) ± standard deviation (SD) in three *Ophisaurus ventralis* microhabitats in Florida, USA over 12 d in August 2021. More exposed microhabitats had lower minimum temperatures, higher and more variable maximum temperatures, and a greater overall temperature range.

Hist. 8:1–156) and exceed critical thermal maxima measured for other anguids (Brattstrom 1965. Am. Midl. Nat. 73:376–422; Clusella-Trullas et al. 2011. Am. Nat. 177:738–751).

These observations suggest that juvenile *O. ventralis* sometimes exhibit site fidelity over periods of at least several weeks. While preliminary, our temperature data suggests that they likely select thermally buffered microhabitats, which is not unexpected for ectotherms (e.g., Goller et al. 2014. Ecol. Evol. 4:3319–3329), it reinforces that microsite selection likely plays a larger role than mean ambient temperature, even in the tropics (Vickers et al. 2011. Am. Nat. 177:452–461; Clusella-Trullas and Chown 2014. J. Comp. Physiol. B 184:5–21). Finally, the small size of the individual first observed 12 July suggests that hatching probably occurs earlier in southern Florida than previously reported from more northern populations (August–September; Mount 1975. The Reptiles and Amphibians of Alabama. Alabama Agricultural Experiment Station, Auburn University, Auburn, Alabama. 360 pp.; Palmer and Braswell 1995. Reptiles of North Carolina. University of North Carolina Press, Chapel Hill, North Carolina. 444 pp.).

ANDREW M. DURSO, Department of Biological Sciences, Florida Gulf Coast University, Ft. Myers, Florida 33965, USA (e-mail: amdurso@gmail.com); **KENDALYNN A. MORRIS**, Joint Global Change Research Institute, 5825 University Research Ct, College Park, Maryland 20740, USA (e-mail: kendalynn.morris@gmail.com).

OPLURUS CUVIERI **(Cuvier's Swift Iguana). CANNIBALISM and DISTRIBUTION.** *Oplurus cuvieri* is endemic to Madagascar and is restricted to the western half of the island (Glaw and Vences 2007. A Field Guide to the Amphibians and Reptiles of Madagascar. Third edition. Cologne, Germany. 310 pp.). The diet of *O. cuvieri* is typically composed of ants (Randriamahazo and Mori 2012. Curr. Herpetol. 31:8–13), but they have also been observed consuming larger prey such as *Rattus rattus* (Roza and Rakotozafy 2013. Herpetol. Notes 6:459–461) and *Furcifer rhinoceratus* (Kawai 2016. Herpetol. Rev. 47:300–301). Herein, we report on a newly introduced population of *O. cuvieri* in eastern Madagascar and a case of cannibalism.

PHOTO BY GENE GLOVER

Fig. 1. A juvenile *Oplurus cuvieri* being consumed by a larger adult in the Ankanin'ny nofy Reserve, Madagascar.

PHOTO BY GENE GLOVER

Fig. 2. An adult *Oplurus cuvieri* retreats with its juvenile conspecific prey on a nearby tree at the Ankanin'ny nofy Reserve, Madagascar.

The privately owned Ankanin'ny nofy Reserve is ca. 35 ha and is located on a peninsula in eastern Madagascar along Lake Ampitabe. The former owner G. Gottlebe apparently released a wide variety of fauna and flora native to other regions of Madagascar to this property sometime after 1961, and we hypothesize that one of these species was *O. cuvieri*. The private reserve and hotel have since changed owners in the early 2000s and during an excursion in the Ankanin'ny nofy Reserve from 11–12 March 2022, we noted a now established population of *O. cuvieri* occurring in the reserve and adjacent Palmarium Hotel.

On the morning of 12 March 2022, at 0930 h, we observed several juvenile *O. cuvieri* in a highly recreated spiny forest garden on the grounds of the Palmarium Hotel at Ankanin'ny nofy Reserve (18.605°S, 49.213°E; WGS 84; ca. 24 m elev.). We captured one of these juvenile lizards, sex unknown, for closer observation and noticed a large adult *O. cuvieri* perched 1 m high on a tree ca. 1 m away. The adult appeared to be tracking the movements of the juvenile *O. cuvieri* as we held and processed it. After processing it, we released the juvenile on the ground ca. 10 m from the point of capture. Almost immediately the adult jumped down from the tree and chased down the juvenile for ca. 0.8 m for ca. 5 s before capturing the juvenile by the back just behind the head in its mouth (Fig. 1). In this position the juvenile could not defend itself as the adult partially swallowed it tail first before carrying its prey back to its original perch (Fig. 2). The adult *O. cuvieri* made several swallowing motions to work the prey further into its mouth and it took ca. 3 min to fully swallow the conspecific juvenile, during which time the juvenile's neck was still moving in an indication of respiration.

To our knowledge this is the first instance of cannibalism in *O. cuvieri*, and we note that this observation is not within the species natural Madagascan range, but we suspect this is a type of predation not limited to the introduced population. It is not clear if the introduced *O. cuvieri* are outcompeting or preying on native lizards in the area and further work is needed to determine this.

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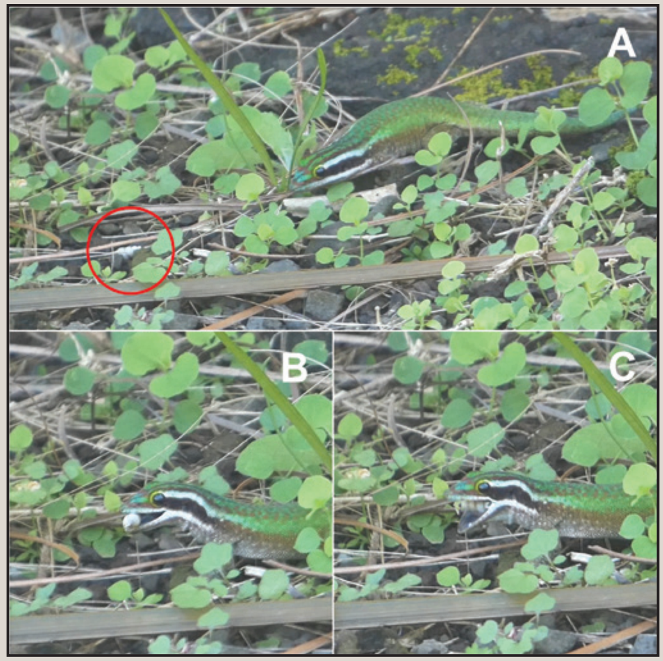
HUGH GABRIEL (e-mail: hughgabriel17@yahoo.com) and **GENE GLOVER**, Macalester College, 1600 Grand Ave, St. Paul, Minnesota, 55105, USA (e-mail: gglover2@macalester.edu); **RACHEL RUGGERA**, Boston College, 140 Commonwealth Avenue, Chestnut Hill, Massachusetts, 02467, USA (e-mail: ruggera@bc.edu); **ANDOLALAO RAKOTOARISON**, School for International Training, VN 41A Bis Ambohitsoa, 101 Antananarivo, Madagascar (e-mail: andolalao.rakotoarison@sit.edu).

***PHELSUMA INEXPECTATA* (Manapany Day Gecko). DIET.** *Phelsuma inexpectata* is a small-bodied, diurnal, and arboreal gecko endemic to Reunion Island, where it is restricted to an 11 km band along the coastline on the southern part of the island. This species is a dietary generalist known to feed on insects, nectar, pollen and fruits (Sanchez and Caceres 2019. Plan national d'actions en faveur des Geckos verts de La Réunion *Phelsuma borbonica* et *Phelsuma inexpectata*. NOI/ONCFS/DEAL, Reunion Island, France. 173 pp.). Herein, we report a novel foraging behavior and prey item to the diet of *P. inexpectata*.

On 14 September 2021, at 1112 h, near Saint-Joseph (21.378°S, 55.641°E; WGS 84; 101 m elev.), we observed a female *P. inexpectata* (ca. 55 mm SVL) that appeared to be foraging on the ground in an agricultural area dominated by *Pandanus utilis*, *Cocos nucifera*, and *Acanthophoenix rubra*. The gecko slowly moved and seemed to be searching for prey among rocks, gravel, and low herbaceous plants (Fig. 1A). As it searched, it opened its mouth several times and sticking its tongue out. After 1 min, we observed the gecko picking up a snail's shell (ca. 10 mm length) in its mouth (Fig. 1B), it then broke the shell with its jaws, and swallowed it (Fig. 1C). While chewing the shell, a small fragment fell to the ground and the lizard quickly picked it up and swallowed in the same manner. After consuming the shell, the gecko continued to search the area for a few more seconds before it turned around and climbed up a nearby tree. The observation time in total was ca. 2 min and 63 sec of video was recorded (video available at: http://dx.doi.org/10.26153/tsw/41405).



PHOTOS BY MARGOT CAUBIT

Fig. 1. Female *Phelsuma inexpectata* approaching the dead snail shell, red circle indicates the position of the shell (A) and eating the snail shell (B, C), on Saint Joseph, Reunion Island.

Based on the consumed shells whitish color, we surmise it was empty and from a dead snail because live snails have a distinct yellowish tinge. We also harvested ten snail shells from the surrounding area, ca. 0.25 m², and all were whitish and empty and of two species. Both species from our collection were non-native, introduced species to Reunion Island: *Subulina octona* (native to tropical Americas including the Caribbean) and *Striosubulina striatella* (native to West Africa; Griffiths and Florens 2006. A Field Guide to the Non-Marine Molluscs of the Mascarene Islands [Mauritius, Rodrigues and Réunion] and the Northern Dependencies of Mauritius. Bioculture Press, Mauritius. 185 pp.), and we are not sure which species the observed *P. inexpectata* had eaten.

To our knowledge, this is the first report of *P. inexpectata* eating snail shells, although snail shells as well as gecko eggshells and/or coral sand have been reported in the diet of *P. grandis* on Reunion Island (Dervin et al. 2013. Cah. Sci. Océan Indien Occident. 4:29–38) and *P. astriata* on Praslin, Seychelles (Gardner 1984. Ph.D. Thesis, University of Aberdeen, Aberdeen, Scotland. 391 pp.). The consumption of calcium rich food items such as snail shells likely contributes to replacing the calcium used in the production of eggshells and growth and bone reinforcement during embryonic skeletal development (Stewart and Ecay 2010. Herpetol. Conserv. Biol. 5:341–359; Ineich et al. 2018. Bull. Soc. Herpetol. Fr. 168:1–14).

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MARGOT CAUBIT, Laboratoire PVBMT, Université de La Réunion, 97410 Saint Pierre, Reunion Island, France (e-mail: margot.caubit@univ-reunion.fr); **F. B. VINCENT FLORENS**, TIBEC Pole of Research, Faculty of Science, University of Mauritius, Mauritius (e-mail: vin.florens@uom.ac.mu); **MICKAËL SANCHEZ**, Laboratoire PVBMT, Université de La Réunion (e-mail: mickael.sanchez@univ-reunion.fr).

***PHELSUMA LATICAUDA* (Gold Dust Day Gecko) and *PHELSUMA BORBONICA* (Reunion Day Gecko). DISPERSAL BY MOTOR VEHICLE.** Dispersal of reptiles by motor vehicles has been described for several genera of geckos: *Hemidactylus* (Norval et al. 2012. Herpetol. Notes 5:451–452; Hecnar and Hecnar 2018. Herpetol. Rev. 49:742), *Lygodactylus* (Rebelo et al. 2019. Herpetol. Notes 12:643–650), and *Phelsuma* (Deso 2001. Bull. Phaeth. 13:56). Small-bodied geckos are ideal candidates for motor vehicle dispersal because of their secretive behavior, small size, and ability to hide into small spaces (Norval et al. 2012, *op. cit.*; Rebelo et al. 2019, *op. cit.*). As such, vehicle dispersal can promote spread of both native and non-native species to new areas (see Davis and Thompson 2000. Bull. Ecol. Soc. Am. 81:226–230) and understanding the frequency of such occurrences may have implications for the management and mitigation of the spread of invasive species (Hulme 2009. J. Appl. Ecol. 46:10–18). Herein, we report two instances of motor vehicle dispersal (i.e., vehicular rafting) in two *Phelsuma* species: the native *P. borbonica* and the non-native *P. laticauda* on Reunion Island, which was introduced from Madagascar (Sanchez and Probst 2016. Bull. Soc. Herp. Fr. 160:49–78). *Phelsuma* day geckos are naturally distributed on most islands in the western Indian Ocean (Rocha et al. 2010. Zootaxa 2429:1–28).

We have two observations of vehicle dispersal of the non-native *P. laticauda*, the first being on February 2010, when an unsexed adult *P. laticauda* (ca. 12 cm total length) emerged from the hood of the 4×4 vehicle just after a 1.5 h drive covering 89 rd km. The vehicle left the University de La Réunion, Sainte-Clotilde (20.9021°S, 55.4833°E; WGS 84; 96 m elev.) and it arrived on the Mare Longue Forest, near Saint-Philippe (21.3551°S, 55.7407°E; WGS 84; 210 m elev.), transporting this lizard from an urban environment to a natural one. The second observation occurred on 29 August 2021 when an unsexed adult *P. laticauda* (ca. 12 cm total length) emerged from the left exterior mirror housing of a car after a 10 min drive, covering 1 rd km, from Saint-Denis (20.8955°S, 55.4565°E; WGS 84; 38 m elev.). The same gecko (identified by a characteristic tail break and color pattern) was observed during the next four days, until 1 September 2021. During this period and despite daily journeys of about 2.5 km, the gecko was already observed in the same place, as well when the vehicle was travelled (Fig. 1A) and was parked (Fig. 1B), both on and inside the exterior mirror.

PHOTOS BY SARAH CACERES

Fig. 1. *Phelsuma laticauda* on the exterior mirror of a vehicle on Reunion Island while the vehicle was travelling on 30 August 2021 (A) and while the vehicle was parked on 31 August 2021 (B).

We have one observation of vehicular rafting in an adult *P. borbonica* (ca. 13 cm total length) from 2007, which emerged from inside a car just after it arrived at the town of Saint-Denis (20.8937°S, 55.5006°E; WGS 84; 35 m elev.) from Grand Etang (21.0965°S, 55.6536°E; WGS 84; 515 m elev.), a distance of 42 rd km. We presume the lizard originated from Grand Etang, and after catching the lizard, we returned it to its site of origin the next day. The car was parked with open windows while at Grand Etang, which is how we suspect the lizard entered the car. To our knowledge, this is the first documented record of vehicular-rafting for *P. borbonica* and *P. laticauda* and it appears vehicular-rafting may be a viable method of dispersal for both species. This could be especially problematic for facilitating the spread of invasive *Phelsuma* species, like *P. laticauda*, into new areas.

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SARAH CACERES (e-mail: sarah.caceres@ofb.gouv.fr) and **HELENE UDO**, Office Français de la Biodiversité (OFB), 97400 Saint-Denis, Reunion Island, France (e-mail: helene.udo@ofb.gouv.fr); **MICKAËL SANCHEZ**, Université de La Réunion, Laboratoire PVBMT, 97410 Saint-Pierre, Reunion Island, France (e-mail: mickael.sanchez@univ-reunion.fr).

***PHRYNOSOMA MODESTUM* (Round-tailed Horned Lizard). DEFENSIVE BEHAVIOR.** *Phrynosoma modestum* has a variety of predators and its defensive behaviors vary according to the type of predator being faced (Sherbrooke 1991. Amer. Midl. Nat. 15:187–195). Sherbrooke (1991, *op. cit.*) described in detail the defensive strategy used by *P. modestum* and by *P. cornutum* when confronted by the predatory *Onychomys torridus* (Southern Grasshopper Mouse) inside glass terraria. When attacked by this mouse species, the lizards defended themselves by raising and inflating their bodies, opened their mouths, hissed and charged the mice, with 43% of the encounters being fatal to the lizards (Sherbrooke 1991, *op. cit.*). Herein, we report an instance of defensive behavior for *P. modestum* in the field against a potential human threat on The University of Texas at El Paso Indio Mountains Research Station (IMRS) located in the northern Chihuahuan Desert Trans-Pecos region, Texas.

On 13 July 2018 at 1700 h, we observed an adult female *P. modestum* (Fig. 1) active next to a dirt road situated ca. 1.5 km southwest of the IMRS Headquarters (30.77026°N, 105.03039°W; WGS 84; 1207 m elev.) in a plant community dominated by *Larrea tridentata*, *Bouteloua eriopoda*, and *Fouqueria splendens*. Initially, the lizard remained motionless, but as we proceeded to pick up the lizard it inflated its body, stood erect on its legs for a few seconds and began to open and close its mouth in an apparent threatening or defensive behavior. After a short time, we repeatedly pretended to grab the lizard for ca. 1 min, and each time it repeated the same behavior until we captured it for measuring. While being measured, the lizard flattened its body, stuck out its tongue, and aimed its horns against the processor's hand, presumably as a remaining defense effort.

PHOTO BY VICENTE MATA-SILVA

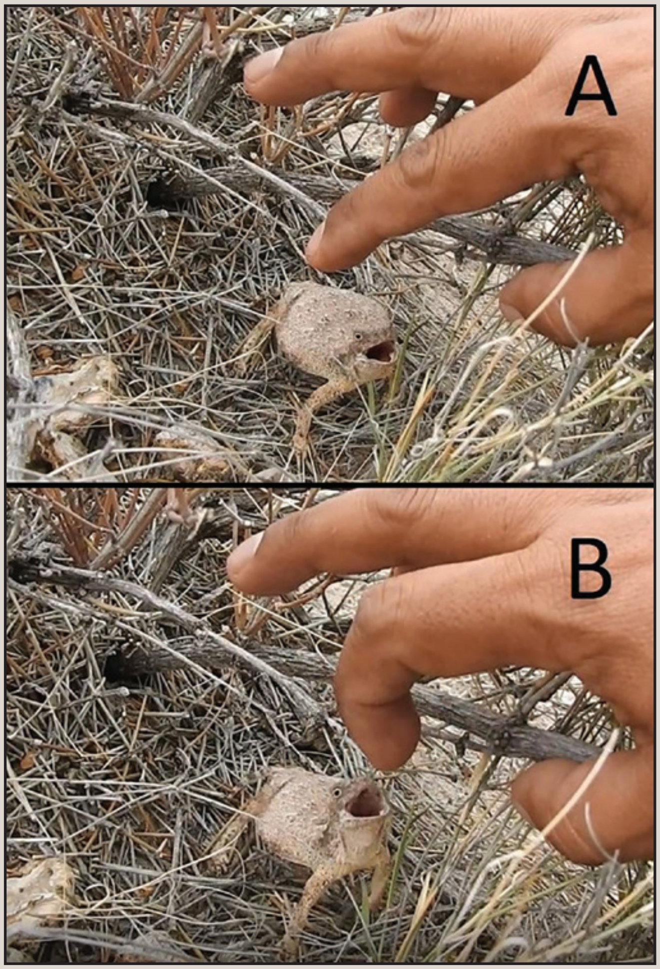

FIG. 1. Adult female *Phrynosoma modestum* from The University of Texas at El Paso Indio Mountains Research Station, Texas, USA, displaying a defensive behavior: A) flattening the body with mouth open; B) lunging toward a potential threat with mouth open.

The defensive behaviors in response to a potential human threat we observed is similar to those reported for how *P. modestum* responded to *O. torridus* (Sherbrooke 1991, *op. cit.*), but this mouse does not occur on IMRS. This suggests that *P. modestum* defensive behaviors are more generalized, but it is still unknown there what natural predators elicit *P. modestum* to display this defensive behavior. Lastly, accounts of similar behavior exhibited by *P. cornutum* and *P. hernandesi* were reported by Milne and Milne (1950. Am. Midl. Nat. 44:720–741).

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VICENTE MATA-SILVA (e-mail: vmata@utep.edu), **JERRY D. JOHNSON** (e-mail: jjohnson@utep.edu), and **GUILLERMO ALVAREZ**, Department of Biological Sciences, 500 W University Avenue, The University of Texas at El Paso, El Paso, Texas 79968, USA (e-mail: galvarez63@miners.utep.edu); **DOMINIC DESANTIS**, Department of Biological & Environmental Sciences, Georgia College & State University, Herty Hall 05, Campus Box 081, Milledgeville, Georgia 31061, USA (e-mail: dominic.desantis@gcsu.edu).

***PODARCIS SICULA* (Italian Wall Lizard). HIBERNATION.** *Podarcis sicula* is native to southern Europe and extreme North Africa but introduced populations have become established beyond its native range, including in southern New York, USA, where reproductive populations now exist on Long Island and in the Bronx (Burke and Ner 2005. Northeast. Nat. 12:349–360). It is believed the species first became established on Long Island around 1966, after several individuals reportedly escaped from a pet store (Gossweiler 1975. Copeia 1975:584–585), with further populations spreading subsequently, possibly via corridors and intentionally by collectors (Burke and Deichsel 2008. *In* Mitchell et al. [eds.], Urban Herpetology, pp. 347–353. Society for the Study of Amphibians and Reptiles, Salt Lake City, Utah). In New York, *P. sicula* is active from April to October and overwinter in hibernacula at least 24 cm below the frost line or near buildings, to avoid freezing and death (Burke et al. 2002. Copeia 2002:836–842). Here I report the first observation of *P. sicula* shallow winter refugia use during the winter in New York City, USA.

On 21 February 2022, I observed two *P. sicula* underneath a large log in Soundview Park, an urban park in the Bronx, New York, USA (40.81125°N, 73.86173°W; WGS 84; 7 m elev.). The park is bounded by the confluence of the estuarine East River to the south and freshwater Bronx River to the west, and dense residential housing to the north and east. My observation occurred approximately 150 m from the Bronx River, and between 80–115 m from the closest housing developments. The two *P. sicula* were found in an apparent winter dormancy state, lying in a shallow depression under a log in a sandy, grassy field. The lizards were near each other, with one individual's head in contact with the dorsum of the other, and both had the top part of their heads to the postorbital region above ground with the rest of the body below the soil. One individual was superficially buried at ca. 1.27 cm deep; the depth of the other individual was not measured. Each lizard appeared to be in a state of torpor and did not move when the log was flipped. The one lizard I removed from its burrow began to perform slow ambulatory movements upon disturbance and was immediately returned to its winter refugia.

Podarcis sicula is not known to be freeze tolerant and a study on Long Island showed no surface activity during the months of January, February, and March, and found no activity during winter warm spells (Burke and Ner 2005, *op. cit.*). I surveyed this area daily for two weeks prior to this observation and although temperatures were unseasonably warm (6.1° to 20°C daytime temperature range from 17–21 February 2022) and no active lizards were observed during this time. One explanation is that, in some cases, *P. sicula* may be able to hibernate at lesser depths than previously known. Alternatively, although I did not observe active lizards during prior warm spells, these lizards may have become surface active and moved from a hibernating location to the site where I found them and subsequently became stranded when temperatures dropped to freezing again.

I would like to thank Jeremy Feinberg of the Smithsonian National Museum of Natural History for reviewing early drafts of my notes.

NELSON TEXEIRA, 550 Beach Avenue, Bronx, New York 10473, USA; e-mail: nelsontexeira@gmail.com.

***PRISTIDACTYLUS SCAPULATUS* (Burmeister's Anole). DIET.** *Pristidactylus scapulatus* is a medium-sized lizard (mean SVL = 105 mm) that inhabits mainly rocky areas with large shrubs where it shelters (Cei 1986. Reptiles del centro, centro-oeste y sur de Argentina: Herpetofauna de las Zonas Aridas y Semiáridas. Mus. Reg. Sci. Nat. Torino. Monogr. IV. 527 pp.). The species is mainly insectivorous (Etheridge and Williams 1985. Breviora

Fig. 1. Adult male *Pristidactylus scapulatus* feeding on the flowers of the *Sphaeralcea philippiana* plant in the Andes Mountains, Mendoza, Argentina.

483:1–18; Cei 1986, *op. cit.*; Acosta et al. 2004. Herpetol. Rev 35:171–172), however, there are multiple cases of saurophagy (Sanabria and Quiroga 2009. Herpetol. Rev. 40:349–350; Villavicencio et al. 2009. Herpetol. Rev. 40:225–226; Victorica et al. 2018. Herpetol. Rev. 49:539) and frugivory (Acosta et al. 2004, *op. cit.*). Here we report on *P. scapulatus* eating flowers from montane Puna grasslands, in the Andes Mountains of Argentina.

At 1525 h on 8 March 2022, we observed an adult male of *P. scapulatus* feeding on the flowers of the small plant *Sphaeralcea philippiana* (Malvaceae; Fig. 1) in a Puna grassland within the Las Heras Department, Mendoza Province, Argentina (32.1948°S, 69.5101°W; WGS 84; 2900 m elev.). We watched the lizard pick and eat three flowers directly from the plant, pulling all of them off at the same time, and then swallowing them together. Shortly after eating the flowers, the lizard left the plant and continued with his daily activity, and we lost sight of it. To rule out the possibility that the lizard was targeting insects on the flowers, we investigated the plant 5 min later to look for the presence of insects visiting the plant or the flowers, but we did not find any. Thus, we are confident that the lizard consumed only the flowers.

While *P. scapulatus* has been reported to eat fruit (Acosta et al. 2004, *op. cit.*), to our knowledge this is the first instance of the species exhibiting florivory. This is the second report of a *Pristidactylus* species eating plant material, the first being *P. achalensis* which has been reported to consume leaves and flowers (Etheridge and Williams 1985, *op. cit.*). Our observation suggests that *P. scapulatus* may be more omnivorous than previously thought.

FRANCO VALDEZ OVALLEZ, Gabinete de Diversidad y Biología de Vertebrados del Árido (DIBIOVA), Departamento de Biología, Facultad de Ciencias Exactas, Físicas y Naturales, Universidad Nacional de San Juan, Av. José Ignacio de la Roza 590 (Oeste), Rivadavia, San Juan, Argentina and Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICET), Argentina (e-mail: franco.valdez408@gmail.com); **RODRIGO ACOSTA** (e-mail: atzoka@gmail.com); **JOSÉ VILLAVICENCIO** (e-mail: hjvillavicencio@gmail.com), **JOSÉ A. MARINERO** (e-mail: marinero.jose@gmail.com), and **JUAN C. ACOSTA**, Gabinete de Diversidad y Biología de Vertebrados del Árido (DIBIOVA), Departamento de Biología, Facultad de Ciencias Exactas, Físicas y Naturales, Universidad Nacional de San Juan, Av. José Ignacio de la Roza 590 (Oeste), Rivadavia, San Juan, Argentina (e-mail: jcacostasanjuan@gmail.com).

PTYCTOLAEMUS GULARIS **(Green Fan-throated Lizard). WATER INTAKE.** Water intake in lizards can occur metabolically from prey, consumed in liquid form from standing water or dew on leaves, absorption through the skin (Ditmars 1933. Reptiles of the World: The Crocodilians, Lizards, Snakes, Turtles and Tortoises of the Eastern and Western Hemispheres. Revised edition. The Macmillan Co., New York, New York. 321 pp.), or rain-harvesting with their scales (Vesely and Modry 2002. J. Herpetol. 36:311–314; Pough et al. 2004. Herpetology. Third edition. Pearson Prentice Hall, New York, New York. 736 pp.) and agamid lizards have been reported to obtain water via the latter two methods. *Ptyctolaemus gularis* is diurnal and inhabits rocky habitats near forest streams, open habitats, and areas near human habitations in primary and secondary tropical and subtropical forests (70–1370 m) of Bangladesh, Myanmar, northeast India (south of the River Brahmaputra) and southern China (Ahmed et al. 2009. Amphibians and Reptiles of Northeast India: A Photographic Guide, Aaranyak, Guwahati, Assam. 169 pp.). Yet, despite its large distribution, little is known about the species basic ecology and behavior, including water intake. Herein we report noteworthy behavior of *P. gularis* seeking and drinking water at a hilly stream in Dampa Tiger Reserve (DTR) in Mizoram in India (24.36442°N, 92.24485°E; WSG 84; 426 m elev.).

On 25 March 2021, at 1340 h, we encountered an adult male *P. gularis* (60.6 mm SVL, 144.4 mm tail length, 5.01 g) descending to the ground from a rock fissure ca. 180.8 cm high in a rock outcrop next to the seasonal Kawngkan Stream. After the lizard reached the ground, it briefly rested and scanned the surrounding area for ca. 32 s, then walked slowly in a direct line to small pool in the streambed. When the lizard reached the water's edge, it bent its head down and dipped its snout four times in the water and started to drink gently by raising its head to swallow water between dips, it spent 49 s drinking at the pool. To our knowledge, this is the first report of drinking in the wild by *P. gularis* while the only other water intake observation in agamids were from two rain-harvesting postures in *Trapelus ruderatus* and *T. sanguinolentus* were from semiarid areas of Africa and the Middle East (Vesely and Modry 2002, *op. cit.*) and the present observation provides the first observation on the non-rain harvesting behavior in agamids.

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H.T. DECEMSON (e-mail: htdecemson@gmail.com) and **H.T. LALREMSANGA**, Developmental Biology and Herpetology Laboratory, Department of Zoology, Mizoram University, Aizawl 796 004, Mizoram, India (e-mail: htlrsa@yahoo.co.in).

TRACHYLEPIS STRIATA **(Striped Skink). DIET.** *Trachylepis striata* is among the most common skinks in East Africa, occurring in natural open habitats as well as urban areas (Spawls et al. 2018. A Field Guide to East African Reptiles. Bloomsbury, London. 624 pp). Its predators have been relatively well reported (Hughes and Behangana 2017. African Herp. News 65:26–28) and its food items consist mainly of invertebrates, but an unidentified gecko has also been reported as a prey item (Spawls et al. 2018, *op. cit.*). Here I report an observation of *T. striata* preying on a *Hemidactylus mabouia* in Tanzania.

Fig. 1. *Trachylepis striata* holding *Hemidactylus mabouia* around the vent when moving out of the crevice before killing and attempting to swallow it at Mazumbai Forest Reserve, Tanzania.

Fig. 2. *Trachylepis striata* trying to swallow the remaining part of its prey (*Hemidactylus mabouia*) in Mazumbai Forest Reserve, Tanzania. The skink spent nearly 2 h trying to swallow this portion.

Fig. 3. A partially digested *Hemidactylus mabouia* regurgitated by *Trachylepis striata* at Mazumbai Forest Reserve, Tanzania.

At 1205 h, on 12 September 2021, I observed an adult *T. striata* (ca. 21 cm total length) basking on a stone retaining wall at Mazumbai Forest Reserve, West Usambara Mountains, Tanzania (4.81169°S, 38.50415°E; WGS 84; 1498 m elev.). Periodically the skink would actively forage in the crevices between stones along the wall. After ca. 7 min the skink emerged from a crevice holding a medium sized *H. mabouia* (ca. 6 cm SVL) near the base of the tail, which was freshly autotomized (Fig. 1). The *H. mabouia* was still struggling as the *T. striata* repeatedly swung and hit the gecko on the stones until the gecko ceased moving. Once subdued, the skink then started swallowing the gecko tail first, manipulating the prey on the surrounding rocks to help push the gecko into its mouth. At 1222 h, 17 min after first observing the event, the skink had swallowed most of the gecko with only the head and front legs sticking out of the skink's mouth (Fig. 2). For almost two hours, from 1222 h to 1405 h, the *T. striata* struggled to completely swallow the *H. mabouia*, and at 1410 h the now dead and partially digested *H. mabouia* was regurgitated (Fig. 3). After regurgitation, the skink went back to basking ca. 3 m from the dead gecko and did not try to eat the gecko again. Although the *T. striata* didn't manage to swallow the *H. mabouia*, this lizard seemed capable and accustomed to catching and manipulating lizard prey and strongly suggests saurophagy may be more common in *T. striata* than has been reported (e.g., Hughes and Behangana 2017, o*p. cit.*). The failure of the *T. striata* to completely ingest the *H. mabouia* in this instance was likely due to the large size of the gecko relative to the skink.

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JOHN VALENTINE LYAKURWA, Department of Zoology and Wildlife Conservation, University of Dar es Salaam, Dar es Salaam, Tanzania; e-mail: johnlyakurwa@udsm.ac.tz.

***TROPIDURUS TORQUATUS* (Calango). DIET**. *Tropidurus torquatus* is a common lizard, widely distributed from central Brazil to northern Argentina (Frost et al. 2001. Mol. Phylogenet. Evol. 21:352–371). Like other congeners, *T. torquatus* have a sit-and-wait foraging strategy (Vitt et al. 1996. J. Trop. Ecol. 12:81–101) and gut analysis studies report a diet dominated by small invertebrates such as ants (Fialho et al. 2000. J. Herpetol. 34:325–330; Carvalho et al. 2007. Rev. Bras. Zool. 24:222–227), but they also feed on plant material such as flowers and fruits (Siqueira et al. 2013. Biota Neotrop. 13:93–101). Here we report on a *T. torquatus* capturing and consuming a sand wasp (Cabronidae, Bembicinae).

PHOTO BY FLÁVIO MENDES.

Fig. 1. *Tropidurus torquatus* preying a Bembicinae wasp at Convento da Penha, Municipality of Vila Velha, Espírito Santo, southeastern Brazil.

At 1000 h on 31 December 2021, we observed an adult *T. torquatus* capturing and eating a large Bembicinae wasp (Fig. 1) at Convento da Penha, municipality of Vila Velha, Espírito Santo, southeastern Brazil (20.3276°S; 40.2876°W; WGS 84; 61 m elev.). We observed the sand wasp for 10 min, which are solitary and feed on flower nectar (Evans and O'Neill 2007. The Sand Wasps: Natural History and Behavior. Harvard University Press, Cambridge, Massachusetts, London. 360 pp.), as it flew ca. 50 cm above the ground near general vegetation and a cactus (*Opuntia monacantha*). During this time, the *T. torquatus* was standing on the ground next to a rock exposed to the sun, 50 cm away, before it quickly ran towards the cactus, and using the cactus for support, it jumped ca. 50 cm into the air to capture the wasp in mid-flight. After catching the wasp, which appeared to be roughly equal in length to the lizard's head (Fig. 1), the lizard ate the wasp where it landed next to the cactus. After eating the wasp, the lizard slowly walked into the vegetation out of sight. To our knowledge, this is the first record of *T. torquatus* preying upon a sand wasp and capturing a prey item out of the air. Since the lizard was still for 10 min before attacking, it is unclear when it may have noticed the wasp, but this lizard exhibited a lot of dexterity in catching the wasp in mid-flight.

CAIO MARINHO MELLO, Herpeto Capixaba, Avenida Lã Paloma, 120, Condomínio Village dos Pássaros, Bloco Sabiá 15, apto 202, bairro Enseada Azul, CEP 29206-090, Guarapari, Espírito Santo, Brazil. Instituto Neotropical: Pesquisa e Conservação, Rua Purus nº 33, CEP 82520-750, Curitiba, Paraná, Brazil. Laboratório de Ecologia e Conservação de Anfíbios do Brasil – LECAB, Universidade Tecnológica Federal do Paraná, campus Francisco Beltrão. Linha Santa Bárbara, s/n, CEP 85601-970, Francisco Beltrão, Paraná, Brazil. Universidade Federal do Espírito Santo, Departamento de Ciências Biológicas, CEP 29075-910, Vitória, Espírito Santo, Brazil (e-mail: caio.anuros@gmail.com); **DÉBORA C. MEDEIROS** (e-mail: deboracbio@gmail.com) and **FLÁVIO MENDES**, Herpeto Capixaba, Avenida Lã Paloma, 120, Condomínio Village dos Pássaros, Bloco Sabiá 15, apto 202, bairro Enseada Azul, CEP 29206-090, Guarapari, Espírito Santo, Brazil (e-mail: f.mendes.eco@gmail.com); **SANDOR CHRISTIANO BUYS**, Laboratório de Biodiversidade Entomológica, Instituto Oswaldo Cruz, Fundação Oswaldo Cruz, Avenida Brasil 4.365, Pavilhão Mourisco, sala 214, Manguinhos, CEP 21045-900, Rio de Janeiro, Rio de Janeiro, Brazil (e-mail: sandor.buys@gmail.com); **THIAGO SILVA-SOARES**, Museu de História Natural do Sul do Estado do Espírito Santo, Universidade Federal do Espírito Santo, CEP 29550-000, Jerônimo Monteiro, Espírito Santo, Brazil. Herpeto Capixaba, Rua Lã Paloma, s/n, Enseada Azul, CEP 29206-090, Guarapari, Espírito Santo, Brazil (e-mail: thiagosilvasoares@hotmail.com).

TROPIDURUS TORQUATUS **(Calango; Amazon Lava Lizard). DIET.** *Tropidurus torquatus* is a medium-sized lizard (males: 10.1 cm SVL; females: 8.7 cm SVL; Pinto et al. 2005. Amphibia-Reptilia 26:127–137) that lives in open habitats in the Atlantic Forest and Cerrado of southeastern Brazil. *Thoropa miliaris* is a nocturnal, terrestrial, medium-sized frog (males: 5.8 cm SVL; females: 6.3 cm SVL) that lives in rocky outcrops of the Atlantic Forest in the states of Minas Gerais, São Paulo, Rio de Janeiro, Espírito Santo and Bahia (Haddad et al. 2013. Guia de anfíbios da Mata Atlântica: Diversidade e Biologia. Editora Anolis Books, São Paulo, Brazil. 544 pp.). On 2 April 2022, at ca. 1520 h, we observed an adult *Tr. torquatus* with an adult of *Th. miliaris* in its mouth as the lizard was perched on the outside wall of a house (Fig. 1) in the São Roque do Canaã Municipality countryside, Espírito Santo, Brazil (40.73789°W, 19.68618°S; WGS 84; 126 m elev.). Because *T. miliaris* is terrestrial and does not climb, we presume the lizard caught the frog from the ground and returned to its perch 1.4 m on the wall. The frog's head was in the lizard's mouth and made rapid struggling movements and tried to pull itself out of the lizard's mouth but appeared to die after ca. 40 s. After <2 min of observing this event, the lizard appeared to notice our presence and then fled out of view with the frog's head in its mouth. Even though *T. torquatus* is a generalist feeder, there are few cases of them preying on anurans (e.g., Kiefer et al. 2006. Herpetol. Rev. 37: 475–476; Ciqueira et al. 2013. Biota Neotrop. 13:93–101; Souza et al. 2021. Oecol. Aust. 25:904–908) and to our knowledge, this is the first report of predation on *T. miliaris* by *T. torquatus*.

FIG. 1. *Tropidurus torquatus* preying upon *Thoropa miliaris* on a house wall in the São Roque do Canaã Municipality countryside, Espírito Santo, Brazil.

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ALEXANDER T. MÔNICO, Instituto Nacional de Pesquisas da Amazônia, Programa de Pós-Graduação em Biologia (Ecologia), 69.067-375, Manaus, Amazonas, Brazil (e-mail: alexandermonico@hotmail.com); **ANDERSON T. MÔNICO**, Insituto Federal do Espírito Santo campus Aracruz, Curso de Graduação em Engenharia Mecânica, 29192-733, Aracruz, Espírito Santo, Brazil (e-mail: andersontmonico@gmail.com).

VARANUS MACRAEI **(Blue Tree Monitor). ENDOPARASITES.** *Varanus macraei* is a diurnal, highly specialized tree monitor known from Batanta Island, in West Papua Province, West Irian, Indonesia (Pianka et al. 2004. Varanoid Lizards of the World. Indiana University Press, Bloomington, Indiana. 588 pp.). We know of no published records of helminths from *V. macraei* and herein establish the initial helminth list for the species.

In March 2017, a single male adult *V. macraei* (325 mm SVL, 675 mm tail length) was collected from Waigeo Island (0.2000°S, 130.8333°E; WGS 84; 457 m elev.), West Papua Province, West Irian, Indonesia and deposited in the University of Northern Colorado, Museum of Natural History (UNC–MNH 10153). I examined the stomach for parasites and found three nematodes present. They were removed with jewelers' forceps, cleared in a drop of lactophenol, placed on a glass slide, cover–slipped and examined under a compound microscope. The helminths were identified as *Abbreviata borneensis* after comparing the samples with drawings in their original description from *Varanus rudicollis* and *V. salvadorii* from Sarawak, Malaysia (Schad 1959. Can. J. Zool. 37:71–74). *Varanus macraei* is a new host record for this helminth. *Abbreviata borneensis* has also been found in two species of *Gonocephalus*, *G. bellii* and *G. grandis*, from Peninsular Malaysia (Goldberg et al. 2016. Pac. Sci. 70:373–380). The nematodes are deposited in the Harold W. Manter Parasitology Laboratory (HWML 112293), The University of Nebraska, Lincoln, Nebraska, USA.

STEPHEN R. GOLDBERG, Whittier College, Department of Biology, Whittier, California 90608, USA (e-mail: sgoldberg@whittier.edu); **CHARLES R. BURSEY**, Pennsylvania State University, Department of Biology, Shenango Campus, Sharon, Pennsylvania 16146, USA (e-mail: cxb123@psu.edu); **STEPHEN P. MACKESSY**, University of Northern Colorado, School of Biological Sciences, Greeley, Colorado 80639, USA (e-mail: stephen.mackessy @unco.edu).

SQUAMATA — SNAKES

AGKISTRODON CONTORTRIX **(Eastern Copperhead). DIET.** Vipers are typically ambush predators that sit and wait for prey, but they will actively forage when feeding on insects as juveniles or seasonally as adults. During June to September, we studied the foraging ecology of *Agkistrodon contortrix* as they feed on annual cicadas (*Neotibicen tibicen*). During this period, adult copperheads at our site adopt arboreal foraging strategies, climbing trees, bushes, and other vertical structures to eat freshly emerged cicadas. While this activity occurs, cicadas make up a high proportion of their diet, and we had not observed them consuming any other prey during this time of year. However, at 2130 h on 9 July 2021, we observed a large male *A. contortrix* (66.0 cm SVL, 74.5 cm total length, 230.1 g) prey upon a Southern Flying Squirrel (*Glaucomys volans*) at a campground in the Red River Gorge, Daniel Boone National Forest, Wolfe County, Kentucky, USA (37.78098°N; 83.63611°W; WGS 84). The snake was climbing a small tree (circumference <15 cm) to consume a cicada. As the snake reached the cicada (ca. 1.5 m up the tree), the flying squirrel glided in to capture the cicada, and as it did, the snake struck and envenomated it. The flying squirrel immediately fell to the ground, at which point the snake climbed down the tree and consumed it over a 64 min period.

PHOTO BY BEN STRATTON

Fig. 1. Male *Agkistrodon contortrix* feeding on a Southern Flying Squirrel, *Glaucomys volans*, that it envenomated while actively foraging arboreally for annual cicadas (*Neotibicen tibicen*) in Daniel Boone National Forest, Wolfe County, Kentucky, USA.

Although *Pantherophis obsoletus* (Western Ratsnake; Pierce et al. 2008. Southeast. Nat. 7:359–366), and *Crotalus horridus* (Timber Rattlesnake; Savage 1967. Copeia 1967:226–227), have been documented consuming flying squirrels, we are unaware of any reports for *A. contortrix*. Prior to these findings, we had documented *A. contortrix* at our study site for the past five years preying exclusively upon emerging annual cicadas during the summer months, although we have observed other potential prey items throughout the site during nightly surveys, including White-footed Mice (*Peromyscus leucopus*), Little Brown Skinks (*Scincella lateralis*), American Toads (*Anaxyrus americanus*), Fowler's Toads (*A. fowleri*), and Wood Frogs (*Lithobates sylvaticus*). This is interesting, as prior work found that three geographically separated populations of copperheads all exhibited non-envenomated prey preference towards small mammals, followed by insects, and then amphibians (Greenbaum 2004. Behav. Ecol. 15:345–350). This seasonal, cicada-specific predation behavior has likely developed as a strategy to maximize caloric intake and predation success. Our observations, however, indicate that a degree of opportunism does exist within individuals of our study population.

J. BENJAMIN STRATTON (e-mail: james_stratton13@mymail.eku.edu), **HENDERSON C. GULL** (e-mail: henderson_gull@mymail.eku.edu), and **STEPHEN C. RICHTER**, Department of Biological Sciences and Division of Natural Areas, Eastern Kentucky University, Richmond, Kentucky 40475, USA (e-mail: stephen.richter@eku.edu).

AGKISTRODON RUSSEOLUS **(Yucatecan Cantil). PREDATION.** *Agkistrodon russeolus*, is a medium-sized pitviper (up to 1050 mm total length) endemic to the Yucatán Peninsula (Porras et al. 2013. Amphib. Reptile Conserv. 7:48–73). Information on the ecology of this species is limited (Lee 1996. The Amphibians and Reptiles of the Yucatán Peninsula. Cornell University Press, Ithaca, New York. 500 pp.; Heimes 2016. Herpetofauna Mexicana Vol. 1, Snakes of Mexico. Edition Chimaira, Frankfurt am Main, Germany. 572 pp.), including reports on its predators. Herein, we report an account of a Crested Caracara (*Caracara plancus*) feeding on an individual of *A. russeolus* in southeastern Mexico.

The observation took place at 1830 h on 23 October 2021, at a site located in the Municipality of Telchac Puerto, Yucatán, Mexico (21.33°N, 89.32°W; WGS 84; 4 m elev.), while performing an ongoing radio-telemetry study of *A. russeolus* on the northern coast of the Yucatán Peninsula, within an area significantly impacted by hotel complexes. While attempting to locate one of our radio-equipped snakes, two of us (JAOM and JIVS) observed in the distance an adult *C. plancus* that took off from the site disturbed by our presence and perched on a nearby building (Fig. 1). When approaching the site where the bird of prey was, we found the fresh remains of a non-radio-equipped adult *A. russeolus*. Upon closer examination, we noticed that only the anterior half of the snake's body was left, without the guts, and with the marks of claws and beak in various areas of the snake's body (Fig. 1).

FIG. 1. Remains of an adult *Agkistrodon russeolus* preyed upon by a *Caracara plancus* (inset) in Yucatán, Mexico.

The Crested Caracara is a known dietary opportunist with a wide spectrum of prey types (Morrison and Pias. 2006. Fla. Sci. 69:36–46). Although it is considered largely a scavenger that also steals food from other avian predators (kleptoparasitism) (e.g., Partida and Rodríguez-Estrella. 2015. Acta Zool. Mex. 31:306–308), quantitative studies on its diet and feeding behavior indicate that much of its prey are actually captured alive, including snakes (Rodríguez-Estrella and Rivera-Rodríguez 1997. J. Raptor Res. 31:228–233; Morrison and Pias 2006, *op. cit.*). Therefore, although we did not observe the moment when the falcon actually captured the snake, it is very likely that the individual of *A. russeolus* was attacked, subdued, and consumed at the observation site, given this raptor's active foraging behavior often taking place on the ground (Brown and Amadon 1968. Eagles, Hawks, and Falcons of the World. McGraw-Hill Book Co., New York, New York. 945 pp.), This is further substantiated by the fresh condition of the prey. To the best of our knowledge, this observation represents the first published account of *A. russeolus* as prey of *C. plancus.*

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JAVIER A. ORTIZ-MEDINA, Departamento de Sistemática y Ecología Acuática, El Colegio de la Frontera Sur, Chetumal, Quintana Roo, Mexico; Herp.mx A.C., Villa de Álvarez, Colima, Mexico and Unidad de Manejo para la Conservación de la Vida Silvestre Tsáab Kaan, Baca, Yucatán, Mexico (e-mail: ortizmedina.ja@gmail.com); **JESÚS ISAAC VINAJERA-SOSA**, Tecnológico Nacional de México, Campus Conkal, Conkal, Yucatán, Mexico and Unidad de Manejo para la Conservación de la Vida Silvestre Tsáab Kaan, Baca, Yucatán, Mexico (e-mail: isac9271@gmail.com); **J. ROGELIO CEDEÑO-VÁZQUEZ**, Departamento de Sistemática y Ecología Acuática, El Colegio de la Frontera Sur, Chetumal, Quintana Roo, Mexico (e-mail: rcedenov@ecosur.mx); **VICENTE MATA-SILVA**, Department of Biological Sciences, The University of Texas at El Paso, El Paso, Texas, USA (e-mail: vmata@utep.edu).

***BOA CONSTRICTOR* (Boa Constrictor). DIET.** *Boa constrictor* is found throughout rainforests, savannas, and wetlands in northern South America (Reynolds and Henderson 2018. Bull. Mus. Comp. Zool. 162:1–62). In Brazil, it is distributed throughout the Amazon, Atlantic Forest, Cerrado, and Caatinga biomes (Nogueira et al. 2019. S. Am. J. Herpetol. 14:1–274). Considered top predators, opportunistic, and generalist (Monroy-Vilchis et al. 2011. Rev. Mex. Biodiv. 82:319–321), they are sit-and-wait strategists capable of feeding both in terrestrial and arboreal environments (Scartozzoni and Molina 2004. Rev. Etol. 6:25–31.; Pizzatto et al. 2009. Amphibia-Reptilia 30:533–544) and usually feed on birds, mammals and lizards (Pizzatto et al. 2009, *op. cit.*).

FIG. 1. Young *Boa constrictor* as found during a predation attempt on *Gnorimopsar chopi* (Chopi Blackbird), Fazenda Milagres, Conde, Bahia, Brazil.

At 1010 h on 27 March 2021, we observed a young *B. constrictor* attempting to eat an adult *Gnorimopsar chopi* (Chopi Blackbird) in a tree within a restinga ecosystem in Fazenda Milagres, Conde, Bahia, Brazil (11.94651°S, 37.61043°W; WGS 84). The *B. constrictor* immobilized the bird (Fig. 1), but it is unclear whether the snake was about to begin the ingestion process. After watching this event for 20 min, we approached within 2 m of the snake and at this moment the snake released the bird and started to retreat. Although the *B. constrictor* released the bird, the snake appeared to have completely immobilized the prey and would have consumed it if not for our presence. To our knowledge, this is the first record of attempted predation of *G. chopi* by a *B. constrictor*. *Gnorimopsar chopi* is an icterid endemic to South America (Di Giacomo and Reboreda 2015. Auk 132:16–24) that mainly nests in preexisting holes, forming colonies of 3–7 nests (Di Giacomo et al. 2010. Wilson J. Ornithol. 122:795–799). After confirming the identity of the bird, we checked the nearby nest for possible eggs or chicks, but it was empty.

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RAISSA NUNES CERQUEIRA (e-mail: nunes.raissa@ucsal.edu.br), **MARINA NÓBREGA GONÇALVES**, **GUILHERME SOUZA PAGEL, LARA COSTA CARNEIRO DE OLIVEIRA, MÁIRA SANTOS LOPES,** and **MOACIR SANTOS TINÔCO,** Universidade Católica do Salvador, Centro de Ecologia e Conservação Animal (ECOA). Avenida Prof. Pinto de Aguiar,2589, Pituaçu, CEP 41740-090, Salvador, BA, Brazil; **MATEUS DA S. BONFIM**, Universidade Federal Rural de Pernambuco, Departamento de Biologia, Rua Dom Manoel de Medeiros, s/n, Dois Irmãos, CEP 52171-900, Recife, PE, Brazil (e-mail: bonfim.mds@gmail.com).

***BOA IMPERATOR* (Central American Boa Constrictor). DIET.** *Boa imperator* is distributed from Mexico to Colombia (Card et al. 2016. Mol. Phylogenet. Evol. 102:104–116). It is the largest snake in Mexico, reaching a total length of 320 cm (Heimes 2016. Herpetofauna Mexicana Vol. 1: Snakes of Mexico. Edition Chimaira, Frankfurt am Main, Germany. 435 pp.). It is terrestrial and arboreal, kills by constriction, and feeds on a wide variety

PHOTO BY OSCAR CID-MORA

Fig. 1. *Boa imperator* eating *Sciurus yucatanensis* in Quintana Roo, México.

of prey, including frogs (Pérez-Higareda et al. 2007. Serpientes de la Región de los Tuxtlas, Veracruz, México. Guía de Identificación Ilustrada. México D.F. Universidad Nacional Autónoma de México. 189 pp.), saurians (e.g., Cid-Mora and Vásquez-Cruz 2020. Herpetol. Rev. 51:341), and birds (e.g., Pavón-Vázquez et al. 2016. Mesoamer. Herpetol. 3:490–492), but mainly small and medium-sized mammals (e.g., Pérez-Alvarado et al. 2021. Rev. Latinoamer. Herpetol. 2:91–93).

At 1455 h on 23 August 2020, OCM encountered a subadult *B. imperator* preying on a *Sciurus yucatanensis* (Yucatan Squirrel; Fig. 1) near a beach in Xel-Há park in the Municipality of Solidaridad, Quintana Roo, Mexico (20.31669°N, 87.35422°W; WGS 84; 5 m elev.). The snake swallowed the prey alive starting from the head. To our knowledge, this represents the first record of *S. yucatanensis* in the natural diet of *B. imperator*.

OSCAR CID-MORA, Colegio de Postgraduados Campus Córdoba. Carretera Federal Córdoba-Veracruz Km 348, Congregación Manuel León, Amatlán de los Reyes, Veracruz, 94946, México (e-mail: racso10390@gmail.com); **VÍCTOR VÁSQUEZ-CRUZ**, PIMVS Herpetario Palancoatl, Avenida 19 número 5525, Colonia Nueva Esperanza, Córdoba, Veracruz, Mexico (e-mail: victorbiolvc@gmail.com).

***CHIRONIUS BICARINATUS* (Two-headed Sipo). DIET.** *Chironius bicarinatus* is a large colubrid snake, which is distributed along the Atlantic coast of Brazil, occurring from Ceará to northern Rio Grande do Sul. It is present, but apparently less common, in areas of the interior of Brazil, with the westernmost record reported for Coxim, Mato Grosso do Sul (Entiauspe-Neto et al. 2020. Herpetol. Monogr. 34:98–115). This species has semi-arboreal habits, with its diet composed predominantly of birds, amphibians, and lizards. It has the habit of descending to the ground but returning to the branches at the first sign of danger (Marques and Sazima 2004. *In* Marques and Duleba [eds.], Estação Ecológica Juréia-Itatins: Ambiente Físico, Flora, Fauna, pp. 257–277. Holos, São Paulo, Ribeirão Preto). Herein, we describe a predatory event that occurred at 1001 h on 12 October 2021, in the city of Peruíbe, located on the southern coast of the state of São Paulo, close to the Juréia - Itatins Ecological Station (24.3641ºS, 47.0202ºW; WGS 84).

The *C. bicarinatus* was seen in a residential area of the city. When the villagers approached, the snake assumed a defensive posture, raising approximately one-third of its body off the ground. After a few minutes in this posture, the snake turned and

PHOTO BY ERIC LEMOS KRÜGER

Fig. 1. Adult *Chironius bicarinatus* preying on a *Boana albomarginata*, which was displaying defensive behaviors (e.g., inflating its body) in São Paulo, Brazil.

climbed ca. 3 m into a tree, where there was a resting *Boana albormaginata*. The snake tried to capture it but missed. The frog fell and jumped to the ground in escape. The snake dropped to the ground and quickly crawled towards the amphibian, capturing it by the head and commencing consumption without constriction. The *B. albomarginata* displayed some known defensive behaviors (Toledo et al. 2011. Ethol. Ecol. Evol. 23:1–25). It made a distress call, puffed up its body by filling its lungs with air, and tried to fight off the snake using its limbs (Fig. 1). Despite its efforts, the *B. albomarginata* was subdued and consumed in ca. 4 min. To our knowledge, this is the first record of *B. albomarginata* in the diet of *C. bicarinatus*, although it is common for this species to feed on other frogs (Bovo and Sueiro 2012. Herpetol. Notes. 5:291–292).

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ERIC LEMOS KRÜGER, Universidade Estadual Paulista "Júlio de Mesquita Filho", Instituto de Biociências, 13506-900, Rio Claro, São Paulo, Brazil (e-mail: ericlemos97@gmail.com); **LUCAS DE SOUZA ALMEIDA**, Universidade Estadual Paulista "Júlio de Mesquita Filho", Departamento de Biodiversidade e Centro de Aquicultura, Instituto de Biociências, 13506-900, Rio Claro, São Paulo, Brazil (e-mail: almeidals1994@gmail.com).

***CHIRONIUS LAEVICOLLIS* (Brazilian Sipo). MATING BEHAVIOR.** *Chironius laevicollis* is a colubrid snake found in the Atlantic Forest of southeastern Brazil (Nogueira et al. 2019. S. Am. J. Herpetol. 14:1–274). It has diurnal and terrestrial habits and preys on anurans (Guimarães et al. 2014. Acta Zool. 95:341–346). Female *C. laevicollis* are oviparous and reproduce seasonally. Vitellogenesis occurs from late winter to late spring, and egg-laying occurs from early spring to early summer (Marques 1998. Composição faunística: História natural e ecologia de serpentes da Mata Atlântica, na região da Estação Ecológica Juréia-Itatins, São Paulo. Instituto de Biociências, São Paulo. 142 pp.; Costa et al. 2005. Herpetol. Bull. 92:26–27). However, no information on the mating season and mating behavior of the species is available. Here, we provide the first record of mating of *C. laevicollis* in nature and discuss the potential implications of the presence of another male in the area for the species' mating system.

At ca. 1130 h on 30 September 2019 (early austral spring), a male and female *C. laevicollis* were found copulating near the Parque Estadual do Rio Vermelho, Florianópolis City, Santa Catarina, Brazil (27.47530°S, 48.39630°W; WGS 84). The temperature of the area that day ranged from 25–30°C. The observation lasted ca. 35 min, during which a sequence of photos and videos

PHOTOS BY JULIANA A. FLORÊNCIO

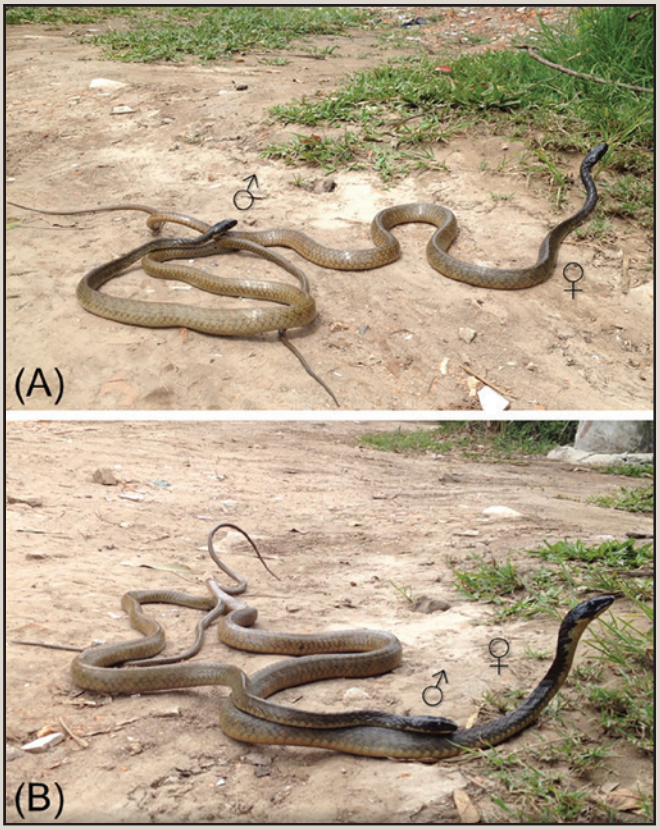

Fig. 1. Mating behavior of *Chironius laevicollis* in Santa Catarina, Brazil, including wave movements and chin rubbing along the dorsum of the female.

PHOTO BY JULIANA A. FLORÊNCIO

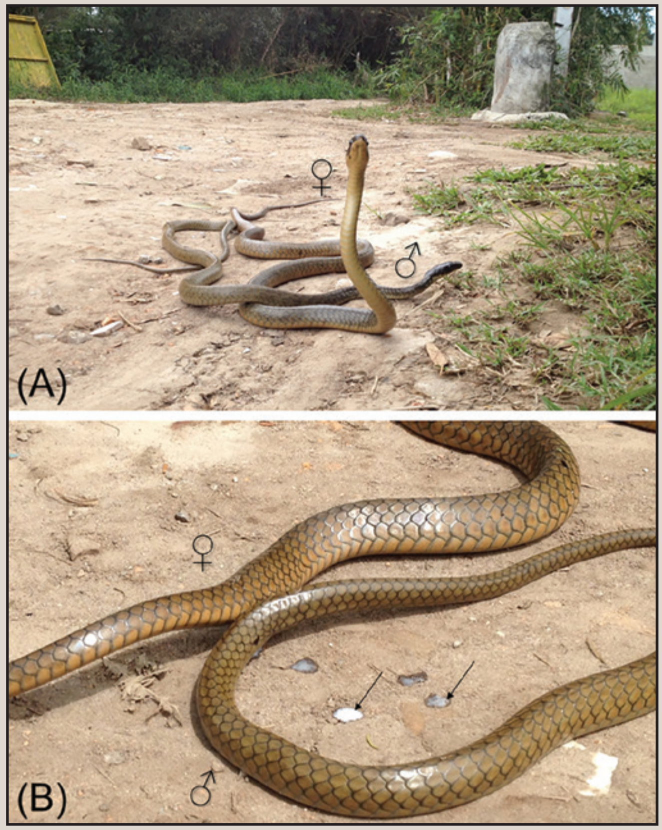

Fig. 2. Mating behavior of *Chironius laevicollis* in Santa Catarina State, Brazil: A) head lifting of the female B) cloacal gaping and copulation (arrows: semen).

were taken. The male performed wave movements towards the female's anterior trunk and chin rubbing along the female's dorsum (Fig. 1). In response, the female lifted her head (Fig. 2A) and showed cloacal gaping (Fig. 2B). We also noticed semen on the ground near the mating pair (Fig. 2B). A conspecific individual (possibly another male) was observed nearby the mating pair, but it moved away quickly as the observer approached.

Although some behaviors typical of the beginning of courtship were not observed (i.e., chasing, dorsal mount with parallel alignment, tail entwining), the courtship and copulation behaviors identified here are similar to those described for other snakes (Carpenter 1977. Integr. Comp. Biol. 17:217–223). Head lifting has been reported in females of the viperid *Agkistrodon contortrix* during courtship (Schuett and Duvall 1996. Anim. Behav. 51:367–373), but it may also occur in other taxa in which males engage in vertical combat (Almeida-Santos and Marques 2002. Amphibia-Reptilia 23:528–533). Head lifting by females might be a mechanism of female potential mate choice involving intraspecific sexual mimicry (Schuett and Duvall 1996, *op. cit.*).

Both male combat and aggregation have been reported in several species of *Chironius* (Almeida-Santos and Marques 1998, *op. cit.*; Starace 1998. Guide des Serpents et Amphisbènes de Guyane Française. Ibis Rouge Editions, Guadeloupe, Guiane. 452 pp.; Feio et al. 1999. Herpetol. Rev. 30:99). In *C. laevicollis*, male-male combat has also been observed in spring (SMAS, pers. obs.). Thus, in *C. laevicollis*, male–male combat occurs synchronously with both mating and vitellogenesis, between August and December (Marques 1998, *op. cit.*). Synchrony between male–male combat and vitellogenesis (in March) has also been recorded in *C. carinatus* (Starace 1998, *op. cit.*; Guimarães et al. 2013. Acta Zool. 95:341–346). In contrast, in *C. bicarinatus*, vitellogenesis begins in autumn and is synchronous with mating (Marques et al. 2009. S. Am. J. Herpetol. 1:76–80), but male-male combat has been recorded in spring when a greater number of vitellogenic females are observed (Almeida-Santos and Marques 2002, *op. cit.*; Marques et al. 2009, *op. cit.*). In *C. flavolineatus*, males aggregate and compete to court and mate with a female, and no combat seems to occur (Feio et al. 1999. Herpetol. Rev. 30:99), although data are limited. These observations suggest that both the mating season and the mating system may vary interspecifically in *Chironius*. Additional data are needed to assess whether the interspecific variation in the mating systems of species of *Chironius* exhibits phylogenetic structure.

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GABRIELI S. ARAÚJO, **SELMA M. ALMEIDA-SANTOS**, **SERENA N. MIGLIORE**, and **LUIS M. LOBO**, Laboratório de Ecologia e Evolução, Instituto Butantan, Avenida Vital Brazil, 1500, CEP 05503-900, São Paulo, Brazil (e-mail: miguellobo013@gmail.com).

CONOPSIS ACUTA **(Spotted Earthsnake). DIET.** *Conopsis acuta* is a semifossorial colubrid that occupies desert shrub, pine, pine-oak, and fir forest, usually found under rocks, decaying wood, and agave leaves. It is endemic to Mexico, distributed from southeastern Puebla (Valle de Tehuacán) and west-central

Veracruz (Puerto del Aire), south to central Oaxaca and southeastern Guerrero, from 1600–2660 m (Heimes 2016. Herpetofauna Mexicana. Vol. 1 Snakes of Mexico. Edition Chimaira, Frankfurt am Main, Germany. 572 pp.). Information on its natural history is scarce, and it is only mentioned that the diet of this snake is composed of arthropods (Canseco-Márquez and Gutiérrez-Mayén 2010. Anfibios y Reptiles del Valle de Tehuacán-Cuicatlán. CONABIO, Cuicatlaán A.C. and BUAP, México. 302 pp.). Here we report a new prey species.

At 1640 h on 10 September 2021, we found an adult male *C. acuta* (202 mm SVL, 263 mm total length) under a rock, 3.9 airline km SW from Cacaloapan, Municipality of Tepanco de López, Puebla, México (18.56851°N, 97.61847°W; WGS 84; 2019 m elev.). After dissecting the snake, we found a partially digested Small Jerusalem Cricket (*Stenopelmatus minor*; see Weissman et al. 2021. Zootaxa 4917:1–122), which was ingested headfirst. The specimen and the gut content were deposited at the Colección Zoológica, Universidad Autónoma de Aguascalientes (UAA-REP 865). We captured the snake with permit SGPA/DGVS/08831-20, issued by the Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT).

RUBÉN ALONSO CARBAJAL-MÁRQUEZ (e-mail: ruben.carbajal@edu.uaa.mx), **JAIME A. ESCOTO-MORENO** (e-mail: antonio.escoto@edu.uaa.mx), and **JOSÉ JESÚS SIGALA-RODRÍGUEZ**, Colección Zoológica, Departamento de Biología, Centro de Ciencias Básicas, Universidad Autónoma de Aguascalientes, 20131, Aguascalientes, Aguascalientes, México (e-mail: jesus.sigala@edu.uaa.mx); **LEONARDO FERNÁNDEZ-BADILLO**, Centro de Investigaciones Biológicas (CIB), Universidad Autónoma del Estado de Hidalgo, km 4.5 carretera Pachuca-Tulancingo, Mineral de la Reforma, Hidalgo, 42180, México; Predio Intensivo de Manejo de Vida Silvestre X-Plora Reptilia, km 65 carretera México-Tampico, Pilas y Granadas, Metztitlán, Hidalgo, 43350, México (e-mail: fernandezbadillo80@gmail.com); **NALLELY MORALES-CAPELLÁN**, Predio Intensivo de Manejo de Vida Silvestre X-Plora Reptilia, km 65 carretera México-Tampico, Pilas y Granadas, Metztitlán, Hidalgo, 43350, México (e-mail: nallelymc07@gmail.com); **JUAN MIGUEL BORJA-JIMÉNEZ**, Universidad Juárez del Estado de Durango, Facultad en Ciencias Biológicas, Av. Universidad s/n, Fraccionamiento Filadelfia, Gómez Palacio, Durango, México C.P. 35010 (e-mail: juanmiguel.borja@ujed.mx).

***CROTALUS ATROX* (Western Diamond-backed Rattlesnake). COURTSHIP and PHENOLOGY.** Observations of courtship among rattlesnakes in the field are sparse. *Crotalus atrox*, though arguably the most abundant rattlesnake in much of the North American southwest (Schuett et al. 2016. *In* Schuett et al. [eds.], Rattlesnakes of Arizona, pp. 333–394. ECO Publishing, Rodeo, New Mexico; Spencer et al. 2021. *In* Holycross and Mitchell [eds.]. Snakes of Arizona, pp. 476–498. ECO Publishing, Rodeo, New Mexico), is no exception. Early observations, which included elements of both courtship and mating, were brief and lacking photographs (Taylor 1935. Copeia 1935:154–155; Bogert 1942. Copeia 1942:262; Whisenhunt 1949. Nat. Hist. Misc. Chicago Acad. Sci. 49:1–2). Moreover, in some early photographs (Gloyd 1948. Nat. Hist. Misc. Chicago Acad. Sci. 34:1–3) it is difficult to interpret whether male-female pairs were actually involved (Lowe 1948. Herpetologica 4:129–135; Shaw 1948. Herpetologica 4:137–145). In relatively recent work describing the mating system of *C. atrox*, Clark et al. (2014. PLoS ONE 9:e90616) provided color plates that contrast courtship (their figure 1b) and mating postures (their figure 1a). Here, we augment the sparse descriptive data on *C. atrox* courtship with a high-resolution color photograph- and video-documented field observation.

Fig. 1. Courting pair of *Crotalus atrox* found 11 March 2020 along the Grand Enchantment Trail, Pinal County, Arizona. Note the relative alignment of both snakes and the proportionally larger size of the male's "coon" tail.

At 1237 h on 11 March 2020, one of us (MSS) found a pair of *C. atrox* near the intersection of Arizona and Grand Enchantment Trails, 7 km west of the San Pedro River, Pinal County, Arizona, USA (32.82451°N, 110.80721°W; WGS 84; 926 m elev.), just west of the eastern margin of the Sonoran Desert. Conditions were sunny and air temperature was ca. 23–27°C. A Brittlebush (*Encelia farinosa*) in full flower partially shaded the two snakes (Fig. 1). Over the 6 min that MSS observed and photographed the pair, their bodies were generally aligned but in contact in three areas. The male's head intermittently touched the female's neck; the male's posterior body was looped over her body just anterior to her tail; and his tail was wrapped beneath that of the female such that the base of his tail was near her cloaca (Fig. 1). This tail contact position was maintained during the entire observation. We inferred sex from the position of the two snakes (Clark et al. 2014, *op. cit.*) and the proportionally different lengths of the "coon" tail coloration (longer and more black bands in the male; Spencer et al. 2021, *op. cit.*) because the two snakes appeared similar in size. When found, both individuals were immobile, but videography revealed that the male made subtle but jerky movements with his head (http://dx.doi.org/10.26153/tsw/40706). Videography also showed that the male's tail and lower body made intermittent short-pulse contractions. Neither snake rattled during the observation nor displayed any other overt signs of being disturbed; both were essentially in the same position when MSS left the location.

Several aspects of this observation merit comment. First, alignment of the snakes generally agrees with the color figure in Clark et al. (2014, *op. cit.*) for a *C. atrox* pair in courtship and the tactile alignment phase of courtship described for *C. atrox* from captivity (Gillingham et al. 1983. J. Herpetol. 17:265–270). Second, the lower body loop that the male had positioned over the female's posterior body during courtship is similar to the tail search copulatory attempt posture that Gillingham et al. (1983, *op. cit.*; their fig. 2A) described. Third, the head-jerking movements the male made during our observation (see video cited above) probably correspond to similar movements Gillingham et al. (1983. *op. cit.*) described for the tactile chase phase of courtship, but which they described as extending into the tactile alignment and intromission and mating phases. Fourth, in captivity, tactile alignment was described as brief in contrast to intromission and mating, which may last for 18–29 h (Gillingham et al. 1983, *op. cit.*). The brevity of courtship may contribute to its scarcity in field observations. Fifth, lack of rattling during courtship has been noted in both captive (Lederer 1935, *op. cit.*; Hoessle 1963, *op. cit.*; Petzold 1963, *op. cit.*; Klauber 1972, *op. cit.*; Gillingham et al. 1983, *op. cit.*) and field (Taylor 1935, *op. cit.*; Whisenhunt Jr. 1949, *op. cit.*) observations of courtship and mating. Selection to avoid detection is likely strong for a largely immobile and likely vulnerable courting and mating pair. Hence, suppression of rattling may help to maintain crypsis-dependent concealment similar to that described for pregnant female Prairie Rattlesnakes (*C. viridis*; Kissner et al. 2010. Ethology 103:1042–1050). Finally, the reproductive phenology of *C. atrox* from the Suizo Mountains, ca. 34 km southwest of our observation and at a near-identical elevation (927 m), extends over two intervals annually: late summer-early fall pre-overwintering and spring post-overwintering (Clark et al. 2014, *op. cit.*). Though technically in late winter, our 11 March date represents the latter period (mating season two) and is among the earliest reports of courtship and mating from the Sonoran Desert (Taylor and DeNardo 2005. Copeia 2005:152–158; Schuett et al. 2016, *op. cit.*).

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MARK S. SCHRAMM, 245 Tolman Creek Road, Ashland, Oregon 97520, USA; **MARC P. HAYES**, Aquatic and Herpetological Consultants LLC, 1574 Brentwood Drive, Eagle Point, Oregon 97524-3200, USA (e-mail: aardvarkdiners33@gmail.com); **GORDON W. SCHUETT**, Department of Biology and Neuroscience Institute, Georgia State University, Atlanta, Georgia 30303, USA, and Chiricahua Desert Museum, Rodeo, New Mexico 88056, USA (e-mail: gwschuett@yahoo.com).

CROTALUS OREGANUS HELLERI **(Southern Pacific Rattlesnake). DIET.** *Crotalus oreganus helleri* is considered a dietary generalist, consuming lizards when young and transitioning to a nearly exclusive mammalian diet at ca. 500 mm total length (Mackessy 1988. Copeia 1988:92–101). Avian prey are rarely taken, and field observations of predation on birds are uncommon (Klauber 1972. Rattlesnakes: Their Habits, Life Histories, and Influence on Mankind. University of California Press, Berkeley, California. 1533 pp.; Dugan 2011. Ph.D. Dissertation, Loma Linda University, Loma Linda, California. 143 pp.).

On 18 July 2020, at 1345 h, an adult *C. o. helleri* (995 mm total length) was observed consuming a *Sialia currucoides* (Mountain Bluebird) along the margins of a riparian zone within a native conifer pine forest in the San Jacinto Mountains, Riverside County, California, USA (33.79692°N, 116.74893°W; WGS 84). Upon discovery, the snake had struck, killed, and held onto the bluebird. After 33 min, the snake had entirely consumed the bird, and was left in place, untouched by the observer. This observation represents the first record of *S. currucoides* in the natural diet of *C. o. helleri* and adds to the short list of documented avian prey species.

Fig. 1. *Crotalus oreganus helleri* consuming a *Sialia currucoides* (Mountain Bluebird) in the San Jacinto Mountains, California, USA.

ERIC A. DUGAN, Dugan Biological Services LLC, Upland, California, USA (e-mail: eric.dugan@dbsbio.com); **EMILY CHEBUL**, California State University, Fullerton, California, USA (e-mail: emilychebul@csu.fullerton.edu).

CROTALUS PYRRHUS **(Southwestern Speckled Rattlesnake). DIET.** *Crotalus pyrrhus* is considered a dietary generalist, consuming lizards when young and transitioning to a largely mammalian diet as adults (Meik and Babb 2020. *In* Holycross and Mitchell [eds.], Snakes of Arizona, pp. 588–599. Eco Publishing, Rodeo, New Mexico). Predation on avian prey is relatively uncommon, representing only 6.7% of prey items identified in a recent study on the natural diet of *C. pyrrhus* (Cochran et al. 2021. J. Herpetol. 55:77–87). As a result, field observations of predation events by rattlesnakes on birds are exceptionally rare. Recent popularity and increased use of trail cameras have increased observations of secretive wildlife species, while also capturing rarely observed natural behaviors.

At 1551 h on 21 August 2021, an adult *C. pyrrhus* (995 mm total length) was observed striking and consuming a *Melozone crissalis* (California Towhee) at the edge of a freshwater spring within a mixed oak-riparian woodland in the Santa Ana Mountains, Orange County, California, USA (33.5896°N, 117.5051°W; WGS 84). The predation event was captured on film by a Wing-Home 360 trail camera. The snake was concealed in a sedentary ambush coil on the back side of a small rock. Upon landing on the rock to drink from the spring, the towhee was struck, held by the head until it died, and subsequently consumed. The duration of the predation event was ca. 30 min. This observation represents the first record of *M. crissalis* in the natural diet of *C. pyrrhus* and adds to the short list of documented avian prey species.

ERIC A. DUGAN, Dugan Biological Services LLC, Upland, California, USA (e-mail: eric.dugan@dbsbio.com); **ROBERT DLUGOS**, California, USA (e-mail: robert@dlugos.com).

CROTALUS SCUTULATUS **(Mohave Rattlesnake). PREDATION.** *Crotalus scutulatus* is a medium-sized rattlesnake that inhabits arid grasslands and deserts in the southwestern United States and northern Mexico. *Crotalus scutulatus* possesses a potent neurotoxic venom with some populations containing both neurotoxins and hemotoxins (Glenn et al. 1983. Toxicon 21:119–130; Dobson et al. 2018. Comp. Biochem. Phys. C. 205:62–69). Rattlesnakes use their venom both for predation and defense (Hayes et al. 2002. *In* Schuett et al. 2002. Biology of Vipers, pp. 207–234. Eagle Mountain Publishing, Eagle Mountain, Utah) and some predators of rattlesnakes include mammals, birds, and other snakes. Herein we report on a novel case of predation on *C. scutulatus* by *Masticophis flagellum* (Coachwhip).

We examined the gut contents of 144 *M. flagellum* specimens from the collection at the Museum of Vertebrate Zoology, University of California, Berkeley (MVZ). Stomach contents were identified to the lowest taxonomic level possible. We found 179 items of which 140 were identifiable to the genus level, representing no fewer than 39 species. These contents included many items previously reported including arthropods, one amphibian, lizards, snakes, birds, and mice. Among them we found the partial remains of *Crotalus* spp. in two of the *M. flagellum* specimens. In one of the specimens (MVZ 6836) the *Crotalus* remains were determined to be *C. scutulatus*. The species was determined based on the posterior remains and tail, which exhibited narrow dark rings and wider light rings adjacent to an existing rattle. The locality of the specimen (Kern County, California, USA) also comported with the range of *C. scutulatus*.

Masticophis flagellum is a widespread North American colubrid that consumes a variety of prey items including reptiles, birds, mammals, and insects (Hamilton and Pollock 1956. Ecology 37:519–526). Our work indicates that this species is capable of consuming *C. scutulatus*, however the frequency at which this occurs remains unknown. Ophiophagy in snakes is not uncommon and North American colubrid genera that are known to eat rattlesnakes include *Lampropeltis* (Wiseman et al. 2019. Herpetol. Conserv. Biol. 14:1–30), *Drymarchon* (Keegan 1944. Copeia 1944:59; Babis 1949. Copeia 1949:147), and *Masticophis* (Ernst and Ernst 2003. Snakes of the United States and Canada, Smithsonian Books, Washington, D.C. 668 pp.). *Masticophis flagellum* have been documented eating *C. oreganus* (Western Rattlesnake; Tabor and Germano 1997. Herpetol. Rev. 28:90), *C. cerastes* (Sidewinder; Secor 1995. Herpetol. Monogr. 9:169–186), and *C. atrox* (Western Diamond-backed Rattlesnake; Ortenburger 1928. Univ. Michigan Stud., Mem. Univ. Michigan Mus. 1:1–247), but to the best of our knowledge, this is the first report of predation on *C. scutulatus*. Klauber (1972. Rattlesnakes: Their Habits, Life Histories, and Influence on Mankind, 2nd edition. University of California Press, Berkeley, California. 1534 pp.) reported that the closely related *M. lateralis* (California Whipsnake) consumed a *C. scutulatus*. Some snakes that regularly consume rattlesnakes (e.g., *Lampropeltis* spp.) are known to have resistance to rattlesnake venom (Weinstein et. al. 1992. J. Herpetol. 26:452–461). Predation on *C. scutulatus* by *M. flagellum* raises the possibility that *M. flagellum* have some degree of resistance to *C. scutulatus* venom; however, more research is needed in this area.

We would like to acknowledge C. Spencer for providing us access to the specimen collection at the Museum of Vertebrate Zoology (MVZ), Berkeley, California. We are grateful for J. T. Wilcox for facilitating our access to the MVZ and for early reviews of the manuscript.

KYLA M. GARTEN, 16973 El Jardin Road, Perris, California, USA; **JEFF A. ALVAREZ**, The Wildlife Project, P.O. Box 188888, Sacramento, California, USA (e-mail: jeff@thewildlifeproject.com); **ZACHARY A. CAVA**, 2615 F Street #6, Sacramento, California, USA.

DRYMOBIUS MARGARITIFERUS **(Speckled Racer). COURTSHIP and THANATOSIS.** *Drymobius margaritiferus* is a widely distributed colubrid, both on the Atlantic slope from southern Texas, USA, to northern Colombia, and on the Pacific slope from southern Sonora, Mexico to central Panama (McCranie 2011. The Snakes of Honduras: Systematics, Distribution, and Conservation. Society for the Study of Amphibians and Reptiles, Ithaca, New York. 714 pp.). It is diurnal, slender, fast, and usually has a rather irritable temperament (Köhler 2008. Reptiles of Central America. Herpeton Verlag, Offenbach, Germany. 400 pp.). This species occurs in diverse habitats (Dixon and Werler 2000. Texas Snakes. A Field Guide. University of Texas Press, Austin, Texas, United States, 384 pp.) and uses arboreal habitats (Harrington et al. 2018. Biol. J. Linn. Soc. 125:61–71) to search for prey (Altamirano-Alvarez et al. 2012. Revista de Zoología 23:21–36). In addition, this species sometimes exhibits a death feigning behavior known as thanatosis (Farr and Lazcano 2011. Herpetol. Rev. 42:613), where it remains immobile for a short period of time to avoid predators, and then escapes at the first opportunity. In this note, we describe new aspects of courtship and defensive behaviors in *D. margaritiferus*.


PHOTO BY LUIS FRANCISCO NIETO-TOSCANO

Fig. 1. *Drymobius margaritiferus* showing thanatosis as a defense mechanism in Palomares, Municipality of Matías Romero Avendaño, Oaxaca, Mexico.

At 1604 h on 20 August 2021, at Rancho Santa Lupita, located between Bacalar and Reforma, Municipality of Bacalar, Quintana Roo, México (18.76199°N, 88.52454°W; WGS 84; elev. 55 m), one of us (PMBG) found three adult *D. margaritiferus* (two males and one female) during courtship activity in a patch of secondary vegetation. These observations were recorded in several videos. In a first observation, a male is seen descending between the branches of the tree canopy and encounters another male upon leaf litter on the ground. Afterwards, the same male explores the surrounding area, seeming to be searching for something. Moments later, a female that was hidden in the leaf litter appears, observes the searching male for ca. 25 s, and then climbs up into the branches. Then, the male begins to follow the female (while the other male remains immobile on the ground), climbing up the same branches, catches up with the female and they intertwine for a few seconds, and then the pair continue climbing until they are lost in the canopy (http://dx.doi.org/10.26153/tsw/40743). Moments later, one of the snakes falls to the ground, while the other remains in the branches. These observations are novel, as they involve a new spatial substrate (tree branches) that *D. margaritiferus* may use not only for hunting, but also for courtship and possibly mating.

At 1250 h on 4 December 2021, in Palomares, Municipality of Matías Romero Avendaño, Oaxaca, Mexico (17.11523°N, 95.05496°W; WGS 84; elev. 103 m), one of us (LFNT), observed and documented through photography and video, death feigning (thanatosis) in an adult *D. margaritiferus*. The snake was found hidden in grassy vegetation in an open area near small bodies of water. When caught and handled for measurement, the snake behaved very defensively, trying at every moment to bite, in a first attempt to escape. After ca. 5 min, during which time the snake remained alert and trying to bite, it began to remain still, to the point of not moving. When released on the ground in an open area, the snake did not move and its dorsal posture appeared to be tense; when touched with a pair of snake tongs, it did not react, remaining in that state for ca. 2 min (Fig. 1). When the observer stepped back to see the snake's reaction, the snake began to relax its body and then began to move quickly and try to escape; however, when the observer approached the snake again, it again became still, and when he caught the snake, it quickly used thanatosis once again as a defense mechanism. This time the snake was placed back on the ground, but near a mound of vegetation, and when released, it returned to its normal posture and quickly moved away, hiding in the vegetation. Based on our observations, it appears that *D. margaritiferus* might take advantage of areas with abundant vegetation to escape, whereas in areas without much vegetation, it uses a passive defensive mechanism, such as thanatosis, until it finds the right moment to escape. Similarly, and coinciding with the observations of Farr and Lazcano (2011, *op. cit.*), the snake remained motionless during the time of capture, but in our observations and contradicting Farr and Lazcano (2011, *op. cit.*), the snake did not move its tail at any time.

JOSÉ ROGELIO CEDEÑO-VÁZQUEZ, El Colegio de la Frontera Sur, Departamento de Sistemática y Ecología Acuática, Av. Centenario Km 5.5, C.P. 77014, Chetumal, Quintana Roo, México (e-mail: rcedenov@ecosur.mx); **LUIS FRANCISCO NIETO-TOSCANO**, El Colegio de la Frontera Sur, Av. Centenario Km 5.5, C.P. 77014, Chetumal, Quintana Roo, México (e-mail: luisnietotoscano913@gmail.com); **PABLO M. BEUTELSPACHER-GARCÍA**, Martinica 342, Fracc. Caribe, C.P. 77086, Chetumal, Quintana Roo, México (e-mail: bothropspacher@hotmail.com).

DRYMOBIUS RHOMBIFER **(Esmarald Racer). PREDATION.** *Drymobius rhombifer* is a widely distributed Central and South American colubrid. Although it is common and diurnal, little of its ecology, including its potential predators, have been described (e.g., Savage 2002. The Amphibians and Reptiles of Costa Rica: a Herpetofauna between Two Continents, between Two Seas. University of Chicago Press, Chicago, Illinois. 934 pp.; Duellman 2005. Cusco Amazónico. Comstock Pub. Associates, Ithaca, New York. 433 pp.; Bernarde et al. 2011. Biota Neotropica 11.3:117–44.). On 4 June 2002, between 1600 and 1615 h, we found a dead and headless *D. rhombifer* (ca. 50 cm total body length) near the Cocha Cashu Biological Station (11.8750°S, 71.4086°W; WGS 84, 400 m elev.) in the Madre de Dios region of southeastern Peru. The snake was found in floodplain forest and positioned on a log ca. 150 cm off the ground. We set a camera trap prior to leaving the snake which captured a *Buteogallus schistaceus* (Slate-coloured Hawk) feeding on the snake at 1618 h (Fig. 1). It is likely the same individual that killed the snake; however, it is impossible to determine if the log was the exact location of the predation event. We would like to thank the assistants and field personnel of Cocha Cashu Biological Station.

PHOTO BY RENATA LEITE

Fig. 1. *Buteogallus schistaceus* feeding on a *Drymobius rhombifer* in the Madre de Dios region of southeastern Peru.

RENATA LEITE PITMAN, Duke University, Durham, North Carolina 27708, USA (e-mail: renata.leite@duke.edu); **PATRICK S. CHAMPAGNE**, Asociación para la Conservación de la Cuenca Amazónica, Puerto Maldonado, Madre de Dios, Peru (e-mail: patrickchampgne@gmail.com).

EUNECTES MURINUS **(Green Anaconda). XANTHISM.** *Eunectes murinus* is the largest snake species in the Neotropics. The species has a wide distribution and inhabits several ecoregions, including Llanos, Amazon Forest, Pantanal, Cerrado, and Atlantic Forest (Rivas 2016. Natural History of the Green Anaconda [*Eunectes murinus*]: with Emphasis on Its Reproductive Biology. CreateSpace Independent Publishing Platform, Coppell, Texas. 206 pp.; Nogueira et al. 2019. J. Herpetol. 14:1–276). The species typically exhibits an olive green or brown color, with some dorsal spots and light-colored lateral ocelli in the center. Moreover, it is the only species of the genus that has four cephalic stripes, usually brown, red, or orange (Dirksen 2002. Anakondas. Münster: Natur-und-Tier-Verlag, Münster, North Rhine-Westphalia. 190 pp.). In 2020, an *E. murinus* was captured by the Batalhão de Polícia Ambiental in an urban area of the Municipality of Belém, Pará, Brazil, exhibiting an extremely light yellowish-brown color with no lateral ocelli spots and brownish gray (Fig. 1). This adult specimen (2.56 m total length; 7 kg) is in the Centro de Herpetologia da Amazônia (license 2018/0000002540), in good health.

Due to the predominance of yellow color, we classified the specimen as xanthic (Bortiero et al. 2021. Salamandra 57:124–138), representing the first case in *E. murinus*. Another

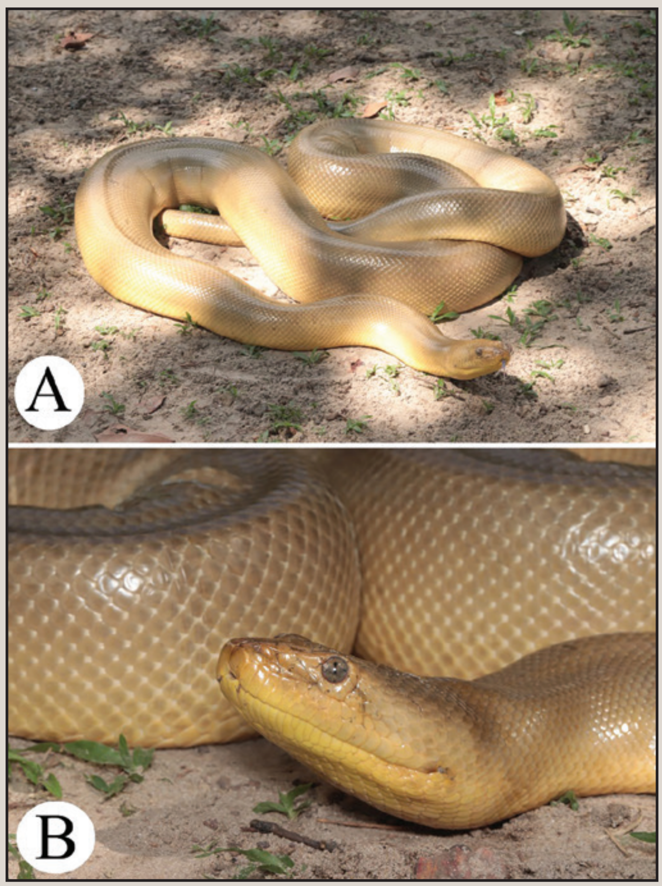

Fig. 1. Xanthic *Eunectes murinus* found in Belém, Pará State, Brazil: A) photo showing absence of body spots; B) photo showing eye color.

remarkable aspect of this record is that the *E. murinus* does not exhibit dorsal spots and lateral ocelli, instead exhibiting a homogeneous color pattern. Xanthic snakes can synthesize small amounts of melanin and have colored eyes (Bechtel 1995. Reptile and Amphibian Color Variants: Colors, Patterns, and Scales. Krieger Publishing Co., Malabar, Florida. 206 pp.), as is the case for this snake. Color anomalies are rare in wild snakes (Bortiero et al. 2021, *op. cit.*) and could increase mortality by exposing the animal to increased predation risk. The large size of *E. murinus* neonates and its defensive behaviors may have been a factor in the survival of this individual in the wild.

BRUNO FELIPE CAMERA (e-mail: camera_bruno@hotmail.com) and **ANA CAROLINE GOMES LOURENÇO**, Laboratório de Herpetologia, Museu Paraense Emílio Goeldi, Belém, Pará, CEP 66040-170, Brazil (e-mail: anaglourenco1@gmail.com); **LEANDRO OLIVEIRA BANDEIRA**, **BRENO JACKSON DE LIMA ALMEIDA**, and **MILENA SANTOS MONTEIRO DE ALMEIDA**, Centro Amazônico de Herpetologia, Benevides, Pará, CEP 68795-000, Brazil (e-mail: alphabiotox.animais@gmail.com); **ANA LÚCIA DA COSTA PRUDENTE** (e-mail: prudente@museu-goeldi.br) and **AFONSO SANTIAGO DE OLIVEIRA MENESES**, Laboratório de Herpetologia, Museu Paraense Emílio Goeldi, Belém, Pará, CEP 66040-170, Brazil (e-mail: afonso.santiago.06@gmail.com).

***FARANCIA ABACURA* (Red-bellied Mudsnake). PREDATION.** *Farancia abacura* is a semi-aquatic, fossorial, colubrid snake species that inhabits a variety of freshwater wetland habitats in the southeastern United States (Wright and Wright 1957. Handbook of Snakes of the United States and Canada. Vol. 1. Comstock, Ithaca, New York. 564 pp.) but occasionally makes terrestrial movements (Steen et al. 2013. Herpetol. Rev. 44:208–213). Documented predators are *Alligator mississippiensis* (American Alligator; Palmer and Braswell 1995. Reptiles of North Carolina. University of North Carolina Press, Chapel Hill, North Carolina. 444 pp.; Rice. 2004. M.S. Thesis, University of Florida, Gainesville, Florida. 89 pp.), *Agkistrodon piscivorus* (Cottonmouth; Rossman 1959. Quart. J. Florida Acad. Sci. 22:207225; Burkett 1966. Univ. Kansas Publ. Mus. Nat. Hist. 17:435–491; Palmer and Braswell 1995, *op. cit.*; Plummer et al. 2020. Wetlands 40:2489–2498), *Drymarchon couperi* (Eastern Indigo Snake; Stevenson et al. 2010. Southeast. Nat. 9:118), *Nerodia rhombifer* (Diamond-backed Watersnake; Auffenberg 1948. Herpetologica 4:193), *Ardea alba* (Great Egret; Abercrombie and Hofmann 2021. Herpetol. Rev. 52:666), and *Lutra canadensis* (River Otter; Tumlison and Karnes 1987. Mammalia 51:225232). Based on damage to implanted transmitters, Plummer et al. (2020, *op. cit.*) speculated that small mammals had depredated two radio-tracked *F. abacura* in Arkansas.

Fig. 1. Screen capture from a video of an Everglades Mink (*Neovison vison evergladensis*) dragging a *Farancia abacura* across a road in Collier County, Florida, USA, on 1 January 2022.

On 1 January 2022 at 1507 h, HC recorded a video of a *Neovison vison evergladensis* (Everglades Mink) running across a dirt road while dragging a limp snake by its neck (Fig. 1). Approximately 8 min earlier, the mink had crossed the road in the opposite direction without the snake and 4 min later, the mink briefly stuck its head out of the bushes along the road with the snake in its mouth. This video from Fakahatchee Strand Preserve State Park, Collier County, Florida, USA, was reposted by the Florida Fish and Wildlife Conservation Commission without initially identifying the species of "giant snake" (http://dx.doi.org/10.26153/tsw/40707). We zoomed in on one frame of the video and observed pink bands on the lower sides of the snake's body, confirming our suspicion that it was an *F. abacura*. This mink subspecies is listed as state threatened and occurs as a disjunct population in southern Florida, where it typically inhabits shallow freshwater marshes, salt marshes, and swamp forests (Humphrey and Zinn 1982. J. Wildl. Manage. 46:375381). The snake was ca. three times the length of the mink's body. If this were an adult mink, we estimate the *F. abacura* measured ca. 120 cm total length. An Everglades Mink contained scales of *Nerodia* sp. (watersnake; Smith 1980. South Florida Research Center Report T-555, Homestead, Florida. 17 pp.) in its intestines, and mink in other states have been reported preying on *Nerodia*, *Thamnophis*, and *Pantherophis* (Hamilton 1940; J. Wildl. Manage. 4:8084; Sealander 1943. J. Wildl. Manage. 7:411417; Wilson 1954. J. Wildl. Manage. 18:199207; Korschgen 1958. J. Mammal. 39:521527).

HANNAH CARDENAS, San Francisco, California 94115, USA (e-mail: hannah.a.cardenas@gmail.com); **KEVIN M. ENGE** (e-mail: kevin.enge@myfwc.com), **DAVID A. STEEN**, **PAUL E. MOLER**, **JONATHAN D. MAYS**, and **AUBREY HEUPEL GREENE**, Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, 1105 SW Williston Road, Gainesville, Florida 32601, USA; **E. PIERSON HILL**, Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, 5300 High Bridge Road, Quincy, Florida 32351, USA.

***HEBIUS VIBAKARI* (Asian Japanese Keelback). DIET.** *Hebius* (previously *Amphiesma*) *vibakari* is a small to medium-sized natricine distributed throughout east Asia, including Russia (Primorskiy and Khabarovskiy territories, Amurskaya Oblast), northeast China (Heilongjiang, Jilin, and Liaoning), Korea (the Korean Peninsula and Jeju Island), and Japan (Kyushu, Shikoku, Honshu, and Ryukyu Islands; Song 2007. Korean J. Environ. Biol. 25:124–138; Maslova et al. 2018. Nat. Conserv. Res. 3:61–72). *Hebius vibakari* is found in a variety of habitats, including forests, grasslands, agricultural lands, coastal areas, and at the outskirts of villages and cities (Maslova et al. 2018. Nat. Conserv. Res. 3:61–72). There are anecdotal reports of *H. vibakari* feeding on frogs, tadpoles, and loaches (Song 2007, *op. cit.*). In addition, there are two records of earthworm remains observed within the stomachs of *H. vibakari* collected from Jeju Island in the Republic of Korea and Izu Island in Japan (Webb et al. 1962. Univ. Kansas Publ. Mus. Nat. Hist. 15:149–173; Hasegawa 1990. Nat. Hist. Res. 1:81–84). Here we report the first direct behavioral observations of *H. vibakari* feeding on earthworms in the field.

At 0931 h on 31 July 2021, we observed an *H. vibakari* individual (male, 16.6 cm SVL, 4.2 cm tail length) feeding on an earthworm on a forest trail on Oeyeon Island, Boryeong-si,

Fig. 1. *Hebius vibakari* feeding on an earthworm on 30 September 2021 on Oeyeon Island, Republic of Korea.

Chungcheongnam-do, Republic of Korea (36.23125°N, 126.08699°W; WGS 84; 62 m elev.). At the time of the observation, the air temperature and relative humidity were 28.8°C and 68%, respectively. Oak (*Quercus*) and ash trees were the dominant canopy vegetation along the edge of the forest trail, which was covered with irregular-shaped flagstones to prevent soil erosion. We initially observed an *H. vibakari* feeding on an earthworm under a gap created between the flagstones and trail surface. Additionally, we observed another *H. vibakari* feeding on an earthworm, at 1009 h on 30 September 2021 (22.1°C, 83% relative humidity), on a similar type of forest trail (36.22865°N, 126.08101°W; WGS 84; 22 m elev.) on Oeyeon Island (Fig. 1). Our observations suggest that *H. vibakari* may routinely consume earthworms on Oeyeon Island, or possibly throughout the species' range.

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IL-KOOK PARK (e-mail: ileveli2@naver.com), **HOJUN JEONG**, **JONGSUN KIM** (e-mail: jongsun331@naver.com), and **DAESIK PARK**, Division of Science Education, Kangwon National University, 24341, Republic of Korea (e-mail: parkda@kangwon.ac.kr); **ALEJANDRO GRAJAL-PUCHE**, Biological Sciences, Northern Arizona University, Flagstaff, 86011 Arizona, USA (e-mail: ag3599@nau.edu); **HOANJIN JANG**, Division of Science Education, Kangwon National University, 24341, Republic of Korea (e-mail: amphibia1978@gmail.com).

***LAMPROPELTIS CALLIGASTER* (Prairie Kingsnake). WINTER PREDATION.** Snakes are well known as a dietary component of various hawk species (Bent 1937. Birds of Prey. Part 1. Dover Publications, Inc., New York, New York. 425 pp.; Knight and Erickson 1976. Rapt. Res. 10:108110; Heckel et al. 1994. J. Wildl. Dis. 30:616619). *Buteo jamaicensis* (Red-tailed Hawk), are no exception and are opportunistic feeders that mainly eat rodents, but will also prey on amphibians, lizards, birds, and both venomous and non-venomous snakes. In Arkansas, USA, Trauth and Klotz (2002. Herpetol. Rev. 33:143) reported a *B. jamaicensis* preying upon two *Thamnophis sirtalis sirtalis* (Eastern Gartersnake), in the northeastern part of the state.

Fitch (1978. Trans. Kansas Acad. Sci. 81:353–363) and Richardson et al. (2006. J. Herpetol. 40:423–428) provided detailed information on the ecology of *Lampropeltis calligaster* in Kansas, USA and Illinois, USA, respectively, but did not mention any predators. In addition, although biological information on *L. calligaster* was provided in a species account by Blaney (1979. Cat. Am. Amphib. Rept. 229:229.1–229.2), nothing was mentioned of

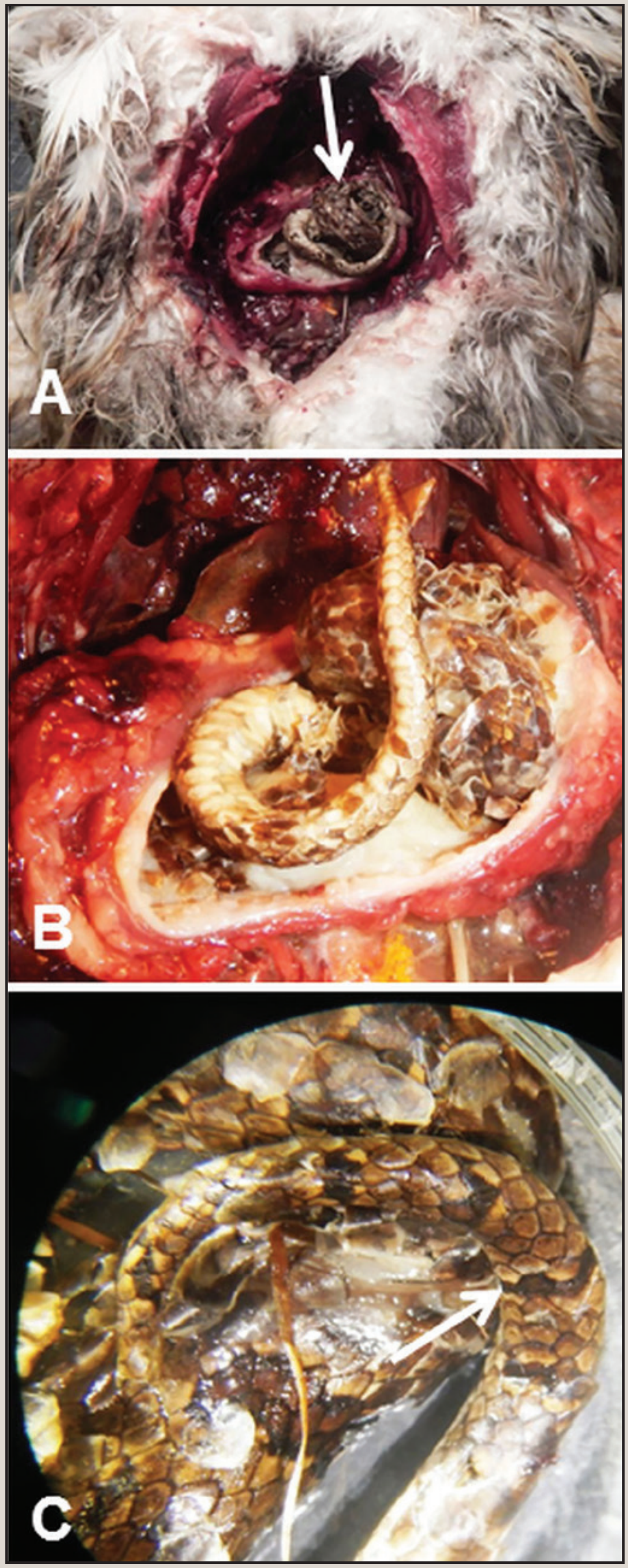

Fig. 1. Juvenile *Lampropeltis calligaster* in stomach of *Buteo jamaicensis* (Red-tailed Hawk), from Arkansas, USA: A) prey item (arrow) in situ; B) posterior end of snake showing single anal plate; C) closer view showing characteristic dorsal chevron-like pattern (arrow) of *L. calligaster*.

its predators. In Arkansas, Trauth et al. (2004. Amphibians and Reptiles of Arkansas. University of Arkansas Press, Fayetteville, Arkansas. 421 pp.) did not mention any of its predators. Here, I provide an instance of an *L. calligaster* being predated by a *B. jamaicensis* in southwestern Arkansas.

On 3 December 2021, an adult *B. jamaicensis* was found dead on the road off US 70/71, 8.0 km E of DeQueen, Sevier County, Arkansas, USA (34.04615°N, 94.22391°W; WGS 84). It was taken to the laboratory and a mid-ventral incision was made to expose the stomach, which contained a snake (Fig. 1A). The prey item was missing its head and some of the extreme tail region but possessed a single anal plate (Fig. 1B), smooth scales, divided subcaudals, and a long and tapered tail as well as characteristic dorsal blotches (Fig. 1C); it was subsequently identified as a juvenile (ca. 180 mm SVL) *L. calligaster*. The snake was deposited into the Arkansas State University Museum of Zoology (ASUMZ 34141). To my knowledge, this is the first time *L. calligaster* has been reported to be preyed upon by a *B. jamaicensis* in Arkansas, and the seasonal timing of this event appears to be uncommon.

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CHRIS T. MCALLISTER, Science and Mathematics Division, Eastern Oklahoma State College, Idabel, Oklahoma 74745, USA; e-mail: cmcallister@se.edu.

***LEPTODEIRA ANNULATA* (Banded Cat-eyed Snake). REPRODUCTIVE AGGREGATION.** During courtship, multiple male snakes can coil around a female, pushing each other while trying to copulate. This behavior is called reproductive aggregation or a "mating ball" (Rivas and Burghardt 2005. J. Comp. Psychol. 119:447–454). The behavior has been reported for diverse snake species, but it is still scarce for neotropical snakes (e.g., Rivas and Burghardt 2001. Anim. Behav. 62:F1–F6; Schuett et al. 2019. Herpetol. Rev. 50:383–384; Banci et al. 2021. Herpetol. Rev. 52:881).

Leptodeira annulata is an arboreal, nocturnal dipsadid snake widely distributed in the Neotropics with a continuous reproductive cycle (Ávila and Morais 2007. Herpetol. Rev. 38:278–280; Pizzatto et al. 2008. Herpetologica 64:168–179). At 2050 h on 29 November 2019, at an air temperature of ca. 29°C, in the Nhecolândia subregion of the Pantanal wetlands at Corumbá County, Mato Grosso do Sul, Brazil (18.98805°S, 56.61905°W; WGS 84), we observed two simultaneous aggregations of *L. annulata* (Fig. 1) very close to each other. After observing for about 20 min, the snakes were captured, sexed, measured, microchipped, housed for 24 h in individual plastic boxes, and released at the capture site (license numbers: SISBIO #72577-1 and Ethics Committee of the Federal University of Mato Grosso do Sul #1.092/2019). All the individuals: two females (36 and 40 cm SVL; 10 and 10.5 cm tail length; 14 and 23 g) and five males (39.9, 42.3, 41, 44, and 51.5 cm SVL; 11.5, 12, 12.6, 10.2, and 16 cm tail length; 15, 20, 13.5, 21, and 20 g), were found tangled in the branches of a Tarumã Tree (*Vitex cymose*; Verbenaceae) at ca. 4 m above the ground. The high ratio of males to females and physical contact among the individuals associated with tangled motions suggest a mating aggregation. Each breeding ball was most likely induced by a female, but it was impossible to distinguish males from each aggregation because apparently, males were moving from one ball to another. Through the next five nights following the release, none of these individuals were seen or recaptured near or at the event site. Fortuitous observations of behavior can bring insights about species in their natural environment. Here we reinforce the occurrence of reproductive aggregation between individuals of *L. annulata*, reported in a previous study (Passos and Borges-Nojosa 2015. Herpetol. Rev. 46:646–647) and add behavioral detail that males can possibly move between nearby aggregations.

RAFAELA THALER (e-mail: rafaelathaler@gmail.com) and **FERNANDO PAIVA**, Universidade Federal de Mato Grosso do Sul, Av. Costa e Silva, Bairro Universitário, 79070-900, Campo Grande - MS, Brazil (e-mail: fernando.paiva@ufms.br); **JULIANA DE SOUZA TERRA**, Fundação Neotrópica do Brasil, Rua Clívis Cintra, Bairro Vila Donária, 79290-000, Bonito - MS, Brazil (e-mail: terraju@gmail.com); **VANDA LÚCIA FERREIRA**, Universidade Federal de Mato Grosso do Sul, Av. Costa e Silva, Bairro Universitário, 79070-900, Campo Grande - MS, Brazil (e-mail: vandalferreira@gmail.com).

PHOTO BY FERNANDO PAIVA; 1B) PHOTO BY MARIANA FERREIRA PIÑEIRO

Fig. 1. A) Two mating balls (indicated by the arrows) of *Leptodeira annulata* at ca. 4 m above the ground at Nhecolândia subregion of the Pantanal wetlands in Corumbá Municipality, Mato Grosso do Sul, Brazil; B) closeup view of a male *L. annulata* after release. 1A)

***LEPTODEIRA ANNULATA* (Banded Cat-eyed Snake). PREDATION.** *Leptodeira annulata* is a medium-sized dipsadid with a vast distribution in Central and South America (Uetz et al. [eds.] 2022. The Reptile Database. http://www.reptile-database.org; 1 Feb 2022). It is preyed upon by other snakes (Cavalcanti et al. 2012. Herpetol. Notes 5:129–131; Souza-Pelegrini et al. 2019. Herpetol. Notes 12:1193–1195; Sosa et al. 2019. Herpetol. Rev.

Fig. 1. *Buteogallus meridionalis* preying on *Leptodeira annulata* and being chased by *Caracara plancus*, municipality of Corumbá, Mato Grosso do Sul, Brazil.

50:518–519), carabid beetles (Markezich and Parrillo 1999. Herpetol. Rev. 30:46–47), and theraphosid spiders (Silva et al. 2019. Herpetol. Notes 12:953–956) as well as presumably by birds and mammals, although no detailed accounts of bird predation have been reported in the literature.

Buteogallus meridionalis (Savanna Hawk) and *Caracara plancus* (Crested Caracara) are generalist raptors that forage in diverse habitats (Baladrón et al. 2017. J. Raptor Res. 51:38–49). *Buteogallus meridionalis* captures its prey on the ground or from a perch (Sick 1997. Ornitologia Brasileira. Nova Fronteira, Rio de Janeiro, Brazil. 862 pp.), whereas *C. plancus*, in addition to hunting, uses a kleptoparasitism strategy of stealing food from other birds (Freitas 2006. Boletim ABFPAR 9:39–43).

On the afternoon of 13 July 2021, during an ecological assessment in the Pantanal biome, municipality of Corumbá, Mato Grosso do Sul, Brazil (18.01511°S, 55.93836°W; WGS 84), we recorded an adult *B. meridionalis* flying and carrying an *L. annulata*. The *B. meridionalis* landed on a fence to feed on the snake when it was stalked by the *C. plancus*, which pursued it into the forest still carrying the *L. annulata* (Fig. 1).

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RODNEY MURILLO PEIXOTO COUTO, Biotério Pantanal Ltda, Assentamento Santa Maria da Lagoa, Ilha Solteira, São Paulo 15385-000, Brazil (e-mail: couto.murillo@gmail.com); **ALYSON VIEIRA DE MELO,** Universidade Federal Rural de Pernambuco, Programa de Pós-graduação em Biodiversidade e Conservação, Serra Talhada, PE, Brazil (e-mail: alysonmelo@hotmail.com); **MAICON VELASCO DE MELO**, Universidade Federal de Mato Grosso do Sul, Programa de Pós-graduação em Recursos Naturais, Campo Grande, MS, Brazil (e-mail: maiconvdm@gmail.com); **PAULO LANDGREF FILHO**, Universidade Federal de Mato Grosso do Sul, Campus Universitário de Aquidauana - CPAQ, Departamento de Biociências, Aquidauana, MS, Brazil (e-mail: p.landgref@gmail.com).

MASTIGODRYAS MELANOLOMUS **(Salmon-bellied Racer). DIET.** *Mastigodryas melanolomus* is a colubrid with a distribution from Mexico to Costa Rica (Heimes 2016. Herpetofauna Mexicana. Vol. 1. Snakes of Mexico, Edition Chimaira, Frankfurt am Main, Germany. 385 pp.). This species is known to feed mostly on lizards, but also eats small snakes, reptile eggs, frogs, nestling birds, rodents, and shrews (Heimes 2016, *op. cit.*). However, there have been no reports of the diet of *M. melanolomus* in western Mexico. Here, we report two additional species of lizard prey, *Anolis nebulosus* (Clouded Anole) and *Aspidoscelis lineattissimus* (Many-lined Whiptail).

Fig. 1. *Mastigodryas melanolomus* predation on *Anolis nebulosus* in Compostela, Nayarit, México.

Fig. 2 *Mastigodryas melanolomus* predation on *Aspidoscelis lineattissimus* in Bahia de Banderas, Nayarit, México.

On 27 February 2016, at 1312 h, two of the authors (JALB and GAWP), observed a juvenile *M. melanolomus* preying on an adult *Anolis nebulosus* (Fig. 1) in an oak forest in Ejido Mazatan, Municipality of Compostela, Nayarit, Mexico (21.13941°N, 104.97965°W; WGS, 84; 732 m elev.). A second observation occurred on 29 July 2021, ca. 1358 h, when one of the authors (LDSM), observed an adult *M. melanolomus* preying an adult *Aspidoscelis lineattissimus* (Fig. 2) in tropical deciduous forest in Cruz de Huanacaxtle, Municipality of Bahia de Banderas, Nayarit, Mexico (20.73770°N, 105.40598°W; WGS 84; 8 m elev.). To our knowledge, both lizards are novel prey items in the natural diet of *M. melanolomus*.

JESÚS A. LOC-BARRAGÁN, Maestría en Ciencias Ambientales, Instituto Tecnológico Superior de Zacapoaxtla, Tecnológico Nacional de México, CP 73680, Zacapoaxtla, Puebla, México; Red Mesoamericana y del Caribe para la Conservación de Anfibios y Reptiles (MesoHerp) (e-mail: biolocbarragan@gmail.com); **GUILLERMO A. WOOLRICH-PIÑA**, Laboratorio de Zoología, División de Biología, Subdirección de Investigación y Posgrado, Instituto Tecnológico Superior de Zacapoaxtla, Tecnológico Nacional de México, CP 73680, Zacapoaxtla, Puebla, México; **LUIS D. SANTANA-MORENO**, Instituto Tecnológico de Bahía de Banderas, Tecnológico Nacional de México, C.P. 63734, La Cruz de Huanacaxtle, Bahía de Banderas, Nayarit, México.

NERODIA FASCIATA **(Banded Watersnake). DIET and PARASITES.** *Nerodia fasciata* is a widespread natricine that feeds primarily on fishes and amphibians (Gibbons and Dorcas 2004. North American Watersnakes: A Natural History. University of Oklahoma, Norman, Oklahoma. 438 pp.) and occasionally on invertebrates, such as earthworms (Ernst and Ernst 2003. Snakes of the United States and Canada, Smithsonian Books, Washington, D.C. 668 pp.), snails (Fuchs et al. 2020. Herpetol. Rev. 51:149–150), crayfish (Gibbons and Dorcas 2004, *op. cit.*; Durso et al. 2013. J. Zool. 291:185–193), and caterpillars (Durso et al. 2013, *op. cit.*). In some places, *Nerodia* thrive on non-native fishes (e.g., King et al. 2006. Can. J. Zool. 84:108–115). In Florida, USA, consumption of some non-native prey can be dangerous (e.g., *Pomacea maculata*: Fuchs et al. 2020, *op. cit.*; *Rhinella horribilis*: Williams and Bunkley-Williams 2021. Herpetol. Rev. 52:880), whereas *N. fasciata* seem to be able to safely prey on other non-native species (e.g., *Clarias batrachus* [Asian Walking Catfish]: Donini 2018.

Herpetol. Rev. 49:757; *Rhinella marina* [Cane Toad]: Donini and Doody 2021. J. N. Am. Herpetol. 2021:12–18).

Hemichromis letourneuxi (Letourneuxi's Jewel Cichlid) is a small (to 15 cm) species of cichlid native to western Africa that was introduced to Florida prior to 1965. These fishes and their hybrids have become problematic invasive species in freshwater ecosystems throughout the southern part of the state, spreading west and north following water management actions in the Greater Everglades Ecosystem in 1999 (Kline et al. 2014. Wetlands 34:175–187). This cichlid has detrimental impacts on native snail, shrimp, and fish species (PorterWhitaker et al. 2012. Ecol. Freshw. Fish 21:375–385; Schofield et al. 2014. Hydrobiologia 722:171–182) and might directly or indirectly have negative impacts on amphibians, reptiles, and odonates (O'Connor and Rothermel 2013. Am. Midl. Nat. 170:52–65). It is eaten by *Nerodia floridana* (Krysko et al. 2012. IRCF Rept. Amphib. 19:161–162) but has not yet been reported in the diet of *N. fasciata*.

As part of a broader survey of aquatic organisms between October 2021 and March 2022, we set 15–30 plastic minnow traps for 44 nights (total of 3210 trap-nights) in 10 different wetlands on Florida Gulf Coast University's campus in Lee County, Florida, USA (26.46441°N, 81.7788°W; WGS 84). Of 50 *N. fasciata* captured in minnow traps, 16 contained a total of 43 prey items. Of these, six contained one *H. letourneuxi* each, two contained *Lithobates grylio* (Pig Frog) tadpoles, four contained adult *L. grylio*, one contained a *Gambusia holbrooki* (Eastern Mosquitofish), one contained a mostly-digested hylid frog, one contained three *H. letourneuxi*, an adult *L. grylio*, and a fish that was too digested to identify, and one contained sixteen *Jordanella floridae* (Flagfish), three *H. letourneuxi*, three *G. holbrooki*, and at least three small poecilid or fundulid fishes that were too digested to identify (one suspected to be *Lucania goodei* [Bluefin Killifish]).

Mass of most prey items was not measured but mean (± SD) prey snout–vent or fork length as a percentage of snake SVL was similar between the two most common prey types (8 ± 3% [max 15, min 4] for *H. letourneuxi* vs. 8.5 ± 3% [max 15, min 6] for *L. grylio*). Although the ratio of 4 fishes:1 anuran in stomach contents seems to suggest a preference for fishes, prey availability in wetlands is heavily skewed towards fishes (6066 fishes including 2930 *H. letourneuxi* vs. 100 anurans including 70 *L. grylio* [tadpoles and adults] captured during the trapping period for a ratio of 61:1), so we interpret the relatively high prevalence of anurans in stomach contents as evidence of a preference for feeding on amphibians. Between these two prey species, differences in shape, rather than nutritional composition, are likely to be most important to *N. fasciata* (Willson and Hopkins 2011. Ecology 92:744–754). Amphibians can be consumed at larger sizes, require shorter intra-oral transport times, are digested faster, and have a lesser effect on post-feeding movement compared with fishes (Willson and Hopkins 2011, *op. cit.*). As exotic aquarium fishes continue to invade aquatic ecosystems in southern Florida, their effects may differ from those of native fishes (Schofield et al. 2014, *op. cit.*), with cascading effects throughout food webs (Trexler et al. 2005. Oecologia 145:140–152; Kellogg and Dorn 2012. Oecologia 168:1111–1121).

One of the *N. fasciata* regurgitated a *H. letourneuxi* and a live *Raillietiella orientalis*, and all four road-killed *N. fasicata* we have dissected from this site contained between 1 and 30 adult *R. orientalis* in their lung (one also contained a single individual of a native species of pentastome, *Porocephalus crotali*). The pentastome *R. orientalis* was introduced from Asia with *Python bivittatus* (Burmese Python) and has been reported from *N. fasciata* elsewhere in Florida (Walden et al. 2020. Front. Vet. Sci. 7:467), but the intermediate hosts have yet to be identified (Miller et al. 2020. Ecosphere 11:e03153). Native and non-native anurans and lizards were recently shown to be competent intermediate hosts in Florida (Palmisano et al. *in press*, J. Herpetol.). Other species of *Raillietiella* are known to infect anurans (Barton and Riley 2004. Comp. Parasitol. 71:251–254) but it may be worth investigating *H. letourneuxi* and other fish species as potential intermediate hosts in the life cycle of *R. orientalis*.

ANDREW M. DURSO (e-mail: amdurso@gmail.com); **EMRY EL-RUBAIE**; **KARA OPHEIM**, Department of Biological Sciences, Florida Gulf Coast University, Ft. Myers Florida 33965, USA; **CASSIE VALENTI**, Department of Ecology & Environmental Studies, The Water School, Florida Gulf Coast University, Ft. Myers Florida 33965, USA.

***NERODIA SIPEDON PLEURALIS* (Midland Watersnake). PREDATION.** *Nerodia sipedon* are one of several species of watersnakes that perform important roles in food webs of aquatic ecosystems. Predators of this snake include a variety of vertebrates,

FIG. 1. *Nerodia sipedon pleuralis* eaten by *Ictalurus punctatus* in Arkansas, USA: A) specimen in situ in stomach contents; B) partially digested individual removed from stomach.

including Largemouth Bass (*Micropterus salmoides*), Snapping Turtle (*Chelydra serpentina*), Eastern Kingsnake (*Lampropeltis getula*), Northern Cottonmouth (*Agkistrodon piscivorus*), wading birds, Virginia Opossum (*Didelphis virginianus*), and Common Raccoon (*Procyon lotor*; Mitchell 1994. The Reptiles of Virginia. Smithsonian Institution Press, Washington, D.C. 352 pp.; Cross 2002. Herpetol. Rev. 33:55–56; Gibbons and Dorcas 2004. North American Watersnakes: A Natural History. University of Oklahoma Press, Norman. 438 pp.; Walley et al. 2012. Cat. Am. Amph. Rept. 899:899.1–899.58). Black (1983. Bull. Okla. Herpetol. Soc. 8:63–65) reported a Northern Watersnake (*N. s. sipedon*) eaten by a Channel Catfish (*Ictalurus punctatus*) in Oklahoma. Here, we document an occurrence of *I. punctatus* feeding on a *Nerodia sipedon pleuralis*.

An adult *I. punctatus* (490 mm total length [TL]) was collected by a commercial fisherman with a hoop net on 24 February 2022 from the Black River at Black Rock, Lawrence County, Arkansas, USA (36.10121°N, 90.91446°W; WGS 84). It was killed by cervical dislocation and a midventral incision was made from throat to anus to expose its gastrointestinal tract. An incision was made on the stomach and a partially digested juvenile *N. s. pleuralis* (345 mm SVL; Fig. 1) was found. We are unaware of previous reports of *I. punctatus* feeding on this subspecies of *N. sipedon*. *Ictalurus punctatus* are omnivorous and feed primarily on small sh but will also consume aquatic plants and plant seeds, crustaceans (craysh), clams and snails, aquatic insects, small birds, and mammals (Bailey and Harrison 1948. Trans. Am. Fish. Soc. 75:110–138; Jearld and Brown 1971. Am. Midl. Nat. 86:110–115; Hill et al. 1995. J. Fresh. Ecol. 10:319–323). Interestingly, three other adult *I. punctatus* (501–650 mm TL) as well as three adult Flathead Catfish, *Pylodictis olivaris* (570–615 mm TL) from the same collection site (and date) did not contain any watersnakes in their stomachs. Voucher snake deposited in the Arkansas State University Museum of Zoology (ASUMZ 34142).

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CHRIS T. MCALLISTER, Science and Mathematics Division, Eastern Oklahoma State College, Idabel, Oklahoma 74745, USA (e-mail: cmcallister@se.edu); **THOMAS J. FAYTON**, Lamar Fish Health Center, U.S. Fish and Wildlife Service, 400 Washington Avenue, Lamar, Pennsylvania 16848, USA (e-mail: tjfayton@gmail.com); **DONALD G. CLOUTMAN,** P.O. Box 197, Burdett, Kansas 67523, USA (e-mail: don.cloutman@yahoo.com); **ANINDO CHOUDHURY**, Division of Natural Sciences, St. Norbert College, DePere, Wisconsin 54115, USA (e-mail: anindo.choudhury@snc.edu); **HENRY W. ROBISON**, 602 Big Creek Drive, Sherwood, Arkansas 72120, USA (e-mail: hwrobison@yahoo.com).

***PHILODRYAS OLFERSII* (Lichtenstein's Green Racer). DIET.** *Philodryas olfersii* is an opistoglyphous, diurnal dipsadid snake with semiarboreal habits. It has a generalist diet, but its dietary preferences may shift during ontogeny. Juveniles primarily feed on frogs, whereas adults usually prey upon mammals and birds (Marques and Hartmann. 2006. Amphibia-Reptilia 26:25–31; Leite et al. 2009. North-West. J. Zool. 5:53–60). It has a wide distribution throughout South America and can be found in all Brazilian ecoregions, although it is most commonly associated with the Atlantic Forest (Nogueira et al. 2019. S. Am. J. Herpetol. 14:1–274). This species is known for frequent non-lethal snakebites that can cause localized edema (Ribeiro et al. 1999. Toxicon 37:943–948; Castro et al. 2021. Toxicon 197:55–64). Snake–human interactions are not restricted to natural environments. *Philodryas olfersii* is found in anthropogenic environments, primarily in rural communities

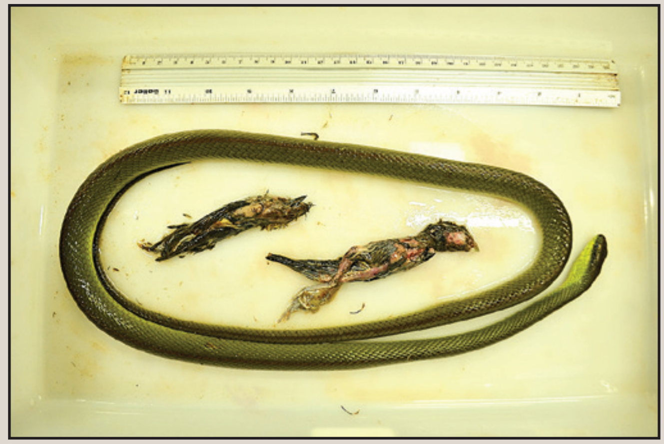

Fig. 1. Two hatchling *Sicalis flaveola* that were consumed by *Philodryas olfersii* in the Municipality of Foz do Iguaçu, Paraná, Brazil.

with gallery forests nearby (Castro et al. 2021, *op. cit.*). The presence of snakes in human settlements is associated with changes in their natural environment, resulting in overlap of habitat (e.g., snakes may use the anthropogenic environment to forage; French et al. 2018 Integr. Comp. Biol. 58:948–966).

At ca. 1130 h on 29 November 2021, we observed an adult female *P. olfersii* (81.8 cm SVL, 112.4 cm total length) in an urban area in the municipality of Foz do Iguaçu, Paraná, Brazil (25.44587°S, 54.58563°W; WGS 84). The snake was discovered coiled within a nest of *Sicalis flaveola* (Saffron Finch, canário-da-terra [in Portuguese]), which is widely distributed in Brazil. The nest was located ca. 2.5 m above the ground, over a metal structure shading a bus stop shelter. The first observer was attracted by two adult *S. flaveola* that were mobbing the snake, exhibiting alarm calls and visual displays. These efforts were unsuccessful in preventing the snake from preying upon the hatchlings. When captured, the snake had already ingested the hatchlings and was still in the nest and ignoring the two adult birds. After the snake was euthanized, two hatchlings of *S. flaveola* were extracted from its digestive tract. To our knowledge, only one record of *P. olfersii* predation on *S. flaveola* has been published (Mise et al. 2021. Neotrop. Biodivers. 7:61–66) and it reported predation on an adult. We report predation by *P. olfersii* on hatchlings of *S. flaveola* on an anthropogenic structure, emphasizing the behavioral plasticity of semiarboreal snakes in exploring anthropized environments for food resources. The snake specimen was deposited at the Coleção de Répteis da Universidade Federal da Integração Latino-Americana - UNILA, municipality of Foz do Iguaçu, Paraná, Brazil (CR038) along with the bird specimens (PTI740). This work was licensed by ICMBio (SISBIO Process n° 73800). We thank Flávia Guimarães Chaves for helping identify the prey items.

GABRIEL SPANGHERO VICENTE FERREIRA (e-mail: spangheri@gmail.com) and **ELOIZE FERREIRA DO NASCIMENTO**, Núcleo de Inteligência Territorial da Itaipu, Parque Fundação Parque Tecnológico Itaipu, Avenida Tancredo Neves, 6731, CEP 85867900, Foz do Iguaçu, Paraná, Brazil; **MICHEL VAREJÃO GAREY**, Instituto Latino-Americano de Ciências da Vida e da Natureza, Universidade Federal da Integração Latino-Americana, 1000, Jardim Universitário, CEP: 85870901 Foz do Iguaçu, Paraná, Brazil (e-mail: michel.garey@unila.edu.br).

***PITUOPHIS CATENIFER* (Gophersnake). DIET.** Three instances of *Pituophis catenifer* predation on *Sialia currucoides* (Mountain Bluebird) nestlings have been observed in British Columbia,

Fig. 1. An adult *Pituophis catenifer* as observed coiled into and on a nest box after consuming an unknown number of *Sialia currucoides* nestlings in New Mexico, USA.

Canada (Haras 2005. Wildlife Afield 2:17–18). We herein provide a verified report of *P. catenifer* preying on *S. currucoides* nestlings in north-central New Mexico, USA. An avian nest box monitoring network was established in 1997 to monitor secondary cavity-nesting avian species on the Pajarito Plateau at Los Alamos National Laboratory (LANL), Los Alamos County, New Mexico, USA (Fair and Meyer 2002. Environ. Pollut. 118:321–330). A long-term dataset was developed for *Sialia mexicana* (Western Bluebird), *S. currucoides*, and *Myiarchus cinerascens* (Ash-throated Flycatcher). Nest boxes are monitored annually for bird demography. At active nest boxes, each nestling was handled and processed for less than 5 min to reduce the chance that a predator detected a human scent trail leading to the nest box (Purcell 1997. J. Field Ornithol. 68:283–286.).

On 23 May 2014, a ca. 1.5 m (total length) *P. catenifer* was photographed coiled in a nestbox 1.8 m off the ground in Mortandad Canyon (35.86113°N, 106.26375°W; WGS 84; 2071 m elev.). The nest box was mounted on a Ponderosa Pine (*Pinus ponderosa*) and contained an unknown number of *S. currucoides* nestlings (Fig. 1). The *P. catenifer* was observed predating the nestlings at 1420 h. It is unknown what the nestling age was at the time of predation. The snake was assisted out of the nest box and released.

Pituophis catenifer is known to be a habitat generalist within the southwestern region of the United States (Holycross and Mitchell 2020. Snakes of Arizona. ECO Publishing, Rodeo, New Mexico. 860 pp.). This diurnal snake is capable of climbing trees and predating the eggs and nestlings of other birds, but primarily consumes mammals. Eichholz and Koenig (1992. Southwest. Nat. 37:293–298) observed that *P. catenifer* would target nest boxes with active *S. mexicana* nests more frequently than empty nest boxes. The snakes were more attracted to active nests containing older nestlings, while nests containing eggs incubated by adults did not attract any snakes during the study. Even so, egg predation has been documented for both *S. mexicana* and *S. currucoides* species (Rodríguez-Robles 2002. Biol. J. Linn. Soc. 2002:165–183). It is important to continue observing predation events to understand mechanisms that drive changes in environmentally sensitive bird populations.

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JADZIA M. RODRIGUEZ (e-mail: rodriguez.mira@hotmail.com) and **CHARLES D. HATHCOCK**, Los Alamos National Laboratory, Los Alamos, New Mexico, 87544, USA.

***PYTHON BIVITTATUS* (Burmese Python). PARASITES.** *Python bivittatus* is an invasive snake species in Florida, USA known to carry pathogens such as *Raillietiella orientalis* (lung parasite, Pentastomida; Miller et al. 2018. Ecol. Evol. 8:830–840) and nidovirus (order Nidovirales; S. Tillis, unpubl. data). Although non-native species can introduce novel parasites to a given region, as observed with the introduction of *R. orientalis* by pythons, non-native species may also acquire parasites from their introduced range, potentially altering parasite infection dynamics among hosts.

On 11 May 2021, an FWC contractor captured a 158.8 cm (139.7 cm SVL, 19.1 cm tail length, 1.59 kg) male *P. bivittatus* on Levee-28 in Everglades and Francis S. Taylor Wildlife Management Area, Miami-Dade County, Florida, USA (25.98991°N, 80.83952°W; WGS 84; 7.9 m elev.). After the python was humanely killed, it defecated, and the feces contained three motile intact parasites. The python and feces were frozen and necropsied on 14 June 2021. During necropsy, 11 adult nematodes were recovered from a mass of fur and bones located in the stomach. In the defecated stool sample, we found an additional seven adult nematodes among fur and bone fragments (Fig. 1). A subset of the nematodes were identified based on morphology by JMK and MAM as *Physaloptera hispida* (Nematoda: Physalopteridae;

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Fig. 1. Two adult females (right) and two adult males (left) of *Physaloptera hispida*, recovered from the stomach and feces of *P. bivittatus*, are shown next to a dime for size comparison.

PHOTO BY JOHN KINSELLA

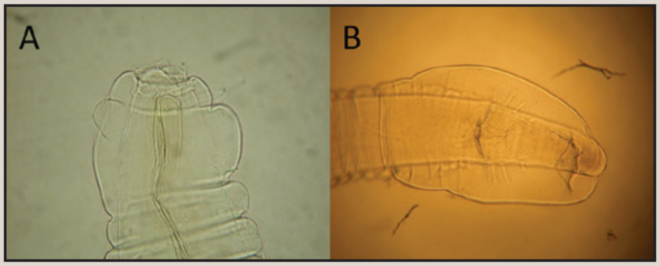

Fig. 2. *Physaloptera hispida*, cleared in phenol solution, showing traits distinctive of the genus including an anterior collarette (A) and posterior wide, muscular alae (B) around the tail of a male with both pedunculate (stalked) and sessile papillae.

Fig. 2), an intestinal parasitic roundworm known to infect *Sigmodon hispidus* (Hispid Cotton Rat) and *Oryzomys palustris* (Rice Rat) as definitive hosts (Kinsella 1988. Proc. Helminthol. Soc. Wash. 55:275–280; Kinsella 1974. Am. Mus. Novit. 2540). Parasites examined included adult males and gravid females. While snakes are known to be paratenic hosts of larval *Physaloptera* spp. (Goldberg et al. 2002. Southwest. Nat. 47:307–310) and definitive hosts to several *Physaloptera* spp. (Matias et al. 2020. Zootaza 4766:173–180), to our knowledge adult *P. hispida* have not been reported from snakes. We are unable to definitively determine if adult *P. hispida* infecting this python are remnants of the rodent prey recovered from the python's stomach and feces or if they were surviving within the python's gut independent of the rodent prey. As the rodent prey item recovered from the python was in late-stage decomposition and the feces consisted of fur and bone fragments, it could be expected that any *P. hispida* using the rodent as a definitive host would have been similarly decomposed, and not viable as were the roundworms we observed. Conversely, as intestinal parasites, the ability of *P. hispida* to prevail in the python's stomach well beyond decomposition of its rodent host is probable. Nonetheless, gravid viable female *P. hispida* were recovered from *P. bivittatus*, indicating pythons may aid the spread of this parasite. Therefore, we cautiously report the first instance of an invasive *P. bivittatus* as a reservoir host of adult *P. hispida*. As a reservoir host of *P. hispida*, pythons may increase transmission of this parasite, through fecal excretion of eggs and expulsion of gravid female parasites, among sympatric native mammals susceptible to infection.

MCKAYLA M. SPENCER, Florida Fish and Wildlife Conservation Commission, Sunrise, Florida, USA (e-mail: mckayla.spencer@myfwc.com); **MELISSA A. MILLER**, University of Florida, Fort Lauderdale Research and Education Center, Fort Lauderdale, Florida, USA (e-mail: melissamiller@ufl.edu); **ALI COURTEMANCHE**, Florida Fish and Wildlife Conservation Commission, Sunrise, Florida, USA ; **JOHN M. KINSELLA**, Helm West Laboratory, Missoula, Montana, USA (e-mail: wormdwb@aol.com); **SARAH FUNCK**, Florida Fish and Wildlife Conservation Commission, West Palm Beach, Florida, USA.

***TANTILLA HOBARTSMITHI* (Smith's Black-headed Snake). PREDATION.** *Tantilla hobartsmithi* is a small (up to 313 mm total length) nocturnally active snake with a distribution in the United States that includes parts of Arizona, California, Colorado, Nevada, New Mexico, Texas, and Utah. (Ernst and Ernst 2003. Snakes of the United States and Canada, Smithsonian Books, Washington, D.C. 668 pp.). In much of its range, *T. hobartsmithi* occurs in habitats also occupied by scorpions of the genus *Hadrurus* (desert hairy scorpions). Scorpions of this genus are large (averaging 150 mm total length), nocturnally active, and have been reported to prey on small snakes (McCormick and Polis 1990. *In* Polis [ed.] The Biology of Scorpions, pp. 294–320, Stanford University Press, Stanford, California).

Fig. 1. *Tantilla hobartsmithi* held in the chelicerae of a *Hadrurus* scorpion, both dead on the road in southern Clark County, Nevada, USA.

On 21 June 2014, at 2044 h, while conducting a road survey in southern Clark County, Nevada, USA (36.1708°N, 115.4737°W; WGS 84; 1446 elev.), we encountered a 146 mm (total length) *T. hobartsmithi* in the grasp of a *Hadrurus* scorpion. When found, both animals were dead on the road and apparently had been killed by the same vehicle (Fig. 1). The tail of the *Tantilla* was still held in the chelicerae of the scorpion, indicating that cheliceral mastication was underway at the time of death. Both were collected and the specimens were deposited at Monte Bean Museum Life Science Museum, Brigham Young University at Provo Utah (BYU 51615) and verified by Alison Whiting.

During a three-year participation in the Nevada Department of Wildlife nocturnal road surveys of this transect, *T. hobartsmithi* ranked fifth in encounter frequency among fourteen species recorded (17 of 174 snakes observed). *Hadrurus* scorpion observations were not individually documented but occurred at greater frequency than those of *Tantilla*. While it could not be ruled out, the likelihood of the *Tantilla* having been a roadkill scavenged by the scorpion does not seem likely in light of the observations of *Hadrurus* by Bub and Bowerman (1979. J. Arachnology 7:243–253). In their study of *H. arizonensis*, they found that "immobile prey did not elicit either orientation or grasp attempts."

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ROBERT W. MCKEEVER (e-mail: rwmckeever@earthlink.net) and **JASON L. JONES**, Nevada Department of Wildlife, 3373 Pepper Lane, Las Vegas, Nevada 89120 USA (e-mail: jljones@ndow.org).

***TRACHISCHIUM GUENTHERI* (Rose-belly Worm-eating Snake). PREDATION.** *Trachischium guentheri* is a fossorial natricine colubrid snake, reaching a total length of 42 cm. The species is known to prefer damp and moist areas and favors living under boulders, rocks and fallen logs (Chettri et al. 2009. Russian J. Herpetol. 16:177–182). It is distributed across the mountainous regions of India, Bangladesh, Nepal, Bhutan, and China (Wallach et al. 2014. Snakes of the World: A Catalogue of Living and Extinct Species. CRC Press, Boca Raton, Florida. 1209 pp.; Wang et al. 2019. Zootaxa 4688:101–110), where it is known from elevations between

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FIG. 1. Predation of *Trachischium guentheri* by *Urocissa flavirostris* in Lachen Valley, North Sikkim, India.

900 and 2600 m (Schleich and Kästle [eds.] 2002. The Amphibians and Reptiles of Nepal: Biology, Systematics, Field Guide. Koeltz Scientific Books, Koenigstein, Germany. 1201 pp.). Like other species of this genus, *T. guentheri* feeds on insects and annelids, however, very little is known about its ecology and natural history, including its predators. Herein, we report predation of *T. guentheri* by a Yellow-billed Blue Magpie (*Urocissa flavirostris*).

At 0638 h on 3 October 2021, while observing birds along a road in a human-dominated area of Lachen Valley in North Sikkim, India (27.7284°N, 88.5516°E; WGS 84; 2675 m elev.), we observed an adult *U. flavirostris* swoop down from a tree branch and catch an adult *T. guentheri* from the litter laden forest floor. The bird successfully caught the snake in its beak and flew to a perch in a nearby tree branch (Fig. 1), where it started tearing off the head using its talons and consuming the *T. guentheri*. After ca. 2 min, the bird flew away, holding the snake, across the valley into the forested area about 300 m from the initial sighting, making it impossible to further observe or photograph it completely consume the snake.

Urocissa flavirostris is mainly insectivorous but is known to feed on small reptiles (Madge 2020. *In* del Hoyo et al. [eds.], Birds of the World, Cornell Lab of Ornithology, Ithaca, New York. https://doi.org/10.2173/bow.gobmag1.01). However, to our knowledge, this is the first report with photographic evidence of *U. flavirostris* preying on *T. guentheri*.

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ADITYA PRADHAN (e-mail: aditya.pradhan@atree.org) and **ARUN SUBBA**, Ashoka Trust for Research in Ecology and the Environment, Regional Office Eastern Himalaya-Northeast India, NH 10 Tadong, Gangtok-737102, Sikkim, India (e-mail: arun.subba@atree.org); **TAMDING CHEWANG LACHENPA**, Biodiversity Management Committee, Lachen-737120, Sikkim, India (e-mail: dezoporough@gmail.com).

***UROMACER CATESBYI* (Blunt-headed Hispaniolan Vinesnake). ESCAPE BEHAVIOR.** Snakes in the Hispaniolan dipsadid genus *Uromacer* are slender, elongated, arboreal, and diurnally active. At 2100 h on 6 January 2022, at a site near the shore of Lago Enriquillo, south of La Descubierta, Independencia Province, Dominican Republic (18.56197°N, 71.72614°W; WGS 84), a roosting *Uromacer catesbyi* (715 mm SVL, stub tail) was observed perched at a height of ca. 6 m on thin, bare branches in a 10-m tall tree in wooded riparian habitat. As a means to capture it, the branches on which the snake was perched were shaken in order to induce the snake to move or fall. The snake progressively moved to a point where most of its body was hanging from a branch and eventually fell in a vertically straight orientation. At ca. 4 m above the ground (and about 1 m in front of one of us, ML), the snake conspicuously flattened its body to more than two times the normal width. Its pale bright greenish-yellow venter was very conspicuous when lit with the headlamp. No body undulations were observed; the snake was not gliding in the manner described for species of *Chrysopelea* (e.g., Socha 2011. Integr. Comp. Biol. 51:969–982). After the snake landed it remained momentarily motionless; when approached it started to flee.

This is the first observation of this behavior in a species of *Uromacer*. The three species of *Uromacer* are highly arboreal and spend most of their time in bushes and trees (Henderson and Powell 2009. Natural History of West Indian Reptiles and Amphibians. University Press of Florida, Gainesville, Florida. 495 pp.). Of the three species, *U. catesbyi* is the most heavy-bodied: range of mid-body circumference/SVL is 0.058–0.083; that of *U. oxyrhynchus* is 0.030–0.041 (Henderson 1982. Amphibia-Reptilia 3:71–80); of the three species, *U. catesbyi* is, at least superficially, the closest to a *Chrysopelea* body type. As they are likely to perch higher in the vegetation at night when inactive, this escape behavior may serve as a mechanism for safely landing while avoiding a potential predator.

MIGUEL A. LANDESTOY T., Escuela de Biología, Universidad Autónoma de Santo Domingo, Distrito Nacional, Dominican Republic (e-mail: hispanioland@gmail.com); **ROBERT W. HENDERSON**, Section of Vertebrate Zoology, Milwaukee Public Museum, 800 W Wells Street, Milwaukee, Wisconsin 53233, USA.