NATURAL HISTORY NOTES

CAUDATA — SALAMANDERS

PLETHODON DIXI **(Dixie Cavern Salamander). HABITAT.** *Plethodon dixi* was first described by Pope and Fowler (1949. Nat. Hist. Misc. 47:1–4), but its species status was later refuted (Highton 1962. Bull. Florida State Mus. 6:235–367). However, this taxon was recently resurrected by Kuchta et al. (2018. Zool. Scripta 47:285–299) based on phylogenetic evidence. Pope and Fowler (1949, *op. cit.*) described *P. dixi* as occurring solely within Dixie Caverns and New Dixie Caverns in Roanoke County, Virginia, USA, and during multiple recent revisions of the *P. wehrlei* species complex (Kuchta et al. 2018, *op. cit.*; Felix et al. 2019. Zootaxa 4609:429–448) the confinement of this species to these two caves has been assumed. Herein, I report terrestrial observations of salamanders morphologically consistent with *P. dixi* from a forested ridgeline 5 km NW of the Dixie Caverns cave system.

Between 2000 and 2030 h on 26 April 2018, I observed ca. 20 adult *P. dixi* on the southwestern ridgeline of Fort Lewis Mountain, near the Montgomery–Roanoke County line, Virginia, USA (37.26356°N, 80.21919°W; WGS 84). I discovered three individuals under rotting logs shortly after sunset (2000 h) and observed an additional 15–20 active on the surface over the next 30 min. All individuals were located directly atop the ridgeline. I found no evidence of fissures, caves, or rock outcroppings in the area, though I did not extensively search the mountainside. Local vegetation on the ridgeline consisted mostly of 20–50-year-old *Acer* and *Quercus* sp. intermixed with multiple other small deciduous trees. It rained lightly throughout the course of my observations, and the air temperature was ca. 15°C.

Fig. 1. *Plethodon dixi* observed atop the southwestern ridgeline of Fort Lewis Mountain, in Virginia, USA.

Several months after my observations, the area where I observed all salamanders was clearcut to allow for the construction of the Mountain Valley Pipeline; a proposed natural gas pipeline that will span ca. 500 km across Virginia and West Virginia. It is unclear how this action will ultimately affect the status of these salamanders, but clearcuts have been implicated in the declines of several closely related plethodontids (deMaynadier and Hunter 1995. Environ. Rev. 3:230–261). Therefore, given the data deficient status and likely microendemic distribution of *P. dixi*, it is possible that recent clearcutting of Fort Lewis Mountain ridgeline will substantially impact populations locally or even range-wide (e.g., if gene flow is reduced). My observations thus highlight the importance of considering data deficient and microendemic taxa when conducting environmental assessments of proposed development projects.

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PLETHODON DORSALIS **(Northern Zigzag Salamander). PREDATION.** Natural predators of *Plethodon dorsalis* are poorly documented (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, D.C. 587 pp.). In laboratory trials, *P. dorsalis* avoid substrates marked with the scent of *Diadophis punctatus*, suggesting these snakes may be significant predators of *P. dorsalis* (Cupp 1994. Anim. Behav. 48:232–235). Here, we report a field observation of *D. punctatus* preying upon *P. dorsalis*.

At 1524 h, on 3 April 2019, we observed an adult *D. punctatus* within a narrow, vertical crevice within a limestone bluff, 1.2 m above the ground in LaRue-Pine Hills/Otter Pond Research Natural Area, Shawnee National Forest, Union County, Illinois, USA (37.55993°N, 89.44095°W; WGS 84). Initially, the snake's head was obscured by moss, but its body movements suggested it was attempting to move down and backwards into a larger hollow in the crevice. Within one minute, the snake pulled its head and forebody downward into the larger space, revealing an adult *P. dorsalis* in its mouth. The snake was holding the salamander just behind the head (Fig. 1). The salamander's tail was coiled around the snake, a defensive strategy employed by plethodontid salamanders to thwart snake predation (Arnold 1982. Copeia 1982:247–253). Although salamanders may comprise a large proportion of their diet (Uhler et al. 1939.

PHOTO BY MARY B. BOEHLER

Fig. 1. *Diadophis punctatus* preying upon *Plethodon dorsalis*.

Trans. N. Am. Wildl. Conf. 4:605–622), *D. punctatus* were not previously confirmed predators of *P. dorsalis* (Ernst and Ernst 2003. Snakes of the United States and Canada. Smithsonian Institution Press, Washington, D.C. 680 pp.).

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ANURA — FROGS

***ANAXYRUS TERRESTRIS* (Southern Toad) and *RHINELLA MARINA* (Cane Toad). INTERSPECIFIC AMPLEXUS.** *Anaxyrus terrestris* (Bufonidae) is a native species in Florida, USA, with a range extending northward through most of the southeastern states. *Rhinella marina* (Bufonidae) is an invasive, exotic species in Florida with a current established range throughout portions of the southern peninsula north to Tampa. In regions throughout the world where *R. marina* is an established exotic, many examples of negative interactions occur with native anurans through both predation and competition (Shine 2010. Quart. Rev. Bio. 85:253–291; Meshaka and Powell 2010. Florida Scient. 73:175–179). One of the less frequently observed interactions is reproductive interference through interspecific amplexus. Although this behavior has been reported for *R. marina* (Machado and Bernarde 2011. Herpetol. Notes. 4:167–169), to the best of our knowledge this is the first observation of interspecific amplexus between *A. terrestris* and *R. marina*.

Between 0300 h and 0600 h during June–August 2018, four instances of interspecific amplexus between *A. terrestris* and *R. marina* were observed at three separate locations, where more than 1100 *R. marina* were caught by hand and removed

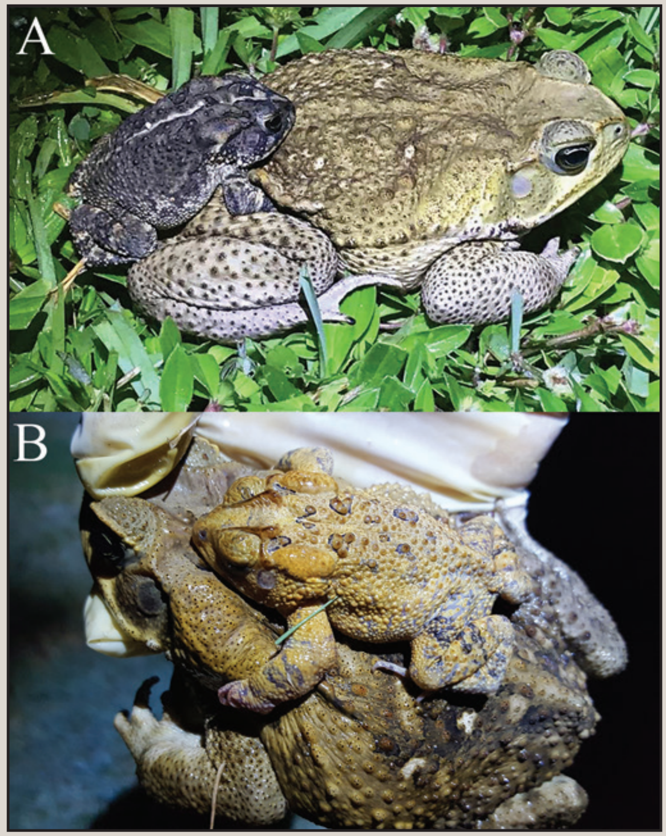

Fig. 1. Male *Anaxyrus terrestris* engaging in amplexus with *Rhinella marina*. A) inguinal amplexus at Bonita Springs, Florida, USA; B) axillary amplexus at Naples, Florida, USA.

in southwest Florida. Two instances were photographed (Fig. 1). Two of the locations were near artificial lakes in residential golf course communities in Naples, Collier County, Florida, USA (26.18566°N, 81.74964°W and 26.28484°N, 81.62964°W; WGS 84), and the third location was near artificial lakes in a gated community in Bonita Springs, Lee County, Florida, USA (26.33125°N, 81.70987°W; WGS 84). Precisely how frequently interspecific amplexus involving *R. marina* occurs in southwest Florida, or if it adversely affects the fitness of native populations, is unknown.

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***ANAXYRUS MICROSCAPHUS* (Arizona Toad) and *LITHOBATES YAVAPAIENSIS* (Lowland Leopard Frog). PREDATION.** On 28 May, and 6, 8 June 2017, I observed several Ravens (*Corvus corax*) and Turkey Vultures (*Cathartes aura*) feeding on live and dead toadlets and tadpoles of *Anaxyrus microscaphus* and *Lithobates yavapaiensis* in the shallow and drying side rivulets and ponds of the Big Sandy River in Mohave County, Arizona, USA (35.53000°N, 113.56000°W; WGS 84). The birds continued to feed even though at times I was less than 3 m away in my car. On 8 June 2017, I saw no live toadlets or tadpoles, though the birds were picking up dead frog tadpoles, toadlets, and fish. To my knowledge, this is the first report of predation by *Corvus corax* and *Cathartes aura* on these frog species (Dodd 2013. Frogs of the United States and Canada. Johns Hopkins University Press, Baltimore, Maryland. 982 pp.).

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***BOANA ALBOMARGINATA*. (White-edged Treefrog). ECTOPARASITES.** *Boana albomarginata* is found in Atlantic rainforests of eastern Brazil from Paraiba to Santa Catarina (Frost 2019. http://research.amnh.org/vz/herpetology/amphibia/Amphibia/Anura/Hylidae/Cophomantinae/Boana/Boana-albomarginata; 21 Feb 2019). In this note, we report the first record of mosquito parasitism involving the species *Mansonia wilsoni* with *B. albomarginata*. On 13 July 2018, during herpetological surveys in the Tapacurá Ecological Station, municipality of São Lourenço da Mata, metropolitan region of Recife, in Pernambuco, Brazil (25.02990°S, 91.08260°W; WGS 84), two specimens of *B. albomarginata* were perched in amplexus being parasitized by three individuals of the species *Mansonia wilsoni* (Fig. 1). As far as we are aware this is the first report of mosquito ectoparasitism in *B. albomarginata*.

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Fig 1. *Boana albomarginata* being parasitized by *Mansonia wilsoni*.

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***DENDROPSOPHUS MINUTUS* (Lesser Treefrog). PREDATION.** In this study, we recorded the predatory interactions between two spiders, *Thaumasia* sp. (Pisauridae) and *Parawixia* sp. (Araneidae), and the Neotropical hylid frog *Dendropsophus minutus*. At 2113 h on 17 January 2018 we recorded *Parawixia* sp. preying on *D. minutus* on a shrub close to a stream in Atlantic rainforest located in the city of Igaratá, São Paulo, Brazil (23.09994°S, 46.17828°W; WGS 84; Fig. 1A, C, D). This frog measured 2.40 cm SUL, while the spider had a body length of 2.30 cm. At 2058 h on 18 January 2018 we observed *Thaumasia* sp. capturing *D. minutus* on the surface of the water at the same location (Fig. 1B). This spider measured 2.56 cm, but we could not estimate the size of the prey.

Predation of frogs by *Thaumasia* sp. is frequently observed because fishing spiders are specialized for the capture of aquatic vertebrates (Nyffeler and Pusey 2014. PLoS ONE 9:e99459). There is a previous record for *D. minutus* being consumed by *Thaumasia velox* (Bovo et al. 2014. Herpetol. Notes 7:329–331). There are also records of *D. minutus* being captured by other spiders, such as *Ancylometes rufus* (Ctenidae), *A. concolor* (Ctenidae), and *Dolomedes* sp. (Pisauridae; Menin et al. 2005. Phyllomedusa 4:39–47). On the other hand, our report of predation by *Parawixia* sp. is the first record of an orb-weaving spider feeding upon *D. minutus*. Orb-weaving spiders usually build webs to intercept and capture insects (Xavier et al. 2017, J. Arachnol. 45:160–165), but they can opportunistically prey on vertebrates. For example, *Parawixia* sp. opportunistically captures vertebrates such as lizards (Ranade 2015. Reptil. Rap. 17:56–58) and bats (Nyffeler and Knörnschild 2013. PLoS ONE 9:e99459). Our record could be a consequence of an explosive

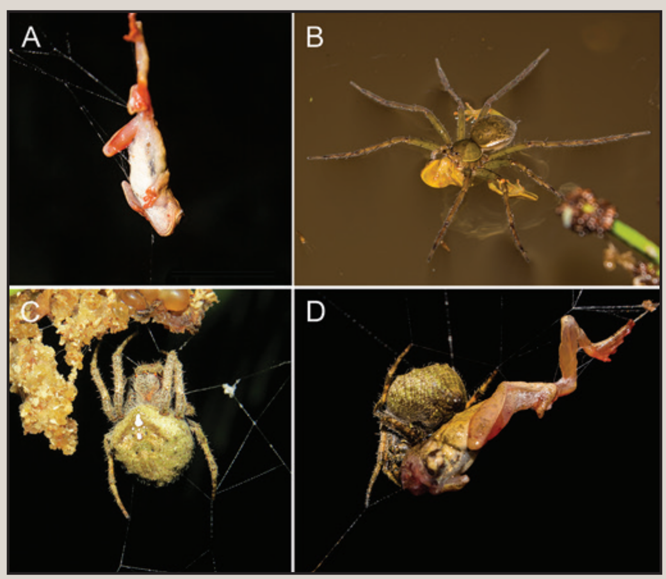

Fig. 1. A) *Dendropsophus minutus* (Hylidae) trapped in a spider web; B) *Thaumasia* sp. feeding on *D. minutus* on the surface of the stream; C) *Parawixia* sp. (Araneidae) on its web; D) *Parawixia* sp. feeding on *D. minutus*.

mating aggregation of *D. minutus* (Leivas et al. 2018. Herpetol. Notes 11:395–403), in which the intense activity of frogs created suitable opportunities for predation by spiders using different foraging strategies.

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***HADDADUS BINOTATUS* (Clay Robber Frog). PREDATION.** The frog species *Haddadus binotatus* (Craugastoridae) is distributed throughout coastal Brazil, ranging from the northeastern State of Bahia to the southern state of Rio Grande do Sul (Carvalho and Dias 2012. Herpetol. Notes 5:419–422). Even though it is a locally common leaf-litter species of the Atlantic Rainforest, its natural history is still understudied, and little is known of its ecological interactions. Herein, we report an interaction between army ants and *H. binotatus*.

At 1145 h on 2 February 2019 I noticed a column of army ants (*Eciton* sp.) on the edge of a frequently used trail at Serra da Cantareira, the extensive Atlantic Forest urban area next to São Paulo, Brazil (23.25450°S, 46.38030°W; WGS 84; 889 m elev.). Several arthropods, such as grasshoppers and harvestmen, were seen or heard escaping the column, whilst simultaneously being chased by several parasitoid flies (Sarcophagidae). An adult individual of *H. binotatus* was then seen jumping on the trail away from the ants, which were biting and stinging it (Fig. 1). Since *H. binotatus* is mainly nocturnal (Rocha et al. 2007. Trop. Zool. 20: 99–108), it is likely that it was only moving during a dry hot morning due to the raiding ants. A frog died after being parasitoidized by a sarcophagid fly while hiding adjacent to an army ant column (Rettenmeyer 1961. Arthropods Associated with Neotropical Army Ants with a Review of the Behavior of these Ants [Arthropoda; Formicidae; Dorylinae]. Ph.D. Dissertation, University of Kansas, Lawrence, Kansas). Neotropical army ants rarely feed on live small vertebrates. However, they occasionally sting and kill small-sized vertebrates such as lizards and snakes (Schneirla 1971. Army Ants: A Study in Social Organization. W. H. Freeman & Co., San Francisco, California. 349 pp.). This suggests that army ants can be a potential hazard to frog species either involving direct mortality or indirect effects such as desiccation or parasitism by parasitoid flies.

Fig. 1. *Haddadus binotatus* bitten by *Eciton* sp. during a swarming raid.

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***HYPEROLIUS ADSPERSUS* (Sprinkled Long Reed Frog). PREDATION.** Spiders are known predators of adult and larval anurans in both temperate and tropical regions, but such predation events have rarely been documented in the Afrotropics. In Tanzania, fishing spiders (Pisauridae: *Thalassius* sp.) prey on both metamorph and adult *Hyperolius spinigularis* reed frogs (Vonesh 2005. Oecologia 143:280–290). Likewise, Portik et al. (2018. Herpetol. Rev. 49:397–408) reported predation of an adult female *H. fusciventris* reed frog by a fishing spider (*Nilus* sp.) and Barej et al. (2009. Herpetol. Notes 2:137–139) reported predation of a *Leptopelis brevirostris* tree frog by a wandering spider (Ctenidae), both in Cameroon. Here, we report predation of a *H. adspersus* reed frog by a fishing spider (Pisauridae: *Nilus* sp.) in Gabon.

At 2053 h on 16 December 2017, we observed an adult *H. adspersus* being consumed by a spider (Fig. 1) in an open, flooded grassland at the edge of a lowland forest patch in the vicinity of Yenzi and Gamba town, Nyanga Province, Gabon (2.78011°N, 10.03758°E; WGS 84; 2 m elev). The spider (Pisauridae: *Nilus* sp.) was hanging by its hind legs from tall grasses ca. 30 cm above the water. The frog was already partially digested when we happened

FIG. 1. Predation of *Hyperolius adspersus* by a fishing spider (Pisauridae: *Nilus* sp.) in Nyanga Province, Gabon.

upon the spider, so we did not attempt to intervene and preserve a voucher specimen of the frog. We observed several species of *Hyperolius* chorusing at this site including *H. adspersus*, *H. platyceps*, *H. tuberculatus*, and *H. olivaceus*, as well as three larger anuran species (*Leptopelis aubryi*, *Ptychadena perreti*, and *Hoplobatrachus occipitalis*).

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ITAPOTIHYLA LANGSDORFFII **(Ocellated Treefrog). DEFENSIVE BEHAVIOR.** At least 30 behavioral defense strategies are described for anurans, including eye-protection (Toledo et al. 2011. Ethol. Ecol. Evol. 23:1–25). Here, we observed an individual of *Itapotihyla langsdorffii* displaying eye-protection during a capture by hand. At 2125 h on 12 May 2017, during a night survey of the inventory research in Reserva Particular do Patrimônio Natural - Reserva Natural Guaricica, Brazil (25.30000°S, 48.66666°W; WGS 84), we captured an individual of *I. langsdorffii* which remained in the eye-protection position with eyes opened for at least 2 min while we identified the species (Fig. 1). We did not observe other defensive behaviors such as vocalization, cloacal urine, or others common in anurans. Eye-protection behavior has been reported in other families of anurans such as Rhacophoridae (Maát and Jablonski 2011. Herpetol. Rev. 42:307), Mantellidae (Andreone 2002. Herpetol. Rev. 33:299–300), and Ranidae (Haberl and Wilkinson 1997. Herpetol. Bull. 61:16–20), however, most instances, such as the one we report here, were observed in hylids (Toledo et al. 2011, *op. cit.*).

FIG. 1. Eye-protection behavior of *Itapotihyla langsdorffii* during capture.

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LEPTOPELIS FLAVOMACULATUS **(Brown-backed Tree Frog). INTERSPECIFIC AMPLEXUS.** Unusual forms of amplexus in anurans have been reported, including between males only (Mollov et al. 2010. Biharean Biol. 4:121–125), males with female of a different species (Bettaso et al. 2011. Herpetol. Rev. 42:578–621), males with dead animals (Bettaso et al. 2008. Herpetol. Rev. 39:384–498; Müller 2016. Herpetol. Notes 9:283–284), and even males with inanimate objects (Streicher 2008. Herpetol. Rev. 39:75; Mollov et al. 2010; Biharean Biol. 4:121–125). Most records on interspecific amplexus involve other frogs, and little is known regarding amplexus between amphibians and non-amphibians.

At ca. 2030 h on 10 March 2019, while surveying frogs in Amani Pond in Amani Nature Reserve, Eastern Usambara Mountains, Tanzania (5.09980°S, 38.63120°E; WGS 84; 917 m elev.), I observed a male *Leptopelis flavomaculatus* (Brown-backed Tree Frog) in amplexus with a slug (family Urocyclidae; Fig. 1) on a leaf about 1 m above the ground. The frog remained motionless when approached and was undisturbed by my closer observation, which lasted for 5 min. After photography was completed, I left the animals in their amplectic position. The slug was not identified to a more specific classification as dissection would be required (Rowson et al. 2017. ZooKeys 723:11–42). To my knowledge, this is the first record of amplexus between *L. flavomaculatus* and a urocyclid slug.

I thank D. Green for inviting me to join the McGill program in Amani Nature Reserve. It is through this program that this observation was made possible. Thanks also to J. John who not

Fig. 1. Interspecific amplexus between *Leptopelis flavomaculatus* and a slug in Tanzania.

only accompanied me to Amani, but also proposed surveying Amani Pond. Finally, I thank K. Howell for advice on this note and C. Liedtke for comments.

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LITHOBATES CATESBEIANUS **(American Bullfrog). DIET.** *Lithobates catesbeianus* is an opportunistic feeder whose diet consists of a wide array of prey species (Hirai 2004. Ecol. Res. 19:375–380). Aquatic or semi-aquatic vertebrates can account for a substantial proportion of *L. catesbeianus* diet (Werner et al. 1995. J. Herpetol. 29:600–607). Stomach contents were previously examined during a study of *L. catesbeianus* in Missouri, and prey listed from highest to lowest importance: crustaceans, insects, cicadas, mammals, amphibians and reptiles, and miscellaneous invertebrates (Korschgen and Baskett 1963. Herpetologica 19:89–99). *Lithobates catesbeianus* have been known to consume small birds which are associated with water, but this does not seem to be a common occurrence. A similar study reported finding a fledgling *Agelaius phoeniceus* (Red-winged Blackbird) in the stomach contents of a *L. catesbeianus*, and also discussed a local case of the same finding (Korschgen and Moyle 1955. Am. Midl. Nat. 54:332–341).

Our study site consists of two research areas on a privately-owned property in eastern Brunswick County, North Carolina, USA (34.04138°N, 78.01020°W; WGS 84). The research areas are 518 and 648 ha. These areas are predominately covered in pine savanna/woodlands, native warm season grass fields, and Carolina Bay. The dominant overstory species in the savanna/woodlands are *Pinus palustris* (Longleaf Pine) and *Pinus taeda* (Loblolly Pine), while the dominant groundcover plant is *Aristida stricta* (Wiregrass). Dominant species in grasslands include *Andropogon capillipes* (Chalky Bluestem), *Schizachyrium scoparium* (Little Bluestem), and *Panicum virgatum* (Switchgrass). Carolina Bays are dominated by *Ilex glabra* (Gallberry), *Luonia lucida* (fFetterbush), *Persea borbonia* (Red Bay), *Magnolia virginiana* (Sweetbay Magnolia), and other wetland shrubs. Hardwood drains, ponds and vernal pools, and fallow fields (seasonally disked fields predominantly composed of forbs) make up a small percentage of the overall landscape. Dormant season prescribed fire is implemented on approximately half of the property annually, as well as annual disking of fields. Meso-mammalian predator trapping and supplemental feeding are also implemented year-round throughout the property.

Fig. 1. Two neonate bobwhites removed from stomach contents of *Lithobates catesbeianus* after field dissection.

As part of an ongoing research project, *Colinus virginianus* chicks were captured at ca. 13 d post-hatching on 9 June 2018 using methods described by Smith et al. (2003. Wildlife Soc. Bull. 31:1054–1060) and radio-tagged. Upon relocation, one chick was located inside a *L. catesbeianus* on the edge of a vernal pool ca. 15 m from the quail's original position. Upon collection, we conducted a field dissection of the *L. catesbeianus* and discovered that it had consumed two *C. virginianus* chicks, both of which had been captured earlier that morning (Fig. 1). Weights of the chicks at capture were 18.5 and 15.25 g, and the total length (legs extended) of the *L. catesbeianus* upon dissection was 29.2 cm. To our knowledge, this is first recorded instance of *L. catesbeianus* predation on *C. virginianus* (Dodd 2013. Frogs of the United States and Canada. Johns Hopkins University Press, Baltimore, Maryland. 982 pp.).

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PHYSALAEMUS CROMBIEI **(Rãzinha-do-folhiço, rã-chorona). PREDATION.** At ca. 1800 h on 5 June 2018, on the edge of a dam located in a fragment of seasonal semideciduous forest in São Gonçalo do Rio Abaixo, Brazil (19.88120°S, 43.37530°W; WGS 84), an adult *Physalaemus crombiei* was found being preyed on by a male specimen of the spider *Ctenus medius* (Fig. 1). The behavior was observed for 20 min, and the arachnid remained immobile for the majority of the time with the anuran trapped by the chelicerae placed in the dorsal region between the cloaca and the left posterior thigh with pedipalps lending support. No more individuals were found in the area during the active search or vocalization of other males during sampling. This is the first predation record of *P. crombiei* by *C. medius* (Toledo 2005. Herpetol. Rev. 36:395–400).

Fig. 1. Predation of *Physalaemus crombiei* by *Ctenus medius* in São Gonçalo do Rio Abaixo, Brazil.

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***PLECTROHYLA GUATEMALENSIS* (Guatemalan Spikethumb Frog). SCAVENGING.** During visual encounter surveys in streams at Finca Carmona, Sacatepéquez, Guatemala (14.50986°N, 90.70108°W; WGS 84), we observed tadpoles of *Plectrohyla guatemalensis*. Around 200 tadpoles were counted in a stream and were observed feeding on periphyton. However, we also observed them scavenging a millipede (order Polydesmida; Fig. 1) and, more remarkably, on a dead adult of their own species (Fig. 2). Both observations of scavenging behavior were carried out by groups of around 30 individuals. The dead *P. guatemalensis* had recently died, as it showed little signs of decomposition and its skin had not been penetrated. Most tadpoles were feeding underneath it. Tadpoles are considered opportunistic scavengers (Altig et al. 2007. Freshwater Biol. 52:386–395) and animal tissue consumption could possibly enhance their growth (Crump 1990. Copeia 1990:560–564).

Scavenging on dead adults can pose a risk of exposure and transmission of chytridiomycosis in this especially susceptible genus (Altig et al. 2007, *op. cit.*). This behavior could be directly linked to mouth deformations due to chytrid infections that have been reported in the region for species of *Plectrohyla* and other genera such as *Ptychohyla* and *Lithobates* (Campbell and Smith 1992. Herpetologica 48:153–167; Fellers et al. 2001. Copeia 2001:945–953; Mendelson III et al. 2004. Rev. Biol. Trop. 52:991–1000). The mechanism of infection by scavenging of deceased adults is a topic that could be explored further in other susceptible species and genera, especially if determined using quantitative data.

Fig. 1. *Plectrohyla guatemalensis* tadpoles scavenging a millipede (order Polydesmida) in Sacatepéquez, Guatemala.

Fig. 2. *Plectrohyla guatemalensis* tadpoles scavenging a deceased adult conspecific in Sacatepéquez, Guatemala.

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***PSEUDACRIS REGILLA* (Pacific Treefrog). CALLING and TEMPERATURE TOLERANCE.** *Pseudacris regilla* is a highly tolerant species which is active under a wide range of habitats and temperatures (Stebbins 2003. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Company, Boston, Massachusetts. xiii + 533 pp.; Lannoo 2005. Amphibian Declines. University of California Press, Berkeley, California. 1094 pp.). Here, we report an unusual observation which reflects this tolerance: a breeding chorus of *P. regilla* in a frozen marsh.

During the night of 20 February 2018, at a large (24 ha) shallow wetland located in an active floodplain of the Tualatin River, Washington County, Oregon, USA (45.50470°N, 122.99000°W;

WGS 84; 39 m elev.), the surface of the wetland froze. Measured air temperatures were at or below freezing from 1920 h on 20 February to 0950 h on 21 February, with a nighttime low of -2.9°C. During this period, 0.5 cm of precipitation fell as snow. At 1040 h on 21 February 2018, we heard a chorus of ca. 10 male *P. regilla* calling from the wetland, ca. 30 m from shore. The surface of the wetland was completely frozen over; ice thickness ranged from 0.3–0.6 cm. Frogs were calling from the dead stems of marsh plants (*Alisma plantago-aquatica*, *Madia glomerata*, and *Polygonum hydropiperoides*) which protruded above the ice and were lightly covered with snow. Weather at this time was sunny, with high clouds, low wind (< 1 kph NNE), and no precipitation. Measured air temperature at calling frogs was 0.5°C. The frogs were all making breeding calls (diphasic advertisement calls; Allan 1973. Herpetologica 29:366–371). This chorus continued all morning. At 1140 h, the number of calling frogs had increased to >30 males; the surface of the wetland was still frozen, and the measured air temperature at calling frogs was 1.6°C.

Two aspects of our observations merit discussion. First, this observation may represent the lowest temperature at which *P. regilla* has been reported to call. Schaub and Larsen (1978. Herpetologica 34:409–416) reported calling in *P. regilla* at air temperatures as low as 0.5°C and water temperatures of 2.0°C. Although the air temperature at calling frogs in this case reported here was 0.5°C, the water surface temperature was 0°C (i.e., it was ice). In addition, observations in Schaub and Larsen (1978, *op. cit.*) were made in northern Idaho, and thus refer to frogs tentatively referred to the new taxon *P. sierra* (*sensu* Recuero et al. 2006. Mol. Phylogen. and Evol. 39:293–304; Recuero et al. 2006. Mol. Phylogen. and Evol. 41:511).

Dodd (2013. Frogs of the United States and Canada. Johns Hopkins University Press, Baltimore, Maryland. 982 pp.) states that "calling males even have been reported to sing from under ice sheaths or during falling snow"; however, neither a reference nor context are provided for this statement. Indeed, we have repeatedly observed adult *P. regilla* giving non-advertisement calls (outside the breeding season) from perches in shrubs or weeds under small caps of snow. We have also repeatedly observed choruses of breeding males (n = 20 to >100 individuals) during freezing weather, including snowstorms (e.g., water temperature = 2.0–3.9°C, air temperature = -1.7°C, wind = 2 kph). However, in none of these instances was the wetland's surface frozen, as it was in the observation we reported here.

Second, the positions of the frogs we observed (i.e., in weeds above the ice) suggests that they remained above the water's surface during the night. Alternatively, they would have had to move >30 m out into the marsh prior to 1040 h in order to occupy the calling positions in which they were observed. This, in turn, suggests a degree of freeze tolerance similar to that determined experimentally for *P. sierra* by Croes and Thomas (2000. Copeia 2000:863–868). We believe the latter possibility merits further investigation, and welcome correspondence from other researchers on this topic.

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***PSEUDACRIS REGILLA* (Pacific Treefrog). PREDATION.** Reported avian predators of *Pseudacris regilla* include wading birds (egrets and herons), kingfishers (*Megaceryle alcyon*), and ducks (*Anas platyrhynchos*; see Rorabaugh and Lannoo 2005 *In* Lannoo [ed.], Amphibian Declines: The Conservation Status of United States Species, pp. 478–484. University of California Press, Berkeley, California). However, to the best of our knowledge, raptors have not been reported as predators of *P. regilla* (Dodd 2013. Frogs of the United States and Canada. Johns Hopkins University Press, Baltimore, Maryland. 982 pp.). Here, we relate observations of a Red-tailed Hawk (*Buteo jamaicensis*) feeding on *P. regilla*.

These observations occurred at the Jackson Bottom Wetlands Preserve (JBWP), a series of floodplain wetlands adjacent to the Tualatin River, Washington County, Oregon, USA (45.50470°N, 122.99000°W; WGS 84; 39 m elev.). At the time of observation, the Tualatin River had flooded most of the surrounding lowlands (an area > 2000 ha); at JBWP, only the tops of a few hills remained above water. At 1300 h on 31 January 2018, we saw a juvenile *B. jamaicensis* atop one of these hills. The hawk was sitting on the ground, pecking at something. When the hawk was approached, it flew off. The object that it had been pecking at was found to be an adult male *P. regilla*. The *P. regilla* was upside down (on its back), with limbs pulled in close to its body. It remained in that position for ca. 10 minutes, while we walked around the area. At the end of that time, it remained upside down. When gently righted, it sat motionless for several minutes and then slowly crawled away. Weather was partly cloudy, with no wind; air temperature was 7.4°C.

At 1431 h on 1 February 2018, we saw what appeared to be the same hawk sitting on the same hill ca. 20 m south of where it was spotted the previous day. By moving quietly, we were able to approach the hawk closely and observe it from 2 m away. The hawk was pecking at an adult *P. regilla*. While we watched, the hawk swallowed the *P. regilla* and, after sitting in place for a minute, flapped up and landed a few feet away. From this new position, it was seen to step on another *P. regilla*, holding it down with its left foot while it leaned over and grabbed it with its beak. After the hawk ate this *P. regilla*, it flew off, likely due to our proximity and attempts to take a picture. However, it was seen again ca. 7 min later, sitting on a low tree branch ca. 30 m away, with what appeared to be another *P. regilla* in its beak. Weather at the time of observation was overcast, with light rain; air temperature was 7.7°C. A cursory examination of the hill revealed *P. regilla* to be abundant there; >20 frogs were seen in 3 m^2.

Over the next several weeks, we observed the same hawk capturing *P. regilla* on multiple occasions. In most cases, it perched on a nearby limb or pole before flying down to the hill to catch a frog. Following capture of the first frog, it often 'walked' a short distance among the grass to catch another. As the weather warmed, it used the same behavior and perch locations to capture garter snakes (*Thamnophis sirtalis*); we observed it catch four *T. sirtalis* in this way.

Red-tailed hawks are generalist predators which consume an incredibly wide variety of prey, from insects and earthworms to a variety of mammals (Fitch et al. 1946. The Condor 48:205–237; Sibley 2001. The Sibley Guide to Bird Life and Behavior. Alfred A. Knopf, New York. 608 pp.), and even Tui Chub (*Siphateles bicolor*; J. Bowerman, unpubl. data). Anurans are at least occasionally taken as prey; in a sample of 754 red-tailed hawks, McAtee (1935. Food habits of common hawks. U.S. Dept. of Agriculture Circular 370:1–36) found frogs in the stomachs of 13 birds, and toads in the stomachs of eight. Fisher (1893. The Hawks and Owls of the United States. Washington, D.C. 210 pp.) reported that "in the warmer parts of the year, the Red-tail feeds extensively on snakes and frogs…" and that, of 562 *B. jamaicensis* stomachs which he examined, 37 contained remains of "batrachians and reptiles". A review by Ross (1991. Wisconsin Endangered Resources Report 59. Wisconsin DNR, Madison, Wisconsin. 33 pp.) lists three temperate anurans, *Rana clamitans* (= *Lithobates clamitans*), *R. sylvatica* (= *L. sylvaticus*), and *Bufo americanus* (= *Anaxyrus americanus*), as prey of *Buteo jamaicensis*. Finally, Santana and Temple (1988. Biotropica 20:151–160) reported both *Eleutherodactylus* sp. and *Bufo marinus* (= *Rhinella marina*) as prey items of nesting *B. jamaicensis* in Puerto Rico.

Observations indicate that juvenile birds go through a "learning" phase in which they attempt capture of a wide variety of prey species (Fitch et al. 1946, *op. cit.*; J. Bowerman, pers. comm.). We believe that the age of the *B. jamaicensis* we observed, coupled with a temporary reduction in available food during flooding, contributed to the use of *P. regilla* as a food source.

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***RHINELLA JIMI* (Cururu Frog). ARBOREALITY.** *Rhinella jimi* is a large bufonid (147 mm SVL; Stevaux 2002. Rev. Bras. Zool. 19:235–242) found mainly in open areas close to urbanized regions and forest edges (Garba et al. 2010. S. Am. J. Herpetol. 5:151–156). Currently, the distribution known for the species is restricted to the Atlantic Forest and Caatinga from Maranhão to Bahia, Brazil. *Rhinella jimi* is nocturnal and terrestrial, exhibits explosive reproduction, and feeds mostly upon insects. Microhabitats documented to date include the humid shore of ponds, floating in the water, or in undergrowth (Moreira and Barreto 1996. Rev. Bras. Zool. 13: 313–320; Barbosa and Alves 2014. Gaia Sci. 8: 215–225). Herein, we present the first observation of *R. jimi* arboreal activity.

At 1830 h on 19 July 2018, among artificial dams in a pasture area within the Caatinga region, municipality of Craíbas, Alagoas, Brazil (9.67651°S, 36.76197°W; WGS 84; 226 m elev.), we observed adult individuals of *R. jimi* perched in trees (*Mimosa* sp.) and on top of bird nests (*Pseudoseisura cristata*) built within branches of the same tree (Fig. 1). The average height for the toads was ca. 1.5 m above of ground, with some individuals slightly above the ground and others over 2 m high. To our knowledge, this is the first record of arboreal habit in *R. jimi*.

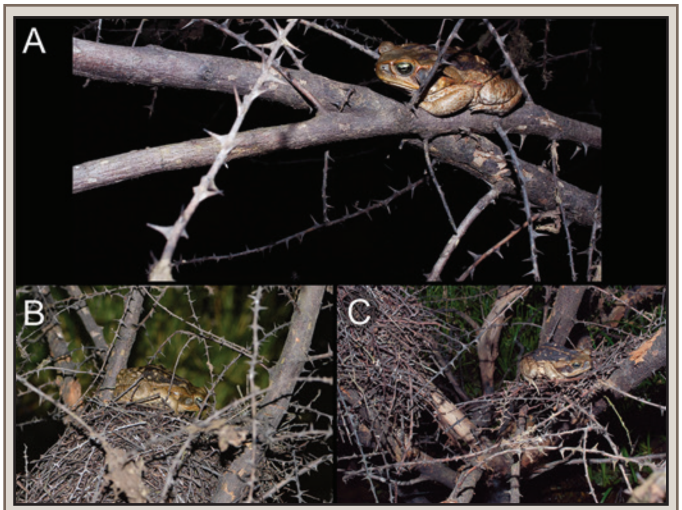

Fig 1. *Rhinella jimi* frog in tree at 2 m in height in the municipally of Craíbas, Alagoas state, Brazil. A) individual about the bifurcation of a branch attached to the main trunk; B, C) individuals on top of bird's nests.

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***SCAPHIOPUS HOLBROOKII* (Eastern Spadefoot) and *HYLA CHRYSOSCELIS* (Cope's Gray Treefrog). INTERSPECIFIC AMPLEXUS.** In explosive breeding anurans, males will attempt to grasp virtually any moving object in a trial and error process of obtaining a mate (Wells 2007. The Ecology and Behavior of Amphibians. University of Chicago Press, Chicago, Illinois. 1148 pp.). This can result in interspecies amplexus among anurans (Wells 2007, *op. cit.*) as well as inter-order amplexus among anurans and caudates (Simovic et al. 2014. Herpetol. Notes 7:25–29).

Scaphiopus holbrookii are explosive breeders that typically breed in temporary water bodies formed during heavy or prolonged rains (Dodd 2013. Frogs of the United States and Canada. Johns Hopkins University Press, Baltimore, Maryland. 982 pp.). Previous reports of *S. holbrookii* interspecies amplexus include male *S. holbrookii* amplexing female *Bufo americanus* (Gooley and Pauley 2013. Ohio Biol. Surv. Notes 4:1–5) and male *Rana sphenocephala* amplexing male *S. holbrookii* (Butler 2007. Herpetol. Rev. 38:444).

At 2205 h on 25 April 2019 (air temp. = 14.5°C), I stopped my car to listen to *S. holbrookii*, *Hyla chrysoscelis*, and *Pseudacris crucifer* chorusing in a forested wetland adjacent to a road in rural Cobden, Union County, Illinois, USA (precise location withheld due to conservation concerns). While relocating live *S. holbrookii* off of the road, I discovered an adult male *S. holbrookii* in axillary amplexus with a gravid adult female

Fig. 1. Adult male *Scaphiopus holbrookii* amplexing gravid adult female *Hyla chrysoscelis* in Union County, Illinois, USA.

H. chrysoscelis (Fig. 1). Both frogs were oriented towards the wetland. Although *S. holbrookii* and *H. chrysoscelis* often breed syntopically in southern Illinois (pers. obs.), this appears to be the first observation of interspecific amplexus between these two species.

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TESTUDINES — TURTLES

***BATAGUR TRIVITTATA* (Burmese Roofed Turtle). BEHAVIOR.** *Batagur trivittata* is a critically endangered, conservation-dependent, aquatic turtle endemic to the larger rivers of Myanmar (Ernst and Barbour 1989. Turtles of the World. Smithsonian Institution Press, Washington, D.C. 313 pp.; 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.). Fewer than 10 reproductive females are thought to survive in the wild (Çilingir et al. 2018. Conserv. Biol. 31:1469–1476), but with a captive population now approaching 1000 individuals, *B. trivittata* is no longer considered at risk of eminent biological extinction (Platt and Platt 2018. Turtle Survival 2018:41–48). Unsurprising in light of its rarity, almost nothing is known concerning the ecology and behavior of *B. trivittata* (Platt et al. 2017. Herpetol. Rev. 48:420–422). Indeed, with the exception of a perfunctory description of basking (Maxwell 1911. Reports on Inland and Sea fisheries in the Thongwa, Myaungmya, and Bassein Districts and the Turtle-banks of the Irrawaddy Division. Government Printing Office, Rangoon, Myanmar. 57 pp.), the behavior of wild and captive *B. trivittata* has gone unreported. Herein, we describe a sand-flinging behavior that appears commonplace among captive *B. trivittata*.

Our observations were made on sandbanks along the Chindwin River at Limpha (25.80526°N, 95.52888°E; WGS 84) and Htamanthi (25.33277°N, 95.29388°E; WGS 84) villages in the Sagaing Region, Myanmar. As part of a study to determine the relationship between body size and dimensions of trackways (impressions of feet and plastron left on substrate) at nesting sites, we individually transported (in heavy cloth sacks) 48 female *B. trivittata* from captive-breeding colonies in Limpha and Htamanthi to sandbanks near these villages, on 7 and 22 March 2019, respectively. These turtles were 6–10 years-old and had a mean (± 1 SD) carapace length (CL) of 314 ± 51 mm (range: 226–397 mm). We removed each turtle from the sack, placed it on the coarse sand substrate, quickly moved a short distance away (ca. 10 m), and waited until the turtle had walked 10–20 m across the sand before recapturing them. We then measured CL and plastron length (PL) of the turtle together with several trackway dimensions (Platt et al., unpubl. data). We simultaneously monitored four to five turtles that were spaced 3–4 m apart and hence, in view of one another.

Upon being placed on the substrate, turtles usually remained stationary for 10–12 min (sometimes longer), all the while slowly moving the head from side-to-side in what we interpreted as an attempt to become oriented in an unfamiliar environment. Within 5–10 min of being placed on the substrate most turtles suddenly began to vigorously fling sand over their carapace with an alternating flipping motion of the forefeet and rearfeet (Fig. 1). Sand flinging would then cease after which turtles walked rapidly forward at a steady pace, often halting to resume sand

PHOTO BY MYO MIN WIN

Fig. 1. Sand flinging by a female *Batagur trivittata* on a sandbank along the Chindwin River, Myanmar.

PHOTO BY BORJA REH

Fig. 2. *Batagur trivittata* basking in captive-breeding colony at the Singapore Zoo. This turtle engaged in sand flinging shortly before this photograph was taken. Note light covering of sand on carapace and deep scrape in substrate near forelegs.

flinging before again continuing to move forward. At times accumulating sand would almost completely obscure the surface of the carapace, particularly if the shell was moist. Otherwise, the sand was quickly dislodged from the carapace when the turtle resumed walking. Although we neglected to keep an individual tally during our first trial (Limpha), sand flinging was observed in most of the turtles being monitored. An individual tally was kept when we repeated the trials at Htamanthi where sand-flinging behavior was recorded in 16 of 18 (88.8%) turtles.

In addition to our observations in Myanmar, one of us (BR) opportunistically noted similar sand flinging behavior among a captive-breeding group of 23 *B. trivittata* at the Singapore Zoo. These turtles were reared in captivity after being hatched from eggs deposited by females held at the Yadanabon Zoological Gardens (Mandalay, Myanmar) or collected from nests of wild females along the Chindwin River, ranged in age from 10 to 14 years-old, and had a mean (± 1 SD) CL of 387 ± 85 mm (range: 289–531 mm). Sand flinging was frequently observed among both male and female *B. trivittata* basking on an artificial sandbank beside the pond in their enclosure. In most cases, the turtles remained stationary and, as described earlier, used the rear feet and forefeet to fling sand onto their carapace, often excavating prominent crescent-shaped scrapes in the substrate around the feet (Fig. 2). Because the curatorial staff assumed sand flinging was a normal activity for *B. trivittata*, little further notice was taken of this behavior.

Sand flinging behavior similar to what we report for *B. trivittata* has also been observed in at least two other species of freshwater turtles. According to Harding and Bloomer (1979. Bull. New York Herpetol. Soc. 15:9–26), *Glyptemys insculpta* (Wood Turtle) "throw sand or dirt over their shells with a quick alternating flipping motion of the front feet" when exiting the water. The authors considered this a highly stereotyped behavior that often occurred in the absence of any loose substrate, and moreover, was observed in hatchlings only minutes after emerging from the nest. Additionally, in a personnel communication to SGP, C. R. Ferrara stated that *Podocnemis expansa* (Giant South American River Turtle) often use the forefeet to fling sand onto their carapace while basking on riverside sandbanks.

We are unable to explain the functional significance of sand flinging behavior in *B. trivittata* or other turtles but offer several non-exclusive hypotheses that warrant further testing. First, covering the carapace with sand would lessen the amount of solar radiation reaching the shell with possible thermoregulatory benefits to the turtle. Furthermore, a light covering of sand on the carapace could potentially provide some degree of camouflage for basking turtles, although crypsis seems unnecessary for a large turtle such as *B. trivittata* with few known predators (possibly large felids; Platt et al., unpubl. data), basking a short distance from the water on an open sandbank that offers little concealment for an approaching predator. We consider it more likely that sand flinging serves as some form of social signaling among *B. trivittata*, which historically was known to form large basking aggregations consisting of hundreds of turtles on sandbanks (Maxwell 1911, *op. cit.*); similar communal basking likewise occurs in captivity, albeit involving many fewer individuals. In this regard, sand flinging may constitute a type of displacement activity, whereby nervous energy is channeled away from a repressed behavior in a social context (Gould 1982. Ethology: The Mechanisms and Evolution of Behavior. W.W. Norton and Company, Inc., New York, New York. 544 pp.).

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***CARETTA CARETTA* (Loggerhead Sea Turtle). PREDATION.** *Caretta caretta* is predated, at various stages of their life cycle, by several species of marine and terrestrial animals (Stancyk 1995. *In* Bjorndal [ed.], Biology and Conservation of Sea Turtles, pp. 139–152. Smithsonian Institution Press, Washington, D.C.). In the marine environment, it is assumed that predation rates are greater at early life stages and decline as turtles gain larger sizes (Bjorndal 2003. *In* Bolten and Witherington [eds.], Loggerhead Sea Turtles, pp. 235–254. Smithsonian Books, Washington, D.C.; Stewart and Wyneken 2004. Bull. Mar. Sci. 74:325–335). Marine predators for larger size *C. caretta* are mainly sharks (Witzell 1987. Japan. J. Herpetol. 12:22–29; Fergusson et al. 2000. Environ. Biol. Fish. 58:447–453) as well as Mediterranean Monk Seals (Margaritoulis and Touliatou 2011. Mar. Turt. Newsl. 131:18–23), and large fish (Yeiser et al 2008. Herpetol. Rev. 39:344).

We report here predation of a juvenile *C. caretta* by an angler fish *Lophius* sp. in the northern Aegean Sea, Greece. ARCHELON, the Sea Turtle Protection Society of Greece, has since 1992 operated a nationwide Stranding Network, which reports injured and dead turtles found along the Greek coastline. Members of the network include Coast Guard officers, local NGOs, and concerned citizens. Upon location of a dead turtle, members of the network fill-in a standardized Stranding Sheet with information on turtle's species, its condition, shell measurements, etc. This form, along with photographs, is then conveyed to ARCHELON. In the case of an injured turtle, network members arrange for its transportation to the ARCHELON Rescue Centre in Glyfada, close to Athens.

On 13 March 2010, the Coast Guard officers on duty at the fish market of Nea Mihaniona (40.45907°, 22.85971°; WGS 84), northern Greece, conveyed to ARCHELON a Stranding Sheet reporting a juvenile *C. caretta* that was taken out of the stomach of a 65 cm long (total length) anglerfish (*Lophius* sp.; Fig. 1). The anglerfish was caught by the bottom trawler "Michalis T." (reg. no 961). The turtle, fresh and totally intact (Fig. 2), was photographed and measured (30 cm straight carapace length, 25 cm straight carapace width) by the Coast Guard officers. The turtle's total length was estimated at 40–45 cm.

Fig. 1. A 65-cm long anglerfish (*Lophius* sp.) at the fish market of Nea Mihaniona (northern Greece) that had consumed the 30 cm long (SCL) *Carettta caretta.*

Fig. 2. The 30 cm long (SCL) *Caretta caretta* taken intact out of the stomach of a 65 cm long anglerfish (*Lophius* sp.) caught in the northern Aegean Sea, Greece.

As far as can be ascertained no previous record of *Caretta* predation by this fish species has been reported in the Mediterranean Sea. Anglerfish (*Lophius* sp.), distributed widely in the Mediterranean as well as in the eastern Atlantic, are a target species of bottom-trawl fisheries (Ungaro et al. 2002. Sci. Mar. 66:55–63). Anglerfish are opportunistic predators feeding mainly on fish, crustaceans, and to a lesser extent on cephalopods, gastropods, bivalves, and echinoderms (López et al. 2016. Est. Coast. Shelf Sci. 175:15–23). Among 61 fish species examined in the northern Aegean Sea, anglerfish had the largest mouth openings (Karachle and Stergiou 2011. Acta Ichthyol. Piscat. 41:265–275). Anglerfish rest on the seafloor and take passing prey by surprise or by luring prey with their angling spine (illicium) close to their wide mouths (Armstrong et al. 1996. J. Northw. Atl. Fish. Sci. 18:99–103). *Caretta caretta* is abundant in Greece (Margaritoulis and Panagopoulou 2010. *In* Casale and Margaritoulis [eds.], Sea Turtles in the Mediterranean: Distribution, Threats and Conservation Priorities, pp. 85–111. IUCN, Gland, Switzerland). The current observation suggests that anglerfish in Greece are likely opportunistic consumers of juvenile *C. caretta*. We thank the two Coast Guard officers who provided the measurements and the photographs.

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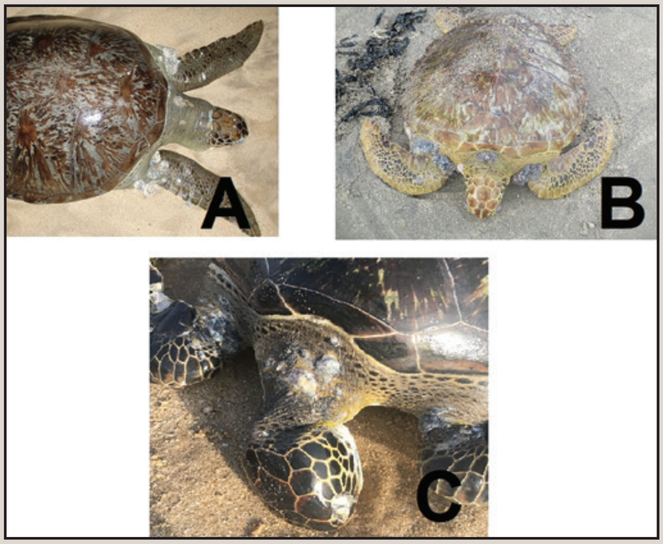
***CHELONIA MYDAS* (Green Sea Turtle). DISEASE.** Many populations of *Chelonia mydas* have been negatively impacted by fibropapillomatosis around the world (Herbst 1994. Ann. Rev. Fish. Dis. 4:389-425). The impact of this disease will only be fully understood when there is a better understanding of which populations are affected. The disease has been reported in populations in North, Central, and South America, Europe, Asia, and Australia, but is poorly documented in Africa (Formia et al. 2003. Mar. Turt. Newsl. 100:33–37). Fibropapillomatosis has been recently documented in Principe Island, Gabon, and Equatorial Guinea (Formia et al. 2007. Mar. Turt. Newsl. 116:20–22; Duarte et al. 2012. Arch. Virol. 157:1155–1159). Here, we report the first recorded cases of fibropapillomatosis in Ghana, West Africa.

We observed a *C. mydas* on 12 March 2007 from Ada Foah, Ghana (Fig. 1A) with large cauliflower like tumors on the shoulder and small polyps on the neck, which appears to be the first record of fibropapillomatosis in the country. An adult *C. mydas* was observed in Ada Foah, Ghana on 26 January 2010 with polyps on both eyes and a cauliflower blub on the underside of the neck. Another *C. mydas* was found on 25 November 2017 in Mankoadze, Ghana (Fig. 1B), with bulbous cauliflower-like tumors on the soft tissue near on the neck, shoulders, and eye sockets. Lastly, we found one adult *C. mydas* washed ashore, dead, in Winneba, Ghana, on 13 March 2019 with many small polyp-like tumors on the neck and bases of the front flippers (Fig. 1C). No other evidence of cause of death was present, and all limbs were undamaged in all turtles. The turtles had no damage to the carapace or plastron, or any opened wounds, except that the turtle found in 2010 had bloody eyes and face, but it was difficult to determine the cause of death. There was not any evidence to suggest collision with vessels or propeller strikes. A limited number of additional infected *C. mydas* have been encountered by the authors along beaches in Ghana.



PHOTOS BY L. R. STEMLE, A. AGYEKUMHENE, AND P. ALLMAN

Fig. 1. *Chelonia mydas* with evidence of fibropapillomatosis from Winneba, Ghana (A), Mankoadze, Ghana (B), and Ada Foah, Ghana (C).

We suggest histological and virologic studies be done on fibropapillomatosis in the Gulf of Guinea in order to determine the potential impact of this daunting disease. Fibropapillomatosis may be more common in African waters than what might be suggested by the available literature, and it may become more prevalent as habitat degradation continues.

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***CHELYDRA SERPENTINA* (Snapping Turtle). FEEDING BEHAVIOR.** *Chelydra serpentina* is an omnivore, known to consume a diverse array of prey items, including aquatic vegetation, flatworms, annelids, arthropods, snails, and various vertebrate species. Amphibians compose a sizeable portion of the vertebrate prey category, with anurans representing the most common amphibians consumed by *C. serpentina* (Punzo 1975. J. Herpetol. 9:207–210). When feeding on large prey items, either plants

Fig. 1. A) Failed attempt by *Chelydra serpentina* to engulf an adult *Lithobates catesbeianus* whole; B) Defensive display performed by *C. serpentina* in response to observation during feeding. Note the removal of skin from the midsection of the *L. catesbeianus* resulting from the claw-raking behavior of the turtle.

or animals, *C. serpentina* has been observed using the foreclaws to shred or dismember prey prior to ingestion (Moldowan et al. 2015. Can. Field-Nat. 129:403–408). This account provides a detailed description of the specific timing and behaviors observed during one such predation event.

At 2021 h on 29 June 2019, an adult *C. serpentina* was observed feeding on an adult *Lithobates catesbeianus* (American Bullfrog) in an artificial pond located behind the Black Warrior Work Station in William B. Bankhead National Forest, Lawrence County, Alabama, USA (34.34343°N, 87.33833°W; WGS 84; 307 m elev.). The turtle was initially found submerged underwater, grasping the frog in its jaws by the left hindlimb while using the foreclaws to rake the dorsal and lateral surfaces of the frog's body and head. This activity persisted for 4 min, after which the only apparent damage to the frog consisted of a few claw marks on the dorsal surface of the pelvic region. At this point, the turtle began to move its jaws over the frog (starting with the left hindlimb and moving anteriorly), engulfing all but the head, forelimbs, and right rear foot of the frog (Fig. 1A). This process took 30 sec and concluded with the turtle expelling the body of the frog from its mouth and resuming the previously described claw-raking action. Three additional failed attempts to orally engulf the frog were observed over a period of 2 min and 11 sec, after which intermittent claw-raking had resulted in a nearly complete removal of skin from the mid-section of the still living *L. catesbeianus*. Continued claw-raking resulted in bisection of the frog at the pelvic region 18 min after the initiation of the predation process. Following this event, the turtle rapidly consumed first the anterior and then the posterior portion of its prey, each piece swallowed whole.

Various portions of this event were photographed and recorded, and while the turtle was not collected or approached beyond the edge of the pond, the animal was aware that it was being observed. No attempt was made by the turtle to retreat deeper into the pond, but at four points throughout the predation event, it paused to raise its head above the water, expanding the buccal region and rapidly releasing air in such a way that a growl-like vocalization was produced—all while continuing to grasp the frog in its jaws (Fig. 1B). Following each display, the turtle returned to normal claw-raking behavior beneath the water, in one instance audibly blowing bubbles through the rostrum as it lowered its head back into the pond. The duration of the entire predation sequence was just over 20 min, suggesting that ingestion of large prey items may be more expensive for *C. serpentina* in terms of energy expenditure than consumption of multiple, smaller prey items due to the extensive period of time required for successful mechanical breakdown of large prey.

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***CHELYDRA SERPENTINA* (Snapping Turtle). HATCHLING SOUNDS.** While some adult turtles have long been known to produce sounds (e.g., Leatherback Turtle [*Dermochelys coriacea*]; Mrosovsky 1972. Herpetologica 28:256-258), there is renewed interest in this aspect of chelonian biology following research on the Oblong Turtle (*Chelodina colliei*) that established, for the first time, that at least some adult freshwater turtles purposefully produce sounds of potential communicative value (Giles et al. 2009. J. Acoustic Soc. America 126:434-443). Subsequent research is rapidly expanding the list of adult freshwater turtles known to make sounds (reviewed in Ferrara et al. 2018. Herpetol. Rev. 49:526-527), while parallel findings on freshwater turtle hatchlings appear limited to three species within the South American genus *Podocnemis* and the North American *Graptemys ouachitensis* (Geller and Casper 2019. Herpetol. Rev. 50:449-452). Here, we provide evidence of sound production by late-term embryos and hatchlings of a second North American freshwater turtle, the Snapping Turtle (*Chelydra serpentina*), made before their emergence onto the surface of the nesting substrate.

We analyzed digital acoustic recordings from a laboratory-incubated clutch of 20 *C. serpentina* eggs from a nest discovered post-construction on a spoil pile near a quarry pond in Taylor County, Wisconsin, USA (45.1144°N, 90.5753°W; WGS 84). On 14 July 2018 the clutch was excavated and the eggs subsequently buried to a depth of 13-21 cm in slightly moist, local sand within a 5-gal plastic pail. On 15 July 2018 this plastic pail was placed into an incubator maintained at a constant 27.8°C and ≥ 95.0% relative humidity.

Beginning on 2 August 2018, we acoustically monitored this clutch to investigate the potential for sound production by hatchlings. Monitoring units (Song Meter 2, Wildlife Acoustics, Inc., Maynard, Massachusetts) were programmed to continually record the first 5-min of each h from this date (a few weeks before expected hatchling emergence) through 28 August 2018, when all the hatchlings emerged onto the surface shortly after having been discovered to be hatched, but still buried within the sand during an exploratory check. The degree to which this examination disturbance may have influenced emergence timelines, and, therefore, sound production timelines relative to this date, is unknown.

One microphone (model SMX-II, omni-directional, sensitivity 20 Hz–20 kHz, Wildlife Acoustics, Inc., Maynard, Massachusetts) was secured to the inside of the lid of the plastic pail containing the eggs ca. 2 cm above the sand surface, to monitor the near-clutch environment. A second identical microphone was positioned on a shelf inside the incubator to monitor ambient sounds. Recordings were made at a sampling rate of 24 kHz.

Spectrograms were visually examined in Song Scope (v4.1.4; Wildlife Acoustics, Inc., Maynard, Massachusetts), and visual acoustic signatures played back and compared to the sound recording from the exact same time on the second ambient microphone. Where sounds were clearly louder in the egg clutch container than in the ambient environment, we concluded they originated in the egg clutch container. Detected sounds were classified into types based on acoustic characteristics. We detected and classified three types of sounds produced within the egg clutch container during the monitoring period, described as follows.

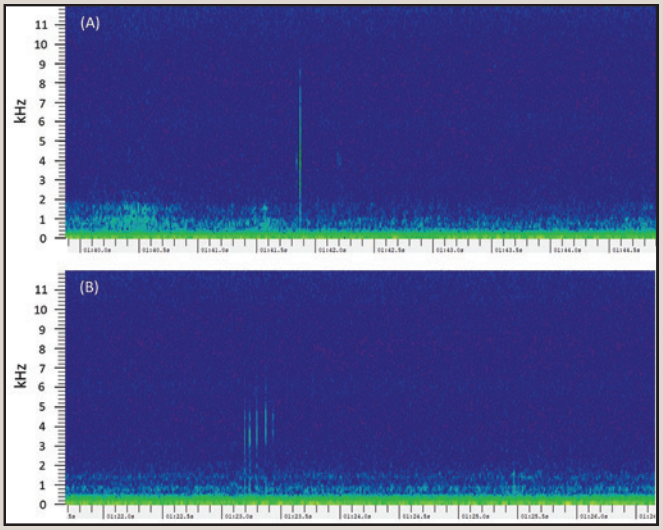

Fig. 1. Example spectrograms of single (A) and multiple (B) click "Type I" sounds from artificially incubated *Chelydra serpentina* hatchlings. Display modified from Song Scope v4.1.5 (Wildlife Acoustics, Inc., Maynard, Massachusetts): Fast Fourier Transform [FFT] = 256, FFT overlap = ½, amplitude gain = 0, no filters were used.

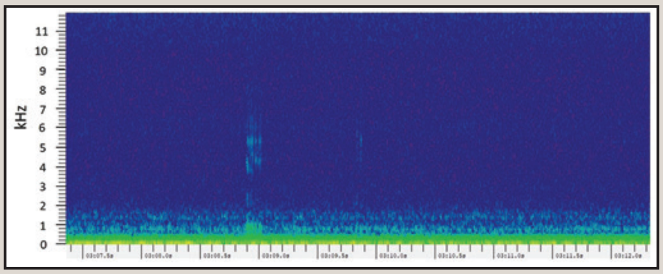

Fig. 2. Example spectrogram of "Type II" sounds detected from artificially incubated *Chelydra serpentina* hatchlings. Display modified from Song Scope v4.1.5 (Wildlife Acoustics, Inc., Maynard, Massachusetts): Fast Fourier Transform [FFT] = 256, FFT overlap = ½, amplitude gain = 0, no filters were used.

Type I.—The most commonly detected sound was a click-type sound, present at least as early as 14 d before emergence, beginning ca. 7 h before the first sounds indicative of hatchling movement on that same day, and continuing until the day of hatchling emergence. These sounds were abrupt, "crisp" sounds of short duration (< 0.1 s), with a frequency range up to 10 kHz, and occurred singly (Fig. 1A), in pairs, or in multiple groupings (Fig. 1B). They were present both with and without concurrent movement-related sounds. These sounds were produced most frequently 11–13 d before hatchling emergence onto the surface, when they occurred as often as 12 times/min and in the majority of the 5-min daily samples.

Since Type I sounds were similar to what might be expected from static discharge events, we set up a control chamber of plain sand in a plastic bucket with the same recorder and microphones and monitored both this container and ambient sounds for 19 d. We then examined 20 5-min control samples for each microphone evenly spaced across this period and found no similar Type I sounds. These results, and the fact that Type I sounds were produced only on the microphone in the chamber with turtle eggs and not simultaneously on the ambient microphone, support the conclusion that Type I sounds were originating within the egg clutch.

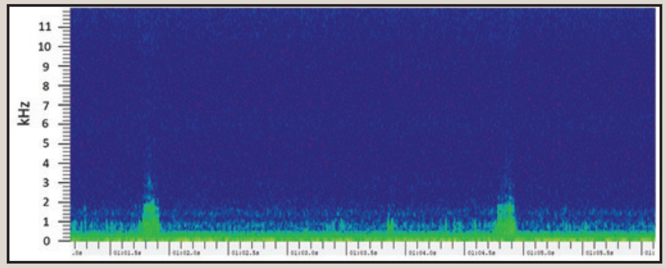

Fig. 3. Example spectrogram of "Type III" sounds detected from artificially incubated *Chelydra serpentina* hatchlings. Display modified from Song Scope v4.1.5 (Wildlife Acoustics, Inc., Maynard, Massachusetts): Fast Fourier Transform [FFT] = 256, FFT overlap = ½, amplitude gain = 0, no filters were used.

Type I "click" sounds produced by *C. serpentina* sounded much like those produced by *G. ouachitensis* hatchlings, and had similar parameters of duration, frequency range, and occurrence patterns (Geller and Casper 2019, *op. cit.*). These sounds also shared tonal and spectral resemblance to percussive "double-clicks" found in adult *Chelodina colliei* (Giles et al. 2009, *op. cit.*), possibly suggesting a common mode of production (e.g., via respiratory movements; reviewed in Rumpf and Tzschentke 2010. Open Ornith. J. 3:141–149).

Type II.—A second sound type was detected much less often than Type I sounds (total $n = 3$ during three, 5-min sample periods) in our samples, and only during day 12 and 13 before hatchling emergence, ca. 1 d after the first noted hatchling movement related sounds. These sounds were of longer duration than Type I sounds (< 0.25 s), with a frequency range up to 10 kHz, but much denser below 1.5 kHz (Fig. 2). They sounded somewhat like a "creak" or rubbing a finger along a fine-toothed comb.

Type III.—A tentative third sound type, also detected only during day 12 and 13 before emergence (total $n = 23$ during five, 5-min sample periods), was similar to Type II but slighter longer in duration and denser yet in the low frequency range (≤ 2 kHz; Fig. 3). These sounded like a relatively atonal, short-duration "rasp" noise, and were present within the timelines described for Type II sounds. As with Type I sounds, these were aurally and structurally much like "rasp" sounds we detected for *G. ouachitensis* ("Type IV"; Geller and Casper 2019, *op. cit.*). However, these sounds could not be definitively differentiated from short-duration, hatchling movement sounds and, thus, have uncertain origin.

While this report is descriptive in nature and represents only those sounds detected in acoustic samples from one nest, we believe it is sufficient to demonstrate that pre-emergent *C. serpentina* hatchlings produce at least two types of sounds, making them the second North American turtle species known to do so as hatchlings. Expanded field and laboratory research on the potential for sound production by hatchling chelonians, and the proximate and ultimate functions these sounds may have in emergence timing, are warranted. Representative files of these sound types are posted online (https://www.youtube.com/watch?v=SBM1a_j71j4).

We are grateful to B. Hay for his efforts in collecting and maintaining the artificially incubated clutch, to M. Day for producing the YouTube presentation, and to C. Ferrara and D. Vogt for manuscript reviews.

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***CHRYSEMYS PICTA* (Painted Turtle). BASKING BEHAVIOR.** *Chrysemys picta* is a widespread species of emydid turtle, ranging from southern Canada to the southeastern United States (Ernst 1971. Cat. Am. Amphib. Rept. 106:1–4; Ernst and Lovich 2009. Turtles of the United States and Canada. Second Edition. The Johns Hopkins University Press, Baltimore, Maryland. xii + 827 pp.). Across this wide distribution, *C. picta* typically uses shallow, slow-moving, aquatic habitats with abundant submerged vegetation (Ernst and Lovich 2009, *op. cit.*), including lakes (Bury and Germano 2003. Am. Midl. Nat. 149:241–244), sloughs (Anderson et al. 2003. J. Freshw. Ecol. 17:171–177), and disturbed sites, such as wastewater settling ponds (Lindeman 1996. Copeia 1996:114–130). In South Dakota, *C. picta* is found state-wide, occurring in most aquatic habitats (Ballinger et al. 2000. Trans. Nebraska Acad. Sci. 26:29–46) and is the most abundant turtle species in the state (DRD, unpubl. data). In the Prairie Pothole Region (PPR) of eastern South Dakota, depressional wetlands dominate the landscape and exist among a matrix of row-crop agriculture (e.g., corn, soybeans; Dahl 2014. Status and Trends of Prairie Wetlands in the United States 1997 to 2009. U.S. Department of the Interior, Fish and Wildlife Service, Ecological Services, Washington, DC. 67 pp.). Surrounding many of these wetlands are thick stands of cattails (*Typha* spp.) and further upland, invasive Reed Canary Grass (*Phalaris arundinacea*) and agriculture (Wright and Wimberley 2013. Proc. Natl. Acad. Sci. U. S. A. 110:4134–4139). Most trees are restricted to riparian corridors, and therefore, there is a noticeable absence of woody debris that can be used as basking substrates at most PPR wetlands. Occasionally, rocks are present in these wetlands, which arrived from glacial till deposited during the last glacial periods (Flint 1955. Geol. Surv. Prof. Pap. 262:vi + 1–173 pp). Given the limited availability of physical basking substrates in many PPR wetlands, *C. picta* has been observed basking on top of dense aquatic macrophytes or vegetation and on nests of Common Loons (*Gavia immer*; Gelatt and Kelley 1995. Can. Field-Nat. 109:456–458), Canada Geese (*Branta canadensis*), and other waterfowl (DRD, pers. obs.). Additionally, Hunt et al. (2018. Herpetol. Rev. 49:524–525) reported unusual basking substrates for *C. picta* in Minnesota, USA, finding individuals basking on the carcasses of an American Beaver (*Castor canadensis*) and a Common Carp (*Cyprinus carpio*) floating in the water. Here, we report an additional unusual basking substrate used by *C. picta* in South Dakota.

On 12 May 2019 at 1636 h, we observed a single adult female *C. picta* basking on top of a White-tailed Deer (*Odocoileus virginianus*) carcass along a flooded road-side ditch along IH-90 in McCook County, South Dakota, USA (43.66490°N, 97.47478°W; WGS 84; Fig. 1). It was surmised that the deer was killed from a vehicle collision, especially considering the proximity to a major interstate. The road-side ditch was ca. 1 m deep and was connected to series of adjacent wetlands to the south, likely the result of recent heavy spring rains in the region. We observed no other suitable basking substrates (e.g., logs, rocks) within the immediate vicinity of this individual. This observation adds to the list of animal carcasses used as basking substrates by *C. picta* and other emydid turtles (see Munscher and Butterfield 2016. Herpetol. Rev. 47:455). The use of animal carcasses as basking substrates may be common in habitats where typical basking substrates are limited.

We thank R. Davis for helpful comments on this note. This photo has been deposited at HerpMapper (HM 277471).

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PHOTO BY JILLIAN K. FARKAS

Fig. 1. Adult female *Chrysemys picta* basking on a White-tailed Deer (*Odocoileus virginianus*) carcass in McCook County, South Dakota, USA.

***CHRYSEMYS PICTA* (Painted Turtle). PREDATION.** Common Ravens (*Corvus corax*) are known predators of eggs of multiple turtle species (Ernst et al. 1994. Turtles of the United States and Canada. Smithsonian Institution, Washington, D.C., 578 pp) and juvenile Desert Tortoises (*Gopherus agassizii*; Boarman 2003. Environ. Manage. 32:205–217). Predation of adult turtles by Common Ravens appears to be largely unreported in published literature. However, the mortality of multiple Wood Turtles (*Glyptemys insculpta*) in New Brunswick, Canada, was attributed to Common Raven predation (McCullum 2016. Wood Turtle Mass Mortalities in New Brunswick, Canada. Blanding's and Wood Turtle Conservation Symposium, Westborough, Massachusetts, 3–4 October 2016).

I here report suspected predation of adult *Chrysemys picta* by Common Ravens. We documented 49 dead adult Painted Turtles from 19–29 June 2018 in Wilton, New Hampshire, USA. All of the turtles were found along a sandy woodland road and associated sandy openings adjacent to a large wetland system. All but one of the turtles where sex was known were females, presumably on land to lay eggs. At least one deceased turtle had an egg remaining in the otherwise empty shell. All of the turtles with remains that could be evaluated had roughly circular holes in the skin directly anterior to the rear legs, and all viscera were missing. Eighty-six percent of turtles were found resting upside down on their carapaces. Eighty percent of turtles that could be evaluated had no obvious damage to head and limbs. Where head and/or limbs were obviously chewed, it is not known whether this occurred during predation or from subsequent scavengers. During each survey period, Common Ravens were observed vocalizing and flying over the wooded road and nearby wetlands.

In an attempt to confirm whether Common Ravens were the primary predator, a game camera was set up, pointed at three to six dead *C. picta* that were positioned to appear as if they were living turtles laying eggs in the sandy road. The camera was set 21–26 June, 26–29 June, and 29 June–12 July 2018. At camera checks, 67% (10 of 15) of the turtles were flipped onto their backs but cameras did not detect the turtles being flipped. One turtle that was not flipped had fresh white bird feces on the carapace. Following turtles being flipped on 21 June, a raven was filmed walking on top of one turtle and then walking directly to another turtle to investigate. No mammalian predators were recorded on film. Although Common Ravens were not directly observed killing turtles, the signs are consistent with the report from New Brunswick, Canada (McCullum 2016, *op. cit.*). Henry David Thoreau described a similar predation event of a Painted Turtle but suspected the predator was an American Bittern (*Botaurus lentiginosus*; Thoreau 1861. The Journal of Henry David Thoreau, 1837–1861. Journal XIII, Chapter VII June 1860). This manuscript is apparently the first published report of Common Ravens predating adult freshwater turtles in the United States. These observations indicate that ravens were routinely searching these areas and targeting nesting turtles. Raven predation could have a negative impact on local freshwater turtle populations, especially where turtle nesting is concentrated near raven activity areas.

I thank E. Belair and B. Volz for reporting their observation of multiple deceased turtles and M. Jones for helpful suggestions on the manuscript.

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***CHRYSEMYS PICTA PICTA* (Eastern Painted Turtle). PLASTRON COLOR VARIATION.** *Chrysemys picta* is among the most common and widely distributed chelonians of North America (Ernst 1971. Cat. Am. Amphib. Rept. 106:1–4). This species ranges from southern Canada to northern Mexico and occupies a diverse range of freshwater habitats (ponds, lakes, rivers and streams) and wetlands (freshwater marshes, forested or scrub swamps), particularly those that are slow-flowing or stagnant and shallow, containing a thick layer of mud-based substrate (Ernst et al. 1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington, D.C. 578 pp.).

Natural plastron coloration and pattern varies dramatically across the species' range, but plain yellow coloration (sometimes with a few dark spots) is characteristic of most individuals of the eastern subspecies, *C. p. picta* (Powell et al. 2016. Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America, Houghton Mifflin, Boston, Massachusetts. 494 pp.). However, brown to reddish-brown colored plastrons have been noted in some places; such coloration is likely due to scute staining presumably from concentrations of dissolved iron-based minerals in the water or substrate. This can result in misidentification of turtles by persons unfamiliar with this phenomenon.

We document unusually dark staining in plastrons of three *C. p. picta* at Massachusetts Audubon Society's Tidmarsh Wildlife Sanctuary, in Plymouth, Massachusetts, USA. The plastron color was mostly black, although the typical plain yellow coloration was visible along the plastron sutures (Fig. 1). The black color extended throughout the plastron (exclusive of the shield sutures), up to the plastron edge as well as the bridge. Staining of the carapaces was also evident, but was not as prominent due to the naturally dark carapace color of the species. In some individuals, the plastrons appeared to be iridescent when directly exposed to sunlight. The coloration appeared superficial, as evident by the flaky appearance particularly along the plastral midline. These three turtles were captured on 20 and 26 June 2019 via large collapsible minnow traps deployed at a coastal, low-gradient headwater stream bank (41.90117°S, 70.57131°W; WGS 84; 4 m elev.) where the substrate is composed of a thick layer of decomposing vegetation and slit. In addition to the aforementioned blackish color noted in these three specimens, other specimens with red-brown and red colored plastrons were noted from the same location on 24 June 2018 and 7 June 2019. Although our surveyed continued in this locality as well as several other freshwater and wetland habitats at Tidmarsh Wildlife Sanctuary, this scute staining was not observed elsewhere.

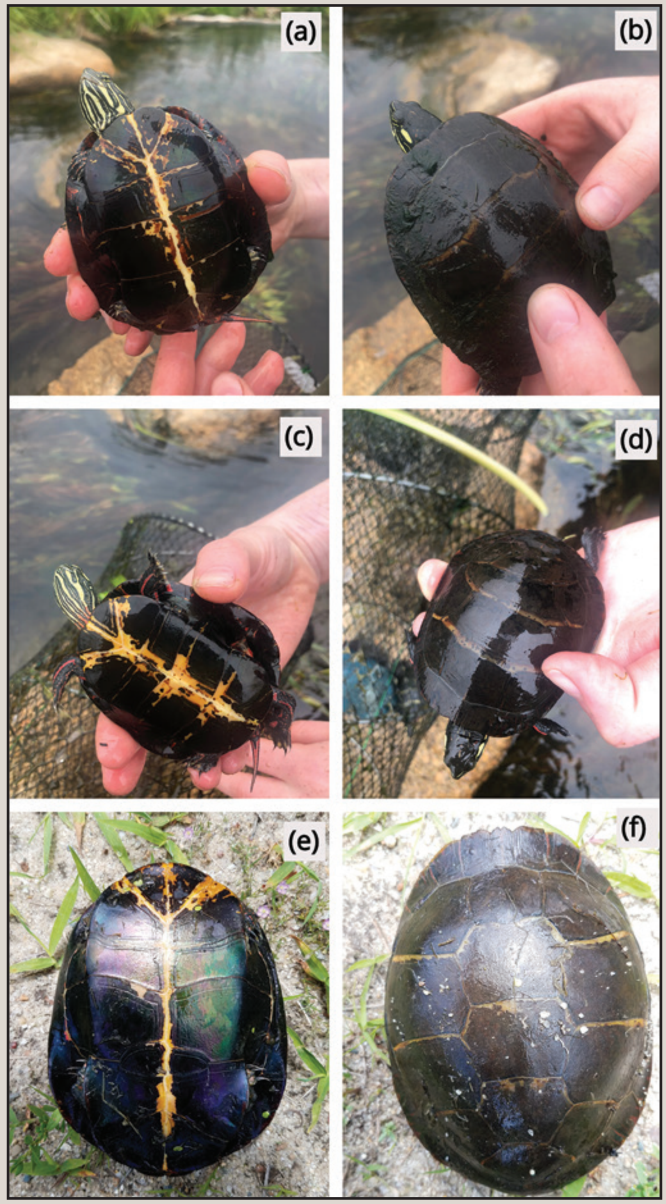

Fig. 1. Plastron and carapace of three individuals of *Chrysemys picta picta*, captured at Massachusetts Audubon Society's Tidmarsh Wildlife Sanctuary, in Plymouth, Massachusetts, USA. Each row of the panel represents the same individual. The plastron of all individuals was predominantly black.

This research was permitted by Massachusetts Division of Fisheries and Wildlife (permit #088.19SCRA) and approved by IACUC of Bridgewater State University (permit #2019-06).

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***GOPHERUS MORAFKAI* (Sonora Desert Tortoise). MINIMUM SIZE AT REPRODUCTION.** The Sonoran Desert Tortoise (*Gopherus morafkai*) occurs in the Sonoran Desert in Arizona, south and east of the Colorado River, and northern Sonora, Mexico, and south into the Sinaloan thornscrub of southern Sonora and northern Sinaloa, Mexico (Edwards et al. 2016. ZooKeys 562:131–158). Reproductive behavior is known in this species primarily from radio-telemetry and radiography of females (Averill-Murray et al. 2018. Herpetol. Monogr. 32:34–50). Minimum size at maturity in female *G. morafkai* in the Sonoran Desert of Arizona is reported at 220 mm carapace length (CL) based on the smallest size at which females have been found with eggs (Averill-Murray et al. 2018, *op. cit.*). However, minimum size at maturity for males is unknown, because reproductive status of males needs to be deduced based on opportunistic observation of mating behavior. Here, we report a 210 mm CL male *G. morafkai* mating and include observations of minimum size for male secondary sexual characteristic development.

On 24 July 2014 at 1108 h, while radio-tracking juvenile *G. morafkai* at a site in the Mazatzal Mountains, ca. 50 km NE of Phoenix, Maricopa County, Arizona, USA (549–853 m elev.), we observed a transmittered male study animal mounting a female *G. morafkai*. The female was not part of the radio-telemetry study but had been marked as part of a long-term monitoring study at the site. Upon our approach, the transmittered tortoise appeared to be copulating with the female based on its position and the movement of its front and back legs, although we could not determine if there was intromission. Our presence caused it to cease movement momentarily, however it soon began movement that again suggested copulation. After ca. 3 min, the transmittered tortoise separated from the female and walked away. Although we do not know if the copulation was successful, a wet exudate could be seen underneath his tail. During the observation, neither tortoise was disturbed other than by our presence. The male was captured and measured on 26 September 2014 and was 210 mm CL. Growth curves of male *G. morafkai* from across the Sonoran Desert (Germano et al. 2002. *In* Van Devender [ed.], The Sonoran Desert Tortoise: Natural History, Biology, and Conservation, pp. 265–288. University of Arizona Press, Tucson, Arizona), suggest this male tortoise was ca. 18–19 years old at the time of our observation. The female tortoise was not measured in 2014, but in 2013 it was 224 mm CL and ca. 20 years old, just above the minimize size at maturity which corresponds to an age of ca. 19 y (Germano et al. 2002, *op. cit.*; Averill-Murray et al. 2018, *op. cit.*).

In the weeks prior to the mating observation, we observed changes in the male tortoise's appearance and behavior. On 12 and 15 September, the tortoise had swollen chin glands and was exhibiting head bobbing behavior, presumably directed toward the observer as we saw no other tortoises in the vicinity. Chin glands are found in *Gopherus* of both sexes but are particularly prominent in males (Auffenberg 1977. Am. Zool. 17:241–250). Enlarged chin glands suggest sexual maturity, because in Mojave Desert Tortoises (*G. agassizii*) chin gland secretions play a role in social behavior related to male–male competition and in courtship behavior (Bulova 1997. Copeia 1997:802–810). We had not observed enlarged chin glands previously in this individual, despite capturing and examining it at least twice a year (spring and fall) between 2011–2014, and locating it through radio-telemetry two to three times a week March through October each year. We first observed sexual dimorphism in this tortoise during an examination in October 2013, when we noted that his plastron was "very concave." The tortoise was 205 mm CL at that time.

For this study, we captured and affixed transmitters to 15 *G. morafkai* that were between 124–175 mm CL at initial capture. During the course of the study, we observed plastral concavity in eight of the transmittered tortoises (including the individual observed mating) that were 151–216 mm CL when plastral concavity was first noted (described as very slightly, slightly or very concave). The individual that we observed mating was the only one of those tortoises in which the plastron was noted to be "very concave." Two other larger juveniles (both 216 mm CL) had concave plastrons, and one also had enlarged chin glands. Secondary male sexual characteristics in *G. agassizii*, including plastral concavity, have been reported to appear in juveniles > 120 or 140 mm CL (Grant 1936. Zoologica 21:225–229). In our study, two tortoises without plastral concavity at 124 and 135 mm CL, had concave plastrons at 151 and 154 mm CL, respectively. Thus, *G. morafkai* may begin to exhibit sexual dimorphism at approximately 151 mm CL, but may not reach reproductive maturity until ≥ 210 mm.

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***KINOSTERNON BAURII* (Striped Mud Turtle). BODY SIZE VARIATION.** *Kinosternon baurii* is a common benthic omnivore that occurs in most freshwater habitats throughout the southeastern United States, but much of its ecology and natural history are not well-understood (Ernst and Lovich 2009. Turtles of the United States and Canada. Second Edition. The Johns Hopkins University Press, Baltimore, Maryland. 827 pp.; Lovich and Ennen 2013. Amphibia-Reptilia 34:11–23). During capture-mark-recapture studies in southeastern Virginia (1980–1989) and northern Florida (2004–2019), we accumulated data that provide insight into variation in body size among *K. baurii* populations (Mitchell 1994. The Reptiles of Virginia. Smithsonian Institution Press, Washington, D.C. 352 pp.; Norman and Mitchell 2014. Banisteria 43:70–78; Johnston et al. 2016. Bull. Florida Mus. Nat. Hist. 54:69–103). Our measure of body size was straight-midline carapace length (CL).

In southeastern Virginia, JCM used 2.5-cm mesh baited funnel traps to sample turtles in the Blackwater River (Isle of Wight, Prince George, Southampton, Surry, and Sussex counties, Virginia, USA [ca. 36.7–37.1°N, 76.9–77.2°W; WGS 84; 2–27 m elev.]) and interdunal cypress swamps (First Landing State Park [formerly Seashore State Park], Virginia Beach County, Florida, USA [36.903°N, 76.026°W; WGS 84; 2 m elev.]). Females were significantly larger in the Blackwater River (mean CL = 109.6 mm, range = 82.6–122, N = 17) than in the cypress swamps (mean CL = 95.7 mm, range = 70.2–111.1, N = 31; t-test: t = -5.103, P < 0.001). Males were also significantly larger in the Blackwater River (mean

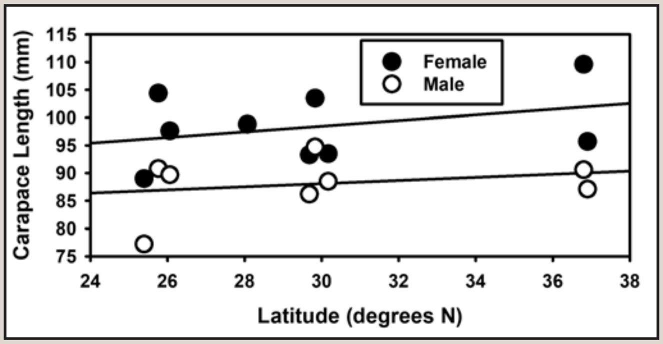

Fig. 1. Relationship between latitude and population-specific mean straight-midline carapace length (CL) in *Kinosternon baurii* based on this study and published data in Wilson et al. (1999. Copeia 1999:958–968), Meshaka and Blind (2001. Chelon. Conserv. Biol. 4:75–80), and Johnston et al. (2008. Florida Sci. 71:360–369). Least square regression lines are plotted separately for females (r = 0.345, P = 0.364) and males (r = 0.255, P = 0.542).

CL = 90.6 mm, range = 75.6–114.7, N = 46) than in the cypress swamps (mean CL = 87.1 mm, range = 71.1–101.5, N = 51; t-test: t = 2.078, P = 0.04).

In northern Florida, we used 2.5-cm mesh baited hoop traps and hand capture to sample turtles in ponds on the Santa Fe College (SFC) campus (Gainesville, Alachua County, Florida, USA [29.683°N, 82.439°W; WGS 84; 52 m elev.]), in a network of ponds and small creeks on the Quail Heights Golf Course (QHGC; Lake City, Columbia County, Florida, USA; 30.165°N, 82.673°W; WGS 84; 45 m elev.), and in the Santa Fe River (SFR) ecosystem (Alachua, Columbia, and Gilchrist counties, Florida, USA [ca. 29.8°N, 82.6–82.7°W; WGS 84; 9–20 m elev.]). Body sizes of both sexes differed significantly among sites (one-way ANOVA; females: F = 25.356, P < 0.001; males: F = 11.612, P < 0.001). Females from the SFR (mean CL = 103.5 mm, range = 86–125, N = 57) were significantly larger than females from SFC (mean CL = 93.3 mm, range = 75–116, N = 33; t = 6.398, P < 0.001) and QHGC (mean CL = 93.5 mm, range = 74–110, N = 58; t = 5.566, P < 0.001). Among males, individuals from the SFR (mean CL = 94.7 mm, range = 81–110, N = 40) were significantly larger than those from SFC (mean CL = 86.2 mm, range = 74–102, N = 18; t = 4.292, P < 0.001) and QHGC (mean CL = 88.5 mm, range = 77–97, N = 25; t = 3.520, P = 0.001). Body sizes were similar in SFC and QHGC (females: t = 0.135, P = 0.893; males: t = 1.054, P = 0.295).

In each state, large body sizes of both sexes are associated with a river. The Blackwater River and SFR are low gradient tannin-stained rivers that originate from swamps. However, the SFR receives substantial input of clear, thermally stable (22–23°C) water from many artesian springs in its lower reaches, and this region is where *K. baurii* is primarily found (Mitchell and Johnston 2012. Herpetol. Rev. 43:127; Johnston et al. 2016, *op. cit.*). Because large *K. baurii* occur in ecologically different areas of rivers separated by > 850 km, we hypothesize that some aspect of riverine habitat in general may select for large body size. Alternatively, different environmental factors in each river may have independently favored large body size.

The largest known individual of this species is a 138 mm CL female observed nesting along the lower Apalachicola River in northwestern Florida (Ewert and Jackson 2005. Herpetol. Rev. 36:442). The largest known male is a 114.7 mm CL individual we report from the Blackwater River, Virginia. Body sizes of *K. baurii* also differ between populations in southern Florida (Meshaka and Blind 2001. Chelon. Conserv. Biol. 4:75–80). Both sexes were larger in Miami canals than in Everglades National Park, and Meshaka and Blind (2001, *op. cit.*) hypothesized that oligotrophic conditions in the southern Everglades were responsible for these differences.

Kinosternon baurii exhibits substantial variation in body size among populations throughout its range, but this geographic variation is primarily associated with habitat differences within local areas. Available data do not demonstrate a broad geographical pattern such as a latitudinal cline (Fig. 1). Additional data from *K. baurii* populations in a variety of habitats in Georgia, South Carolina, and North Carolina are needed for a more thorough analysis and to test whether Bergmann's Rule applies to all North American turtle species with distributions exceeding 10° latitude, as suggested by Lewis et al. (2018. Herpetol. Conserv. Biol. 13:700–710).

This natural history note is dedicated to JCM.

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***KINOSTERNON SONORIENSE* (Sonoran Mud Turtle). DIET and SCAVENGING.** *Kinosternon sonoriense* is an omnivorous kinosternid turtle that reportedly eats insects, crustaceans, snails, fish, frogs, tadpoles, and some plant material (Stebbins 2003. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Company, Boston, Massachusetts. xiii + 533 pp.). Predation on lizards and snakes has also been observed (Lovich et al. 2010. Southwest. Nat. 55:135–138). Apparently, no documentation of predation on avian or mammalian species has been reported. Herein, I describe predation of a Western Tanager (*Piranga ludovician*) by a *K. sonoriense*, and an incident of scavenging of a juvenile Javelina (or Collared Peccary [*Tayassu tajacu*]) carcass by a group of *K. sonoriense*, in Arizona, USA.

The 7B Ranch is located in Pinal County, Arizona, USA and occupies over 3000 acres of river bottom, mesquite bosque, and Sonoran Desert upland. Nestled within the mesquite bosque, and adjacent to the San Pedro River, is a 2-acre wetland created by the outflow of an artesian well. The area is perennially wet due to 25-gal/min flow. This wetland (32.69435°N, 110.62211°W; 735 m elev.) is inhabited by reptiles, amphibians, large and small mammals, and numerous bird species. Of note is a large population of *K. sonoriense*. At 0857 h on 17 May 2018, splashing at the water's edge revealed one *K. sonoriense* feeding on the lower portion of a live *P. ludoviciana* (Fig. 1). The bird was struggling and splashing, exposing the belly which was open, and its legs were gone. The turtle submerged as it was approached, and the bird died shortly after the observation.

On 28 May 2019 at 0839 h, a young Javelina (ca. 35 cm in length) was surrounded by 14 *K. sonoriense* who were feeding on the carcass (Fig. 2). The water was ca 9.0 cm deep where the carcass lay. As the edge of the water was approached, most of the turtles dispersed. Several stayed nearby, feeding inside the body cavity, beneath and along the sides of the carcass. Each of the *K. sonoriense* were ca. 16 cm SVL, with some juvenile turtles ca. 8 cm SVL. It is unknown if the Javelina was alive or already dead at the time the turtles began feeding on it. *Kinosternon sonoriense* that dispersed were seen nearby with pieces of flesh hanging from their mouths.

Fig. 1. Adult *Kinosternon sonoriense* feeding on a live Western Tanager on 17 May 2018.

Fig. 2. Carcass of young Javelina surrounded by *Kinosternon sonoriense* with at least one turtle inside the body cavity on 28 May 2019.

Upon returning to the site at 0734 h on 29 May 2019, the skeleton was completely devoid of flesh, no longer intact, and scattered.

Although it is unclear if the turtles killed or only scavenged the Javelina, the Western Tanager was certainly alive when predated. What is certain is that *K. sonoriense* will feed upon both avian and mammalian species when the opportunity arises. Future monitoring at the wetland will help to gain a better understanding of this feeding behavior.

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***MALACLEMYS TERRAPIN* (Diamond-backed Terrapin). KYPHOSIS and LORDOSIS.** *Malaclemys terrapin* is the only estuarine turtle in North America, inhabiting coastal salt marshes and mangrove swamps along the Gulf of Mexico and Atlantic coastlines (Roosenburg and Kennedy 2019. Ecology and Conservation of the Diamond-backed Terrapin. Johns Hopkins University Press, Baltimore, Maryland. 296 pp.). The species has a storied history with humans, for the bourgeoisie class that delighted in terrapin soup in the late 1800s and early 1900s (Carr 1952. Handbook of Turtles. Cornell University Press, Ithaca, New York. 542 pp.). More recently, there has been increasing attention to terrapin

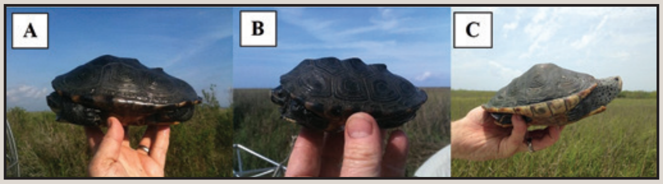

Fig. 1. A–C) Female *Malaclemys terrapin* captured in southwestern Louisiana, USA that exhibited kyphosis.

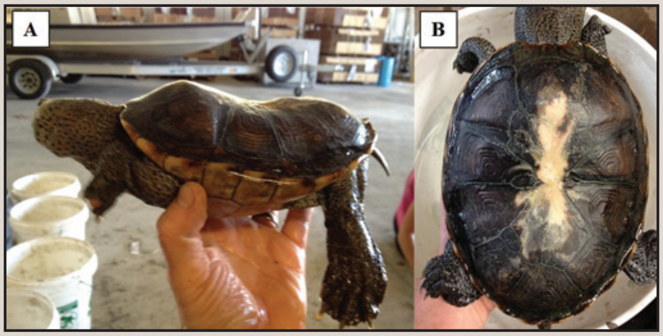

Fig. 2. Sagittal (A) and dorsal (B) views of a female *Malaclemys terrapin* captured in southwestern Louisiana, USA that exhibited lordosis.

conservation due to high mortality associated with commercial and recreational crab traps (Roosenburg et al. 1997. Conserv. Biol. 11:1166–1172; Grosse et al. 2009. Chelon. Conserv. Biol. 8:98–100). Even though numerous ecological studies have been completed on *M. terrapin* over the last 100 years, including several long-term studies with >1000 captures, there are apparently no published reports on the incidence of kyphosis or lordosis in the species. Here, I describe several individuals captured in southwestern Louisiana that exhibited kyphosis (aka, “hump-back”) and lordosis (aka, “sway-back”), and I also discuss the overall rates of these deformities observed in southwestern Louisiana in comparison to other turtle species.

Kyphosis in turtles is a convex deformity of the spine, with most cases reporting an elevated “hump” on the carapace (Rhodin et al. 1984. Brit. J. Herpetol. 6:369–373); some spinal humps resulting from kyphosis can be dramatically large (Elsey et al. 2017. Herpetol. Rev. 48:837–838; Taylor and Mendyk 2017. Herpetol. Rev. 48:418–419). Kyphosis is the most commonly reported malformation of the spine in turtles (Rhodin et al. 1984, *op. cit.*). From 2011–2016, I trapped Diamond-backed Terrapins at multiple locations throughout southwestern Louisiana, USA; for more information about the sites and methodology, see Selman et al. (2014. Chelon. Conserv. Biol. 13:131–139) and Selman et al. (2019. Estuar. Coast. 42:1138–1148). Three females were captured during this time that exhibited kyphosis, and all were captured in Mud Lake, Cameron Parish, Louisiana. On 27 Match 2012, I captured a mature kyphotic female individual (19.3 cm midline carapace length [MCL], 16.9 cm midline plastron length [MPL], 1250 g; Fig. 1A) with the deformity mainly present in vertebral 2. The next day (28 March 2012), I captured a kyphotic juvenile female, ca. 5 km away from the location of the first female (11.0 cm MCL, 10.3 cm MPL, 250 g; Fig. 1B); the deformity was more anterior and present in vertebrals 1 and 2. Two years later, on 7 May 2014 at the same site, I captured another kyphotic mature female (16.7 cm MCL, 15.5 cm MPL, 925 g; Fig. 1C), and the deformity was more posterior in vertebral 3. This third female was captured ca. 3 and ca. 1 km from the first and second females, respectively. Neither of the mature females (the first and third individuals) were found to be gravid via palpation, but only the third female was captured during the reproductive season.

Lordosis is a concave deformity of the spine in the middle of the carapace with most cases reporting a "saddle" in the carapace; this deformity is considerably rarer in turtles with previous cases observed almost entirely in sea turtles (Rhodin et al. 1984, *op. cit.*). On 15 May 2013, I captured a female Diamond-backed Terrapin on Rockefeller Wildlife Refuge, Vermilion Parish, that exhibited lordosis (17.8 cm MCL, 17.0 cm MPL, 1175 g; Fig. 2). The carapace was greatly deformed with anterior and posterior carapace "humps" and an unpigmented section in the "saddle" portion of the carapace. This unpigmented section appeared similar to a burn scar, and marsh fires do occasionally occur on this portion of the refuge. However, this is not entirely explainable as burn scars are usually on the highest portion of the carapace, and the scar was mostly in the lower "saddle" of the carapace. The central three vertebral scutes appeared fused and five internumerary scutes were present between the pleural and vertebral scutes. The female was also missing her right front foot and missing several toes on the left front foot. Interestingly, the individual was palpated and found to be gravid.

During the six-year study, I captured 865 unique terrapins in southwestern Louisiana, and I found three individuals with kyphosis at all sites (0.35%) and only one individual with lordosis (0.11%). When captures from only the Mud Lake site are considered (i.e., the only site where kyphosis was present), 3 of 404 individuals captured (0.74%) exhibited kyphosis, while no kyphotic individuals were captured at 15 other sites with 461 total captures. The reported rates of kyphosis in natural turtle populations are typically <0.50% (e.g., Trembath 2009. Chelon. Conserv. Biol. 8:94–95; Selman and Jones 2012. Chelon. Conserv. Biol. 11:259–261; Louque et al. 2015. Herpetol. Rev. 46:81; Mitchell et al. 2019. Herpetol. Rev. 50:353–354), with the highest population rate of kyphosis, 2.13%, reported in a population of *Trachemys gaigeae* (Big Bend Slider) by Stuart and Painter (2008. Herpetol. Rev. 39:218–219). Thus, the Mud Lake population of *M. terrapin* appears to have a relatively high incidence of kyphosis compared to other reported populations of freshwater turtles. For lordosis, to date only a single observation has been reported in a turtle species that is not a sea turtle. Mitchell (2014. Herpetol. Rev. 45:311) reported a case of lordosis in the freshwater turtle, *Chrysemys picta picta* (Eastern Painted Turtle). Therefore, my observation of lordosis in *M. terrapin* is only the second confirmed case of lordosis in freshwater turtles.

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***PSEUDEMYS GORZUGI* (Rio Grande Cooter). PREDATION.** *Pseudemys gorzugi* is a large freshwater turtle species found throughout south and west Texas and southeastern New Mexico, USA and northeastern Mexico (Ernst and Lovich 2009. Turtles of the United States and Canada. Second Edition. The John Hopkins University Press, Baltimore, Maryland. xii + 827 pp.; Pierce et al. 2016. *In* Rhodin et al. [eds.], Conservation Biology of Freshwater Turtles and Tortoises: A Compilation Project of the IUCN SSC Tortoise and Freshwater Turtle Specialist Group, pp. 100.1–100.12). The conservation status of this species is currently undergoing evaluation by the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service 2015. Fed. Reg. 80:37568–37579) and is currently listed as Near Threatened by the IUCN (http://www.iucnredlist.org/species/18459/97425928; 29 Aug 2019), state-threatened in New Mexico, and a Species of Greatest Conservation Need in Texas (Pierce et al. 2016, *op. cit.*). Knowledge on the ecology and natural history of *P. gorzugi* is extremely limited, and most of what is known about *P. gorzugi* is inferred from the closely related species *P. concinna* (Lovich and Ennen 2013. Amphibia-Reptilia 34:11–23), prior to being elevated to a full species by Ernst (1990. Cat. Am. Amph. Rept. 461:1–2). Additionally, a limited range, elusive behavior, and suspected declines further contribute to the paucity of information on the natural history of *P. gorzugi*. Little is known about *P. gorzugi* predation, but suggested predators of hatchlings include mammals, ravens, and large wading birds (Ernst and Lovich 2009, *op. cit.*). Here, we report an additional predator of *P. gorzugi*.

On 16 May 2019, two of us (APB, DRD) observed an adult Yellow-crowned Night Heron (*Nyctanassa violacea*) along San Felipe Creek in Blue Hole Park, Del Rio, Val Verde County, Texas, USA (29.36913°N, 100.88480°W; WGS 84), with a juvenile *P. gorzugi* (ca. 5 cm carapace length) in its beak. We observed the heron manipulate the juvenile *P. gorzugi* in its beak for ca. 3 min before approaching, causing the heron to fly to the opposite shore of San Felipe Creek, still holding the *P. gorzugi*. When we approached a second time, the heron flew out of sight, again still holding the juvenile *P. gorzugi*. It remains unclear if the heron was ultimately able to consume the juvenile *P. gorzugi*, which appeared dead by the time the heron flew off. We used 10× magnification binoculars to view this interaction and confirm the identification of the turtle. Yellow-crowned Night Herons are generalist predators and are known to consume various crustaceans, arachnids, insects, fish, amphibians, and reptiles, including the turtles *Malaclemys terrapin* (Riegner 1982. Colonial Waterbirds 5:173–176) and *Sternotherus odoratus* (Niethammer and Kaiser 1983. Colonial Waterbirds 6:148–153). Wading birds are recognized as important predators of turtles, especially hatchlings (Janzen et al. 2000. J. Evol. Biol. 13:947–954), and to our knowledge, this is the first direct observation of avian predation on juvenile *P. gorzugi*.

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***TERRAPENE CAROLINA TRIUNGUIS* (Three-toed Box Turtle). DIET.** *Terrapene carolina triunguis* is an omnivorous species known to regularly consume fruits, roots, leaves, seeds, fungi, mollusks, annelids, arthropods, small vertebrates, bird and reptile eggs, and carrion (Ernst et al. 1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington D.C. 577 pp.). Although the literature on box turtle diet is often divided about the degree of carnivory in this species, insects, including many beetles, comprise a significant portion of *T. carolina* diets (Klimstra and Newsome. 1960. Ecology 41:639–647). Here, we report a new invasive prey species for *T. carolina triunguis* from Washington County, Arkansas, USA, *Popillia japonica* (Japanese Beetle).

On 12 August 2019, an adult male turtle (11+ years old, 127 mm max carapace length, 104 mm max carapace width, 126 mm max plastron length, 434.2 g) was collected as part of a demography study. While in captivity, the turtle excreted feces containing arthropod remains of at least one *P. japonica*, identified by large, intact pieces of the exoskeleton. Between 16–22 August 2019, additional *P. japonica* remains were found in three separate fecal samples from one or more of three adult box turtles, although it was impossible to discern the individual turtle(s) responsible as they were temporarily housed together. This suggests that *P. japonica* may already be a common prey item for this population. *Popillia japonica* is among the most widespread and common invasive insects in the eastern United States (Potter and Held. 2002. Annu. Rev. Entomol. 47:175–205), widely overlapping in geographic range with *T. carolina* and inhabiting many of the same habitat types. While the competitive relationships between *P. japonica* and native arthropods in the United States are poorly understood, *P. japonica* could emerge as an important food source should native species exhibit population declines due to competition or anthropogenic factors. *Popillia japonica* have been documented as a common prey item for some populations of *Glyptemys muhlenbergii* (Bog Turtle) and may already be a regular part of *T. carolina* diets in the eastern USA (Melendez et al. 2017. Herpetol. Conserv. Bio. 12:272–278).

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***TRACHEMYS SCRIPTA* (Red-eared Slider) and *PSEUDEMYS GORZUGI* (Rio Grande Cooter). FISH HOOK INGESTION and SHOOTING.** Recreational fishing has contributed to a decline of turtle populations in both marine and freshwater habitats due to boat collisions (Bennett and Litzgus 2014. J. Herpetol. 48:262–266), entanglement in traps and fishing lines (Grosse et al. 2009. Chelon. Conserv. Biol. 8:98–100), and ingestion of fish hooks (Nemoz et al. 2004. Biologia 59:185–189). Due to opportunistic foraging behavior of some turtles, using baited traps or hooks increases the probability of catching turtles as bycatch (Cartabiano et al. 2015. J. Freshw. Ecol. 30:407–415). Incidents of fish hook ingestion have been reported in many turtle species such as *Macrochelys temminckii* (Alligator Snapping Turtle; Trauth et al. 2017. Herpetol. Rev. 48:836), *Phrynop geoffroanus* (Geoffroy's Side-necked Turtle; Borges Da Rocha et al. 2018. Herpetol. Rev. 49:321–322), *Caretta caretta* (Loggerhead Sea Turtle; Hoarau et al. 2014. Mar. Pollut. Bull. 84:90–96), and *Lissemys punctata* (Flapshell Turtle; Sivanarayanan et al. 2014. Intas Polivet 15:178–179). Steen et al. (2014. PLoS ONE 9:e91368) reported that ca. 5% of 438 freshwater turtles of four different species (*Sternotherus odoratus* [Eastern Musk Turtle], *Chelydra serpentina* [Snapping Turtle], *Trachemys scripta* [Red-eared Slider], *Apalone spinifera* [Spiny Softshell]) in Tennessee and 3.5% of 170 *C. serpentina* in Virginia contained fish hooks. Furthermore, Sack et al. (2017. J. Zoo. Wildl. Med. 48:716–724) reported that 2.3% of all turtles (N = 1847) rescued between 2005–2014 had injuries from ingestion of fish hooks.

Fig. 1. X-radiograph images taken at Desert Willow Veterinary Service and Rehabilitation Center. A) female *Trachemys scripta* with a J-type fish hook in the mouth and B) a female *Pseudemys gorzugi* with bullet fragments in the left front leg.

In 2017, during a long-term, mark-recapture study of *Pseudemys gorzugi* (Rio Grande Cooter) on the Black River, Eddy County, New Mexico, USA, one female *P. gorzugi* was found with a fishing line protruding from its mouth and a hook embedded in the throat (Waldon et al. 2017. Herpetol. Rev. 48:837). In this case the hook was safely removed, but injuries from fishing gear could pose a risk for a state-threatened species such as *P. gorzugi*. In addition, carcasses of *P. gorzugi* and *T. scripta* have been found in New Mexico with evidence of gunshots, although the frequency is unknown (Pierce et al. 2016. *In* Rhodin et al. [eds.], Conservation Biology of Freshwater Turtles and Tortoises: A Compilation Project of the IUCN SSC Tortoise and Freshwater Turtle Specialist Group, pp. 100.1–100.12). In New Mexico, *P. gorzugi* can be found in the Pecos River and its tributaries, including the Black River. The river is used for irrigation, cattle ranching, oil industry, and for public recreation (i.e., swimming and fishing). Due to the conservation sensitivity of the species and the overlap between its habitat and recreational fishing areas, an assessment of the prevalence of fish hook ingestion and gunshot wounds is needed.

From 15 May to 17 August 2018, we captured turtles using traditional hoop net traps baited with canned sardines. We focused on two accessible stretches of the Black River. The first stretch is ca. 1500 m long, located upstream near the Black River headwaters and is managed by the Bureau of Land Management (BLM). The second stretch is ca. 3000 m long and is about 30 km downstream from the first stretch; this stretch is located within natural gas and oil industry sites as well as private properties. Captured turtles were transported to Desert Willow Veterinary Services and Wildlife Rehabilitation Center to assess the presence of ingested fish hooks using x-radiograph.

We radiographed 288 turtles: 152 female *P. gorzugi* (117–278 mm SCL), 120 male *P. gorzugi* (125–238 mm SCL), a male *Chrysemys picta* (Painted Turtle; 158 mm SCL), four female *T. scripta* (153–244 mm SCL), 10 male *T. scripta* (123–195 mm SCL), and one *Chelydra serpentina* (298 mm SCL). Of all x-rayed individuals, six turtles were found with signs of injuries caused by anthropogenic activities. Two female *T. scripta* (205, 244 mm SCL) and one female *P. gorzugi* (278 mm SCL) each had a fish hook in the mouth (Fig. 1A). Hooks appeared to be J-type hooks with the size ranging from 8.9–31 mm long. The hooks were removed safely by hand after examination. Unexpectedly, we also found three female *P. gorzugi* with, respectively, a bullet in the hind leg, bullet fragments in the front leg, and a metal piece in the throat region (251, 173, 240 mm SCL, respectively; Fig. 1B). Individuals shot appeared to be in good condition and only had minor scars on their legs.

Our findings showed a relatively low proportion of turtles with ingested fish hooks on the Black River (1%). However, the ingestion of fish hooks could be species and sex specific. Sack et al. (2017, *op. cit.*) noted that the common species likely found with ingested fish hooks were *T. scripta* and *C. serpentina*. Moreover, in *C. serpentina*, the percentage of females with ingested fish hooks could be as high as 33% (Steen et al. 2014, *op. cit.*). It is worth pointing out that all individuals with gunshot wounds and ingested fish hooks were adult females, two of which were reproductively mature (i.e., contained shelled-eggs or oviductal follicles). Ingestion of fish hooks may lead to severe injuries such as lead poisoning and intestinal perforations (Borkowski 1997. J. Zoo. Wildl. Med. 28:109–113).

Individuals that ingested fish hooks had a 1.2–11% chance of mortality (Steen and Robinson 2017. Conserv. Biol. 31:1333–1339). Due to common life history traits of turtles (i.e., late maturing and high mortality of young and eggs), loss of adult females may have a negative effect on the future of the population. Steen and Robinson (2017, *op. cit.*) suggested that fish hooks should be included as one of the threats to turtle populations, especially when the turtles' distribution and habitat overlap with recreational fishing. Although we did not find any carcasses with gunshot wounds, the potential threat posed by shooting should not be neglected. Educating anglers and hunters about the ecological importance of turtles could minimize the misconception that turtles are a nuisance and reduce illegal shooting and killing of turtles.

This study was approved by the BLM, New Mexico Department of Game and Fish (Authorization #3621), and Eastern New Mexico University IACUC (Approval #04-27/2018). This research work was supported in part by the Share with Wildlife Program at New Mexico Department of Game and Fish and State Wildlife Grant T-32-4, #11. We thank Desert Willow Veterinary Service and Rehabilitation Center for assisting us with x-radiographs. Moreover, we thank private landowners for giving us permission to survey on their properties and A. Kreikemeier for helping with surveys.

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CROCODYLIA — CROCODILIANS

***CAIMAN YACARE* (Yacare Caiman). DIET.** *Caiman yacare* has an extensive distribution in South America and it attains high density in the Pantanal wetlands, western Brazil (Mourão et al. 2000. Biol. Cons. 92:175–183). A detailed study found that the food items of *C. yacare* in the Pantanal varied with age, size, and habitats of individuals sampled (Santos et al. 1996. Herpetol. J. 6:111–117). Juveniles (< 50 cm SVL) rely more heavily on aquatic invertebrates (mainly insects) while adults (> 71 cm SVL) rely more heavily on fish. Birds and mammals were rarely recorded in the diet of *C. yacare*, with only one record each for 196 individuals sampled in the Pantanal. It is believed that the main aquatic behavior of *C. yacare* is responsible for the scarcity of birds and mammals in its diet. Here we report two instances of bird predation by adult *C. yacare* in the Brazilian Pantanal, including one on land. Both records were obtained during observations of a congregation of aquatic birds nesting in a mixed species colony (rookery, locally known as *ninhal*) in Rio Negro Ranch, southern Pantanal (19.5902°S, 56.2166°W; SAD 69). The colony had ca. 500 nests in trees (1–67 nests per tree) distributed in an area ca. 0.5 ha of gallery forest facing the right riverbank of the Rio Negro, a 30-m wide perennial black water river. The bottom of the rookery bordered an oxbow lake that was draining to the main river channel as the dry season progressed. The reproductive bird colony was quite noisy and included active nests of Neotropical Cormorant (*Phalacrocorax brasilianus*), American Anhinga (*Anhinga anhinga*), and White-necked Heron (*Ardea cocoi*). Several caimans congregated in the waters close to the riverbank bordering the nesting colony. Juvenile birds commonly exercised their wing muscles at the edge of nests, while adults and nestlings often performed aggressive behavior towards individuals of close nests, and displacements of subordinate individuals were common. On 11 May 2002, we observed a juvenile *P. brasilianus* (similar size to an adult bird and completely feathered) fall down from a nest at the edge of the rookery to the river channel beneath. The bird was promptly captured by an adult *C. yacare* that was in the water surface. After being disturbed by other individuals, the caiman crossed the river to feed on the bird on the shallow waters of the opposite riverbank. On 19 May 2002, another fallen juvenile *P. brasilianus* was observed walking beneath the trees in the center of the rookery. An adult caiman that was laying on the ground within the gallery forest beneath the trees ran up and grabbed the bird with a vigorous bite. The caiman could have been moving on land from the shrinking oxbow lake towards the main river channel (Campos et al. 2003. Copeia 2003:628–634) when it found the bird. Adult *P. brasilianus* weigh from 1.11–1.95 kg (Monteiro et al. 2011. Parasitol. Res. 109:849–855). The consumption of such aquatic birds may constitute a substantial energy input for adult caimans in terms of biomass and nutritional content. As far as we know, this is the first published record of *C. yacare* preying on birds on land within a forest. Caimans can move extensive distances in the Brazilian Pantanal (Campos et al. 2006. Herpetol. J. 16:123–132) and their movement away from drying pools may also provide opportunistic encounters with prey on land such as those described here.

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***CROCODYLUS ACUTUS* (American Crocodile). CANNIBALISM.** *Crocodylus acutus* primarily inhabits coastlines, cays, and coastal lagoons throughout its wide range along the Pacific and Atlantic coast of Mexico, Central America, and northern South America as well as Cuba, Jamaica, Hispaniola and the southern tip of Florida (Thorbjarnarson 1989. *In* Hall [ed.], Crocodiles: Their Ecology, Management, and Conservation, pp. 228–258. IUCN, The World Conservation Union Publication, Gland, Switzerland). Recently in Belize, individuals and populations of *C. acutus* have been observed further inland in what was considered typical *Crocodylus moreletii* (Morelet's Crocodile) habitat, likely reflecting the loss of quality (nesting) habitat on the cayes and the coast due to a rise in development (Tellez and Boucher 2018. Herpetol. Rev. 49:492–498). The habitat modification and human encroachment in coastal environments possibly could contribute to changes in population dynamics and population distribution of *C. acutus*, consequently producing areas with higher densities and potentially triggering aggressive behavior, such as cannibalism (Thorbjarnarson 1989, *op. cit.*; Platt and Thorbjarnarson 2000. Copeia 2000:869–873). Cannibalism is understood to be a common phenomenon among crocodilians and is presumed to be an important population regulation mechanism (Rootes and Chabreck 1993. Herpetologica 49:99–107; Delany et al. 2011. Herpetologica 67:174–185).

As part of an ongoing nationwide *C. acutus* population survey, we witnessed an occurrence of cannibalism in *C. acutus* in the Bourdon Canal, Belize District during a nocturnal eyeshine survey on the night of 19 July 2019 at 2316 h. Upon close examination, we observed a subadult *C. acutus* (estimated total length = 1.2 m) feeding on the carcass of a juvenile crocodile (estimated total length = 0.8 m). It is unknown whether the death of the juvenile crocodile was as a direct result of predation by the subadult, or if it had died by other causes (e.g., diseases). We speculate that this occurrence was the result of predation as the carcass appeared a relatively recent kill while in the jaws of the cannibalizing crocodile. Additionally, the encounter rate of *C. acutus* at Bourdon canal was 0.8 individuals/km which is a relatively low density. Therefore, intraspecific competition for food or territory between the two crocodiles would be of low probability. Furthermore, neither of the crocodiles were of breeding size, therefore competition for mates is likely improbable.

This is the first report of cannibalism among wild *C. acutus* in Belize as well as the first record in Central America. There have been three reported previous cases of cannibalism in the entire range of *C. acutus*. Seijas et al. (1985. Herpetol. Rev. 16:26) reported aggressive behavior in *C. acutus* in Venezuela, observing a juvenile *C. acutus* (total length = 0.63 m) gripping in its jaws a hatchling *C. acutus* (total length = 0.27 m). Richards and Wasilewski (2003. Herpetol. Rev. 34:371) reported cannibalism in *C. acutus* as a form of predation whereby a juvenile (total length = 0.8 m) preyed heavily on microchipped *C. acutus* hatchlings in Florida. Another case by Casas-Andreu and Mendez-de la Cruz (1993. Bol. Soc. Herpetol. Mex. 5:60–61) documents cannibalism among *C. acutus* in Jalisco, Mexico in the form of necrophagy. Our observation represents the fourth reported case of cannibalism among *C. acutus* throughout its extensive distribution. In addition, several reports on cannibalism among New World crocodilians exists documenting larger crocodiles preying upon smaller conspecifics: Cedeño-Vázquez et al. (2016. Mesoamer. Herpetol. 3:470–472) found among the ingesta of an adult male (total length = 1.93 m) a metal tag that had been clipped onto the foot webbing of a subadult female *C. moreletii* (total length = 1.46 m). Rootes and Chabreck (1993, *op. cit.*) reported that a large adult *Alligator mississippiensis* (total length = 2.73 m) preyed upon juvenile and small adult *A. mississippiensis* (total length = 1.22–2.12 m).

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***PALEOSUCHUS PALPEBROSUS* (Dwarf Caiman). NESTING.** *Paleosuchus palpebrosus* is considered the smallest species of extant crocodilians, reaching an average length of 1.7 m, but with occasional records of individuals measuring >2 m (Campos et al. 2010. Amphibia-Reptilia 31:339–442). This species occurs in the Amazon, Orinoco, Paraguay, Paraná, and São Francisco river basins in South America, utilizing flooded forests near rivers or lakes (Magnusson 1985. Amazoniana 2:193–204). This species builds its nests with available organic material from the forest floor, forming mounds with 10–22 eggs per litter (Magnusson and Campos 2010. Crocodile Status Survey and Conserv. Action Plan. 40:42; Medem 1981. Los Crocodylia de Sur America. Colciencias Press, Bogotá, Colombia. 344 pp.). Little is known about the reproductive biology of *P. palpebrosus,* with data only available from the Amazonian and Pantanal biomes in South America (Medem 1981, *op. cit.*; Campos and Sanaiotti 2006. Herpetol. Rev. 37:81; Campos et al. 2015. J. Herpetol. 49:95–98). In this survey, we performed the first nest monitoring of wild individuals in the Atlantic Forest area in northeast Brazil.

On 29 March 2015, we identified a *P. palpebrosus* nest on Dois Irmãos weir margin, a water body located within an Atlantic

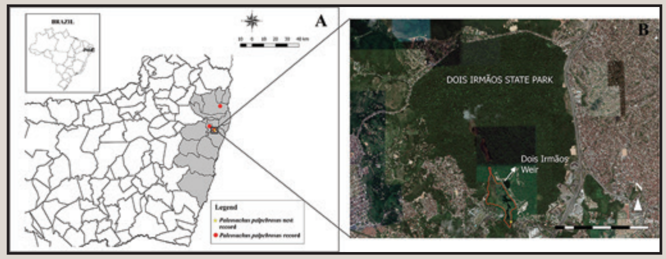

Fig. 1. A) Records of *Paleosuchus palpebrosus* (Dwarf Caiman) in the metropolitan region of Recife, Brazil (highlighted in gray); B) location of Dois Irmãos State Park.

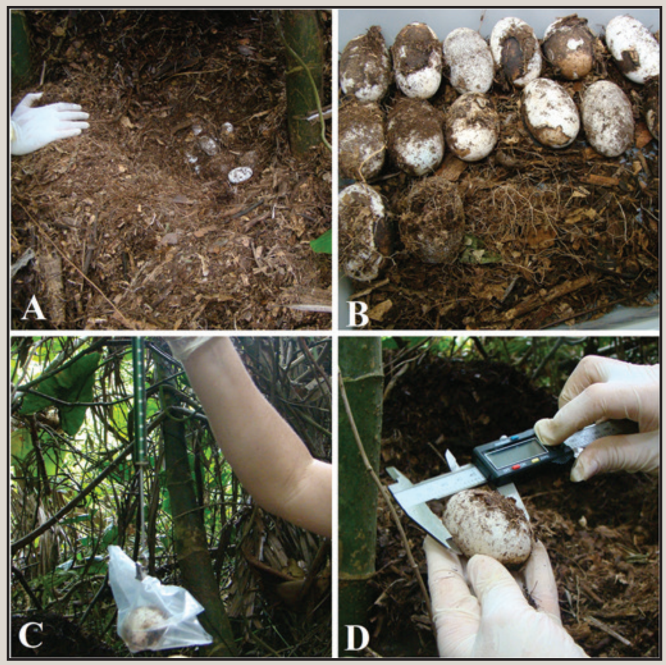

Fig. 2. A) *Paleosuchus palpebrosus* (Dwarf Caiman) nest in the Atlantic rainforest; B) eggs found in the nest; C) weighing eggs; D) measuring eggs.

Forest Conservation Unit, called Dois Irmãos State Park (PEDI), in the city of Recife, Brazil (8.01433°S, 34.94672°W; WGS 84; Fig. 1). The nest was found in a water-logged area, near the water line and constructed with leaves and branches. It had a diameter of 180 cm, with 67 cm of total height, 14 cm of distance from the top of the nest to the incubation chamber, which was 13 cm high (Fig. 2A). We identified 14 eggs (Fig. 2B), a number that corroborates with the average number of eggs in Pantanal and the Amazon in Brazil (Campos et al. 2015, *op. cit.*). The eggs had an average weight of 52.93 ± 10.12 g (Fig. 2C), an average length of 67.47 ± 3.25 cm, and an average width of 38.8 ± 1.06 cm (Fig. 2D).

Nest attendance by the female was observed. When there was a human nearby, she came out of the water and laid atop of the nest (Fig. 3A). Aquatic traps were set for the female, but the attempts were unsuccessful. Besides the female, two adult males were identified and captured in the area (130, 145 cm total length; 75, 65.5 cm in SVL; 7655, 14380 g).

Eggs hatched on 8 May 2015, with 10 neonates successfully emerging. Embryos were dead in two eggs, and the other two was manually hatched by us (Fig. 3B). The two manually hatched neonates measured 21.3 and 21.5 cm total length, 10.5 and 10.8 cm in SVL, and weighed 33 and 37 g (Fig. 3C). In addition, we measured

Fig. 3. A) Parental care of *Paleosuchus palpebrosus* (Dwarf Caiman); B) neonate *P. palpebrosus* that we assisted with hatching; C) individuals released at Dois Irmãos weir in the Atlantic Rainforest.

the nest temperature in the last 10 days of incubation using a data logger, which ranged from 24.7–34.9°C, with an average of 29.8°C.

The presence of a *P. palpebrosus* nest in a forested environment corroborates the species habitat selection characteristic (Campos and Magnusson 2013. J. Therm. Biol. 38:20–33). Previous nesting records are associated with the rainy season in Suriname and Brazilian Pantanal (Ouboter 1996. Ecological Studies on Crocodilians in Suriname: Niche Segregation and Competition in Three Predators. SBP Academic Publishing, Amsterdam. 140 pp.; Campos et al. 2015, *op. cit.*) and the dry season also, in Colombia and Brazilian and Amazon (Medem 1981, *op. cit.*; Campos and Sanaiotti 2006, *op. cit.*). We recorded the hatchings in the early wet season, probably related to the flooding of the weir adjacent areas, that would flood the nest (Campos et al. 2015, *op. cit.*) and kill the embryos in the eggs.

The female presence near the nest is a common behavior of crocodilians, but the time in residence and the type of behavior is variable between species and individuals (Grigg 2015. Biology and Evolution of Crocodylians. Cornell University Press, Ithaca, New York. 649 pp.). According to Kushlan and Kushlan (1980. Herpetologica 36:27–32), there are four phases of parental behavior: attentiveness, threat, aggressive, and withdraw. In this record, the threat behavior was observed when the female was only positioned on the nest, without showing an aggressive behavior.

Aspects related to the reproductive biology of *P. palpebrosus* are still emerging and largely unknown in Atlantic Forest environments. Fragmentation of natural habitats and intensification of anthropic activity have negative impacts on caiman populations (Mascarenhas Junior et al. 2018. Herpetol. Notes. 11:977–980). The knowledge of preliminary reproductive aspects of this species in its global distribution, mainly in protected areas, can provide important data for a better understanding of the biological and ecological conditions of the species when investing in conservation strategies.

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SQUAMATA — LIZARDS

***AMEIVA AMEIVA* (Giant Ameiva). PREDATION.** *Ameiva ameiva* (Linnaeus 1758) is a lizard that inhabits open areas in South America (Vanzolini et al. 1980. Os Répteis das Caatingas. Academia Brasileira de Ciências, Rio de Janeiro, Brazil. 161 pp.; Peters and Donoso-Barros 1986. Catalogue of the Neotropical Squamata. Part II. Lizards and Amphisbaenians. Revised Edition. Smithsonian Institution Press, Washington, D.C. 293 pp.) and feeds mainly on invertebrates, and occasionally on vertebrates (Magnusson and Silva 1993. J. Herpetol. 27:380–385; Sales et al. 2011. Herpetol. J. 21:199–207). There are records of predation on *A. ameiva* by snakes and lizards (Rodrigues et al. 2015. Rev. Bras. Zoo. Ciências 16:123–127; Santos and Vaz-Silva 2012. Herpetol. Notes 5:495–496; Silva et al. 2016. Herpetol. Rev. 47:292), small mammals (Filadelfo et al. 2011. Herpetol. Rev. 42:598; Piatti et al. 2011. Herpetol. Rev. 42:426), and birds (Granzinolli et al. 2007. Herpetol. Rev. 38:448–449). Here, we provide the first report of predation on a juvenile *A. ameiva* by a *Falco femoralis*.

On 21 April 2019, at BR 040 Road (85.3133°S, 135.1418°W; WGS 84; 823 m elev.), Minas Gerais, Brazil, we found a deceased adult *Falco femoralis* (Aplomado Falcon), run over by a car. We collected the specimen, and after its dissection, we found a partially digested juvenile *A. ameiva* in its stomach (Fig. 1). The specimens were deposited at the Laboratório de Anatomia Comparativa de Vertebrados, Universidade de Brasília, Brasília, Brazil (LACV 3471). *Falco femoralis* is a widely distributed species in the Americas, occurring from the southwestern United States to southern Chile (Blake 1977. Manual of Neotropical Birds. University of Chicago Press, Chicago, Illinois. 724 pp.). The species preys mostly upon birds, although there are some records of small mammals, invertebrates (Hector 1985. The Condor 87:366–342; Rojas and Stappung 2005. J. Raptor Res. 39:55–60),

Fig. 1. Partially digested *Ameiva ameiva* found in the stomach of a *Falco femoralis* from Minas Gerais, Brazil.

and snakes (Liébana et al. 2015. Herpetol. Notes 8:411–412). Therefore, this is the first report of predation on a lizard species in the wild.

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***AMEIVULA OCELLIFERA* (Spix's Whiptail). TAIL BIFURCATION.** Caudal autotomy is a defense mechanism widely used by lizards in response to the attack of predators (Meyer et al. 2002. Herpetologica 58:75–86). Lizards can repair many kinds of tissues that are essential to tail regeneration, but this process is not always perfect (Passos et al. 2016. Phyllomedusa 15:79–83). Tail bifurcation is an abnormality related to variations in the process of tail regeneration (Andrade et al. 2015. Herpetol. Bull. 131:28–29), and has been reported in several lizard families, including Teiidae (Gogliath et al. 2012. Herpetol. Rev. 43:129; Passos et al. 2016, *op. cit.*). Herein, we report tail bifurcation in the whiptail lizard *Ameivula ocellifera*, a small teiid (up to 100 mm SVL) widely distributed in northeastern Brazil (Sales and Freire 2015. J. Herpetol. 49:579–585).

At 1110 h on 19 March 2015, during a behavioral study with a population of *A. ocellifera* from Lagoa Nova Municipality, Rio Grande do Norte, northeastern Brazil (6.1233°S, 36.5642°W; WGS 84; 680 m elev.), we filmed a female individual with a bifurcated tail (Fig. 1). The bifurcation point was positioned in the mid-region of the tail. Since we have not captured the individual, we could not take precise measurements of body and tail, but based on the recorded video and comparisons with other individuals that were filmed and then captured, the SVL of the female was estimated around 60 mm, and the right tail branch had about 1.25 × the length of the left one. The regenerated region of tail bifurcation was obvious due to the distinct shape of re-grown scales, which clearly diverged from patterns of the original portion of the tail (Fig. 1). The lizard was actively foraging, spending most of the time walking, but occasionally stopping to move leaf litter and dig the substrate. After observing the lizard, it did not appear that the bifid tail interfered with the individual's movement.

Fig. 1. Individual of *Ameivula ocellifera* with bifurcated tail from Rio Grande do Norte, Brazil.

Throughout the behavioral study, which occurred in March and September 2015, we observed a total of 127 *A. ocellifera* individuals. Fifteen lizards had undergone caudal autotomy, which corresponds to a frequency of 11.8% in the population. Of the 11 individuals with already regenerated tails, only one had a bifurcated tail. Thus, the frequency of tail bifurcation was 0.8% in relation to the entire population, but 9.1% in relation to individuals with regenerated tails. Vrcibrafic and Niemeyer (2013. Herpetol. Rev. 44:510–511) also found a low frequency of tail bifurcation in populations of the Brazilian skinks *Notobauya frenata* and *Psychosaura macrorhyncha* (1.7% and 1.2%, respectively), and Andrade et al. (2015, *op. cit.*) found a slightly higher rate in a population of Brazilian gecko *Hemidactylus agrius* (3.1%). Despite the low frequency in the *A. ocellifera* population (0.8%), based on the rate of occurrence only with respect to individuals with regenerated tails (9.1%), we suggest that this abnormality may not be so rare to occur during the process of tail regeneration following caudal autotomy. This is the first report of tail bifurcation in *A. ocellifera*.

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***AMPHISBAENA VERMICULARIS* (Wagler's Worm Lizard). DIET.** *Amphisbaena vermicularis* is a species of worm lizard distributed from northeastern Brazil to Bolivia (www.icmbio.gov.br; 16 Jun 2019). In Brazil, they are found in the Caatinga, Cerrado, and Atlantic Forest biomes with records for anthropic areas (www.icmbio.gov.br; 16 Jun 2019). The diet of *A. vermicularis* includes mainly insects such as termites, ants, beetles, but also Nematoda (Barros-Filho 1996. Sitientibus 14:57–68; Esteves 2008. Pap. Avulsos. Zool. 48:329–334). Many biological aspects of the *Amphisbaena* are still unknown, especially due to their fossorial habits, making it difficult to collect these specimens and restricting observations in nature (Navega-Gonçalves 2009. Zool. 26:511–526).

At 1324 h on 9 May 2019, an *A. vermicularis* was observed near a trash can within a house in Feira de Santana, Bahia, Brazil (12.23451°S, 38.98007°W; WGS 84). The trash can was in an area with an earthen floor. The specimen had its head outside a hole in the ground biting the external side of a broken chicken eggshell and tried and failed to drag it into the hole (Fig. 1A). The lizard oriented itself more outside the hole and tried again to bite the eggshell (Fig. 1B). Then it began to smell and to lick the egg white on the internal side of the eggshell (Fig. 1C, D). After this, it bit and pulled out a piece of the eggshell, dragging it into the hole (Fig. 1E). Approximately 1 min later, the specimen reappeared and pulled out another piece of the eggshell. The first record of this behavior was at 1334 h and the last record at 1517 h. This is the first record of *A. vermicularis* feeding on chicken eggshells and foraging on human trash.

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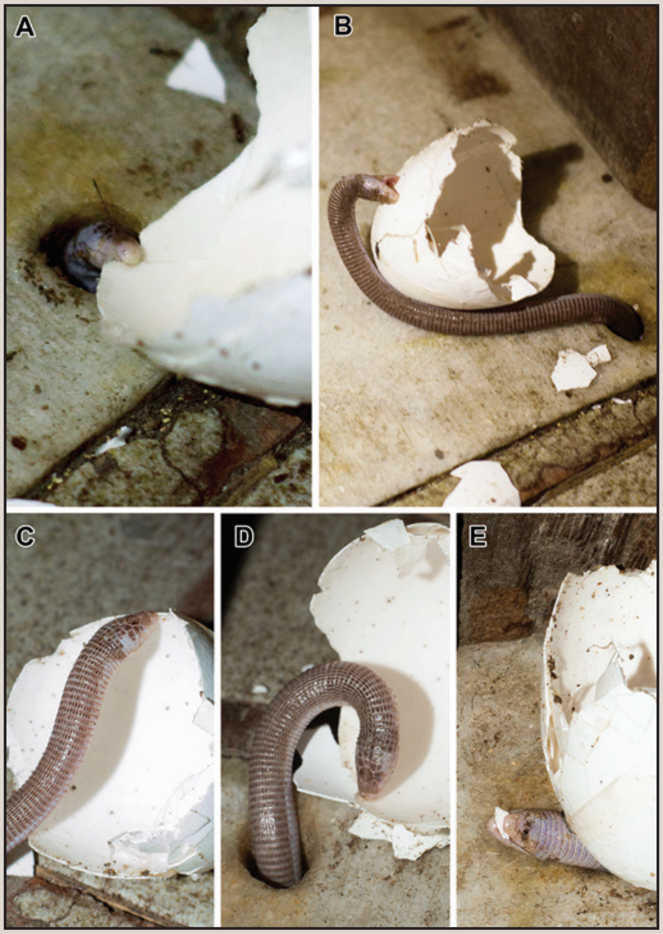

Fig. 1. *Amphisbaena vermicularis* feeding on chicken egg: A) *A. vermicularis* trying to drag the eggshell into the hole; B) biting the eggshell; C–D) smelling and licking the egg white; E. pulling out a piece of eggshell.

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***ANOLIS EVERMANNI* (Puerto Rican Emerald Anole). SAP FEEDING.** Sap feeding has seldom been reported in lizards, such as *Leiocephalus carinatus* (Smith et al. 2008. Herpetol. Rev. 39:228), and geckos such as *Gehyra australis* (Letnic and Madden 1997. West. Austr. Nat. 21:207–208; see review by Cooper and Vitt 2002. J. Zool. 257:487–517) and *Rhacodactylus auriculatus* (Snyder et al. 2008. Herpetol. Rev. 39:93). However, sap-feeding has been documented only once in anoles (Norval and Mao 2013. Herpetol. Notes 6:501–502). Here, we report sap feeding in *Anolis evermanni*, a medium-sized anole (70 mm maximum SVL) that inhabits tree canopies. This species is widely distributed in uplands and intermediate elevations (20–1205 m) in mountains throughout Puerto Rico (Powell and Henderson 2009. Natural History of West Indian Reptiles and Amphibians. University Press of Florida, Gainesville, Florida. xxiv + 495 pp.).

PHOTO BY EMIR PADRÓN-SANTIAGO

Fig. 1. *Anolis evermanni* licking the sap in the trunk of *Cyrilla racemiflora* at Luquillo Experimental Forest, Puerto Rico.

On 25 April 2019 between 1300 and 1400 h, we observed an adult male *A. evermanni* licking the sap on a trunk of *Cyrilla racemiflora* (Cyrillaceae) at a height of 0.5 m in El Toro Trail of the Luquillo Experimental Forest (18.27784°N, 65.84164°W; WGS 84; 912 m elev.), northeastern Puerto Rico (Fig. 1). *Cyrilla racemiflora* is a large canopy tree native to the Caribbean and the southeastern United States. We observed the anole licking the sap from an injury on the main trunk for a period of 2 min.

This behavior is the first documented record of sap feeding for anoles in Puerto Rico, and the second in the world. The first record was for *A. sagrei*, introduced in Taiwan, that was observed licking the sap of a banana plant, *Musa sapientum*, in an agricultural field (Norval and Mao 2013. Herpetol. Notes. 6:501–502). This additional report of sap feeding in anoles suggests that this behavior could be more common than previously acknowledged in the literature, in the same way that has been suggested for other rare anole feeding behaviors not commonly reported such as nectarivory (Perry and Lazell 1997. Herpetol. Rev. 28:150–151).

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***ANOLIS FITCHI* (Fitch's Anole). TAIL BIFURCATION.** Tail bifurcation has been formally documented in many lizard families, which sometimes occurs as a result of previous injury events like intra- or interspecific conflict or predation attempts. In these cases, abnormal tail regeneration is a possibility, where the new tail can grow misaligned from the original one (Lynn 1950. Herpetologica 6:81–84; Arnold 1988. *In* Gans and Huey [eds.], Biology of Reptilia, pp. 235–273. Alan R. Liss, New York, New York; Clause and

Fig. 1. *Anolis fitchi* with a bifurcated tail from Morona Santiago Province, Ecuador.

Capaldi 2006. J. Exp. Zool. 305A:965–973). *Anolis fitchi* is a small lizard distributed in Colombia and Ecuador, and in the eastern foothills of the Andes (Valencia and Garzón 2011. Guía de Anfibios y Reptiles en Ambientes Cercanos a las Estaciones del OCP. Fundación Herpetológica Gustavo Orcés, Quito, Ecuador. 268 pp.). On 16 July 2018 at 2149 h, near Salado Chico River, at Alshi, Nueve de Octubre Parish, Morona Santiago Province, Ecuador (2.23643°S, 78.26681°W; WGS 84; 1640 m elev.), an adult female *A. fitchi* was found sleeping on a leaf of a tree ca. 2 m above the ground. This individual showed a fracture in the middle part of the tail and a noteworthy tail bifurcation located in the posterior region, with a secondary tail measuring ca. 20 mm.

Although several authors have reported tail bifurcation in some species of lizards: *Podarcis muralis* (Sorlin et al 2019. Herpetol. Rev. 50:337–338), *P. melisellensis* (Baeckens and Scholliers 2018. Herpetol. Rev. 49:746), *Anolis porcatus* (Iturriaga and Olcha 2016. Revista Cubana de Ciencias Biológicas 5:1–4), these are uncommon occurrences. To our best knowledge, this is the first record of tail bifurcation in *A. fitchi*.

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***ANOLIS PONCENSIS* (Ponce Small-fanned Anole). REPRODUCTION.** Animal sexual behaviors include courtship and copulation (Hull et al. 2002. *In* Pfaff [eds.], Hormones, Brain and Behavior, pp. 3–137. Academic Press, New York, New York). Sexual behavior in lizards is a topic that has been studied since the early 20th century (Noble and Bradley 1933. Ann. New York Acad. Sci. 35:25–100). However, many of these studies have been done in controlled laboratory conditions and there are few reports on how this occurs in the wild, and less so in anoles. Furthermore, other studies explain that these sexual behaviors are attributable to certain hormones that activate different areas of the central nervous system (Crews 1987. Sci. Am. 257:116–121; Neal and Wade 2007. Behav. Brain Res. 177:177–185). Nevertheless, here we focus on the functionality of sexual behavior in the wild. Herein, we document the sexual behavior of *Anolis poncensis*, a small-sized anole (48 mm maximum SVL) that inhabits exposed grassy areas (Rivero 1998. The Amphibians and Reptiles of Puerto Rico. Second Edition Revised. Editorial de la Universidad de Puerto Rico, San Juan, Puerto Rico. 510 pp.) and occurs within the subtropical dry lowland region of southern Puerto Rico (Powell and Henderson 2009. Natural History of West Indian Reptiles and Amphibians. University Press of Florida, Gainesville, Florida. 520 pp.).

PHOTO BY ALBERTO C. CRUZ-MENDOZA

Fig. 1. Copulation of *Anolis poncensis* on a *Pilosocereus royenii* cactus.

On 20 October 2018 at 1110 h, we observed a courtship-copulation event of *A. poncensis* on the side of a cactus, *Pilosocereus royenii* (Cactaceae), at a height of 0.8 m, in Las Cucharas Natural Reserve, Municipality of Ponce (17.9732°N, 66.6736°W), southern Puerto Rico (Fig. 1). During the courtship, the male displayed in a vertical position on the side of the cactus by lifting its body as if it were doing "push-ups" and by showing off the dewlap at the same time. The male then chased after the female and quickly managed to get on top of the back. The female struggled and tried to escape but was soon seized and secured by a tight gripping of the upper body by the male's forelegs and a bite on the back of the neck. Shortly after achieving a secure grip, the male positioned the left hind leg on top of the female's left hind leg and proceeded to place the cloaca under the female's cloaca, which resulted in copulation for ca. 2 min. Afterwards, the male leaped into the grass on the ground while still holding and biting the back of the female's neck. After this, we did not see them anymore and are unsure if they continued copulating in the grass.

These sexual behaviors presented by *A. poncensis* have been documented previously in other anole species, and already have possible explanations of their functions. Firstly, the courtship behavior that we observed in *A. poncensis* is common within the genus *Anolis* (Greenberg 1943. Physiol. Zool. 16:110–122). It is believed that its main purpose is for sexual selection by females when more than one male is present, in which the female chooses the male that shows off the dewlap most frequent (Evan 1938. J.

Comp. Psychol., 25:7–125). Secondly, the biting behind the back of the neck is a behavior used commonly in lizards to immobilize the female if it tries to escape (Crews 1987, *op. cit.*). These sexual behaviors presented by *A. poncensis* are important to be described in more detail since the courtship attempts that result in copulation are the ones that ensure the viability of the species.

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***ASPIDOSCELIS GUTTATUS* (Mexican Racerunner). ARBOREAL BEHAVIOR.** Many species of typically ground-dwelling lizards and snakes lack an arboreal psychology, but are anatomically capable of climbing trees. Species that occasionally stretch their habitat dimensions at varying ontogenetic stages to include arboreal forays are noteworthy (e.g., the lizard *Cnemidophorus* (*Aspidoscelis*) *tigris* [Anderson 1993. *In* Wright and Vitt [eds.]. Biology of Whiptail Lizards, pp. 83–114. Oklahoma Mus. Nat. Hist., Norman, Oklahoma] and the snakes *Bothrops alternatus* [Entiauspe-Neto 2019. Herpetol. Rev. 50:149–150] and *B. moojeni* [Ferraz et al. 2019. Herpetol. Rev. 50:150]). Species of *Aspidoscelis* (family Teiidae) are typically diurnal and ground-dwelling, even though they are anatomically well equipped to climb. *Aspidoscelis guttatus* (Mexican Racerunner), which has been reported from several states in southern Mexico (Duellman and Wellman 1960. Misc. Publ. Mus. Zool. Univ. Michigan 111:1–81), is a ubiquitous large-bodied species in the Pacific lowlands of the state of Oaxaca (Mata-Silva et al. 2015. Mesoam. Herpetol. 2:1–62). Noteworthy behaviors reported for this species have included drinking water from sources provided by humans for other animals (Mata-González et al. 2016. Mesoam. Herpetol. 3:483–484), and seasonal consumption of emerging winged termites (Walker et al. 2019. Herpetol. Rev. 50:568–569). We here add to the knowledge of noteworthy behaviors for this species.

We recorded observations on *A. guttatus* in May and June 2015 at Paja Blanca, Municipality of San Pedro Huamelula, Oaxaca, Mexico (15.92384°N, 95.73852°W; WGS 84; ca. 20 m elev.). Numerous individuals of this species were routinely observed as they were basking, foraging, feeding, interacting with other lizard species (Walker et al. 2019, *op. cit.*), and/or seeking mates typically either at or near ground level. These lizards have well developed claws enabling them to dig for prey and to routinely utilize slightly elevated structures within a complex assortment of substrate components and litter. We observed a young adult male *A. guttatus*, identified based on color pattern, which was naturally positioned ca. 100 cm up a derelict rough-barked tree within a lowland forest (Fig. 1). The individual was clearly stabilized in the tree by clawed fore- and hind feet. Whether this arboreal foray served the purpose of foraging, basking, or escape behavior (though not from the observers) was open to conjecture. However, even a vertical inclination of a short distances would greatly increase the habitat dimensions and resources available to an individual. To place this observation in perspective, JMW has observed thousands of lizards of the genus *Aspidoscelis* in Mexico and the United States without ever observing one that had climbed to the level in a tree as reported in this note. However, the remarkable and frequent presence of *A. gularis* on granite boulders up to 2.5 m in height in Johnston County, Oklahoma, was reported by Walker et al. 1986 (Southwest. Nat. 31:405–408).

Fig. 1. Young adult male *Aspidoscelis guttatus* that had climbed to a position ca. 100 cm up a derelict rough-barked tree (though not as a reaction to observers) at Paja Blanca in Oaxaca, Mexico.

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***CRYPTOBLEPHARUS PANNOSUS* (Ragged Snake-eyed Skink). TAIL TRIFURCATION.** *Cryptoblepharus pannosus* (Horner 2007. The Beagle. Records of the Museum and Art Galleries of the Northern Territory, Supplement 3:21–198) is a species of small lizard of the family Scinicidae. It occurs in a variety of habitats throughout eastern Australia, west of the Great Dividing Range and north of the Murray River, where it is usually observed in wooded environments (Horner 2007, *op. cit.*). Here, we report a relatively rare lizard tail malformation recorded for the first time in this species.

On the 17 April 2019 at ca. 1030 h AEDT near Reefton, New South Wales, Australia (34.249°S, 147.416°E), LR observed a *C. pannosus* that had a trifurcate tail. However, it escaped before a photo could be taken, and was not able to be found. The following day, at ca. 0900 h, it was observed 35 m away, in the area we had originally observed it the day before. Several images were taken (Fig. 1), over the course of 10 min, as the lizard moved across the pile of firewood it lived in. The lizard was sighted once more in the same location, in the afternoon of 20 April 2019, although no further images were collected. It was not able to be captured at any point, so no further testing was able to be conducted. The lizard did not appear to be suffering any mobility or health issues as compared to the other skinks observed in the area. Measurements of the specimen were performed by zooming in on images of the lizard so that the backdrop was life-size. Measurements were as follows: 35 mm SVL, 35 mm from the base of the tail to the branching point, 6 mm left tail, 8 mm middle tail, 11 mm right tail. The longest of these tail tips was observed to be flexible (Fig. 1), but the other two demonstrated no flexibility. Although the longest of the rigid tips extends straight out from the branching point, the shortest exhibits a bend of ca. 120° at its tip.

It is uncommon to find skinks or other lizards with three or more tails, although such lizards have been reported from Australia and other parts of the world (Broadley 1977. Occas. Pap. Natl. Mus. South Rhod. B Nat. Sci. 6:45–79; Bates 1990. African Herp

Fig. 1. A) *Cryptoblepharus pannosus* sunning itself on a log in New South Wales, Australia; B) detail of the trifurcate tail.

News. 14:19–22; Wilson 2012. Australian Lizards: A Natural History. CSIRO Publishing, Collingwood, Victoria. 208 pp.; Homan 2015. The Victoria Naturalist 132:12–15; Koleska and Jablonski 2015. Ecol. Montenegrina. 3:26–28). Such malformation is well known and described in a variety of cases (e.g., Bates 1990, *op. cit.*; Jablonski 2016. IRCF Rept. Amphib. 23:171–172). However, this report increases the number of species where tail trifurcation is known. The occurrence of tail malformation may be underreported because they often affect survival, fitness, movement, and antipredator strategies (Bates 1990, *op. cit.*). This study was supported by the Slovak Research and Development Agency under the contract no. APVV-15-0147.

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***DACTYLOA PUNCTATA* (Amazon Green Anole). DIET.** To know the diet of a species is fundamental to understand its trophic position, besides providing indications about its abiotic and biotic interactions (Simmons et al. 2005. Herpetologica 61:124–134), therefore informing conservation strategies. The knowledge of the natural history of *Dactyloa punctata* is incipient and information about its diet is lacking. The species is known to include ants and orthopterans in its diet (Vitt et al. 2003. J. Herpetol. 37:276–285), but specific information prey species is absent. In the central Amazon they are arboreal lizards, living on trunks, stems, and canopies having a restricted niche breadth (Vitt et al. 1999. Oikos 87:286–294).

PHOTO BY TÉRCIO DA SILVA MELO

Fig. 1. *Dactyloa punctata* feeding on the ant species *Cephalotes atratus* in Sergipe, Brazil.

On 20 February 2014 we observed a specimen of *D. punctata* feeding on ants (Fig. 1) in an Atlantic Rainforest remnant in eastern Sergipe (10.3223°S, 370327°W; SAD 69). The lizard was parallel to an ant trail and consumed an individual *Cephalotes atratus* at 0930 h, located by its side. *Cephalotes atratus* is an arboreal ant species with a broad distribution in the neotropics and is found in a variety of habitats, including urban areas (Kempf 1951. Rev. Entomol. 22:1–244; www.antweb.org; 14 Mar 2019). Ant specimens were collected and deposited at the Mirmecology Laboratory, Research Center of Cacau (CEPEC), CEPLAC, Ilhéus, Bahia (CPDC 5738). The consumption of *C. atratus* indicates trophic plasticity of *D. punctata* in the Atlantic rainforest. We hypothesize that *C. atratus* is a major item in the diet of *D. punctata* because this ant is also arboreal and widely distributed.

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***GLAUCOMASTIX ITABAIANENSIS*. TAIL BIFURCATION.** Tail bifurcation is known to occur in multiple families, including Anguidae (Conzendey et al. 2013. Herpetol. Rev. 44:145–146), Gekkonidae (Kumbar et al. 2011. Herpetol. Rev. 42:49), Lacertidae (Dudek and Ekner-Grzyb 2014. Nat. Slo. 16:65–66; Koleska and Jablonski 2015. Ecol. 3:1893–1899), and Teiidae (Pelegrin and Leão 2016. Cuad. Herpetol. 30:21–23). *Glaucomastix itabaianensis* is a diurnal teiid lizard. This species is endemic to the "restinga" ecosystem sand dune habitat distributed from the Municipality of Jandaíra in Bahia to Pirambu Municipality in Sergipe, with a disjunct population in Municipality of Areia Branca, Sergipe, Brazil (Xavier and Dias 2015. Herpetol. Rev. 46:430–431; Rosário et al. 2019. Zootaxa 4624:451–477).

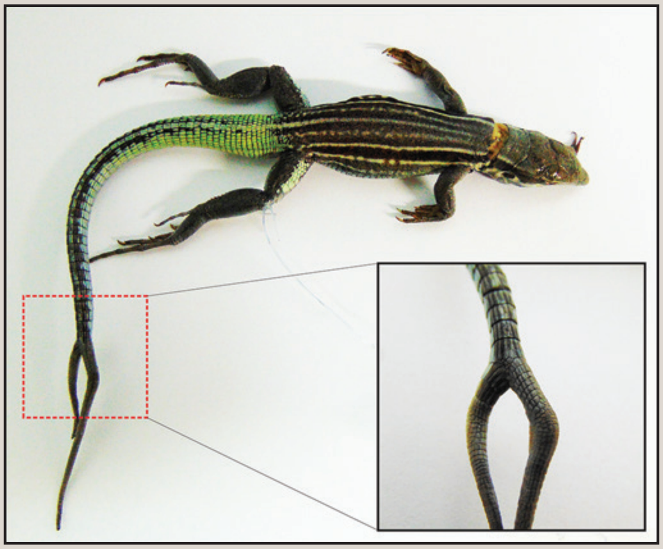

FIG. 1. *Glaucomastix itabaianensis* from Sergipe, Brazil with a bifurcated tail.

On 14 March 2018, we captured an adult male *G. itabaianensis* (60.40 mm SVL, 6.5 g) with a bifurcated tail (Fig. 1) in a fragment of "restinga" habitat (36.84364°W, 10.69363°S; WGS 84; 64 m elev.), Municipality of Pirambu, Sergipe, Brazil. The lizard was captured (collection permit: 53218 SISBIO/ICMBio), euthanized (license protocol: 34/2016), and deposited in the Herpetological Collection of the Laboratório de Biologia e Ecologia de Vertebrados / Universidade Federal de Sergipe (LABEVL 1038). The majority of lizards are able to autotomize their tails and subsequently regenerate it (Arnold 1984. J. Nat. Hist. 18:127–169). This morphological alteration may contribute to the formation of an additional tail during the regeneration process at the affected area due to injury caused by a possible predation attempt (Hayes et al. 2012. Biod. Cons. 21:1893–1835; Gogliath et al. 2012. Herpetol Rev. 43:129; Koleska and Jablonski 2015 Ecol Mont 3:26–28). Thus, tail bifurcation is not believed to be result of the deformity in tail development, contaminants or genetic factors (Lynn 1950. Herpetologica 6:81–84).

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***HOLCOSUS UNDULATUS* (Rainbow Ameiva). REPRODUCTION.** *Holcosus undulatus* is distributed on the Atlantic slopes from southern Tamaulipas, Mexico, to the Nuevo Segovia and Río San Juan, Nicaragua, and on the Pacific slopes from Nayarit, Mexico, to Puntarenas, Costa Rica; it is also found on Isla Mujeres, east of Quintana Roo, Mexico, and the Corn Islands, east of Nicaragua (Echternacht. 1971. Misc. Publ. Univ. Kansas Mus. Nat. Hist. 55:1–86). This diurnal species occurs mainly in shaded habitats in forest or forest-edge areas usually below 1500 m (Echternacht 1971, *op. cit.*). Reproductive information in this species is little known, but it has been suggested that breeding is seasonal (June and July) and females produce 2–7 (mean = 5.3) eggs (Fitch 1970. Misc. Publ. Univ. Kansas Mus. Nat. Hist. 52:1–247).

A gravid female *H. undulatus* (102 mm SVL, 206 mm tail length, 26 g) was collected alive on 17 June 2017 at 1040 h, in a ecotone between conserved forest and secondary forest, 1.6 km S of Nuevo Pensar del Campesino (23.0099°N, 99.1454°W; WGS 84; 258 m elev.), Municipality of Gómez Farías, Tamaulipas, Mexico. The lizard was kept alone in a plastic container and two days later we noticed she had laid five eggs. The length, width, and mass (mean ± SE) of the five eggs were 19.51 ± 0.34 mm, 11.58 ± 0.11 mm, 0.80 ± 0.01 g, respectively. Our observation supports earlier reports concerning seasonality of reproduction and clutch size (Fitch 1980, *op. cit.*).

The specimen was deposited in the Colección de Anfibios y Reptiles of the Instituto Tecnológico de Ciudad Victoria (CAR-ITCV 315), under the collection license Oficio Núm. SGPA/DGVS/02355.

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***IGUANA IGUANA* (Common Green Iguana). PREDATION.** Saurophagy is relatively common among vertebrates with a number of taxa preying on lizards. However, predation on large lizards by primates is uncommon. Comparatively, predation of lizards by arboreal, diurnal primates is rarely observed and biased to small species (Heymann et al. 2000. Am. J. Primatol. 51:153158; Martins and Cassimiro 2011. Herpetol. Rev. 42:433434; Canale et al. 2013. Herpetol. Notes 6:323326; Amora et al. 2014. Herpetol. Notes 7:547549; Melo et al. 2018. Herpetol. Notes 11:171173). *Iguana iguana* is a large (SVL = 7.7 cm in neonates to more than 50 cm in adults; Bock 2014. http://www.iucn-isg.org/species/iguana-species/iguana-iguana/; 19 April 2018), arboreal, herbivorous, diurnal lizard, widely distributed from northern Mexico to southeastern Brazil, including some Caribbean islands (Burghardt and Rand 1982. Iguanas of the World: Their Behavior, Ecology, and Conservation. Noyes Publications, Park Ridge, New Jersey. 472 pp.; Rand et al. 1990. J. Herpetol. 24:211214). Although there is substantial information on *I. iguana* predation by an array of taxa (Greene et al. 1978. J. Herpetol. 12:169–176; Rivas et al. 1998. Herpetol. Rev. 29:238–239; Engeman et al. 2005. Herpetol. Rev. 36:320; Filipiak et al. 2012. Herpetol. Rev. 43:487–488; Mollo Neto et al. 2013. Herpetol. Notes 6:37–38; Coutinho et al. 2014. Rev. Bras. Ornitol. 22:305–306), little information exists on primates preying on this widely distributed and relatively abundant large arboreal lizard (Rivas et al. 1998, *op. cit.*). Herein we report the first record of predation on *I. iguana* by *Mico argentatus* (Silvery Marmoset), a small, diurnal callitrichid, endemic to Brazilian Amazonia. *Mico argentatus* is omnivorous, feeding mainly on gum, fruits, arthropods, bird eggs, and small vertebrates (Tavares and Ferrari 2002. *In* Lisboa [ed.], Caxiuanã: Biodiversidade e Sustentabilidade, pp. 707–719. CNPq/MCT, Belém, Pará; Corrêa 2006. PhD Thesis, Universidade Federal do Pará/Museu Paraense Emilio Goeldi, Belém).

The predation took place in the edge of a ca. 150-ha semi-deciduous forest tract located in the boundary of Alter do Chão village (2.5086°S, 54.9456°W; WGS 84), in the right bank of the Tapajós River, state of Pará, Brazil. The landscape in this region is

Fig. 1. Silvery Marmosets (*Mico argentatus*) preying on two lizard species in Alter do Chão, Pará, Brazil. A) Common Green Iguana (*Iguana iguana*); B) lizard tentatively identified as the Tropical House Gecko (*Hemidactylus mabouia*).

mainly composed of semideciduous forest and patches of Amazonian savanna of varying sizes (Pires and Prance 1985. *In* Prance and Lovejoy [eds.], Key Environments: Amazonia, pp. 109–145. Pergamon Press, Oxford). The vegetation in this area is relatively disturbed, with canopies reaching 10–15 m. Several groups of *M. argentatus* occur there. At 1040 h on 17 December 2017, we observed an adult *M. argentatus* preying upon a juvenile *I. iguana* (length from vent to edge of severed head ca. 10 cm) in the canopy of a tree, at a height of ca. 6 m. We observed the *M. argentatus* handling this prey for ca. 2 min. It consumed the head and most of the tail (Fig. 1A). Other members of the group persistently chased the individual that captured the lizard and it left the area carrying its prey in the mouth. This event is noteworthy in that the *M. argentatus* individual captured and consumed an *I. iguana* weighing ca. 30% (100 g) of its own body weight.

A second predation event occurred in the same locality at 0815 h on 20 December 2017, when another adult *M. argentatus* (smaller than the first one) grabbed and ate an unidentified adult lizard (length from vent to edge of severed body ca. 5 cm). We tentatively identified it as *Hemidactylus mabouia* due to its smooth clear skin and anatomy of hind limbs and tail. The marmoset handled it for ca. 7 min, consuming the head, forelimbs, and shanks (Fig. 1B). The monkey left the area carrying the remains of the prey in its hands after being chased by other monkeys of its social group. Because prey remains were taken in both occasions, lizard identification and size were determined by specialists through diagnostic characters evident from field notes and photographs (Lima et al. 2006. Guide to the frogs of Adolpho Ducke Reserve, Central Amazonia. Áttema Design Editorial, Manaus. 168 pp.), and comparison to preserved specimens. Although marmosets consume a range of animal prey (mostly invertebrates), lizards are an unusual component of their diet. Marmosets must rely on lizards occasionally, probably due to the difficulties involved in preying upon such active prey, particularly in the case of large iguanas that are capable of active defense. Considering the foraging behavior of *M. argentatus* (active inspection of tree holes, forks, and under tree bark), its arboreal habitat, the proximity between the forest and human buildings, and the relatively high abundance of both lizards, we believe that this primate may rely frequently on lizards in this site. Such opportunistic assaults however may be more frequent during the dry season because of the potential vulnerability of small vertebrates due to the seasonally low availability of arthropods, the primary food of callitrichids, including *M. argentatus* (Ferrari 1988. PhD. Dissertation, University of College, London; Corrêa 2006, *op. cit.*). Although predation of lizards by *M. argentatus* has been reported elsewhere (Tavares and Ferrari 2002, *op. cit.*; Corrêa 2006, *op. cit.*), this is the first account of *I. iguana* being preyed by this small callitrichid.

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LACERTA SCHREIBERI **(Schreiber´s Lizard). COLORATION.** During surveys for *Emys orbicularis* (European Pond Turtle), I observed an adult *Lacerta schreiberi* with unusual coloration—a uniform green background color, but with very minimal amounts of the dark reticulate dorsal pattern that usually shows this species. This individual also lacks the ventral dark dots. The lizard

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FIG. 1. Concolor morph of *Lacerta schreiberi* from Paderne de Allariz, Ourense, Spain.

was observed near a small stream on 21 July 2019, in Paderne de Allariz, Ourense, Spain. Concolor morphs are uniformly colored, having virtually no dorsal markings, and has been recorded in several species of *Podarcis*, *Scelarcis*, *Dalmatolacerta*, *Dinarolacerta*, *Lacerta*, *Darevskia*, and *Iberolacerta* (Arnold et al. 2007. Zootaxa 1430:1–86; Arribas 2001. Bulletí de la Societat Catalana d'Herpetologia 15:32–44.)

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***LEPIDODACTYLUS LUGUBRIS* (Mourning Gecko). DIET.** The diet of *Lepidodactylus lugubris* on Fiji is described as "insectivorous, eating small moths, ants, beetles, and other insects" (Zug 1991. Bishop Mus. Bull. Zool. 2:1–136; Morrison 2003. A Field Guide to the Herpetofauna of Fiji. University of the South Pacific, Suva, Fiji. 121 pp.), however, few species-specific details of prey type for *L. lugubris* are recorded. At 1952 h on 6 June 2011, a *L. lugubris* was observed capturing an emerald moth *Thalassodes* sp. (most likely *T. chloropis*) by the head and body (Fig. 1) on an upper beam of wooden deck of a building near Welangi, Taveuni, Fiji (16.7364°S, 179.9356°W; WGS 84), among LED fairy lights. It took the gecko over 3 min to consume the moth. *Emoia cyanura* was also observed foraging nearby on these wooden beams (Fitzsimons and Thomas 2016. Herpetol. Rev. 47:669).

The ecology of moths of Fiji are not well known (Tikoca et al. 2016. Austral Entom. 55:455–462; Tikoca et al. 2017. J. Res. Lepidoptera 49:69–79). *Thalassodes chloropis* is a common species in almost all localities on the largest islands of the Fiji group and other Pacific islands (Robinson 1975. Macrolepidoptera of Fiji and Rotuma: a Taxonomic and Biogeographic Study. Ph.D. Dissertation, Durham University, Durham, North Carolina. 437 pp.). Although Zug (1991, *op. cit.*) did not specify what size "small moths" constituted, it is likely that *T. chloropis* falls at the larger end of prey sizes for *L. lugubris*, and smaller moths (species unknown) were observed being consumed by *L. lugubris* at Colo-i-Suva (18.0361°S, 178.4658°E; WGS 84) on the Fijian island of Viti Levu. *Lepidodactylus lugubris* are native to the Pacific, and until the mid-1980s they were the most common and abundant house geckos before being largely replaced by Asian House Geckos (*Hemidactylus frenatus*; Zug 2013. Reptiles and Amphibians of the Pacific Islands: A Comprehensive Guide. University of California Press, Berkeley, California. 306 pp.) due to competition for insect resources (Petren and Case 1996. Ecology

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FIG. 1. *Lepidodactylus lugubris* consuming an emerald moth (*Thalassodes* sp.) in Taveuni, Fiji.

77:118–132). Nonetheless, *L. lugubris* is also expanding its range (e.g., Limpus et al. 1999. Mem. Queensland Mus. 43:777–781; Fitzsimons 2011. Aust. Zool. 35:619–621; Hoogmoed and Avila-Pires 2015. Zootaxa 4000:90–110) and further documentation of the specific prey and sizes would be important for both better understanding their ecology in their natural range and competitive impact in their expanding range.

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***MICROLOPHUS DELANONIS* (Hood Lava Lizard). CANNIBALISM.** *Microlophus delanonis* is a lizard endemic to Española Island and the Gardner Islets of the Galapagos Archipelago in Ecuador and is not categorized under any conservation criteria according to the IUCN. *Microlophus* are commonly found in the dry lowland zones of Galapagos, often close to the coast, basking on lava rocks, or hidden amongst bush and cacti (Van Denburgh and Slevin 1913. Proc. California Acad. Sci. 4:133–202). The diet of *Microlophus* lizards consists mainly of small arthropods and plant material (Hervías-Parejo et al. 2019. Curr. Zool. 65:353–361).

PHOTO BY LUIS CARLOS BELTRÁN

FIG. 1. Adult female *Microlophus delanonis* feeding on a juvenile conspecific on Española Island, Galapagos, Ecuador.

On 7 November 2015, at 0950 h, we observed an adult female *M. delanonis* preying on a juvenile of the same species on Española Island, Ecuador (1.4093°S, 89.6294°W; WGS 84; 15 m elev.). The lizard had swallowed its prey tail first, until the beginning of the forelimbs, before it was spotted over a lava rock. Upon encounter, both lizards remained motionless for ca. 1 min before the adult slipped away to the bushes out of sight (Fig. 1). We did not find a previous record of cannibalism of this species, though diet sampling of a related species, *M. pacificus* on Pinta Island, did return conspecific tissues (Schluter 1984. Oikos 43:291–300). Together, these findings suggest that cannibalism in *Microlophus* lizards may be more than a rare occurrence, deserving of further investigation. This publication is contribution number 2279 of the Charles Darwin Foundation for the Galapagos Islands.

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***OPHISAURUS VENTRALIS* (Eastern Glass Lizard). DIET.** At 1336 h on 19 March 2018 on Jekyll Island, Georgia, USA (31.0135°N, 81.4321°W; WGS 84) an *Ophisaurus ventralis* was captured in a permanent tidal brackish marsh wetland while consuming an *Uca pugnax* (Mud Fiddler Crab). The partially mauled and digested *U. pugnax* was firmly held in the jaws of the *O. ventralis* throughout its capture and handling (Fig. 1). To our knowledge this is the first record of *O. ventralis* preying on this species.

We commonly observe *O. ventralis* in marsh and wetland habitats on this island where *U. pugnax* (and other fiddler crab species) persist in high numbers and we suggest they potentially serve as a common dietary item. *Ophisaurus ventralis* are a primarily insectivorous species capable of consuming a variety of species. This note as well as previous observations of *O. ventralis* eating snails and beetles (Hamilton and Pollack 1961. Herpetologica 17:99–106) indicate they are capable of foraging on hard-shelled invertebrates. Little is known of *Ophisaurus* ecology, let alone within salt marshes; future research may reveal whether these diverse and regionally significant habitats serve as important and productive foraging grounds for *O. ventralis.*

Fig. 1. *Ophisaurus ventralis* consuming an *Uca pugnax* on Jekyll Island, Georgia, USA.

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***PHRYNOSOMA SOLARE* (Regal Horned Lizard). CLUTCH SIZE.** Most of our understanding of the reproduction of *Phrynosoma solare* comes from its range in Arizona (e.g., Parker 1971. Herpetologica 27:333–338; Van Devender and Howard 1973. Herpetologica 29: 238–239; Howard 1974. J. Arizona Acad. Sci. 9:108–116) or from a captive individual (Schonberger 1945. Copeia 1945:13–17). The only report on its reproduction in the Mexican part of its range is combined with Arizona specimens (Howard 1974, *op. cit.*). Here, we provide observations on the clutch size of *P. solare* from Sonora, Mexico, thus providing the first report on reproduction of *P. solare* solely from Mexico. We dissected several specimens of *P. solare* (N = 16 total) from Ortiz, Valle de Guaymas (28.2900°N, 110.7169°W; WGS 84; 103 m elev.; see Smith et al. [2005. Bull. Chicago Herpetol. Soc. 40:45–51] for collection details) in the collection of the University of Colorado Museum. Five females contained either oviductal eggs or ovarian follicles (mean SVL ± 1 SE: 87.7 ± 2.6 mm; range: 77.6–93.6 mm). Mean (± SE) clutch size was 17.8 ± 1.50 (range: 15–23; N = 5). While a linear regression found no significant relationship between SVL and clutch size ($r^2 = 0.53$, P = 0.16), the smallest clutch size was found in the two smallest females (15 eggs: 77.9, 88.2 mm SVL) and the clutch sizes generally increased with female SVL (17 eggs: 89.5 mm; 19 eggs: 89.4 mm; 23 eggs: 93.6 mm). The mean clutch size for *P. solare* from Sonora is similar to the clutch sizes of other populations of *P. solare*. A captive *P. solare* laid 28 eggs (Schonberger 1945, *op. cit.*). Van Devender and Howard (1973, *op. cit.*) observed a nest of a female *P. solare* (100–110 cm SVL) had 33 eggs in southern Arizona. Mean clutch size of *P. solare* from central Arizona was 20.5 and ranged from 17–25 (females 98–107 mm SVL; Parker 1971, *op. cit.*). Mean clutch size of *P. solare* in Pima County, Arizona was 21.1, and 20.4 for Arizona and Sonora, Mexico, and increased with SVL (Howard 1974, *op. cit.*).

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***PLESTIODON FASCIATUS* (Common Five-lined Skink). SCAVENGING.** *Plestiodon fasciatus* is considered a gape-limited, active predator of ground-dwelling arthropods. Over 80% of their generalized diet consists of Opiliones (harvestmen), Araneae (spiders), Dermaptera (earwigs), Coleoptera (beetles), and Blattaria (cockroaches; Fitch 1954. Univ. Kansas Publ. Mus. of Nat. Hist. 8:1–156; Hecnar et al. 2002. Herpetol. Rev. 33:307–308; Brazeau et al. 2015. Herpetol. Rev. 46:331–336). On 6 October 2018 at ca. 1300 h, in North Pass of Manchac, Tangipahoa Parish, Louisiana, USA (30.3033°N, 90.3300°W; WGS 84), BIC observed an adult *P. fasciatus* scavenge three freshly killed American Cockroaches (*Periplaneta americana*). The lizard did not eat the entire insects but tore off exposed soft parts. Two of the cockroaches were ca. 5 cm and one was ca. 2.5 cm in length. Scavenging of *P. americana* by *P. fasciatus* has not been documented until now. This observation, in addition to previous reports of *P. fasciatus* tearing apart live large prey items prior to swallowing (Judd 1955. Copeia 1955:135–136) and absence of exoskeleton parts in their scats (Fitch 1954, *op. cit.*; Brazeau et al. 2015, *op. cit.*), further demonstrates that *P. fasciatus* is a gape-limited, opportunistic feeder.

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***PLESTIODON* CF. *LATICEPS* (Broad-headed Skink). DIET.** Skinks in the genus *Plestiodon* are relatively abundant lizards found throughout the eastern United States; this group feeds primarily on a variety of small invertebrates. At 1245 h on 25 September 2018 on Jekyll Island, Georgia, USA (31.0599°N, 81.4193°W; WGS 84) we observed a *Plestiodon* skink (most likely *P. laticeps*: Shoop and Ruckdeschel 2003. Florida Sci. 66:43–51) actively feeding upon a mole cricket in the genus *Neoscapteriscus*, either *N. vicinus* or *N. borellii* (Tawny or Southern Mole Cricket, respectively; Fig. 1). Both these mole crickets are South American species considered invasive in the southeastern United States, and our observation demonstrates that native skinks within the genus *Plestiodon* prey upon invasive mole crickets in the *Neoscapteriscus* genus.

Fig. 1. *Plestiodon* sp. feeding upon a mole cricket (*Neoscapteriscus* sp.) on Jekyll Island, Georgia, USA.

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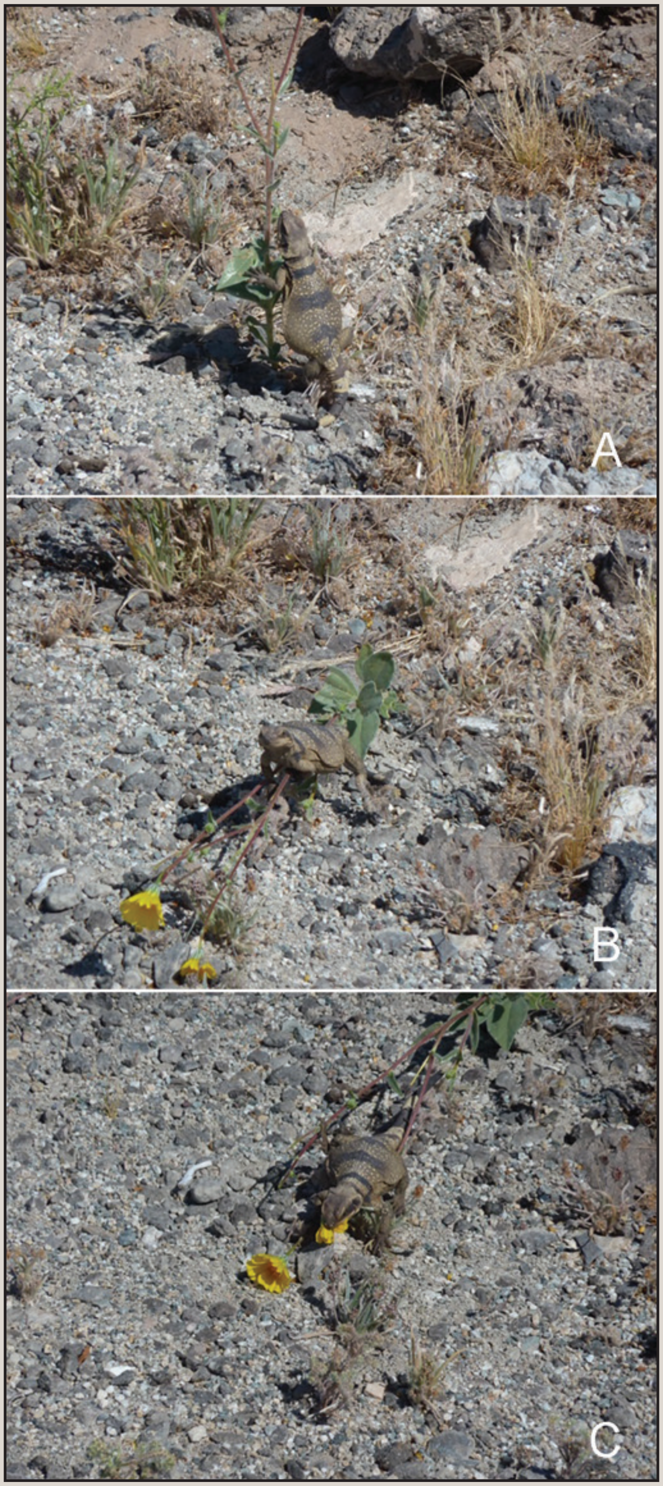
***SAUROMALUS ATER* (Common Chuckwalla). FORAGING BEHAVIOR.** *Sauromalus ater* is a large bodied diurnal herbivore of the Sonora and Mojave deserts of North America. They have been recorded to eat a wide diversity of flora, up to at least 30 species of plants (Nagy 1973. Copeia 1973:93–102; Hansen 1974. Herpetologica 30:120–123). Here, we report on an additional plant food item as well a unique behavior in accessing the flower for consumption.



PHOTOS BY TIMOTHY R. CROTHER

Fig. 1. A juvenile *Sauromalus ater* leaning on a Hairy Desert Sunflower (A), knocking it down (B), in order to reach and consume the flower (C).

On 22 April 2011 at 1500 h near Amboy Crater, San Bernardino County, California, USA (34.56031°N, 115.77469°W; WGS 84) in the Mojave Desert, one of us (TRC) observed multiple juvenile *Sauromalus ater* foraging on Hairy Desert Sunflower (*Geraea canescens*) flowers. The plants were about 45–61 cm tall with the flowers at the top. To access the flowers, the lizards leaned on, or climbed on and leaned to force the plant on its side to the ground. The lizards crawled to the flowers and ate them (Fig. 1). Based on the diet lists from Nagy (1973, *op. cit.*) and Hansen (1974, *op. cit.*) this is the first published record of *S. ater* eating *G. canescens*. More intriguing, it is also the first record of *S. ater* manipulating (knocking down) a plant to gain access to food (flower).

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***SCELOPORUS BROWNORUM* (Brown's Bunchgrass Lizard). AQUATIC ESCAPE BEHAVIOR and FLOTATION.** It has been reported that several lizard species escape from predators by swimming or floating on the water (Pianka and Vitt 2003. Lizards, Windows to the Evolution of Diversity. University of California Press, Berkeley, California. 333 pp.); this behavior has been specifically recorded in species that live near the bodies of water, such as *Basiliscus vittatus*, which is able to run on the surface of water (Rand and Marx 1967. Copeia 1967:230–233). Nevertheless, this escape strategy has also been recorded in some lizard species that live in arid places, like *Uma exsul* (Estrada-Rodríguez and Leyva-Pacheco 2007. Herpetol. Rev. 38:84–85), *Gambelia wislizenii* (Medica 2010. Herpetol. Rev. 41:354–355) and *Cophosaurus texanus* (Neváres de los Reyes et al. 2015. Herpetol. Rev. 46:89). In the genus *Sceloporus*, this behavior has been observed in *S. clarkii* (Zylstra and Weise 2010. Herpetol. Rev. 41:86) and *S. torquatus* (Carbajal-Márquez et al. 2014. Herpetol Rev. 45:134).

On 30 April 2016, we visited the hunting farm "Las Piletas", located on the Sierra Fría, Municipality of San José de Gracia, Aguascalientes, Mexico; we spotted an adult *Sceloporus brownorum* at 1425 h on the path near a small pond (22.20821°N, 102.60373°W; WGS 84). When we approached the individual, it ran into the water and swam ca. 2 m towards the center of the pond, where it stayed afloat for 6 min while attempting to grab pieces of grass that were floating nearby (Fig. 1). When we moved away from the pond, the lizard returned to the road. Approximately 30 min later, we returned to the pond, and the lizard performed the same behavior by swimming ca 1.7 m, staying afloat 4 min, and returning to the original spot once the threat was gone. This behavior is different from previous *Sceloporus* reports: *S. clarki* submerged in 6 cm deep water, and *S. torquatus* stayed close to the water edge, contrary to *S. brownorum* which stayed afloat in the middle of the pond for a couple of minutes. This record could enhance future ethological studies on the species *S. brownorum*.

Fig. 1. *Sceloporus brownorum* floating at the center of the pond in Sierra Fría, Aguascalientes, México.

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***SCELOPORUS MELANORHINUS* (Black-nosed Lizard). ESCAPE BEHAVIOR.** Optimal escape theory has been successful in predicting escape behavior of prey, especially those using fixed refugia, yet many prey individuals escape by fleeing long distances without using refuges (Cooper 2003. Ethology 109:617–626). Decisions to remain stationary or flee are influenced by an extensive cost-benefit analysis (Ydenberg and Dill 1986. Adv. Stud. Behav. 16:229–249). Cost of escaping include energetic cost, potential injury during escape, and loss of social and foraging opportunities (Cooper 2009. Curr. Zool. 55:123–131). Many behavioral aspects remain scarce in *Sceloporus melanorhinus* despite having a wide distribution in Mexico. Due to its cryptic coloring and secret habits, making *in situ* observations are difficult. Here, I present three preliminary mechanisms (immobility, squirreling, and locomotor escape) observed in *S. melanorhinus*, although more observation is needed to reveal other possible anti-predatory mechanisms.

Several observations were made from 2017–2018 in Copoya Municipality of Tuxtla Gutiérrez, Chiapas, Mexico (16.68079°N, 93.12884°W; WGS 84), on the escape behavior in *S. melanorhinus* when occasionally descending to the ground. Escape behaviors consist of fleeing, climbing as I approach, and remaining motionless (sometimes going out of sight on the far side of the trunk or branch). Some climb several meters in large trees, although when they are found perched on trees they just turn to the opposite side. Fleeing to bushes or pastures when they are on the ground has been observed less frequently.

At 1349 h on 21 July 2017, I encountered a gravid female *S. melanorhinus* digging a nest hole in the ground, and when it noticed my presence, it fled and climbed a tree ca. 2.2 m away. On 23 March 2018 at 1629 h, I encountered an adult male perched facing downward on a small tree (at 90 cm height and 46 cm diameter at the perch site). When I tried to photograph the lizard, it went to the opposite side of the tree, then I turned to follow it, but again the lizard went to the opposite part. Then after chasing the lizard again, it turned upward and climbed higher in the trunk at ca. 1 m and remained motionless (Fig. 1). A third observation of the use of arboreal microhabitat concerns a juvenile lizard. At 1510 h on 26 April 2018, a juvenile

FIG. 1. A cryptic colored male *Sceloporus melanorhinus*, trying to hide in the back of a small tree.

S. melanorhinus was perched in a trunk of *Haematoxylum brasiletto* tree ca. 1 m high remained immobile for a moment and then moved into the tree cavity when I attempted to take photographs. Juveniles and hatchlings occupy a wider range of habitat structures than their larger counterparts, by using narrow crevices of *H. brasiletto* trees and these also might be an escape from high temperatures.

Downes and Shine (1998. Anim. Behav. 55:1387–1396) demonstrated that predator avoidance had a higher priority than thermal advantage in the retreat site selected by the gecko *Amalosia lesueurii*, but they also noted that social interactions influenced choice. For a mainly tree-dwelling species such as *S. melanorhinus* (Smith 1948. Nat. Hist. Misc. 20:1–3; Álvarez del Toro 1982. Los Reptiles de Chiapas. 3rd Edition. Publ. Inst. Hist. Nat., Tuxtla Gutiérrez, Chiapas, México. 248 pp.), ecological aspects such as refuge from predators, food, and/or thermoregulation must be highly related to this microhabitat.

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***SCINCELLA GEMMINGERI* (Cope's Forest Ground Skink). REPRODUCTION.** *Scincella gemmingeri* occurs commonly and is widely distributed throughout central, southern, and eastern México (Canseco-Márquez and Gutiérrez-Mayen 2010. Anfibios y Reptiles del Valle de Tehuacán-Cuicatlán. Comisión Nacional para el Conocimiento y el Uso de la Biodiversidad, Fundación para la Reserva de la Biosfera Cuicatlán A. C., and Benemérita Universidad Autónoma de Puebla, Ciudad de México, México. 302 pp; Mata-Silva et al. 2015. Mesoamer. Herpetol. 2:6–62). Canseco-Márquez and Gutiérrez-Mayen (2010, *op. cit.*) report that the mode of reproduction of this species is viviparous because they collected a female adult with three oviductal eggs in San Isidro Buenos Aires, Oaxaca. Nevertheless, at 1300 h on 28 April 2019, we collected an adult female of *S. gemmingeri* (56.2 mm SVL, 3.6 g) from La Joya, Veracruz, México (19.61674°N, 97.02088°W; WGS 84; 2149 m elev.). Days after being captured, the female laid two small eggs (11.39 × 7.28 and 13.60 × 7.69 mm; 0.24, 0.36 g, respectively). The specimen was sacrificed and deposited in the herpetological collection Museo de Zoología, Facultad de Estudios Superiores Zaragoza (MZFZ 4102). This record represents the first evidence of oviparity in *S. gemmingeri*. Previous reports of oviparity in the genus *Scincella* is from *S. lateralis* (Elsey et al. 2017. Herpetol. Rev. 48:661–662).

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***STENOCERCUS FESTAE* (Peracca's Whorltail Iguana). REPRODUCTION.** *Stenocercus* is one of the most widely distributed and diverse lizard genera in the Ecuadorean Andes. However, information on the basic aspects of the reproductive ecology is only available for a few species within the genus (i.e., *S. angel*, *S. humeralis*; Torres-Carvajal 2000. Sci. P. Univ. Kansas Mus. Nat. Hist. 15:1–38; Torres-Carvajal 2007. Herpetol. Monogr. 21:76–178). Here we report the nesting habits and nest description of *S. festae*, a species endemic to the high-elevation ecosystems of south and central Ecuadorean Andes.

On 6 April 2019 we found an adult female *S. festae* (83.4 mm SVL; Fig. 1A) rolled up over a nest in the Culebrillas Lake area, Sangay National Park, Cañar Province (2.42632°S, 78.86176°W; WGS 84; 3942 m elev.). The area is categorized as a paramo grassland, characterized by the presence of small herbs, including *Distichia muscoides*, *Plantago rigida*, *Oritrophium limnophilum*, and *Valeriana plantaginea* (Ministerio del Ambiente del Ecuador 2012. Sistema de Clasificación de los Ecosistemas del Ecuador Continental. Subsecretaría de Patrimonio Natural. Quito, Ecuador. iv + 136 pp.). The nest was positioned in a small (ca. 54 × 35 mm) cavity in the soil and surrounded by the native vegetation (Fig. 1B). Two white oval eggs measuring an average of 20.7 × 12.3 mm were observed inside the nest (Fig. 1C). After seven days we revisited the nest again, however, no eggs or shells were found. Likewise, no other digging marks or evidence of alteration were found.

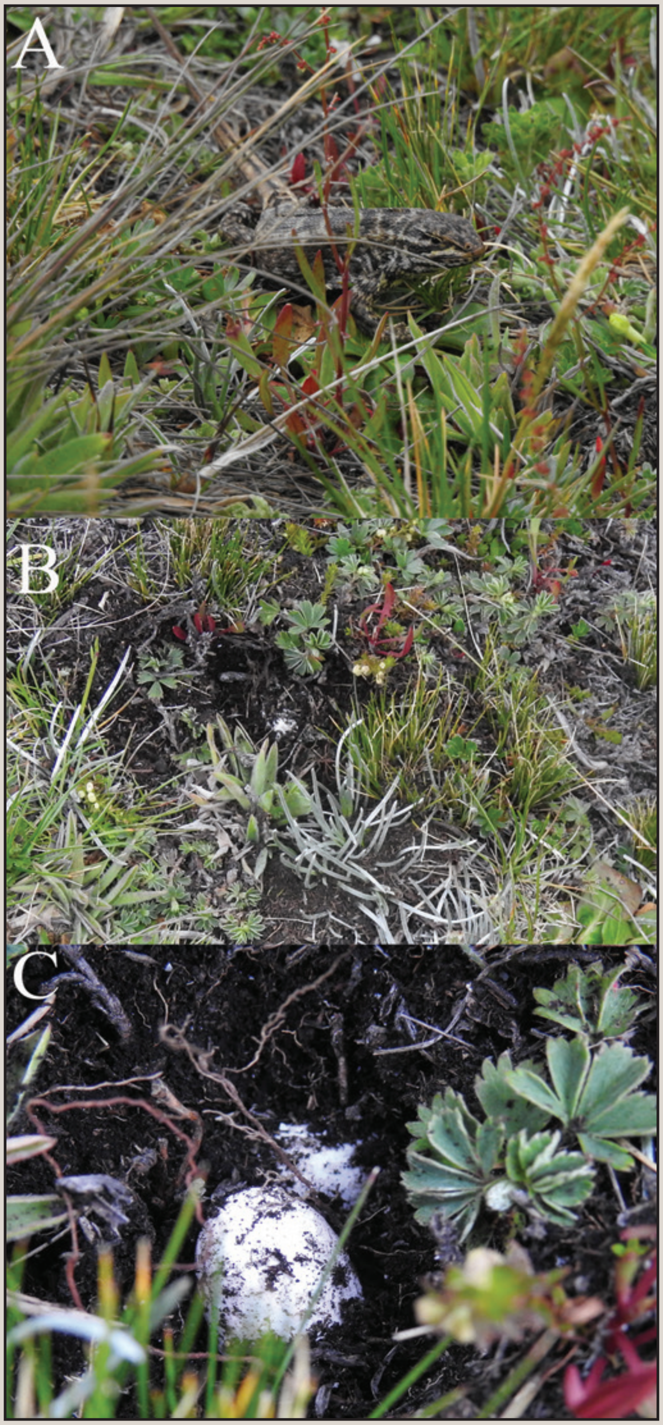

FIG. 1. Nesting of *Stenocercus festae*: A) adult female; B) nest surrounded by native vegetation; and C) eggs buried inside the nest.

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***STENODACTYLUS DORIAE* (Dune Sand Gecko). REPRODUCTION.** *Stenodactylus doriae* is known to occur in Saudi Arabia, Iran, Iraq, United Arab Emirates, Oman, Jordan, Israel, and Kuwait (Bar and Haimovitch 2011. A Field Guide to Reptiles and Amphibians of Israel. Herlizya, Israel. 245 pp.). There is a report in Bar and Haimovitch, (2011. *op. cit.*) of *S. doriae,* beginning in May, producing as many as five clutches of two eggs per reproductive season. Gravid females of *S. doriae* have been observed from March to September (Gardner 2013. The Amphibians and Reptiles of Oman and the UAE. Edition Chimaira, Frankfurt am Main. 480 pp.). In this note we add information on *S. doriae* reproduction in Israel from a histological examination of gonadal material from museum specimens.

A sample of 23 *S. doriae* was examined consisting of 13 adult males (mean SVL: 47.8 mm ± 4.6 SD, range: 43–58 mm), seven adult females (mean SVL: 58.9 mm ± 7.9 SD, range: 51–70 mm), two female subadults (40, 48 mm SVL), and one unsexed subadult (40 mm SVL), all collected during April between 1955–1979 in Israel and deposited in the Steinhardt Museum of Natural History at Tel Aviv University (SMNHTAU), Tel Aviv, Israel. All were from Yotvata (29.8963°N, 35.0592°E; WGS 84) A'rava Valley Region, Israel (SMNHTAU 1811, 1812, 1867, 2180, 2181, 2222, 2562–2564, 2672, 3339–3342, 3409, 3981–3985, 4495, 11645), except for SMNHTAU 11984, which was from Hazeva, (30.7679°N, 35.2785°E; WGS 84), A'rava Valley Region, Israel.

A small slit was made in the left side of the abdomen and the left testis was removed from males and the left ovary was removed from females for histological examination. Enlarged ovarian follicles (> 4 mm) or oviductal eggs were counted *in situ.* No histology was done on them. Removed gonads were embedded in paraffin, sections were cut at 5 µm and stained by Harris hematoxylin followed by eosin counterstain. Histology slides were deposited in The Steinhardt Museum of Natural History at Tel Aviv University (SMNHTAU).

All *S. doriae* adult males from April exhibited spermiogenesis in which lumina of the seminiferous tubules were lined by sperm or clusters of metamorphosing spermatids. The smallest reproductively active males both measured 43 mm SVL (SMNHTAU 2563, 3985). Considering the reproductive status of 7 *S. doriae* females, two females (SMNHTAU 3981, 3982; 70, 64 mm SVL) each contained two enlarged follicles (> 3 mm). One female (SMNHTAU 11984; 67 mm SVL) contained two oviductal eggs and one concurrent yolking follicle (> 4 mm), histological evidence indicating *S. doriae* produces multiple clutches during the same reproductive season. One female (SMNHTAU 2672; 55 mm SVL) contained one enlarged follicle (> 4 mm) and was the smallest reproductively active female. The ovaries of three slightly smaller females (SMNHTAU 3341, 3983, 1811; 51, 52, 53 mm SVL) were quiescent (no yolk deposition). They were arbitrarily considered as adults as it is possible they had not yet commenced reproductive activity.

The reproductive cycle of the congeners *S. sthenodactylus* and *S. petri* from Israel were both studied by Goldberg and Maza (2014. Herpetol. Rev. 45:136–137; 2018. Herpetol. Rev. 49:121–122). Reproduction was similar in all three species as reproduction commences in spring and multiple clutches of two eggs, occasionally one egg are produced.

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***TARENTOLA MAURITANICA* (Moorish Gecko). PREDATION.** *Tarentola mauritanica* naturally occur across a broad native range in the coast of the Mediterranean. However, they have been widely introduced elsewhere, both in Europe as well as other continents. In Argentina, it has been present since at least 1963 (Castello and Gil Rivas 1980. Medicina 40:673–677). At 1807 h on 17 October 2018, in a residential neighborhood of Buenos Aires, Argentina (34.61648°S, 58.51547°W; WGS 84), we observed an individual of *Turdus rufiventris* preying upon *Tarentola mauritanica.* On another occasion, at 1632 h on 25 December 2018, in front of General Paz Park in Buenos Aires, Argentina (34.56716°S, 58.50409°W; WGS 84), we observed an individual of *Parabuteo unicinctus* preying upon a *T. mauritanica* (Fig. 1). These specimens were photographed, but not collected. To our knowledge, this is the first report of *T. mauritanica* predation by *Turdus rufiventris* and *P. unicinctus.* We thank V. Reckitt for the photo.


PHOTO BY VERONICA RECKITT

Fig. 1. *Parabuteo unicinctus* preying upon *Tarentola mauritanica* in Buenos Aires, Argentina.

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***TRACHYLEPIS ATLANTICA* (Noronha Skink). TAIL BIFURCATION.** *Trachylepis atlantica* is an endemic species of lizard inhabiting the archipelago of Fernando de Noronha, located about 350 km off the northeastern Brazilian coast. This species is the most conspicuous element of the Fernando de Noronha herpetofauna, being practically ubiquitous and very abundant locally (Rocha et al. 2009. J. Herpetol.43: 450–459).

Caudal autotomy is a common strategy among lepidosaurs to escape from predator attacks by leaving behind the lost limb, distracting the predator (Brown et al. 1995. J. Herpetol. 29:98–105; Bateman and Fleming 2009. J. Zool. 277:1–14). After the autotomy, lizard tails regenerate as a cartilaginous rod (Alibardi 2007. J. Exp. Zool. B. 328B:493–515). However, in some cases an incomplete autotomy or injury of the tail can stimulate the growing of an additional tail not aligned with the original tail, resulting in two tail tips (Camper and Camper 2017. Herpetol. Rev. 48:634).

At 0928 h on 5 June 2019, we observed a specimen of *Trachylepis atlantica* with a bifid tail, in a trail of Sancho's beach, archipelago of Fernando de Noronha, Brazil (3.85844°S,

Fig. 1. A) *Trachylepis atlantica* on a trunk tree; B) bifurcate tail (left lateral view); C) bifurcate tail (right lateral view).

32.44649°W; WGS 84). The specimens observed were on a tree trunk about 1.80 m above the ground (Fig. 1A). The tail tip was bifurcated, with the two tips almost parallel, the left tip shorter than the right tip (Fig. 1B, 1C). Herein, we describe for the first time a tail bifurcation to *T. atlantica.*

We thank the project Diversidade de insetos com ênfase à região amazônica (FAPEAM/Protax. Process: 062.00645/2017) for research support. AMSN thanks Capes-INPA research grant (Process: 88887.312051/ 2018-00). DMMM thanks the CNPq research grant (Process: 141878/2018-5). RS thanks the FAPEAM for the Ph.D. scholarship (002/2016 – POSGRAD 2017). JAR thanks the CNPq research grant (Process: 300.997/2016-7).

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***TROPIDURUS HISPIDUS.* DEFENSIVE BEHAVIOR and AUTOTOMY.** Tail autotomy, or auto voluntary amputation of the tail, is a well-known antipredator strategy in many species of lizards (Melo et al. 2017. Salamandra 53:435–438), and it has been documented to occur in 13 of the 20 recognized families of lizards (McConnachie and Whiting 2003. Afr. Zool. 38:57–65). Here, we provide evidence of tail autonomy used by *Tropidurus hispidus* to avoid predation.

While analyzing the stomach contents of a *Pseudoboa neuwieddi* (Museu Integrado de Roraima [MIRR] 877: female, 709 mm SVL, 170 mm TL, 130.75 g) from Roraima, Brazil, we identified part of a fresh, undigested tail of a *Tropidurus hispidus* (Fig. 1). Since we found no other parts of this lizard in the digestive tract of the snake it appears that the strategy

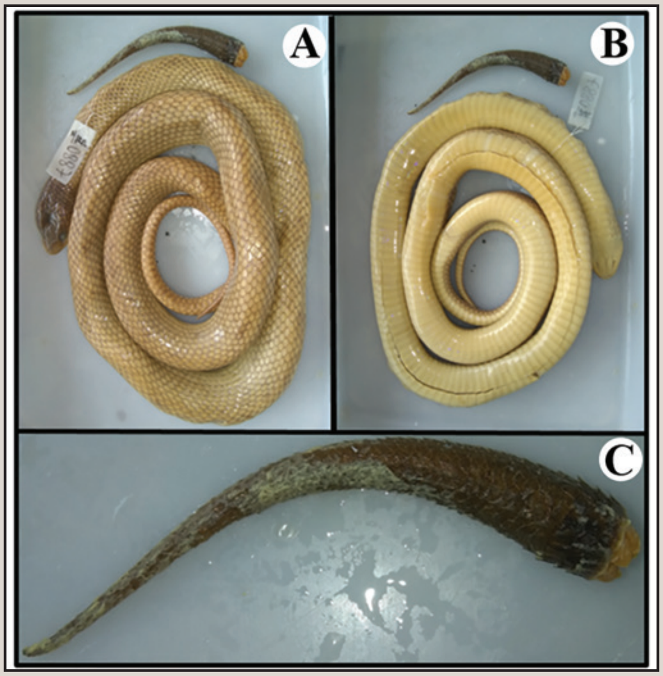

Fig. 1. Dorsal (A) and ventral (B) views of *Pseudoboa neuwiedii* specimen with a recently consumed tail of *Tropidurus hispidus* (C).

worked, and the lizard escaped. This record is important in that it contributes to the understanding of the natural history of *P. neuwieddi*, which is assumed to be a generalist predator (Gaiarsa et al. 2013. Pap. Avulsos Zool. 53:261–283; Lozano and Angarita Sierra 2018. Catálogo de Anfibios y Reptiles de Colombia 4:60–67; Masseli et al. 2019. An. Acad. Bras. Ciênc. 91:1–8), and it also adds to the knowledge of defensive behavior in the lizards of the lavrado of Roraima, an open area within the Guianan Shield and home to an immense lizard fauna (Vanzolini and Carvalho 1991. Pap. Avul. Zool. 12:173–226).

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***UROSAURUS BICARINATUS* (Tropical Tree Lizard). CLUTCH SIZE.** Previous studies have reported on the reproduction of *Urosaurus bicarinatus* from Jalisco (Ramírez-Bautista and Vitt 19998. Southwest. Nat. 43:381–390; Cruz-Elizalde et al. 2017. Salamandra 53:359–367), Michoacán (Ramírez-Bautista et al. 1995. Herpetologica 51:24–33; Cruz-Elizalde et al. 2017, *op. cit.*), Morelos (Ramírez-Bautista et al. 1995, *op. cit.*; Cruz-Elizalde et al. 2017, *op. cit.*), and Puebla (Ramírez-Bautista 2003. Herpetol. Rev. 34:328–331). Here, we report on the first observations of clutch size of *U. bicarinatus* from Chihuahua, Mexico, at the northern extent of its range. We dissected several specimens of *U. bicarinatus* (N = 29) from the collection of the University of Colorado Museum. These specimens were collected from Arroyo El Camache and Batopilas (27.0261°N, 107.7622°W; WGS 84; 435 m elev.) and from Satevo (26.9905°N, 107.7644°W; WGS 84; 567 m elev.; see Lemos-Espinal et al. [2004. Bull. Chicago Herpetol. Soc. 39:1–7] for collection details). Five females contained ovarian follicles (mean SVL ± 1 SE: 49.9 ± 1.0 mm; range: 47.8–52.6 mm). Mean (± 1 SE) clutch size was 6.4 ± 1.12 eggs (range: 4–10; N = 5). This mean clutch size falls within the range of clutch sizes of *U. bicarinatus* from other Mexican states. Mean clutch size of *U. bicarinatus* from Puebla was 7.6 (Ramírez-Bautista 2003, *op. cit.*). Mean clutch size of *U. bicarinatus* from Morelos was 7.7–7.8 and from Michoacán was 6.6–6.7 (Ramírez-Bautista et al. 1995, *op. cit.*; Cruz-Elizalde et al. 2017, *op. cit.*). Mean clutch size of *U. bicarinatus* from Jalisco was 5.4 (Ramírez-Bautista and Vitt 1998, *op. cit.*; Cruz-Elizalde et al. 2017, *op. cit.*).

There was no relationship between clutch size and female SVL (N = 5; r^2 = 0.09, P = 0.62). This is similar to the lack of a relationship between clutch size and female SVL in *U. bicarinatus* from Morelos and Michoacán (Ramírez-Bautista et al. 1995, *op. cit.*; Cruz-Elizalde et al. 2017, *op. cit.*). In contrast, there was a positive relationship between clutch size and female SVL in *U. bicarinatus* from Jalisco (Ramírez-Bautista and Vitt 1998, *op. cit.*; Cruz-Elizalde et al. 2017, *op. cit.*).

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***VARANUS GIGANTEUS* (Perentie). ARBOREAL ACTIVITY.** *Varanus giganteus* is considered the terrestrial apex predator in arid Australia (Jones 1985. Rec. Aus. Mus. 12:379–387; Pianka 1982. W. Austral. Nat. 15:1–8; Stirling 1912. Trans. Roy. Soc. Aus. 36:26–33). The only previously recorded reports of tree climbing involved avoidance behavior from humans (Mertens 1942. Abh. Senckb. Naturforsch. Ges. 462:235–391; Horn and Visser 1988. Salamandra 24:102–118). However, in five months of radio-tracking *V. giganteus* in Central Australia, we made numerous observations of tree climbing not associated with the human approach, suggesting this behavior may be common.

From December 2018–May 2019, we captured and radio-tracked 14 individual *V. giganteus* at Curtin Springs station in the Northern Territory (25.31521°S, 131.75633°E; WGS 84). Between January 25 and April 21, we tracked five of those lizards to trees on 10 occasions in both rocky areas and sand dunes. Lizards were located in trees between 0700 h and 0940 h in the morning, as well as after 2000 h at night (Table 1). The animals were typically found lying on slender, nearly horizontal branches at up to ca. 4 m high, with legs wrapped around or hanging off the branch and head resting on the branch (Fig. 1). The trees were fairly tall for the surrounding habitat, with dark bark and no foliage.

While our radio-tracked animals ranged from 510–825 mm SVL and 1.4–6.2 kg, we only found smaller and lighter animals (510–565 mm SVL, 1.4–1.65 kg) in trees. This may be partly due to the lack of larger trees with thicker branches for perching, which could exclude larger animals from tree climbing as a result of weight limitations. Alternatively, the cost and energy

Table 1. Observations of arboreal behavior of radiotracked *Varanus giganteus* around Curtin Springs, Northern Territory, Australia.

Date	Time (h)	Temp (°C)	Daily max (°C)	Daily min (°C)	Mass (kg)	SVL (mm)	ID#	Cap date
26 Jan 2019	0700	31.2	41	24	1.59	565	P08	07 Jan 2019
04 Feb 2019	0739	29.7	39	26	1.65	530	P09	17 Jan 2019
19 Feb 2019	0740	26.2	39	25	1.40	510	P06	18 Dec 2018
19 Feb 2019	0809	27.3	39	25	1.59	565	P08	07 Jan 2019
21 Feb 2019	0717	26.4	41	25	1.40	510	P06	18 Dec 2018
21 Feb 2019	0750	28.0	41	25	1.59	565	P08	07 Feb 2019
26 Feb 2019	0940	33.3	39	22	1.42	510	P14	26 Feb 2019
05 Mar 2019	0726	24.2	39	22	1.45	540	P13	21 Feb 2019
12 Mar 2019	2020	33.8	40	28	1.45	540	P13	21 Feb 2019
21 Apr 2019	0913	20.5	25	8	1.42	510	P14	26 Feb 2019

PHOTO BY KARI SOENNICHSEN

Fig. 1. *Varanus giganteus* (P09) perched in a tree at 0739 h on 4 February 2019.

PHOTO BY KARI SOENNICHSEN

Fig. 2. *Varanus giganteus* (P13) tracked to a tree after sunset (2020 h) on 12 March 2019.

expenditure of climbing may exceed the benefit for large *V. giganteus*. Potentially, trees could serve as protection for small *V. giganteus* from predators or conspecifics.

The observations of animals in trees both after sunset (2020 h; Fig. 2) and very early in the mornings suggests that they may roost in trees. Tree climbing may thus be fulfilling a thermoregulatory function by providing animals earlier access to sunlight, allowing them to heat up more rapidly. Ambient temperatures at the time which animals were seen in trees was highly variable (20.5–33.8°C) despite very consistent maximum and minimum daily temperatures between January and May when tree climbing was observed (Table 1). While on many days the night-time temperatures did not drop below 20°C, the last observation of a *V. giganteus* individual in a tree was in late April, on a day with a minimum temperature of 8°C. This may indicate that temperature is not the decisive or only stimulus initiating tree-climbing behavior. On 19 and 21 February 2019, two individuals (P06 and P08) were found in a tree in the early morning. Both animals choosing the same days to climb a tree may be indicative of an external stimulus triggering arboreal behavior. Further observation and tracking at night would be useful to better understand the nature and origin of this behavior. A closer examination of tree species used and cardinal orientation of the body with regards to the sun may also provide information on whether or not tree climbing serves a thermoregulatory function.

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SQUAMATA — SNAKES

AHAETULLA ANOMALA **(Variable-colored Vine Snake). DIET.** *Ahaetulla anomala* is the first sexually dichromatic snake described from Indian subcontinent (Mohapatra et al. 2017. Zootaxa 4263:318–332) and was formerly regarded as a subspecies of *A. nasuta*. Its geographic distribution is limited to India (Odisha, West Bengal, Bihar, Jharkhand) and Bangladesh. *Ahaetulla* cf. *nasuta* is known to feed primarily on small mammals, birds, lizards, frogs, and occasionally other snakes and fishes (De Silva 1990. Colour Guide to the Snakes of Sri Lanka. R & A Publishing Ltd., Avon, England. 130 pp.; Das 2010. A Field Guide to the Reptiles of South-East Asia. New Holland Publisher, London, United Kingdom. 376 pp.). There have been no reports of the diet of *A. anomala*, except that of Chowdhury et al. (2017. Herpetol. Rev. 48:444), where it has been reported as *A. nasuta*. Here, we report the first record of *A. anomala* feeding on Red-vented Bulbul (*Pycnonotus cafer*).

We encountered a male *A. anomala* at in the Radha area of Mayurbhanj District, Odisha, India (21.54179°N, 86.59671°E; WGS 84; 58 m elev.) on 17 March 2019 at 1715 h. The snake (ca. 130 cm total length) remained immobile for approximately 18 min, until the bird finally stopped resisting and died (Fig. 1). The snake proceeded to engulf most of the head and climb higher in the tree to an area with more foliage where it was almost impossible to observe.

FIG. 1. *Ahaetulla anomala* feeding on Red-vented Bulbul (*Pycnonotus cafer*) in Odisha, India.

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AHAETULLA PRASINA **(Asian Vine Snake). DIET and FEEDING BEHAVIOR.** *Ahaetulla prasina* is a long (to 1.97 m total length), slender, arboreal snake found in India, Bhutan, Bangladesh, Myanmar, and Southeast Asia (Ahmed et al. 2009. Amphibians and Reptiles of Northeast India. A Photographic Guide. Aaranyak, Guwahati, India. 169 pp.; David and Vogel 1996. The Snakes of Sumatra: An Annotated Checklist and Key with Natural History Notes. Edition Chimaira, Frankfurt am Main. 260 pp.).

At 0932 h on 14 April 2019, in a residential area of College Veng, Aizawl, Mizoram, India (23.72280°N, 92.72506°E; WGS 84; 881 m elev.), a female *A. prasina* (690 mm SVL) was observed preying on a full grown *Calotes versicolor* (Indian Garden Lizard; ca. 300 mm total length). The snake ambushed the wandering lizard, bit it on the neck, and struggled with it for ca. 10 min, while chewing to facilitate venom delivery (Whitaker and Captain 2008. Snakes of India, the Field Guide. Draco Books, Chengalpattu, India. 385 pp.). The lizard finally stopped struggling and the snake began swallowing it from the head (Fig. 1). The elapsed time from striking to complete swallowing was ca. 25 min. The diet of this species is described as lizards, small birds, and frogs (Ahmed et al. 2009, *op. cit.*). They are also known to feed on geckos

FIG. 1. Female *Ahaetulla prasina* preying on *Calotes versicolor* in Mizoram, India.

(*Hemidactylus platyurus*; Dunbar and Dundar 2015. Herpetol. Rev. 46: 264–265), but this report adds *Calotes versicolor* to the list of known prey items.

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***BOTHROPS ERYTHROMELAS* (Jararaca). DIET.** *Bothrops erythromelas* is a small terrestrial pitviper (Martins et al. 2001. J. Zool. 254:528–539) endemic to Brazil (www.sbherpetologia.org.br/; 24 Apr 2019) and is found in xeric habitats of the Caatinga domain (Vanzolini et al. 1980. Repteis Das Caatingas. Acad. Brasileira de Ciências, Rio de Janeiro, Brazil. 161 pp.; Campbell and Lamar 2004. The Venomous Reptiles of the Western Hemisphere. Cornell University Press, Ithaca, New York. 870 pp.). Many pitvipers, including *B. erythromelas*, exhibit an ontogenetic shift in diet from ectothermic prey as juveniles to small mammals as adults (Martins et al. 2002. *In* Schuett et al. [eds.], Biology of the Vipers, pp. 307–328. Eagle Mountain Publishing, Eagle Mountain, Utah; Stuginski et al. 2018. Zool. Sci. 35:373–381). Nevertheless, some species continue to feed on ectothermic prey as adults (Martins et al. 2002, *op. cit.*)

On 15 May 2011, at Tavares (7.7139°S, 36.1269°W; WGS 84; 558 m elev.), a rural part of the city Riacho de Santo Antônio, Paraiba, Brazil, an adult female *B. erythromelas* (50.5 cm SVL, 6.25 cm tail length) was found feeding on an adult female lizard, *Tropidurus hispidus* (8.5 cm SVL; tail autotomized). To our knowledge, this is the first predation record of *T. hispidus* by *B. erythromelas.* Because these species are sympatric and *Bothrops* species have a broad diet reflecting prey availability (Martins et al. 2002, *op. cit.*), this predator-prey relationship is expected. Both reptiles are deposited at the Natural History Museum of the Federal University of Alagoas (MUFAL 11295 [*B. erythromelasi*], 11296 [*T. hispidus*]).

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***BUNGARUS FASCIATUS* (Banded Krait). DIET.** *Bungarus fasciatus* is a slender nocturnal snake whose distribution includes India, Bangladesh, Nepal, Bhutan, Myanmar, China, and Southeast Asia (Ahmed et al. 2009. Amphibians and Reptiles of Northeast India. A Photographic Guide. Aaranyak, Guwahati, India. 169 pp.). The diet of this snake is fairly well documented. It is known to feed on *Xenochrophis piscator* (Checkered Keelback), *Xenopeltis unicolor* (Sunbeam Snake), *Ptyas mucosa* (Dhaman), *Amphiesma stolatum* (Buff Striped Keelback), *Ptyas korros* (Indo-Chinese Rat Snake), *Boiga trigonata* (Common Cat Snake), *Daboia russelii* (Russel's Viper), *Enhydris enhydris* (Rainbow Water Snake), *Cylindrophis ruffus* (Red-tailed Pipe Snake), *Ovophis tonkinensis* (Tonkin Pit-Viper), carrion of *Cylindophis ruffus* (Red-tailed Pipe Snake), skinks, fish and eggs of snakes (Daniels 2002. Book of Indian Reptiles and Amphibians. Oxford University Press, London, United Kingdom. 238 pp; Knierim et al. 2017. Herpetol. Rev. 48:204–205; Luu and Ha 2018. Herpetol. Rev. 49:543). Here, we report a new colubrid snake in its diet.

Fig. 1. Road-killed *Bungarus fasciatus* that had consumed *Boiga ochracea* from Mizoram, India.

At 1445 h on 6 August 2007, on the Buichali Bridge, Sairang Road, Mizoram, India (23.89926°N, 92.65233°E; WGS 84; 88 m elev.), we found a road-killed adult male *B. fasciatus* (Departmental Museum of Zoology, Mizoram University [MZMU] 933: 1174.2 mm SVL) lying on the road (Fig. 1). The abdomen was ruptured, and the gut contents of the snake was partially exposed. The *B. fasciatus* had recently fed on a *Boiga ochracea* (Tawny Catsnake), as indicated by the relatively intact condition of the prey.

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***BUNGARUS NIGER* (Greater Black Krait). DIET and ELEVATION.** *Bungarus niger* is an extremely venomous terrestrial snake restricted to Eastern Himalayas of eastern and northeastern India, Bhutan, Bangladesh, and Nepal (Das and Das 2017. A Naturalist's Guide to the Reptiles of India, Bangladesh, Bhutan, Nepal, Pakistan and Sri Lanka. Prakash Books India Pvt. Ltd. New Delhi, India. 176 pp.). It inhabits tropical evergreen and moist deciduous forests, plantations, grasslands, and around human settlements, between elevations of 100 to 1500 m. It is known to feed on other snakes, but little is known about which species are preyed upon (Ahmed et al. 2009. Amphibians and Reptiles of Northeast India. A Photographic Guide. Aaranyak, Guwahati, India. 169 pp.). Here, we report new observations regarding diet as well as elevational range.

On 12 February 2014 at 1800 h, at the corner of a retaining wall near the building of Zoology Department, Mizoram University,

Fig. 1. *Bungarus niger* preying on *Coelognathus radiatus* in Mizoram University Campus, India.

India (23.73703°N, 92.66340°E; WGS 84; 798 m elev.), a male *Bungarus niger* (Departmental Museum of Zoology, Mizoram University [MZMU] 978: 1100 mm SVL) was observed preying on sub-adult *Coelognathus radiatus* (Copper-headed Trinket Snake). The *B. niger* was biting the head of the *C. radiatus*, which was biting back in defense (Fig. 1A). The snakes struggled for several minutes (Fig. 1B), with the *B. niger* coiling tightly around its prey (Fig. 1C). Finally, the *B. niger* was able to start swallowing the *C. radiatus* from the head, which was completed in ca. 20 min (Fig. 1D).

During our survey on the reptilian and amphibian fauna of Mizoram, we found that *B. niger* was widely distributed within the region across a broad elevational range. On 3 October 2018, a male specimen (MZMU 1315: 995 mm SVL) was collected from Champhai Vengsang, Champhai District, Mizoram, India (23.48027°N, 93.31190°E; WGS 84; 1646 m elev.) representing the maximum elevation for this species. On 21 July 2017, at 2050 h, in Buhchangphai, Kolasib District, Mizoram, India (24.33472°N, 92.65625°E; WGS 84; 42 m elev.), another male *B. niger* (MZMU 975: 785 mm SVL) was captured, representing the minimum elevation for this species. These specimens were preserved and deposited in the Departmental Museum of Zoology, Mizoram University for further study.

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***CONTIA TENUIS* (Common Sharp-tailed Snake). PREDATION.** On 21 April 2015, the owners of Trinity River Adventure Cabins, near Lewiston, Trinity County, California, USA (40.70652°N, 122.84856°W; WGS 84) observed predation of an adult *Contia tenuis* by a *Diadophis punctatus* (Ring-necked Snake; Fig. 1). The predation event was interrupted by a domestic cat that killed the

Fig. 1. *Diadophis punctatus* and *Contia tenuis* following capture by a domestic cat, resulting in fatal injuries to the *D. punctatus*.

D. punctatus during ingestion of the *Contia*. It is not possible to determine if the *C. tenuis*, which appears to be dead in the photo, was killed by envenomation or by the cat. Although *D. punctatus* is known to consume snakes in some parts of its extensive range, reports of ophiophagy in Pacific Coast populations are uncommon (Goodman and Tate 1997. Herpetol. Rev. 28:90; Staub et al. 2006. Herpetol. Rev. 37:231–232; Wiseman et al. 2007. Herpetol. Rev. 38:344–345). Documentation of predation on *C. tenuis*, which may be locally abundant over much of northern California, is almost unknown (Hansen and Thomason 1991. Herpetol. Rev. 22:60–61; Beaman and Tucker 2014. Herpetol. Rev. 45:514).

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***CORALLUS ANNULATUS* (Ringed Tree Boa). DIET and SECONDARY SEED DISPERSAL.** Seed dispersal is a critical ecological process that determines plant population ecology and distribution. In the tropics, frugivorous bats play an important role in primary seed dispersal and forest regeneration (Muscarella and Fleming 2007. Biol. Rev. 82:573–590). Secondary seed dispersal may be performed by an array of animals, including snakes that prey on frugivorous and granivorous animals (Reiserer et al. 2018. Proc. R. Soc. B. 285: 2017275).

At ca. 1900 h on 21 June 2017, we observed an adult *Corallus annulatus* stalk and attack a fruit bat (believed to be in the genus *Carollia*) at La Selva Biological Station, Costa Rica (10.46480°N, 84.06435°W). *Corallus annulatus* are known to eat bats, hunting by ambush (Henderson and Pauers 2012. South Am. J. Herpetol. 7:172–180), which we observed as the tree boa slowly extended along a small branch toward the roosting bat (Fig. 1A). After long feeding bouts, *Carollia* spp. experience a digestive bottleneck and enter an extended roosting period before resuming flight (Bonaccorso et al. 2007. Biotropica 39:249–256). Anchored on a nearby tree trunk, the *C. annulatus* slowly approached and struck at the sedentary bat, capturing the bat in its mouth and constricting (Fig. 1B). The fecal excrement of the bat suggests it had recently consumed *Piper* fruits (Fig. 1C). Thus, this is a new dietary record for *C. annulatus* (feeding on *Carollia* sp.), and it is the first observation of potential secondary seed dispersal performed by boids.

Piper is a hyper-diverse and ecologically important plant genus in Neotropical forests (Jaramillo and Manos 2001. Am. J. Bot. 88:706–716). Secondary seed dispersal of *Piper* and other Neotropical species has been described in ants (Levey and Byrne

PHOTOS BY KRL

Fig. 1. Photos taken on 21 June 2017 at La Selva Biological Station, Costa Rica. A) *Corallus annulatus* extending along a branch toward a roosting bat; B) *C. annulatus* constricting the bat after striking; C) fecal excrement of the bat, suggesting it had recently consumed *Piper* fruits.

1993. Ecology 74:1802-1812), but this is the first observation of possible secondary seed dispersal of *Piper* by snakes. The seeds of many species of *Piper* are viable after gut passage by bats (Baldwin and Whitehead 2015. Oecologia 177:453–466), and it was recently discovered that seeds are still viable after secondary gut passage through rattlesnakes (Reiserer et al. 2018, *op. cit.*). However, more information is needed to understand the effects of boid gastro-intestinal tracts on seed viability. This observation increases our knowledge of the ecosystem services provided by snakes and suggests new directions for research on snake foraging behavior and gut physiology.

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***DENDROPHIDION ATLANTICA*. DIET.** *Dendrophidion atlantica* is a snake in the *Dendrophis* group of the family Colubridae (Freire et al. 2010. Zootaxa 2719:62–68) that is restricted to some remnants of Atlantic Forest in northeastern Brazil, more specifically, in the states of Alagoas (Freire et al. 2010, *op. cit.*), Pernambuco (Nacimento and Santos 2016. Herpetol. Rev. 47:261), and Paraíba (Pereira-Filho et al. 2017. Serpentes da Paraíba: Diversidade e Conservação. João Pessoa. 316 pp.). Herein, we described the first food item for *D. atlantica*, an adult *Pristimantis ramagii*, an anuran genus with most of its species occurring in the northern Brazilian Atlantic Rainforest (Canedo and Haddad 2012. Mol. Phylog. Evol. 65:610–620). The taxonomy of the genus *Pristimantis* is confused because of its high diversity, great intraspecific variation, and few morphological characters to differentiate among species (Duellman and Lehr 2009. Terrestrial Breeding Frogs (Strabomantidae) in Peru. Natur und Tier-Verlag, Naturwissenschaft, Münster. 384 pp.) A recent study at Serra do Urubu, an area ca. 106 km from our observation, found three *Pristimantis* species, *P. ramagii* and two species not yet described (Roberto et al. 2017. Pap. Avul. Zool. 57:347–373). At the locality where the present observation occurred different morphotypes also occur, which may be different species.

Fig. 1. Adult *Dendrophidion atlantica* with an adult *Pristimantis ramagii* in its mouth in Pernambuco, Brazil.

At 1455 h on 28 November 2018 (24.2°C air temp, 73% relative humidity), during a transect survey in a remnant of Atlantic Forest, known as Mata do Siriji (7.61806°S, 35.50425°W; WGS 84; 600 m elev.), in São Vicente Férrer municipality, Pernambuco, northeastern Brazil, we observed an adult *D. atlantica* (ca. 100 cm total length) swallowing an adult *P. ramagii* (ca. 3 cm total length) on the ground. The anuran was captured by the snake after ca. 10 sec. Subsequently, the snake remained immobile for 15 min, with the anuran in its mouth (Fig. 1), before fleeing through the litter with the prey in its mouth, without being ingested.

Dendrophidion atlantica has diurnal activity and terrestrial habits but can be found on low vegetation (Freire et al. 2010, *op. cit.*). However, information on diet are lacking in the literature. Herein we confirm the hypothesis of Freire et al. (2010, *op. cit.*), that this species includes small terrestrial anurans in its diet. Besides that, we also extend the distribution of *D. atlantica* to the west ca. 89.14 km, within the Pernambuco state; all previous records from this state were on the coast (Nascimento and Santos 2016, *op. cit.*; Barbosa et al. 2019. Herpetol. Notes. 12:109–111).

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***ERYTHROLAMPRUS MILIARIS* (Military Ground Snake). DIET and FORAGING BEHAVIOR.** *Erythrolamprus miliaris* is a semiaquatic snake, widely distributed in South America (Dixon 1983. Copeia 1983:791–802; Giraudo 2001. Serpientes de la Selva Paranaense y del Chaco Húmedo. L.O.L.A., Buenos Aires, Argentina. 328 pp.), that feeds on anurans and fishes (Oliveira 2005. PUCRS. Porto Alegre, RS. 107 pp.). Although its diet is well known, little is known about its foraging behavior.

On the night of 12 October 2018, at 2140 h, we captured an *E. miliaris* (680 mm total length) in a natural restinga habitat in the municipality of Tapes, southern Brazil (30.537°S, 51.375°W; WGS 84). The snake was moving over aquatic vegetation in an extensive area of flooded grassland. Immediately after capture, the snake regurgitated two prey, an adult anuran (*Boana pulchella*; 20 mm SVL) and a swamp-eel (*Synbrancus marmoratus*; 290 mm total length). Both prey were intact and the swamp-eel was regurgitated still alive. The eel was 42.6% of the length of the snake, and since it was still alive and without signs of biting, must have been immobilized in a non-lethal manner and ingested. This record suggests predation events in distinct microhabitats: on the floating vegetation, where *B. pulchella* are found, and on the bottom of the water column, where swamp-eels are found. Thus, *E. miliaris* likely uses a generalist foraging strategy in various microhabitats. The specimen was collected along with its prey and deposited in the scientific collection (CHLVET 346) of the Laboratório de Ecologia de Vertebrados Terrestres (LEVERT) at Universidade do Vale do Rio dos Sinos.

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ERYTHROLAMPRUS MILIARIS CRYSOSTOMUS **(Military Ground Snake). DIET.** *Erythrolamprus miliaris chrysostomus* is a medium-sized non-venomous snake with semiaquatic habits that is active both diurnally and nocturnally (De Alcântara et al. 2015. Herpetol. Notes 8:291–293; Hartmann et al. 2009. Pap. Avul. Zool. 49:343–360). It is widely distributed in dense lowland Amazonian forests of South America (Dixon 1983. Copeia 1983:791–802).

On 26 April 2016, at 1405 h, at Tiputini Parish, Aguarico Canton, Orellana Province, Ecuador, a juvenile female *Erythrolamprus miliaris chrysostomus* (ca. 38 cm total length), was observed swimming in a natural spring called Estero Andia (0.79310°S, 81.56602°W; WGS 84; 206 m elev.). The snake was captured for observation. After 20 min, the individual regurgitated two fishes: *Gymnotus javari* (Neotropical Electric Fish) of ca. 6.1 cm and *Pyrrhulina* sp. (sardine) of ca. 2.4 cm. Considering the observed regurgitation, we presume that ingestion of both prey occurred from head to tail. Although it is known that this species feeds on fishes such as *Guavina guavina* (Sleeper Goby; Duarte et al. 2014. Herpetol. Notes 7:577–580) and *Callichthys callichthys* (Armored Catfish; Cadena-Ortiz et al. 2017. Herpetozoa 30:93–96), information about its diet is scarce. Our finding adds two new prey records for this snake.

We thank J. Donoso for field assistance and A. Guijarro and F. Romero for their help with ecological information about species involved in this note.

Fig. 1. *Erythrolamprus miliaris chrysostomus* preying upon *Gymnotus javari* (A) and *Pyrrhulina* sp. (B) from Orellana Provice, Ecuador.

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ERYTHROLAMPRUS MILIARIS MERREMI **(Watersnake). DIET.** *Erythrolamprus miliaris merremi* (Dipsadidae) is a semi-aquatic species with a wide distribution in South America (Dixon 1983. Copeia 1983:791–802; Yanosky et al. 1996. Herpetol. Nat. Hist. 4:97–110). It has a generalist diet, preying on anurans (including tadpoles), fish, lizards, and insects (Carreira 2002. Monografıas de Herpetologıa 6:127). *Erythrolamprus m. merremi* is known to consume the eggs of *Leptodactylus latrans* (Giori et. al. 2016. Herpetol. Rev. 472:311) but has not been reported feeding on post-metamorphic individuals of this species. Here we report the first case of a juvenile *L. latrans* being preyed upon by *E. m. merremi*.

On 2 April 2019, we captured a female *E. m. merremi* (25 cm SVL, 7 cm tail length, 12 g after regurgitation of prey) at Parque Ecológico Universitário (PEU/UCSAL), Bahia, Brazil. We forced the snake to regurgitate an obvious prey item, revealing a juvenile *L. latrans* (2.13 cm SVL, 1.34 cm head length, 1.4 g). Our survey was part of the faunistic monitoring program of PEU (license ICMBio-MMA nº 51743-1).

Fig. 1. A) *Erythrolamprus miliaris merremi* and *Leptodactylus latrans* after regurgitation; B) the female *E. m. merremi*; C) the regurgitated *L. latrans*.

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GONYOSOMA OXYCEPHALUM **(Red-tailed Racer). FORAGING BEHAVIOR.** Although numerous snake species from the families Viperidae, Pythonidae, and Boidae are well-documented ambush predators, members belonging to the largest snake family, Colubridae, are more commonly associated with active foraging (Lourdais et al. 2014. Biol. J. Linnean Soc. 111:636–645). However, some colubrid species are known to utilize mixed foraging strategies, incorporating both ambush and active foraging tactics (Balent et al. 1998. J Herpetol. 32:575–579). We hereby report an observation of a juvenile *Gonyosoma oxycephalum* ambush hunting among rocks on the ground surprisingly deep inside a cave.

Gonyosoma oxycephalum is a diurnal and arboreal colubrid species distributed throughout much of Southeast Asia. This species inhabits tropical forests where they are normally found high in the tree canopy, though individuals, particularly

Fig. 1. A juvenile *Gonyosoma oxycephalum* waiting to ambush prey on the ground 75 m inside a cave in Nakhon Si Thammarat, Thailand.

juveniles, exhibit occasional terrestrial activity (Das 2010. A Field Guide to the Reptiles of South-east Asia. Bloomsbury Publishing, London, United Kingdom. 280 pp.). *Gonyosoma oxycephalum* has been observed hunting among cave entrances using two different methods; Manchi and Sankaran (2009. Indian Birds 5:118–120) witnessed *G. oxycephalum* using wooden scaffolding inside caves in order to reach swiftlets among their nests, while Ming and Wai (2011. Nat. Soc. 41–64) observed *G. oxycephalum* individuals perched in bamboo near cave entrances and suggested the snakes may be waiting to ambush bats emerging from or returning to their roosts.

At 1640 h on 17 June 2017, we encountered a juvenile *G. oxycephalum* (ca. 50 cm total length) within Kaeow Surakan Cave at the sourthern edge of Khao Luang National Park, Lan Saka District, Nakhon Si Thammarat, Thailand (8.36167°N, 99.78569°E; WGS 84). The cave is roughly 730 m long and the entrance, which is at the base of a limestone cliff near a two-lane highway, is ca. 10 m wide. The surrounding landscape is primarily dominated by evergreen forests and limestone karsts; however, there are also small villages with monoculture plantations along the national park's border. The *G. oxycephalum* was detected via torch-light illumination near a cave wall within a spacious passageway approximately 75 m from the cave entrance. The snake was perched on a rock, with its prehensile tail grasping the peak of the rock and its head facing the ground towards the nearby wall (Fig. 1). As we slowly crept closer, the snake remained completely motionless. The snake was hunting under extremely low light conditions, as the view of the cave's entrance, and thus nearly all light, was completely obstructed from the vantage point of the hunting snake.

Potential prey species found within 50 m of the ambushing *G. oxycephalum* included *Rhinolophus* spp. (Horseshoe Bats), *Cyrtodactylus pulchellus* (Banded Bent-toed Geckos), and *Phrynoidis aspera* (Asian River Toads). A large number of the observed bats were mothers that were carrying their young. While bats would largely be unavailable to even the most patient of snakes on the ground, they do occasionally fall, and as evidence of this, we noticed a few carcasses of juvenile bats which were being voraciously devoured by crickets and other small arthropods on the cave floor. We did not find additional *G. oxycephalum* individuals in the cave, but we did find 6 adult *Elaphe taeniura ridleyi* (Cave Racers) which mostly appeared to be actively foraging deeper inside the cave in complete darkness.

This observation demonstrates that *G. oxycephalum* uses ambush foraging in addition to active searching for prey. To our knowledge, this is the first reported observation of *G. oxycephalum* hunting this far inside a cave, suggesting they may be important bat predators in Southeast Asia. This low energy hunting strategy could be quite efficient during periods of time when there are high densities of bats, such as their breeding seasons. Additionally, this observation supports the idea that *G. oxycephalum* juveniles exhibit more terrestrial activity than adults. Despite *G. oxycephalum* possessing a tail color which contrasts with the rest of the body, the species is not known to use caudal luring, a combination of behavior and coloration where the snake wiggles a conspicuous colored tail in order to attract insectivorous prey into the snake's striking distance (Heatwole and Davison 1976. Herpetologica 32:332–336). We suggest further field studies investigate the foraging behavior and prey composition of *G. oxycephalum*, including identifying whether the species exhibits ontogenetic shifts in foraging strategy, diet, or habitat use.

I thank Suranaree University of Technology and the National Research Council of Thailand for supporting our ongoing research on the ecology of snakes in Thailand.

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***LAMPROPELTIS ZONATA* (California Mountain Kingsnake). THERMAL ECOLOGY.** Almost nothing is known of the thermal ecology of *Lampropeltis zonata* (sensu lato), a secretive, rock-dwelling species largely associated with montane areas from Washington, USA to Baja California, Mexico (McGurty 1989. *In* H. F. DeLisle et al. [eds.], Proceedings of the Conference on California Herpetology, pp. 73–88. Southwestern Herpetologists Society, Van Nuys, California; Hubbs 2004. Mountain Kings: A Collective Natural History of California, Sonoran, Durango and Queretaro Mountain Kingsnakes. Tricolor Books, Tempe, Arizona. xxiii + 319 pp.). The only available temperature data are based on four field-active snakes with body temperatures

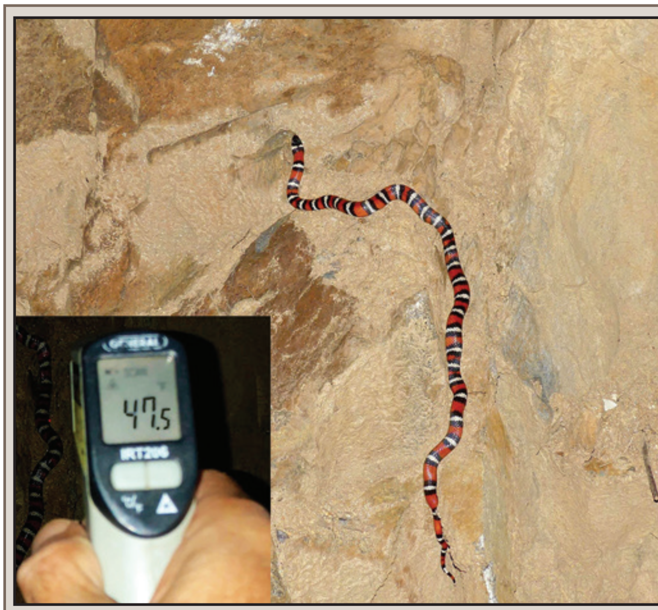

Fig. 1. Adult *Lampropeltis zonata* observed crawling on a rockface at 0030 h during cold weather in San Diego County, California, USA.

of 24.2–27.5°C (Brattstrom 1965. Amer. Midl. Nat. 73:376–422; Cunningham 1966. Herpetologica 22:184–189).

On 30 April 2019, JN encountered an adult *L. zonata* at 0030 h on a roadside rockface during foggy, drizzling conditions (Fig. 1). The snake's body temperature, measured by a hand-held infrared thermometer, was 8.6°C. The snake was observed in the vicinity of Julian, San Diego County, California, USA, at an elevation of ca. 1225 m, in an area of montane chaparral and mixed pine-oak woodland. Additionally, given that *L. zonata* is mostly diurnal and crepuscular (McGurty 1989, *op. cit.*), it is particularly unusual to find a surface-active adult in the middle of the night during cold, wet weather.

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***LAMPROPHIS GEOMETRICUS* (Seychelles House Snake). DIET.** *Lamprophis geometricus* is a small lampropiid snake, endemic to the Seychelles Archipelago. The species only occurs on Mahe, Praslin, Silhouette, and Fregate islands, and is classified as endangered due to its restricted range (Gerlack and Ineich 2006. *Lamprophis geometricus*, the IUCN Red List of Threatened Species, 2006). Little is known about the ecology of *L. geometricus* due to it being nocturnal and tending to favor undisturbed forest habitats away from human habitation. Diet is thought to include juvenile birds and introduced rodents, but the species is most reliant upon skinks and geckos (Gerlack and Ineich 2006, *op. cit.*). The island of Fregate has been free of the invasive Norwegian Rat (*Rattus norvegicus*) since 2001 (Merton 2001. Report on eradication of rats from Curieuse, Denis, and Frégate islands and cats from Curieuse and Denis islands, May–August 2000. Report to Director of Conservation, Ministry of Environment & Transport. Mahé, Seychelles), leaving the island devoid of rodent species but is still thought to have the highest density of *Lamprophis geometricus* within its limited range. Fregate also has one of the highest abundances of skinks in the Seychelles Archipelago (Gerlach 2008. Phelsuma 16:30–48).

At 1830 h on the 14 April 2018, an *L. geometricus* (< 1 m total length) was seen with a small fish in its mouth on a trail through open forest scrub (4.58740°S, 55.94624°E; WGS 84). Consumption was not witnessed as the encounter was opportunistic whilst walking along trails during evening fieldwork and the snake moved out of view quickly. Another nocturnal encounter was made on 28 April 2018 upon a road through dense forest (4.58740°S, 55.94193°E; WGS 84), where a slightly larger individual was witnessed. The snake (startled by our presence) slowly moved off to the side of the road where it encountered a dead fish dropped by a nesting White Tern (*Gygis alba*) from the island's seabird colony. The snake attempted to eat the fish for 30 min under observation (Fig. 1). It did not complete the task but took the prey item out of sight to continue its efforts. Recent conversations with conservation volunteers on Fregate revealed that fish eating by *L. geometricus* had been observed both before and after this observation and full ingestion of fish carrion has been witnessed. The large colonies of seabirds, namely *G. alba* and the Lesser Noddy (*Anous tenuirostris*) on Fregate present an opportunity for the herpetofauna on the island to feed on fish carrion opportunistically. *Gygis alba* is known to breed year-round, often favoring the season where *A. tenuirostris* is least present. Subsequently the supply of dropped fish by the seabird colony is a year-round resource. Unlike *A. tenuirostris*, *G. alba* doesn't feed via regurgitation and so dropped fish carrion is more common in this species. Fish carrion feeding behaviours have also been observed in Florida Cottonmouths (*Agkistrodon piscivorus conanti*) on a singular island in Cedar Keys, Florida. Further studies on *A. p. conanti* have shown that snakes have better body condition in areas where seabird colonies are present (Lillywhite and McCleary 2008. South Am. J. Herpetol. 3:175–185).

PHOTO BY CLAIRE WATERS

Fig. 1. *Lamprophis geometricus* in the process of eating an unidentified fish species on Fregate Island, Seychelles.

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***LEPTODEIRA ANNULATA* (Banded Cat-Eyed Snake). DIET.** *Leptodeira annulata* is a widely distributed snake species that inhabits primary and secondary forests across Central and South America (Cantor and Pizzato 2008. Herpetol. Rev. 39:462–463). There are previous records of this species preying upon anurans belonging to the families Hylidae, Bufonidae and Leptodactylidae, which are the main component of its diet (Santos-Silva et al. 2014. Herpetol. Notes. 7:123–126). Herein, we report the first record of *L. annulata* predation upon a *Leptodactylus rhodonotus* (Peru White-Lipped Frog; Leptodactylidae).

At 0701 h on 10 August 2018, an adult individual of *Leptodeira annulata* (ca. 60 cm total length) was observed ingesting an adult *Leptodactylus rhodonotus* (Fig. 1) in the Mascoitania reserve

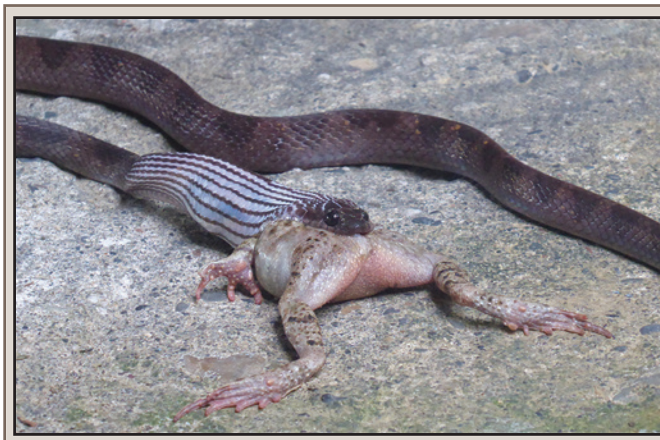

Fig. 1. *Leptodeira annulata* in the process of swallowing and adult *Leptodactylus rhodonotus* in southeastern Peru.

(12.78917°S, 71.39111°W; WGS 84; 460 m elev.) of the Madre de Dios Region in southeastern Peru. The individuals were found in the Manu Learning Centre, a research station and lodge located in the buffer zone of the Manu National Park, owned and operated by The Crees Foundation. The pair was located on concrete ground by the station facilities, with the *Leptodeira annulata* slowly ingesting the *Leptodactylus rhodonotus* head-first (Fig. 1). The entire process took ca. 66 min until the frog was completely consumed, after which the snake moved to a shaded space under one of the buildings where it remained for at least 8 h.

We thank The Crees Foundation and its director, Q. Meyer, for providing the opportunity to participate in their long-term herpetological monitoring programme at the Manu Learning Centre. We also thank the Conservation Interns, B. Miller, L. Clark and S. Moslah, for their help in reviewing this document.

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***LEPTODEIRA ANNULATA* (Banded Cat-eyed Snake). DIET.** *Leptodeira annulata* is a snake of the family Dipsadidae that is widely distributed in Neotropical wetlands between Mexico and Argentina (Peters and Orejas-Miranda 1986. Catalogue of the Neotropical Squamata: Part I, Snakes. Revised Edition. Smithsonian Institution Press, Washington, D.C. 347 pp.). This snake has arboreal habits but can be found on the ground and in bodies of water (Ávila and Morais 2007. Herpetol. Rev. 38:278–280) and is typically batracophagous (Campos et al. 2011. Herpetol. Rev. 42:412; Sales et al. 2013. Herpetol. Rev. 44:524; Santos-Silva et al. 2014. Herpetol. Notes 7:123–126). Here, we describe the attempted predation of an *Osteocephalus taurinus* by a *Leptodeira annulata*.

On 18 May 2016, at 2000 h, in the Municipality of Cantá (2.8640°N, 60.5574°W; WGS 84) in Roraima, Brazil, AMR observed an *L. annulata* trying to prey on an adult male *O. taurinus*. At first the snake bit the head of the frog, then constricted, but failed to kill the prey. The snake remained for ca. 3 h attempting to swallow the anuran, but eventually released the frog. *Osteocephalus taurinus* is an abundant treefrog in central and northern Brazil. It is arboreal and nocturnal, and is found in primary and secondary forests, usually on trunks and branches (Lima et al. 2006. Guia de Sapos da Reserva Adolpho Ducke, Amazônia Central. Áttema, Manaus, Brazil. 168 pp.). Given that *O. taurinus* is not known to be toxic, we believe that the size of the prey prevented consumption by the snake.

Fig. 1. Attempted predation of *Osteocephalus taurinus* by *Leptodeira annulata* in Roraima, Brazil.

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***LEPTODRYMUS PULCHERRIMUS* (Striped Lowland Snake). DEFENSIVE BEHAVIOR.** *Leptodrymus pulcherrimus* is the only member of its genus. It ranges from southern Guatemala to northwestern Costa Rica (Solórzano 2004. Snakes of Costa Rica: Distribution, Taxonomy and Natural History. INBio, Santo Domingo de Heredia, Costa Rica. 792 pp.). *Leptodrymus pulcherrimus* it is a fast-moving, diurnal, mainly ground-dwelling snake, with defensive behaviors that include biting and retreating (Solórzano 2004, *op. cit.*). Here, we report another defensive response: fleeing through the branches.

On 19 April 2018, at 0920 h, José Juárez found an adult *L. pulcherrimus* at 1.5 m above ground in El Rancho, El Progreso, Guatemala (14.90986°N, 90.02145°W; WGS 84; 330 m elev.). While taking footage of the snake, it made short fleeing attempts through the branches, punctuated by rapid bouts of wriggling its anterior body and tail. First the snake moved rapidly through the branches without facing completely away from the observer, then stopped to rapidly wriggle the first third of its body for ca. 2 sec, and then proceeded to wiggle the middle portion of its body. Afterwards, it remained still for several seconds facing towards the observer, then started moving its tail as if luring, and finally wriggling the anterior part of its body again. Video of the behavior was deposited in the Reference Collection of Universidad del Valle de Guatemala (UVGF-0011) and uploaded online (https://m.youtube.com/watch?feature=youtu.be&v=G1bUwHUel2g).

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***LOXOCEMUS BICOLOR* (Mexican Burrowing Python). ATTEMPTED PREDATION.** *Loxocemus bicolor* is the lone member of the monotypic family Loxocemidae and is found along the Pacific Coast of Central America in southwestern and southeastern Mexico, Guatemala, Honduras, El Salvador, Nicaragua, and northwestern Costa Rica (Chaves et al. 2014. The IUCN Red List of Threatened Species 2014; 5 June 2019). *Loxocemus bicolor* is primarily fossorial, but is also known to occur terrestrially, under logs, and in leaf litter (Alvarez del Toro 1982. Los Reptiles de Chiapas. Colección. Instituto de Historia Natural, Tuxtla Gutiérrez, Chiapas, México, 248 pp.). Several studies have documented the diet of *L. bicolor* (Mora-Benavides 1987. J. Herpetol. 21:334–335), however, there have been no reports on predation of *L. bicolor*.

At 1155 h on 29 May 2019, we observed an adult *Tigrisoma mexicanum* (Bare-throated Tiger-heron) attempting to prey upon an *L. bicolor* in Hacienda Solimar, Guanacaste, Costa Rica (10.25919°N, 85.15603°W; WGS 84). The habitat can be described as a heterogenous mix of wetland and agricultural land, with

Fig. 1. *Tigrisoma mexicanum* attempting to prey upon a *Loxocemus bicolor* in Guanacaste, Costa Rica.

scattered trees. We initially observed the snake slowly crossing a dirt road bordered by agricultural canals, following a recent rain. The *T. mexicanum* flew in from the agricultural field on one side of the dirt road, captured the snake by the head, and flew to another tree across the road, while the snake constantly wrapped around the bird's beak (Fig. 1). The *T. mexicanum* did not make any attempts to kill the snake but only jerked its head to unravel the snake from its beak. After ca. 10 min, the *T. mexicanum* dropped the *L. bicolor* in the wetlands as it tried to get a better grip on the snake. There was another *T. mexicanum* on the same branch ca. 1 m away that quietly observed the process.

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LYCODON RUFOZONATUS WALLI **(Sakishima Odd-tooth Snake). DIET.** *Lycodon rufozonatus walli* is an endemic subspecies to the Yaeyama Islands and Miyako Islands, Ryukyu Archipelago, Japan, and is known as a generalist predator of fishes, frogs, lizards, snakes, birds, and small mammals (Mori and Moriguchi 1988. Snake 20:98–113). On Miyako Island, at 2117 h on 5 September 2018, I recovered a male *L. r. walli* (52.8 cm SVL, 15.4 cm tail length), which was eating a juvenile *Mauremys mutica kami* (Yaeyama Brown Pond Turtle; Fig. 1). This is the first report of predation on turtles by *L. r. walli* in the wild and adds to our knowledge of this snake's diet.

Fig. 1. *Lycodon rufozonatus walli* eating *Mauremys mutica kami* on Miyako Island, Ryukyu Archipelago, Japan.

I thank Miyakojima City for permitting this study (permit no. 258).

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MASTICOPHIS FLAGELLUM **(Coachwhip). ARBOREAL ESCAPE BEHAVIOR.** Collectively, over the last decade, we have encountered over 500 *Masticophis flagellum*. Many of these snakes were roadkills, some were captured, and others escaped by going into bushes or down holes. Separately and together we have seen only 10 arboreal escape behaviors, a few of which are worth reporting here:

1) Horned Lizard Ranch, Mohave County, Arizona, USA. BB and EN spotted a *M. flagellum* resting in the sun on a dirt road near a Foothill Palo Verde Tree (*Cercidium microhyllum*). EN grabbed for the snake which twisted up and around in an egg-beater shaped movement, defensively biting EN in the process. The snake headed into the leaf litter and lower branches of the Palo Verde and then quickly, within 2 sec, climbed to the top of the tree (ca. 4 m) and into a Mistletoe (*Phoradendron californicum*) mass, and visually disappeared within that mass, though its tail hung out about 10 cm.

2) Parker Wash, Pinal County, Arizona, USA. EN and RR saw a *M. flagellum* quickly climb 5 m up a tree and disappear into a Mistletoe mass.

3) Cattle Tank Road, just S of Park Link Drive, Pinal County, Arizona, USA. A *M. flagellum*, found by RR and Kate Jackson at the base of two Palo Verde trees, quickly climbed 2.5 m up into the one tree and into a Mistletoe mass.

4) Estancia Road, just N of Davis Rd, Pinal County, Arizona, USA. RR saw an *M. flagellum* climb up into the lower branches of a Mesquite Tree (*Prosopis* sp.).

Although *M. flagellum* have been reported to sometimes climb into trees and bushes to escape (Ernst and Ernst 2003. Snakes of the United States and Canada. Smithsonian Books, Washington D.C. 668 pp.), BHB had never in 50 years seen such arboreal escape behavior in the California desert. Arboreal escape behavior by *M. flagellum* may be more common in eastern USA where there are more trees (K. Dodd, pers. comm.). Brattstrom et al. (2015. Herpetol. Rev. 46:101) reported a *M. flagellum* crawling up and between the spines and grooves of a Saguaro (*Carnegia gigantea*). With a more diverse habitat, there is a greater opportunity for different modes of escape behavior.

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MASTICOPHIS TAENIATUS **(Striped Whipsnake). DIET.** *Masticophis taeniatus* is a colubrid generalist with a broad distribution in western North America. A diurnal, active forager, *M. taeniatus* has a diet that primarily consists of lizards, but can also include mammals, snakes, birds, and insects (Parker and Brown 1980.

Fig. 1. Adult *Masticophis taeniatus* consuming a juvenile *Pituophis catenifer* in Washoe County, Nevada, USA.

Milwaukee Public Mus. Publ. Biol. Geol. 7:1–104; Camper and Dixon 2000. Texas J. Sci 52:83–92). Snakes that have been documented as prey of *M. taeniatus* include *Bogertophis subocularis*, *Coluber constrictor*, *Crotalus atrox*, *C. scutulatus*, *C. viridis*, *M. taeniatus*, *Salvadora hexalepis*, *Sonora semmiannulata*, and *Thamnophis elegans* (Parker and Brown 1980, *op. cit.*; Camper and Dixon 2000, *op. cit.*; Ernst and Ernst 2003. Snakes of the United States and Canada. Smithsonian Books, Washington, D.C. 668 pp.).

On 21 June 2019, at ca. 1130 h, I encountered an *M. taeniatus* (>1.2 m SVL) adjacent to a rock outcropping at the Huffaker Hills Open Space, within the city boundaries of Reno, Nevada, USA (39.47058°N, 119.75127°W; WGS 84; 1436 m elev.). I grabbed the posterior region of the snake and noticed that it had nearly completed ingestion of another snake, a juvenile *Pituophis catenifer*, a common species in this area (Fig. 1). The *M. taeniatus* finished swallowing while I restrained it. Photo vouchers were deposited at HerpMapper (HM 274798–274799). The *P. catenifer* was being swallowed headfirst, as is common for larger prey of *M. taeniatus* (Camper and Dixon 2000, *op. cit.*). Although the ranges for both species overlap widely throughout western North America (Stebbins 2003. A Field Guide to Western Reptiles and Amphibians of North America, Third Edition, Houghton Mifflin Company, New York, New York. 533 pp.), this is the first documented predation of *P. catenifer* by *M. taeniatus*. *Pituophis catenifer* is generally common throughout its range, but its large adult size might preclude predation by *M. taeniatus*. I thank R. W. Hansen for comments on the manuscript.

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***MICRURUS DIASTEMA* (Variable Coral Snake). MAXIMUM SIZE.** *Micrurus diastema* is a slender venomous snake that occurs in low and moderate elevations on Gulf and Caribbean slopes from central Veracruz and Oaxaca, Mexico, southward through the Yucatán Peninsula to northwestern Honduras (Lee 2000. A Field Guide to the Amphibians and Reptiles of the Maya World. Cornell University Press, Ithaca, New York. 402 pp.; Heimes 2016. Herpetofauna Mexicana Vol. I. Snakes of Mexico. Edition Chimaira. Frankfurt am Main. 572 pp.). The snout-vent length (SVL) reported for this species is 550–650 mm (Lee 2000, *op. cit.*), and the total length (TL) is commonly 600–750 mm, and occasionally to 900 mm (Campbell and Lamar 2004. The Venomous Reptiles of the Western Hemisphere. Vol I. Cornell University Press, Ithaca, New York. 475 pp.; Heimes 2016, *op. cit.*).

On 5 November 2017, at 0945 h, JRAN found an adult female *M. diastema* (860 mm SVL, 970 mm TL) killed by farmers in a cornfield, 5.4 km NE of Uxmal Mayan ruins (20.40713°N, 89.75598°W; WGS 84), Municipality of Muna, Yucatán, Mexico. On 14 June 2018 at 2300 h, a road-killed adult female (870 mm SVL, 982 mm TL) was found in the Municipality of Kinchil, Yucatán, Mexico (20.87120°N, 90.05900°W; WGS 84), on the Kinchil–Celestún Highway, in a site surrounded by tropical deciduous forest. To our knowledge, these specimens represent the maximum length recorded in *M. diastema*.

The snakes were collected and are deposited in the herpetological collection of the El Colegio de la Frontera Sur, Unidad Chetumal (ECO-CH-H 4800-4801) under permits #SGPA/DGVS/01205/17 and #SGPA/DGVS/002491/18 issued to Fausto R. Méndez de la Cruz by SEMARNAT, with an extension to JRCV. We thank N. Gabriela Blanco Campos, and D. Adriana Arriola Flores for lab assistance.

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***MICRURUS FRONTALIS* (Cerrado Coralsnake). DEFENSIVE BEHAVIOR, REPRODUCTION, and MELANISM.** *Micrurus frontalis* is a medium-sized venomous coralsnake (Elapidae) that exhibits aposematic coloration. It occurs in Brazil in the states of Minas Gerais, São Paulo, Espírito Santo, Bahia, Goiás, Mato Grosso, Mato Grosso do Sul and in Paraguai (Campbell and Lamar 2004. The Venomous Reptiles of the Western Hemisphere. Cornell University Press, Ithaca, New York. 976 pp.; Silva Jr. et al. 2016. *In* Silva Jr. [org], As Cobras-Corais do Brasil: Biologia, Taxonomia, Venenos e Envenenamentos, pp. 78–167, Goiânia. Ed. PUC Goiás). It is fossorial, oviparous, and eats snakes (Marques et al. 2015. Serpentes do Cerrado. Holos Editora, Ribeirão Preto. 251 pp.).

Two *M. frontalis* were found in a sample of 399 snakes caught by pitfall and funnel traps associated with a drift fence and by hand between January 2012 and May 2018 in the Ritápolis National Forest (21.05587°S, 44.27165°W; WGS 84; 896 m elev.), a small protected area (89.5 ha) in Municipality of Ritápolis, Minas Gerais, Brazil, and were deposited at the Universidade Federal de Juiz de Fora, Minas Gerais, Brazil (CHUFJF). The first specimen was a large male (Fig. 1A) captured in a funnel trap on 17 July 2012 in a seasonal semideciduous forest (CHUFJF 1874: 135.3 cm total length, 8.2 cm tail length). This specimen presented defensive behaviors, including hiding the head, displaying the tail, sudden movements and dorsoventral flattening (Fig. 1B). The second specimen was a melanistic gravid female (CHUFJF 1873: 109.0 cm total length, 7.0 cm tail length, 290 g) which was found DOR on 21 May 2015 on a small dirt road in transition between savannah and seasonal semideciduous forest. This

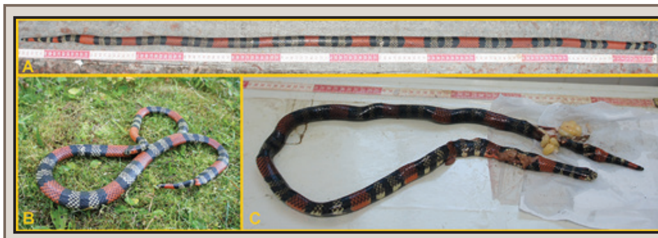

Fig. 1. A) A large *Micrurus frontalis* captured in the Ritápolis National Forest; B) the same specimen presenting defensive behavior of dorsoventral flattening; C) melanistic gravid female *Micrurus frontalis* with 12 oviductal eggs.

specimen was dissected and 12 oviductal eggs were found (Fig. 1C). The average egg length was 19.22 mm (range: 16.55–21.17 mm), the average width was 8.48 mm (range: 7.47–9.57 mm), and the average volume was 1246.66 mm³ (976.36–1676.05 mm³). These are the first measurements of eggs and the first records of *Micrurus frontalis* in the protected area of the Ritápolis National Forest. Specimens were collected under a permit authorized by Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio 31727).

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***NINIA SEBAE* (Coffee Snake). PREDATION.** The Great-tailed Grackle (*Quiscalus mexicanus*) is originally from the coast of the Gulf of Mexico and is currently distributed throughout Mexico (Gurrola-Hidalgo et al. 2009. Acta Zoológica Mexicana (n. s.) 25:427–430). It is an opportunistic species, with a varied diet of vertebrates, invertebrates, small crustaceans and other marine animals, as well as grains and fruits (Gurrola-Hidalgo et al. 2009, *op. cit.*). Herpetofauna documented in its diet include anuran tadpoles (Ideker 1976. Texas J. Sci. 27:244–245), sea turtle neonates (*Lepidochelys* olivacea; Cabrera 1998. Rev. Biol. Trop. 46:845–846), *Aspidoscelis sonorae* (Jennings 1984. Southwest. Nat. 29:514), *Sceloporus occidentalis* (Mahrdt and Barber 1999. Herpetol. Rev. 30:42), *Anolis sagrei* (Platt et al.1999. Brit. Herpetol. Soc. Bull. 66:1–13), *Hemidactylus frenatus* (Sánchez-Soto 2015. Zeledonia 19:2), *Sceloporus melanorhinus*, and *Iguana iguana* (Cupul-Magaña 2018. Huitzil, Rev. Mex. Ornitol. 19:96–99). Here, I present a case of predation on *Ninia sebae* by *Q. mexicanus*.

On 15 February 2018, I observed an adult *Q. mexicanus* foraging among a pile of fallen leaves, where he captured an adult *N. sebae*. After a few minutes, the bird managed to eat the snake. The observation site was a remnant of coffee cultivation, in the interior of the city of Córdoba, Veracruz, Mexico (18.89083°N, 96.95222°W; WGS 84; 910 m elev.). This case is the first record of *N. sebae* in the natural diet of *Q. mexicanus*. *Ninia sebae* has a wide distribution and adapts well to disturbed areas (Santos-Barrera et al., 2010. The IUCN Red List of Threatened Species), so it potentially represents an important source of food.

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***OLIGODON OCTOLINEATUS* (Striped Kukri Snake). PREDATION.** Terrestrial crabs have been observed preying on co-occurring snake species such as *Cerberus rynchops* (Dog-faced Water Snake; Voris and Jefferies, 1995. J. Trop. Ecol. 11:569–576), *Sibon nebulatus* (Cloudy Snail-eating Snake), *Pseudoboa neuwiedii* (Neuwied's False Boa), *Chironius carinatus* (Golden Tree Snake), *Atractus trilineatus* (Three-lined Ground Snake), *Erythrolamprus melanotus* (Dark Ground Snake), and *Oxybelis aeneus* (Brown Vine Snake; Maitland 2003. J. Crustacean Biol. 23:241–246). However, to our knowledge, predation of snakes by arboreal crabs has not been reported. *Arachnothelpha terrapes* (Tree-hole Spider Crab) is a nocturnally active, predominantly arboreal species found within water filled tree holes in the forested habitats of northern Borneo (Ng 1991. Zool. Med. Leiden 65:1–12). Other than a preference for

PHOTO BY SAMI ASAD

Fig. 1. *Arachnothelphusa terrapes* preying upon an *Oligodon octolineatus* within a tree hole in the Deramakot Forest Reserve, Borneo, Malaysia.

tree hole cavities, little ecological and dietary information is available for the *Arachnothelphusa* genus, (Ng and Ng 2018. ZooKeys 760:89–112.). Here, we document the first observation of *A. terrapes* predating a reptile, *Oligodon octolineatus*, within a forest reserve in Sabah, Malaysian Borneo.

On 19 April 2019, at 2045 h, in the Deramakot Forest Reserve (5.35700°N, 117.43444°E; WGS 84; 197 m elev.), the authors observed a small *O. octolineatus* (ca. 15 cm SVL) attempting to escape a water filled tree hole, located ca. 150 cm from the forest floor. On closer inspection, an *A. terrapes* was seen within the tree hole gripping the posterior end of the snake, preventing it from escaping (Fig. 1). For the next 25 min, the authors observed the snake's attempts to escape become less persistent, whilst the crab began removing portions of the snake's side and slowly consuming them. At 2110 h, we observed no further signs of resistance from the snake whilst the crab continued feeding. Tree holes provide isolated habitats that reduce competition and provide protection against potential predators, but lack food availability compared to other aquatic habitats (Kitching 2000. Food Webs and Container Habitats: The Natural History and Ecology of Phytotelmata. Cambridge University Press, Cambridge, United Kingdom. 432 pp.). However, several Bornean amphibians are phylothelmic breeders, relying on water filled tree holes as habitat for their tadpoles (Malkmus and Dehling 2008. Herpetozoa 20:165–172). Thus, arboreal crabs may be more important predators of phytotelmic herpetofauna than we realize. Regardless, the use of tree hole cavities by tropical communities and their interactions remain understudied. Further research is required to determine how these sites are utilized by vertebrate and invertebrate species, and how interactions within this community shape tree hole biota.

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***OPHIOPHAGUS HANNAH* (King Cobra) and *PYTHON MOLURUS* (Indian Rock Python). DIET and PREDATION.** *Ophiophagus hannah* is the longest venomous snake in the world,

PHOTO BY SESHADRI KADABA SHAMANNA

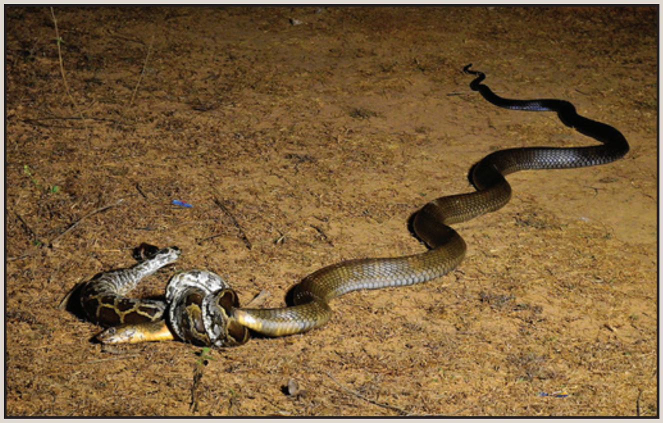

Fig. 1. *Python molurus* with a stranglehold on *Ophiophagus Hannah* in Karnataka, India.

reaching lengths of up to 4750 mm, and is found in parts of the Western and Eastern Ghats of India, North and Northeast India, and throughout much of Southeast Asia (Whitaker and Captain 2004. Snakes of India: The Field Guide. Draco Books, Chennai, India. 481 pp.). It primarily feeds on a wide variety of snakes, as well as varanid lizards. Krishna (2002. Herpetol. Rev. 33:141) reported two observations of *O. hannah* preying on *P. molurus* in the Western Ghats. Here, we report an instance where an *O. hannah* attempted to feed on a *P. molurus* unsuccessfully.

On 8 April 2019, at 1830 h, we were informed about an *O. hannah* attempting to consume a *P. molurus* in an open field near the village of Guddekeri (13.5625°N, 75.1267°E; WGS 84; 671 m elev.) in Sivamogga District, Karnataka, India. The open field was bordered by human habitation on one side and a plantation of *Casuarina equistofolia* trees and a state highway on the other. Villagers first saw the two snakes at 1820 h and continued observing from a distance. When we saw the two snakes, the *O. hannah* was stretched out with the *P. molurus* tightly coiled around its head and neck. They remained motionless for about 5 min when the *P. molurus* began to constrict and after ca. 20 min, the *P. molurus* loosened its coils but retained a stranglehold. We could see the head of the *O. hannah*, which continued to lie motionless all the while (Fig. 1). It was now visibly evident that the *O. hannah* had bitten the *P. molurus* near its head and neck and presumably envenomated it. After another 10 min, the *O. hannah* stopped biting, released its grip and the *P. molurus* began to uncoil. Soon after, the *O. hannah* began to move, forming loose coils. Subsequently, it began to struggle and rolled once, presumably in an attempt to loosen the coils of the *P. molurus*. Then, the *O. hannah* moved intermittently until it escaped the coils of the *P. molurus* and started moving away, obviously disturbed by the presence of a large group of observers with lights.

The duration of our observation was ca. 45 min and well past sunset. Because both snakes were around human settlements, a crowd of over 200 people had gathered. The two snakes were then caught and placed in separate cloth bags and released nearby, away from human habitation. We observed three bite marks on the dorsum in the neck region of the *P. molurus* (female, 1.85 m total length, 3.7 kg) and it was already sluggish when placed in a cloth bag. It was found alive and flicking its tongue but very sluggish the next morning at 1000 h and was dead by 1200 h. No signs of injury were apparent on the *O. hannah* (male, ca. 3.6 m total length).

In the past, we (AG, JS, and, RW) have witnessed incidents or been shown photographs wherein *O. hannah* were preying upon *P. molurus*. In one instance, on 8 September 2018, an *O. hannah* was observed to lay motionless in someone's backyard in the village of Aradi, near the town of Kundapura, Udupi District, Karnataka. Upon closer inspection, the snake was dead. Villagers reported that it died after consuming a *P. molurus* which was as long as it and presumably choked to death. In another instance on 27 March 2019, at Kalkuruadi village, near the town of Kundapura, Udupi District, Karnataka, an *O. hannah* was observed biting a *P. molurus* which escaped and subsequently fell into a well along with the *O. hannah*. The *P. molurus* hid underwater whereas the *O. hannah* was swimming about on the surface and was rescued. The next day, a dead *P. molurus* was seen floating in the water. The aforementioned observations suggest that *O. hannah* will prey on snakes that are often equal in size to their own body size. In addition, there are media reports of *O. hannah* preying upon *Malayopython reticulatus* (Reticulated Python) in Southeast Asia (The Straits Times, 27 Aug 2015). It is likely that *O. hannah* make dynamic decisions by evaluating the benefit and risks of attacking large prey such as *P. molurus* or *M. reticulatus*, which can constrict in self-defense. Other predators of *P. molurus* include eagles (*Aquila* spp. and *Spilornis cheela*; Goel et al. 2017. Herpetol. Rev. 48:866–867) and possibly *Canis aureus* (Golden Jackal) and *Hyena hyena* (Striped Hyena; Bhupathy and Vijayan 1989. J. Bombay Nat. Hist. Soc. 86:381–387); adult pythons may have few predators other than *O. hannah* and humans throughout much of their range.

We thank the villagers who brought the feeding incident to our attention and have supported our ongoing research in the landscape, funding agencies, the Karnataka Forest Department.

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***OXYBELIS FULGIDUS* (Green Vine Snake). DEFENSIVE BEHAVIOR.** *Oxybelis fulgidus* is an arboreal and diurnal snake distributed from southern Mexico to northeastern Argentina (Savage 2002. The Amphibians and Reptiles of Costa Rica. University of Chicago Press, Chicago, Illinois. 934 pp.; McCranie 2011. The Snakes of Honduras. SSAR Press, Salt Lake City, Utah. 714 pp.). This species is recognizable by the slender body, large eyes with binocular vision, elongated snout, and cryptic coloration (Henderson et al. 1980. Contr. Biol. Geol. Milwaukee Public. Mus. 37:1–38). There is a single study reporting the defensive behavior of this species, which includes body inflation, an S-coil, head enlargement, and rapid strikes (Martins et al. 1998. Herpetol. Nat. Hist. 6:78–150).

On 27 April 2008, an adult *O. fulgidus* (ca. 145 cm SVL) was observed on the ground, in a patch of terra firme upland forest, within the Acariquara Environmental Protection Area (APA-Acariquara), Manaus, Amazonas, Brazil (3.08355°S, 59.96294°W; WGS 84). When initially approached, the snake initiated defensive displays. At first, the *O. fulgidus* made an S-coil, began an intermittent lateral expansion and flattening of the body exhibiting contrasting orangish-red coloration (Fig. 1A, B) and flattened the head dorsoventrally (Fig. 1C). When the observer approached more closely, *O. fulgidus* repeated the initial display and then gaped, showing the bluish coloration inside its mouth

Fig. 1. *Oxybelis fulgidus* exhibiting defensive displays in Manaus, Amazonas, Brazil. A, B) intermittent lateral flattening and inflating, exhibiting aposematic coloration; C) S-coil and dorsoventral flattening of the head; D) gaping.

(Fig. 1D). When approached to within striking distance, the *O. fulgidus* repeated the aforementioned displays and added intermittent striking and hissing behavior. This behavior was observed over ca. 30 min.

This is the first report to *O. fulgidus* exhibiting contrasting, potentially aposematic coloration while inflating, intermittently laterally-flattening the body, gaping, and hissing intermittently while striking.

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***PANTHEROPHIS ALLEGHANIENSIS* (Eastern Ratsnake). DIET.** Ratsnakes feed on diverse prey including small mammals, amphibians, lizards, and birds (Uhler et al. 1939. Trans. N. Am. Wildl. Conf. 1939:605–622). Whereas ratsnakes are known to predate birds and their nests, to our knowledge, attempted predation of hummingbirds at feeders has not been previously reported. Here, we present evidence of *P. alleghaniensis* hunting at a plastic sugar water dispenser in an attempt to catch *Archilochus colubris* (Ruby-throated Hummingbird).

Fig. 1. *Pantherophis alleghaniensis* hunting at hummingbird feeder in James City County, Virginia. A) *P. alleghaniensis* climbing a pole from which the hummingbird feeder is hanging; B) the snake positioned in a flowerpot adjacent to the feeder prior to striking at *Archilochus colubris* (a male *A. colubris* is indicated with a white circle); C) after striking, the snake climbed over to the feeder while the birds continued to feed (a female *A. colubris* is indicated with a white circle); D) the snake descended the pole head first after ca.1 h, unsuccessful in catching a bird.

On 29 July 2018, we recorded photographs and videos of a *P. alleghaniensis* (ca. 1.25 m total length) climbing an iron pole (ca. 1.2 m in length) affixed to the edge of a porch about 1.4 m from the ground in James City County, Virginia, USA (37.2393°N, 76.7004°W; WGS 84). The snake used inverted concertina locomotion (Astley and Jayne 2009. J. Exper. Zool. 311:207–216) to climb the pole, and then coiled into a flowerpot hanging on a hook opposite a plastic hummingbird feeder hanging from the same pole (Fig. 1). Initial ascent up the pole took 16 mins (1754–1810 h), during which time at least 3 different *A. colubris* (2 females or juveniles, 1 male) actively fed at the sugar water dispenser. Once in the flowerpot, the snake slowly approached the feeder, tongue-flicking. The birds seemed aware of the snake, pausing to hover within 10 cm of it; in other systems, hummingbirds have shown an ability to recognize snakes as threats (Sherbrooke 1996. Sonoran Herpetol. 9:1–3). Despite this apparent awareness, the hummingbirds continued to feed at the dispenser. At 1820 h, a male *A. colubris* flew close to the side of the feeder opposite the snake; when the birds' shadow passed through the glass bottom of the feeder, the snake struck out but did not catch the bird. The bird hovered and watched the snake for 6 sec and then flew off. Following the failed strike, the snake climbed over the hook holding the feeder, positioning itself closer to the feeder and to the birds, all three of which continued to feed. The snake did not attempt to strike again and descended the pole at 1907 h when we ended our observations. Videos of the snake and hummingbirds are archived at Macaulay Library, Cornell University (ML 488623–488625, accessible at https://macaulaylibrary.org).

There are records of *A. colubris* in the stomach contents of *P. alleghaniensis* (Uhler et al. 1939, *op. cit.*), however, to our knowledge, this is the first record of *P. alleghaniensis* using a hummingbird feeder as a microhabitat for foraging. Our observations support the idea that ratsnakes can orient, either visually or by olfaction, to fixed points in space with focused bird activity, and determine how to access that location (Mullin and Cooper 1998. Am. Midl. Nat. 140:397–401; Cooper et al. 1999. Condor 101:920–923). Like nests with young, feeders represent fixed locations to which birds make reasonably frequent visits, which might provide cues to hunting snakes.

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***PAREAS ATAYAL* (Atayal Slug-eating Snake). DIET.** Slug-eating snakes of the family Pareidae are distributed exclusively in southeast Asia. They are regarded as dietary specialists on terrestrial slugs and snails (Pough et al. 2016. Herpetology. Fourth Edition. Oxford University Press, Oxford, United Kingdom. 776 pp.). At 2305 h on 10 April 2019, we encountered an adult *P. atayal* (45.0 cm SVL, 14.0 cm tail length, 32 g) at Sanxia, New Taipei City, Taiwan (24.9165°N, 121.3776°E; WGS 84; 120 m elev.). The snake had an observable food bolus, which was unusual because these snakes usually consume only the soft portions of slugs and snails. The snake was gently forced to regurgitate (Fig. 1), revealing a *Laevicaulis alte* (Tropical Leatherleaf Slug). Measuring 5 g, this prey item is comparatively much larger than the size of usual prey items we have observed for *Pareas* snakes in Taiwan.

PHOTO BY NAI-PANG CHOU

Fig. 1. An adult *Pareas atayal* regurgitating a *Laevicaulis alte* (Tropical Leatherleaf Slug) in New Taipei City, Taiwan.

The majority of land snails and slugs are members of Stylommatophora, which constitute the major diets of slug-eating snakes. As members of Veronicelloidea, Systellommatophora, *Laevicaulis* species do not share the most recent common ancestor with slugs of Stylommatophora. (Bouchet et. al. 2005. Malacologia. 47:1–397). Instead, the closest clade to Veronicelloidea is Onchidioidea; members of which are mostly marine species. These slugs have extremely tough skin, making them difficult for snakes to swallow, and may differ in the composition of mucus secretions from typical slugs of Stylommatophora. After testing a large number of individuals, Lin (2010. Terrestrial molluscs mucus trailing behavior of Taiwan slug snake, *Pareas formosensis*. M.S. Thesis, National Taiwan Normal University. 62 pp.) mentioned only a single case of *Pareas* snakes preying upon *L. alte* under laboratory conditions, and this event occurred after starvation. Therefore, it has long been assumed that *Pareas* in Taiwan do not prey on this extremely unpalatable prey. Our observation represents the first documentation of a Taiwanese *Pareas* snake preying upon a non-Stylommatophora species in the wild.

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***PAREAS MONTICOLA* (Montane Slug-eating Snake). REPRODUCTION.** *Pareas monticola* is a slender arboreal snake which feeds on slug and snails. They are known to inhabit evergreen hill forest, up to an elevation of ca. 1800 m (Das 2012. A Naturalist's Guide to the Snakes of South-East Asia including Malaysia, Singapore, Thailand, Myanmar, Borneo, Sumatra, Java and Bali. John Beaufoy Publishing (UK) Ltd., Oxford, United Kingdom. 160 pp.) with a maximum clutch size of 8 eggs and hatchling size of 168–178 mm (Das and Das 2017. A Naturalist's Guide to the Reptiles of India, Bangladesh, Bhutan, Nepal, Pakistan and Sri Lanka. Prakash Books India Pvt. Ltd., New Delhi, India. 176 pp.). Their range of distribution includes Myanmar, Vietnam, Bhutan, China and India (Uetz et al. 2018. The Reptile

Fig. 1. Hatchlings of *Pareas monticola* from eggs from a gravid female collected from Tanhril, Mizoram, India.

Fig. 2. Gravid female *Pareas monticola* collected from Durtlang, Mizoram, India.

Database; https://www.reptile-database.org; 31 May 2019). Here, we present a new observation on clutch size for this species from Mizoram, Northeast India.

A gravid female *P. monticola* (535 mm SVL) was captured at 2045 h on 29 May 2018 on a roadside in Tanhril (23.73855°N, 92.67335°E; WGS 84; 974 m elev.) by Lalrinsanga. It was relocated to the Laboratory of Developmental Biology and Herpetology, Mizoram University and maintained under semi-natural conditions. On 3 June 2018, it was found laying 9 eggs which is a new maximum clutch size. Mean (range) measurements of eggs were: length = 21.1 mm (20.1–22.6 mm), and breadth = 11.8 mm (10.6–13.0 mm). The eggs were hatched out after incubating for 47 days (Fig. 1). Unfortunately, only two successfully hatched due to infestation by chironomid larvae. The SVL of two hatchlings were 125 mm and 163 mm. While examining museum specimens, one female *P. monticola* (Departmental Museum of Zoology, Mizoram University [MZMU] 991: 578 mm SVL) collected at 1910 h on 7 May 2018 from Durtlang (23.78913°N, 92.73126°E; WGS 84; 1104 m elev.) by Lalbiakzuala was also found gravid with 9 eggs (Fig. 2). The female *P. monticola* (MZMU 843) and the two hatchlings (MZMU 1386, 1387) were euthanized, preserved and cataloged in the Departmental Museum of Zoology, Mizoram University as a voucher specimen for further studies.

This work was conducted under the permission for herpetofaunal collection throughout Mizoram No.A.33011/2/99-CWLW/225 issued by the Chief Wildlife Warden, Environment, Forest and Climate Change Department, Govt. of Mizoram, India. We are very grateful to the co-ordinator, DBT State Biotech-Hub, Department of Biotechnology, Mizoram University; DST-SERB, New Delhi, Govt. of India for their financial support and to V. Santra for his suggestions in this work.

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***PHILODRYAS PATAGONIENSIS* (Patagonian Green Racer). DIET.** *Philodryas patagoniensis* is a medium-size colubrid with diurnal and predominantly terrestrial habits (Marques et al. 2001. Serpentes da Mata Atlântica: Guia Ilustrado para Serra do Mar. Holos, Ribeirão Preto. 184 pp.). This species occurs in open and woodland areas across South America (Leite et al. 2009. North-West J. Zool. 5:53–60; Hartmann and Marques 2005. Amphibia-Reptilia 26:25–31). It is an opportunistic predator of small mammals, reptiles, anurans and birds (Lopez et al. 2003. Herpetol. Rev. 34:71–72; Franca and Araujo 2007. Braz. J. Biol. 67:33–40; López and Giarudo 2008. J. Herpetol. 42:474–480; Otani et al. 2016. Herpetol. Rev. 47:314–315; Zocche et al. 2017. Herpetol. Rev. 48:217–218). *Passer domesticus* (House Sparrow; Passeriformes: Passeridae) is a non-native bird introduced to the Americas from Europe. It was introduced in Brazil in 1906 for biological control of insects (Sick 1997. Ornitologia Brasileira. Second Edition. Nova Fronteira, Rio de Janeiro, Brazil. 912 pp.). Herein, we report predation by *P. patagoniensis* on a fledgling of *P. domesticus* (Fig. 1).

During a bird survey on 30 November 2018 at 1145 h, in the sandy-coastal plain of the Ecofazenda Experimental UVV, Municipality of Guarapari, Espírito Santo, Brazil (20.5944°S, 40.4579°W; 6 m elev.), we observed a *P. patagoniensis* (ca. 120 cm SVL) feeding on a *P. domesticus* fledging. The bird nest was located at 310 cm on a tree branch. The snake was found on the ground with a fledging headfirst in its mouth. After noticing the approach of the observer, the snake moved 4 m away and continued prey ingestion. The consumption lasted ca. 13 min. After ingesting the bird, the snake moved slowly toward a flooded area. Birds are most often predated by the congener *P. olfersii* due to its arboreal habits (Hartmann et al. 2009. Biot. Neotrop. 9:173–184; Pontes 2007. Pontifícia Universidade Católica do Rio Grande do Sul. 71 pp.). To our knowledge, this is the first record of *P. domesticus* in the diet of *P. patagoniensis*,

Fig. 1. Adult *Philodryas patagoniensis* preying upon a *Passer domesticus* fledging in the sandy-coastal plain of Espírito Santo, Brazil.

supporting the idea that *P. patagoniensis* is an opportunistic predator of both native and non-native birds.

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***PITUOPHIS MELANOLEUCUS* (Pinesnake). DIET.** *Pituophis melanoleucus* is a large, primarily fossorial colubrid found in sandy soil regions of the southeastern USA and is traditionally associated with open canopy habitats (Ernst and Ernst 2003. Snakes of the United States and Canada. Smithsonian Institution Press, Washington, D.C. 668 pp.). It is a powerful constrictor that feeds principally on small mammals, but has occasionally been recorded feeding on lizards, other snakes, and quail eggs (Ernst and Ernst 2003, *op. cit.*). Here, we report consumption of turtle eggs, most likely those of *Gopherus polyphemus* (Gopher Tortoise), by *P. melanoleucus* in Georgia, USA.

At 1300 h on 18 June 2018, AS spotted a *P. melanoleucus* in Longleaf Pine (*Pinus palustris*) sandhill habitat as part of a larger study of secretive upland snakes at Fort Stewart, Long County, Georgia, USA. The snake was near a *G. polyphemus* burrow, stretched out and crawling in exposed sand < 2 m from the edge of an unpaved road. It was an adult female and had ingested several food items (1156 mm SVL, 162 mm tail length, 583.3 g at capture, 533.8 g post-digestion on 27 June 2018 when food items were no longer palpable). The four discrete boluses were located ca. 450–590 mm anterior to the cloaca (Fig. 1A, B). An ultrasound performed on 19 June 2018 confirmed that the items were spherical (Fig. 1C), suggesting that the snake had consumed turtle or bird eggs. While bird eggs are generally ovoid, some owls, including resident *Strix varia* and *Bubo virginianus*, lay near-spherical eggs (Stoddard et al. 2017. Science 356:1249–1254), though mid-June is beyond the egg stage for both species' nesting phenology (http://www.ebird.org; 1 Oct 2019). Given the time of year, and egg size and shape, the most plausible food items were turtle eggs from *Chelydra serpentina*, *Apalone ferox*, *Apalone spinifera*, or *G. polyphemus*. Of these, *G. polyphemus* is most likely, given the prevalence of this species at the capture location and the absence of nearby aquatic habitats likely to harbor populations of *C. serpentina*, *A. ferox*, or *A. spinifera*.

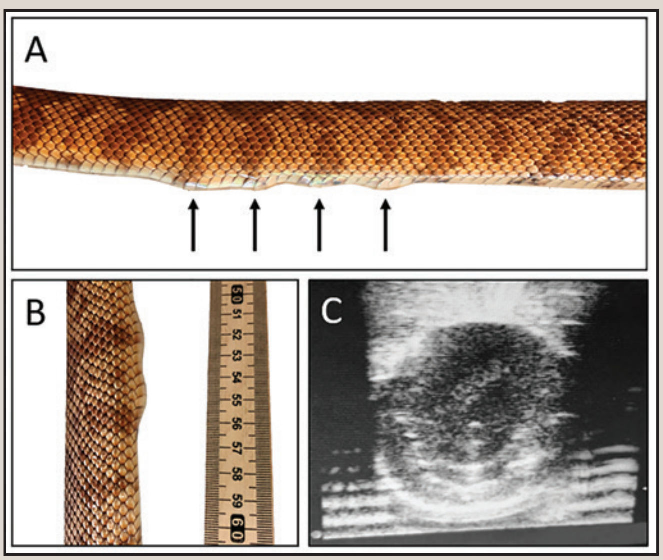

FIG. 1. *Pituophis melanoleucus* at (A) capture and (B) two days later, showing multiple obvious food boluses, and (C) ultrasound showing round eggs in the digestive tract.

Despite the scarcity of records of egg predation by *P. melanoleucus*, the inclusion of eggs in their diet is unsurprising. In a comprehensive study of the diet of *P. catenifer* (the western sister taxon to *P. melanoleucus*), 11.9% of 1,066 prey items were bird eggs (Rodriguez-Robles 2002. Biol. J. Linn. Soc. 77:165–183). However, turtle eggs have seldom been recorded in the diet of *P. catenifer* and have not been reported in the diet of *P. melanoleucus*. Given that *G. polyphemus* can be common in sandy uplands preferred by *P. melanoleucus*, their eggs may be an underappreciated food resource for this species.

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***SENTICOLIS TRIASPIS* (Green Ratsnake). ARBOREAL HABITAT USE.** *Senticolis triaspis* is a large snake (total length to 1830 mm; García-Vázquez et al. 2008. Herpetol. Rev. 39:358) that inhabits in a variety of habitats, including grassland, tropical deciduous forest, semi-evergreen seasonal forest, premontane rain forest, and pine-oak forest, in low and moderate elevations from southeastern Arizona, USA and central Nuevo León, Mexico, southward through much of Mexico and Central America to Costa Rica (Heimes 2016. Herpetofauna Mexicana Vol. I. Snakes of Mexico. Edition Chimaira. Frankfurt am Main. 572 pp.). *Senticolis triaspis* is primarily terrestrial (Lee 2000. A Field Guide to the Amphibians and Reptiles of the Mayan World. Cornell University Press, Ithaca, New York. 402 pp.), and although it is not considered an arboreal species (Radke and Malcom 2005. USDA

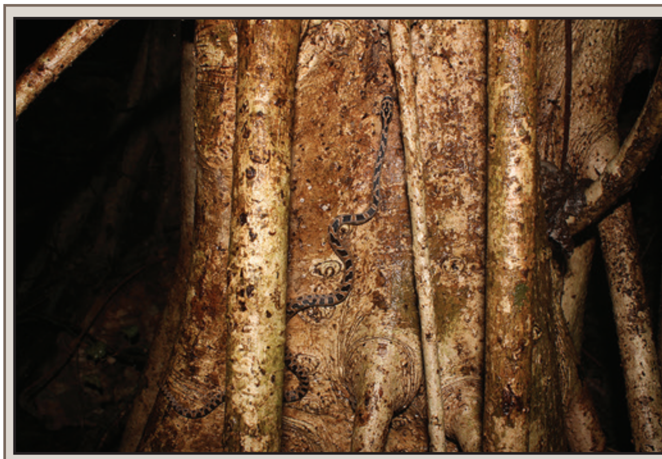

FIG. 1. A juvenile *Senticolis triaspis* at the base of a tree *Cecropia* sp. tree, in the entrance of "Calcehtok" cave, Opichén, Yucatán, Mexico.

Fig. 2. *Senticolis triaspis* at ca. 7 m above ground.

Forest Service Proceedings RMRS-P-36: 434–437), according to Heimes (2016, *op. cit.*) it occasionally climbs low shrubs and trees. During a telemetry study conducted in Arizona, two adult females were recorded over trees while exposing their bodies to sunlight (Sherbrooke 2006. Herpetol. Rev. 37:34–37), one of them was observed first on a branch of a *Quercus arizonica* at 4 m above the ground, and later stretched on a small *Q. hypoleucoides* at 1 m above the ground; the second snake was found on a *Yucca schotii* at 1 m high. The aforementioned cases suggest snakes used perches as basking sites (Sherbrooke 2006. *op. cit.*). Herein we report an observation of climbing behavior in *S. triaspis*.

At 0049 h on 18 March 2019, after a light rain, we found a juvenile (total length ca. 270 mm) *S. triaspis* at the base of the trunk of a *Cecropia* sp. tree, 64 cm above the ground (Fig. 1), in the entrance of "Calcehtok" cave (20.56222°N; 89.93472°W, WGS 84, 67 m. elev.), municipality of Opichén, Yucatán, Mexico. We observed the snake for 27 min while it climbed the trunk to ca. 7 m above the ground (Fig. 2), when it disappeared in the leaves of the tree's crown. As the snake climbed, it appeared to investigate the microhabitat, potentially foraging for prey. Contrary to the report by Sherbrooke (2006, *op. cit.*), the individual of our observation was a juvenile and it happened during the night, so, it is possible that *S. triaspis* also uses arboreal habitats for refuge or foraging. We thank Juan Tun-Garrido for identification of the tree.

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***SPALEROSOPHIS ATRICEPS* (Black-headed Royal Snake). ECTOPARASITES.** *Spalerosophis atriceps* is an aglyphous species and the largest species in the genus *Spalerosophis*. It is nocturnal and is found in desert and semi-desert habitats in India, Pakistan and Nepal (Mukherjee 2015. Newsl. South Asian Reptile Netw. 17:22–24; Baig and Masroor 2008. Herpetozoa 20:109–115).

During a morphological study of 12 specimens of *S. atriceps* (mean SVL [range] = 970 [529–1220] mm; mean tail length [range] = 287 [132–360] mm) from the herpetological collection of National Museum of Natural History, Paris, France (MNHN),

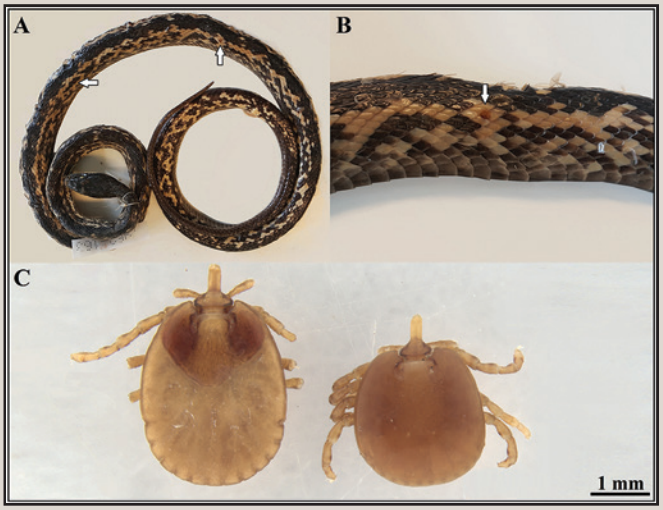

Fig. 1. A, B) *Spalerosophis atriceps* infected by *Amblyomma gervaisi*; C) female (left) and male (right) *A. gervaisi*.

we found three tick specimens (two males and one female) on two snakes (MNHN 1962.163, 1962.164), from Punjab Province, Pakistan (31.33°S, 74.18°W; WGS 84; 217 m elev.). Ticks were found on the dorsal surface of snakes. Prevalence of infestation was 16.6% (2 infected out of 12 total). Tick identification was performed according to the criteria used in previously published keys and reports (Furman and Loomis 1984. Bull. California Insect Surv. 25:1–239; Ghosh and Misra 2012. J. Parasitol. Dis. 36:239–250). The tick specimens were identified as *Amblyomma gervaisi* and are housed in the herpetological collection of Federal University of Paraiba (UFPB), Brazil. Male and female adult ticks differ in their dorsal and ventral surface and the male is smaller than the female (Fig. 1).

There are ca. 130 *Amblyomma* species in the world and ticks found on reptiles mostly belong to this genus. They can be vectors for *Aeromonas hydrophilia*, and pneumonia in snakes, can cause tick paralysis in *Coluber constrictor*, and can transmit blood-borne pathogens like *Aeromonas septicemia* (Sumrandee et al. 2014. Ticks. Tick Borne Dis. 5:632–640; Marcus 1971. J. Am. Vet. Med. Assoc. 159:1626–1631). Our observation establishes the occurrence of *A. gervaisi* in Panjab Province, Pakistan, and also the first record of this species infesting *S. atriceps*.

We wish to thank N. Vidal from National Museum of Natural History, Paris, France (MNHN) for cooperation on access to specimens and scientific guidance. Also we thank CNPq for the research scholarship.

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***STORERIA DEKAYI* (Dekay's Brownsnake). DEFENSIVE BEHAVIOR and PREDATION.** *Storeria dekayi* ranges from Canada and the eastern United States to Honduras. In Canada, this species exists in southern Ontario and southern Quebec, occupying diverse habitat including forests, fields, and urban areas (www.canadianherpetology.ca; 26 June 2019). While assessing water quality of urban rivers, I observed an interaction between *S. dekayi* and *Turdus migratorius* (American Robin). At 1014 h

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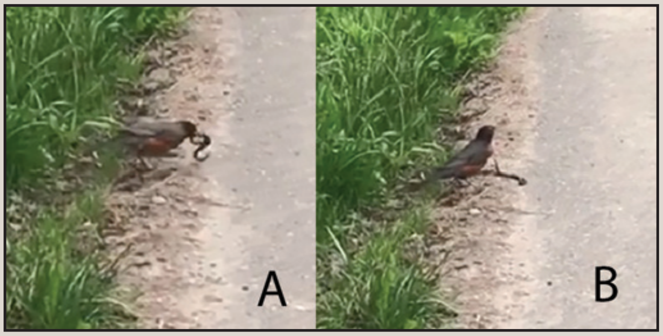

Fig 1. A) *Turdus migratorius* with *Storeria dekayi* in its beak on a riverside pedestrian path in Toronto, Ontario, Canada; B) defensive anterior side-to-side swaying of *S. dekayi* towards *T. migratorius.*

on 18 June 2019 a *T. migratorius* emerged from the grass carrying a ca. 20–25 cm total length *S. dekayi* onto the East Don Trail, 30 m from the Don River in Toronto, Ontario, Canada, a heavily urbanized watershed (Fig. 1A; 43.7123°N, 79.3195°W; WGS 84). During an encounter with a 25 cm *S. dekayi*, LeGros (2017. Can. Field-Nat. 131:235–237) witnessed anterior side-to-side swaying defensive behavior directed against a human observer and speculated that this defensive mechanism might be used against ground-foraging birds, despite the action inherently exposing a vital area of the body. During the encounter on the East Don Trail, the *S. dekayi* exhibited anterior side-to-side swaying as a defensive behavior, thus confirming the speculation of LeGros (2017, *op. cit.*; Fig. 1B). After thrashing the *S. dekayi* back-and-forth for ca. 45 s, the *S. dekayi* was killed, although the *T. migratorius* fled due to the presence of pedestrians passing by on the trail. Following observation for 5 min, the *T. migratorius* did not return to consume the dead *S. dekayi*, likely due to pedestrian presence. *Turdus migratorius* is one of several reported predators of *S. dekayi* (Rowell 2012. The Snakes of Ontario: Natural History, Distribution, and Status. Privately published. 411 pp.). However, the defensive mechanism observed of anterior side-to-side swaying by the *S. dekayi* towards the *T. migratorius* is novel. To my knowledge, this is the first video (https://doi.org/10.6084/m9.figshare.10050302.v1) and photographic recording of predation of *S. dekayi* by *T. migratorius* and the first observation of anterior side-to-side swaying by *S. dekayi* as a defense mechanism against ground-foraging birds. I thank L. Price for field assistance and P. Moldowan for discussing the observation and assisting in collection of information on bird-snake interactions.

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THAMNOPHIS CYRTOPSIS CYRTOPSIS **(Western Black-necked Gartersnake). PREY CAPTURE AND HANDLING.** *Thamnophis cyrtopsis* is an opportunistic aquatic and terrestrial natricine snake. The approximate distribution of this species in Colorado was summarized by Livo et al. (1996. Herpetological Microbiogeography of Colorado II: Documented and Potential County Records. Publ. Colorado Herpetol. Soc. 22 pp.), after which new county records have been reported by others. Its diet varies based upon local conditions and prey availability within its enormous geographic range in the southwestern United States, Mexico, and Guatemala (Ernst and Ernst 2003. Snakes of the United States and Canada. Smithsonian Institution Press, Washington D. C. 661 pp.). Noteworthy comparative dietary studies of the species have been conducted in New Mexico by Fleharty (1967. Southwest. Nat. 12:207–210) and in Texas by Fouquette (1954. Texas J. Sci. 6:172–189). Aquatic predatory behavior in the species in two west-central Arizona streams was described by Jones (1990. Southwest. Nat. 35:115–122) who reported that "snakes fed exclusively at or near the water's surface or on banks of pools and runs." Jones (1990, *op. cit.*) described *T. cyrtopsis* as a mostly sit- or float-and-wait predator in and near aquatic habitats rather than detailing prey capture and deglutition. McCall et al. (2017. Herpetol. Rev. 48:220) also found that two individuals of *T. cyrtopsis* had each preyed upon radio telemetered individuals of *Lithobates chiricahuensis* (Chiricahua Leopard Frog) in the Santa Rita Mountains, Arizona, USA.

Here, we provide the first details of capture and deglutition of terrestrial prey, a large adult of *Anaxyrus woodhousii woodhousii* (Woodhouse's Toad; Bufonidae), by *T. c. cyrtopsis* (Colubridae). These behaviors occurred on 23 July 2017 between 1036 and 1051 h MDT after a rainy night at the remote Carrizo Canyon Picnic Area (37.13524°N, 103.01530°W; WGS 84; ca. 1451 m elev.), Baca County, southeastern Colorado. The area includes a well-vegetated canyon created by persistent East Carrizo Creek. The canyon is bordered by east and west rocky rims with junipers grading into sand sage prairie within an arid landscape (Walker et al. 2019. Herpetol. Conservation and Biol. 14:119–131). We photographed (Fig. 1A–D) and note-documented the snake–toad interaction in the sand sage prairie component east of the canyon rim and well-removed from riparian habitat near permanent water in the canyon, the latter condition often being associated with microhabitat preferences of *T. cyrtopsis* (Ernst and Ernst 2003, *op. cit.*).

We observed a *T. c. cyrtopsis* (ca. 80 cm total length) in well-drained prairie habitat at Carrizo Canyon Picnic Area where it was foraging when it located an individual of *A. woodhousii woodhousii* resting on a rock surface. The snake ambushed the toad from surrounding vegetation and initially the prey made sounds and attempted to escape by vigorous use of the hind limbs. As a result, it was released by the snake for a moment. However, the snake immediately struck a second time and maintained its grasp by seizing the left side of the body anterior to the hind limb (Fig. 1A), a position that would have made deglutition problematic. The toad remained passive during that phase of capture; the proximity of JEC to the event to obtain digital images did not disturb its progression. Slowly, the snake worked its jaws so that the grasp was more posterior in position (Fig. 1B–C); it made no attempt to position the toad for swallowing head first as depicted for *Thamnophis eques megalops* by Emmons et al. (2016. Herpetol. Rev. 47:555–561). The adult toad was then slowly swallowed posterior first by alternating the sides of the jaws forward. The prey made no obvious attempts to avoid being swallowed after being seized the second time. Following deglutition and a series of sinuous contractions of the body, the toad was forced well into the digestive tract of the snake as indicated in Fig. 1D. The bulging predator then began to laboriously crawl away. The snake was neither collected for a voucher specimen nor handled.

We thank L. J. Livo for confirmation of the identities of predator and prey. Partial research funding for field work in southeastern Colorado was derived from an Endowed Professorship to JEC through the Louisiana State University Eunice Foundation and Opelousas General Hospital, Louisiana. A field course conducted in southeastern Colorado by CEM was

PHOTOS BY JAMES E. CORDES

Fig. 1. A) *Anaxyrus woodhousii woodhousii* (Woodhouse's Toad) ambushed from the left side as it was resting on a rock surface by an individual of *Thamnophis cyrtopsis cyrtopsis* from surrounding vegetation in Baca County, southeastern Colorado; B) the snake having shifted its grasp to the posterior aspect of the toad; C) toad pulled away from the rock surface into the vegetation and approximately half swallowed posterior first by the snake; D) bulging snake crawling away.

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THAMNOPHIS ELEGANS TERRESTRIS **(Coast Gartersnake). PREDATION.** Although *Thamnophis elegans* has an extensive range in western North America, there are relatively few documented cases of predation. Known predators include conspecifics (White and Kolb 1974. Copeia 1974:126–136), predaceous diving beetle larvae (Drummond and Wolfe 1981. Coleopterists Bull. 35:121–124), non-native crayfish (Weaver 2004. Herpetol. Rev. 35:278), wild turkeys (Horner et al. 2016. Herpetol. Rev. 47:317), Loggerhead Shrike (Frye and Gerhardt 2001. Wilson Bull. 113:462–464), American Robin, Great Blue Heron, Osprey, Bald Eagle (Sparkman et al. 2013. Am. Midl. Nat. 170:66–85).

At ca. 0500 h on 20 May 2019, I observed a small *T. e. terrestris* in the intertidal zone of the Pacific Ocean (vicinity of Avila Beach, San Luis Obispo County, California, USA) being consumed by a Starburst Anemone (*Anthopleura sola*; Fig. 1). It is not possible to determine if the snake was captured alive by the anemone or was being scavenged. Presumably the snake was foraging for small fish in pools created by low tides.

Fig. 1. *Thamnophis elegans terrestris* being consumed by *Anthopleura sola* in California, USA.

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***THAMNOPHIS SIRTALIS PALLIDULUS* (Maritime Gartesnake). DIET.** *Thamnophis sirtalis pallidulus* is reported to range throughout the Maritime Provinces of Canada, westward to New Hampshire, USA, and northward to James Bay and eastward along the north shore of the Gulf of St. Lawrence (Bleakney 1959. Copeia 1959:52–56). Degraaf and Rudis (1983. Amphibians and Reptiles of New England: Habitats and Natural History. University of Massachusetts Press, Amherst. vii + 85 pp.) report that there is little information available on the life history for this subspecies. Gilhen (1984. Amphibians and Reptiles of Nova Scotia. Nova Scotia Museum, Halifax, Nova Scotia. 162 pp.) identified earthworms (species unknown) and *Plethodon cinereus* as principal dietary items for *T. sirtalis pallidula* in Nova Scotia. More generally, earthworms and anurans have been identified as primary items in the diet of *T. sirtalis* (Rowell 2012. The Snakes of Ontario: Natural History, Distribution, and Status. Privately printed. 411 pp.; Gibbons 2017. Snakes of the Eastern United States, University of Georgia Press, Athens, Georgia. 416 pp.). Gillingham et al. (1990. *In* McDonald et al. [eds.], Chemical Signals in Vertebrates 5, pp. 522–532. Oxford University Press, Oxford, United Kingdom) report that earthworms may be the most commonly taken gartersnake prey. Catling and Freedman (1980. Can. Field-Nat. 94:28–33) identified *Lumbricus terrestris* in the diet of 6 specimens of *T. s. sirtalis* from Ontario, while Gray (2010. Bull. Chicago Herp. Soc. 45:73–86) cites additional sources for *Allolobophora caliginosa*, *L. rubellus*, and *L. terrestris* in the diet of *T. sirtalis* from Kansas and Virginia. In spite of the evident importance of earthworms in the diet of *T. sirtalis*, there are few instances where the earthworm species have been identified.

At 1023 h on 15 June 2018, FWS encountered an adult male *T. s. pallidulus* (481 mm SVL) moving across a mat of cranberry and shore grass at the margin of Spednic Lake, York County, New Brunswick, Canada, about 200 m south of the boundary of Spednic Lake Provincial Park (45.59854°N, 67.44040°W). Spednic Lake, a 6968-ha mesotrophic lake and surrounding woodland encompasses both a provincial park and the 25,726-ha Spednic Lake Protected Natural Area (PNA). The weather was sunny and ca. 15°C. FWS noted the end of an earthworm dangling from the mouth of the snake and proceeded to palpate the snake, forcing the regurgitation of the entire contents (confirmed at later dissection; New Brunswick Museum [NBM] 12345), which consisted of 15 clitellate *Apporectodea turgida*, plus 4 posterior fragments (wet weight 9.9 g). The 15 *A. turgida* ranged in length as follows; 61, 67, 74, 79, 82, 84, 98, 100, 100, 121, 128, 134, 134, 135, 141 mm.

Terrestrial earthworms have been categorized as belonging to one of four ecological categories; epigeic (strict litter dwellers), endogeic (horizontal burrowing soil dwellers), epi-endogeic (horizontal burrowers that occupy the litter layer and the top few cm of mineral soil), and anecic (vertical deep burrowing surface feeders). *Lumbricus terrestris* is considered an anecic species, while *A. turgida* is categorized as endogeic (see Evers et al. 2012. Implications of a potential range expansion of invasive earthworms in Ontario forest ecosystems: a preliminary vulnerability analysis. Climate Change Research Report CCRR-23. OMNR). *Thamnophis sirtalis* is therefore shown to feed across ecological groups in one of its primary, generalized, prey categories ("earthworms"). This observation supports the statement that *T. sirtalis* is an opportunistic, non-specialized predator (Rowell 2012, *op. cit.*) and provides insight into the diet of *T. s. pallidulus*.

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***THAMNOPHIS SIRTALIS PALLIDULUS* (Maritime Gartersnake). MELANISM.** Bleakney (1958. Nat. Mus. Canada Bull. 155:1–119) and Cook (1967. Nat. Mus. Canada Bull 212:1–60) reviewed the many 19th and early 20th century reports of the Northern Black Racer, *Coluber constrictor constrictor*, from Maritime Canada (Nova Scotia, New Brunswick, Prince Edward Island). Although Bleakney (1958, *op. cit.*) stated that there was no other snake in the region that could be confused with the Northern Black Racer, both he and Cook (1967, *op. cit.*) concluded none of the reports were supported by evidence. Rowell (2012. The Snakes of Ontario: Natural History, Distribution, and Status. Privately printed. 411 pp.) reported that melanism is rare or absent in most populations of *Thamnophis sirtalis*. Nonetheless, Gilhen and Scott (2014. Can. Field-Nat. 128:63–71) described uncommon, but widespread, melanistic forms of *T. s. pallidulus* from Nova Scotia, attributing earlier reports of the Northern Black Racer in the region to such individuals. However, to date, melanism has not been confirmed for *T. s. pallidulus* in New Brunswick or Prince Edward Island, although reports of, often large, black, snakes exist for both provinces. Here we provide the first confirmation of melanism in *T. s. pallidulus* from New Brunswick.

On 28 July 2009, JM observed and photographed a melanistic (as per Gilhen and Scott [2014, *op. cit.*]) *T. s. pallidulus* in a semi-rural area dominated by mixed forest, open areas, a golf course, and light industry in the community of Dieppe, Westmorland County, New Brunswick (45.07030°N, 67.68200°W; NAD 83; Fig. 1). The melanistic individual (estimated to be 600–800 mm total length and presumably female) was basking in the company of two, smaller (presumably male), non-melanistic garter snakes. This observation adds further credence to the conclusion of Gilhen and Scott (2014, *op. cit.*) that historical reports of *C. c.*

FIG. 1. Melanistic *Thamnophis sirtalis pallidulus* from New Brunswisk, Canada. Note the milky ocular scales (indicative of imminent ecdysis), light ventral scales, light infralabials, and uniformly black dorsal (apparently keeled) scales, with the exception of dark brown vertebral and lower lateral stripes. The skin between the scales is bluish-white or light gray.

constrictor in Maritime Canada are misidentified melanistic gartersnakes and demonstrates further the widespread, if rare, presence of melanism in *T. s. pallidulus* in Maritime Canada.

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TROPIDODIPSAS SARTORII **(Terrestrial Snail Sucker). COLORATION.** *Tropidodipsas sartorii* is a medium-sized dipsadid snake (to 860 mm total length [TL]) that occurs from Nuevo León and Oaxaca, Mexico, southward, including the Yucatán Peninsula, to northwestern Costa Rica (Heimes 2016. Herpetofauna Mexicana Vol. I. Snakes of Mexico. Edition Chimaira. Frankfurt am Main. 572 pp.). The color pattern of this species consists of narrow white, yellow, orange or reddish-orange rings alternating with much wider black rings (Lee 2000. A Field Guide to the Amphibians and Reptiles of the Maya World. Cornell University Press, Ithaca, New York. 402 pp.), but this color pattern changes with age. The light rings in young snakes are white, cream, or yellowish and become yellow-orange, orange, or reddish-orange as the snake matures (Lee 2000, *op. cit.*). In addition, adults show an important geographic variation in the color of pale rings (Heimes 2016, *op. cit.*). The individuals north of Petén Itzá Lake, Guatemala, including the entire Yucatan peninsula, have reddish-orange rings, and in other locations outside this region they have yellow, orange, white, beige, or cream-colored rings (Campbell 1998. Amphibians and Reptiles of Northern Guatemala, the Yucatán, and Belize. University of Oklahoma Press, Norman, Oklahoma. 380 pp.; Heimes 2016, *op. cit.*). Coinciding with this, all individuals (N = 37) near Chetumal, Quintana Roo examined by Köhler et al. 2016 (Mesoamerican Herpetol. 3:688–705), showed only reddish-orange pale body rings.

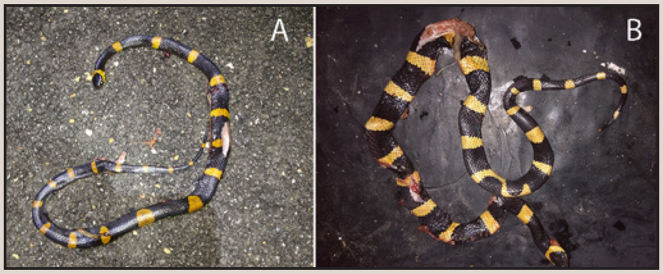

FIG. 1. A) Adult *Tropidodipsas sartorii* with yellow body rings from Hunucmá, Yucatán, Mexico; B) adult male *T. sartorii* with yellow body rings, collected in Kinchil, Yucatán, Mexico.

On 10 October 2017, at 0103 h, a road-killed adult individual (ca. 400 mm TL) with yellow body rings (Fig. 1A) was found in mangrove vegetation zone, 37.1 km NW of Mérida, near Sisal seaport town, municipality of Hunucmá, Yucatán, Mexico (21.12976°N, 90.00760°W; WGS 84). On 29 June 2018, at 2337 h, a road-killed adult male (57.7 cm TL, 44.8 cm SVL) was found with the same color pattern (Fig. 1B) in a site surrounded by tropical deciduous forest, 42.5 km SW of Mérida, municipality of Kinchil, Yucatán, Mexico (20.86968°N, 90.08597°W; WGS 84), and 30 airline km NE of the aforementioned record. To our knowledge, these represent the first records of *T. sartorii* with this coloration in the Yucatán Peninsula.

The second individual was collected and is deposited in the herpetological collection (ECO-CH-H-4409) of El Colegio de la Frontera Sur, Unidad Chetumal under permit #SGPA/DGVS/002491/18 issued to Fausto R. Méndez de la Cruz by SEMARNAT, with an extension to JRCV.

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