NATURAL HISTORY NOTES

CAUDATA — SALAMANDERS

CRYPTOBRANCHUS ALLEGENIENSIS ALLEGENIENSIS **(Eastern Hellbender). JUVENILE DIET.** Identifying the diet and stomach contents of smaller sized, larval salamanders presents challenges, particularly if only small, mostly digested tissue is available (e.g., portion of leg). Subsequently, many diet studies conducted on larval salamanders often only can identify dietary items down to either order or family taxonomic levels (Escoirza et al. 2020. Limnetica 39:667–676). However, recent molecular techniques, including DNA barcoding (COI nucleotide sequences as unique identifiers to species) of extracted portions of scat or stomach contents have allowed for greater resolution of taxonomic identification of diet from wildlife (Dawson et al. 2020. Wild. Res. 48:240–251). While this approach has been utilized for larval *Cryptobranchus allegeniensis allegeniensis* in North Carolina, USA (Unger et al. 2020. Food Webs 22:e00134), it has yet to be applied for populations in northern Georgia, USA.

On 29 September 2019, two juvenile (smaller individual: 10.3 cm TL, 7 g; larger individual: 16 cm TL, 26 g) *C. a. alleganiensis* were sampled for diet by gastric lavage following standard protocols (Cecala et al. 2007. J. Herpetol. 41:741–745) within a tributary within the Toccoa River watershed (specific coordinates withheld but on file with Georgia Department of Natural Resources) in Fannin County, Georgia. In brief, individual juveniles were placed under anesthesia (1 g/L Orajel®), their stomachs were flushed, they were placed in recovery stream water and released unharmed at the site of capture. Stomach contents were placed in ethanol and identified for DNA barcoding using a dissecting microscope at 50× magnification (Fig. 1). Samples were submitted to Lifescanner (lifescanner.net) for extraction and DNA barcode nucleotide sequences were obtained and blasted on NCBI website using a standard nucleotide blastn database and "megablast" option. We successfully identified *Maccaffertium pudicum* (Flathead mayfly 255 bp sequence length; 99.6% match for COI gene) from the smaller juvenile and *Lanthus vernalis* (Southern Pygmy Clubtail Dragonfly 568 bp sequence length; 99.5% match for COI gene) from the larger individual. *Maccaffertium pudicum* has been reported as part of the diet of larval *C. a. alleganiensis* in North Carolina (Unger et al. 2020, *op. cit.*) and other mayflies (Ephemeroptera) have been reported in the diet of larval *C. a. alleganiensis* (Hecht et al. 2017. Southeast Nat. 16:157–162), but our observation of a dragonfly (Odonata) as a dietary item, is the first for juvenile *C. a. alleganiensis* in Georgia. This note on the use of DNA barcoding to investigate diet adds to our existing body of knowledge on species-level aquatic insects consumed by *C. a. alleganiensis* juveniles. We recommend other herpetological researchers conducting dietary studies incorporate DNA barcoding to increase the taxonomic resolution in identifying smaller food items down to species, as it requires little financial investment (~$10 US per sample) and can provide identification using minimal tissue.

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EURYCEA CIRRIGERA **(Southern Two-lined Salamander). DEATH-FEIGNING.** Death-feigning, also known as immobility

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FIG. 1. *Cryptobranchus allegeniensis alleganiensis* stomach contents including a *Lanthus vernalis* nymph hind leg section (left) and a *Maccaffertium pudicum* leg (right) at 50× magnification with one juvenile sampled (center).

or thanatosis, is an anti-predator strategy that has been observed in numerous salamander species (Brodie et al. 1974. Herpetologica 30:79–85). Here, we report an observation of death-feigning behavior in an adult *Eurycea cirrigera*. At 1635 h on 19 March 2021, a gravid, adult female *E. cirrigera* was captured at Eagle Lake—an artificial body of water near Morehead State University in Rowan County, Kentucky, USA (38.19368°N, 83.43716°W; WGS 84; 259 m elev.). Upon initial capture and handling, the individual shed part of the tail (caudal autotomy) and escaped, which is a well-known anti-predator strategy in salamanders, including *E. cirrigera* (Wake and Dresner 1967. J. Morphol. 122:265–305; Ducey and Brodie 1983. Copeia 1983:1036–1041). When recaptured, the salamander flipped itself onto its back and was completely unresponsive, appearing to feign death (Fig. 1A). After ca. 1 min, the individual was righted, but remained immobile (Fig. 1B). This observation is consistent with immobility seen in *E. bislineata* (Ducey and Brodie 1983, *op. cit.*), however we interpret the behavior of flipping itself onto its back and being unresponsive as death-feigning by *E. cirrigera*. When released, the salamander became mobile and retreated to the log under which it was found. We are unaware of any previous observations of death-feigning in *E. cirrigera*; thus, we believe this is the first reported instance of death-feigning in this species.

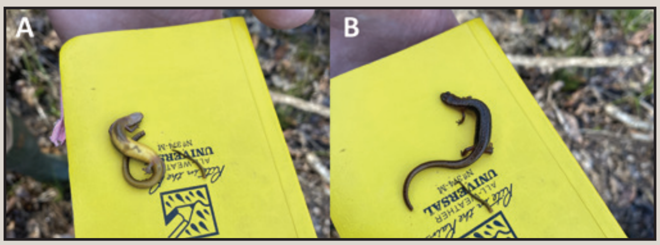

Fig. 1. A) Death feigning in *Eurycea cirrigera* from Rowan County, Kentucky, USA; B) the same individual, immobile after being righted.

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***GYRINOPHILUS PORPHYRITICUS* (Spring Salamander). HABITAT.** *Gyrinophilus porphyriticus* is an aquatic to semi-aquatic plethodontid commonly found within small headwater springs and streams within the Appalachian Mountains and adjacent regions of the eastern United States. While surface habitats for the species are primarily aquatic, *G. porphyriticus* has been found to occasionally disperse through moist hardwood forests surrounding headwater seepages and streams (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, D.C. 592 pp.). However, most of these observations have remained focused around mesic forests within close proximity to aquatic habitat.

During an ongoing survey of *Aneides aeneus* (Green Salamanders) on 18 March 2021, we encountered an adult *G. porphyriticus* occupying a rock crevice ca. 15 cm above the ground level in a sandstone rock outcrop on Stone Mountain in Wise County, Virginia, USA (coordinates withheld due to conservation concerns). This site is located in a ridgetop situation along the upper limits of an exposed cliff face at 1030 m elev., ca. 250 m from and 100 m above the nearest aquatic or semiaquatic habitat. Since the individual was observed following a warm spring rain event, we speculate that it arrived at the cliff system following dispersal during the aforementioned rain event the night before.

To our knowledge, our observation forms the first documented occurrence of *G. porphyriticus* occupying dry crevice refugia in high-elevation surface rock outcrops not associated with riparian zones or cave systems. Importantly, this individual was located only 90-100 cm from numerous *A. aeneus* individuals occupying the same rock face. Previous work has hypothesized that aquatic or semiaquatic taxa dispersing into terrestrial rock outcrops may form a vector for diseases such as chytridiomycosis and ranavirus that are common in aquatic habitats, potentially introducing these diseases into *A. aeneus* populations (Blackburn et al. 2015. Herpetol. Rev. 46:357–361). While we do not know the disease status of the *G. porphyriticus* individual we observed, our observation does confirm the periodic movement of this predominantly aquatic species into terrestrial rock outcrops occupied by *A. aeneus*. More broadly, our observation expands the known terrestrial movements of *G. porphyriticus* into xeric habitats associated with ridgetop cliff and bluff systems at great distances from water, indicating that this species may have at least a limited ability to cross such high-elevation habitats and disperse between adjacent watersheds.

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***HYNOBIUS VANDENBURGHI* (Yamato Salamander). DELAYED BREEDING ACTIVITY.** *Hynobius vandenburghi* is a small salamander distributed in Kinki and Tokai districts, Japan, and is listed as "critically endangered" and protected by Kyoto Prefecture (Kyoto Prefecture, 2015). Its estimated breeding season is from February to May (Matsui et al. 2019. Curr. Herpetol. 38:32–90). In the breeding season, the males come to ponds and wait for the females to arrive. After breeding, the females go back to the forest floor, while the males remain in the ponds to wait for other females. The males usually go back to the forest floor before the beginning of May, however, we found a breeding male in a pond at 1031 h on 22 May 2021 in Kizugawa City, southern Kyoto Prefecture (exact locality withheld because this species is protected by prefectural law), which is the latest record of breeding activity for *H. vandenburghi*. The individual was initially identified as an adult male (55.8 mm SVL, 3.9 g) since it exhibited the typical male breeding characteristics (swollen cloaca and whitish pad on the chin; Fig. 1). Its sex was confirmed by the presence of swollen

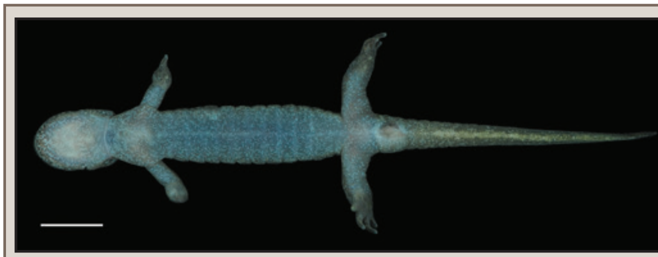

Fig. 1. Ventral view of an adult breeding male *Hynobius vandenburghi* found in a breeding pond in Kizugawa City, Japan, on 22 May 2021. Scale bar = 10 mm.

testes upon dissection. This individual was also missing its right forefoot and it had a deformed cloaca. The salamander was stored as a voucher specimen in the Graduate School of Human and Environmental Studies, Kyoto University (KUHE 62880). The salamander was found in the water, but no larvae were observed in contrast to a nearby pond where some full-grown larvae were observed. This fieldwork took place with the permission of the Kyoto Prefecture provided to KN.

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***HYNOBIUS VANDENBURGHI* (Yamato Salamander). PREDATION.** *Lanius bucephalus* (Bull-headed Shrike) is well known for storing various prey items impaled on twigs during the autumn and winter. This food caching is advantageous for male breeding activity since it is a supplementary source of nutrition (Nishida and Masaoki 2019. Anim. Behav. 152:29–37). One of the authors, KNa, observed a *Hynobius vandenburghi* impaled on a thorn, presumably by a *L. bucephalus*, in Sakai City, southern Osaka Prefecture (details of locality withheld for conservation concerns) at 1008 h on 24 March 2021 (Fig. 1). The individual appeared to be an adult male judging from the widened tail shape. *Hynobius vandenburghi* is listed as an "endangered species I (CR + EN)" in Osaka Prefecture (Osaka Prefecture, 2014: as *H. nebulosus*, now separated as *H. vandenburghi*), however it is quite common in the study site. The *H. vandenburghi* was found dead, impaled on a thorn of a *Rhododendron dilatatum*, 165 cm above the ground. The *R. dilatatum* was located ca. 1.2 m from a breeding pool used by *H. vandenburghi*. The *H. vandenburghi* was still impaled on the twig when we last visited the site at 1139 h on 23 May 2021. This is the first report of predation of a *H. vandenburghi* by a *L. bucephalus*. Fieldwork was performed with permission from Sakai City granted to NH.

Fig. 1. An adult *Hynobius vandenburghi* impaled on a *Rhododendron dilatatum* thorn by a *Lanius bucephalus* in Sakai City, Japan.

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***NOTOPHTHALMUS MERIDIONALIS* (Black-spotted Newt). ALBINSIM.** Albinism and partial albinism have been reported from many salamander families, including Ambystomatidae, Amphiumidae, Cryptobranchidae, Plethodontidae, Proteidae, Salamandridae, and Sirenidae (Hensley 1959. Publ. Mus. Mich. State Univ. 1:133–159; Dyrkacz 1981. SSAR Herpetol. Circ. 11. 1–31). Albinism and partial albinism have been reported in at least nine genera of salamandrids (Lanza 1946 Natura 36:18–20; Brame and Freytag 1963. Zool. Garten 27:130–131; Wells 1964. Herpetologica 19:291; Arribas and Rivera 1992. Bol. Asoc. Herpetol. Esp. 3:14–15; Fontanet et al. 1992. Herpetol. Rev. 23:79; Johnson and Franz 1999. Herpetol. Rev. 30:90; Diego-Rasilla et al. 2007. Herpetol. Rev. 38:68; Modesti et al. 2011. Herpetol. Notes 4:395–396; Heiss 2017. Salamandra 53:137–141). Within the genus *Notophthalmus* (Salamandridae), there have been reports of albinism in *N. perstriatus*, where Johnson and Franz (1999, *op. cit.*) described four individuals with abnormal coloration (partially albino or leucistic) from a pond in Florida, USA. In addition, Banta (1915. Science 41:577–578) reported a putative albino *N. viridescens* from the Catskill Mountains in New York, USA. As part of a study examining morphological variation across the distribution of *N. meridionalis*, we note an occurrence of a single albino specimen.

We examined a *N. meridionalis* specimen (Biodiversity Collections, The University of Texas at Austin [TNHC] 33941) that was collected in San Luis Potosí, Mexico, but lacks specific locality data other than noting the animal was collected in a "sinkhole in cave, in still pool". The specimen was a recently transformed juvenile (32.9 mm SVL, 27.31 mm tail length) that lacked pigment over the body and the eyes were red (Fig. 1). The black spots normally present on *N. meridionalis* were absent,

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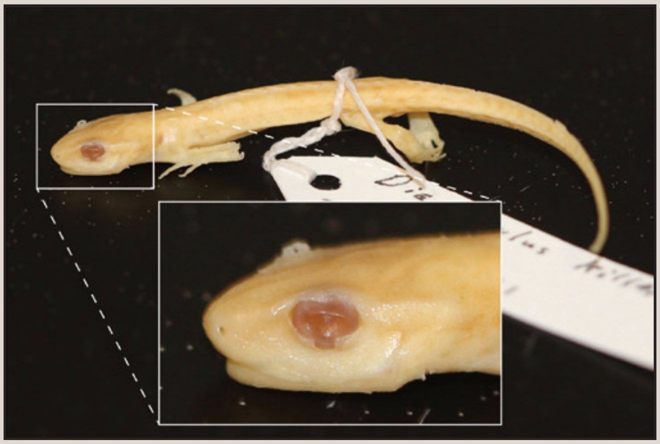

Fig. 1. Albino Black-spotted Newt (*Notophthalmus meridionalis*; TNHC 33941) from San Luis Potosí, Mexico.

with the exception of the tail, which instead had faint pale orange spots. Using the terminology from Dyrkacz (1981, *op. cit.*), this specimen is a partial albino with xanthophores. Preservation techniques can cause coloration to fade, however the presence of the red eyes indicates that this animal exhibits albinism. Of the 310 specimens examined as part of this study, this was the only individual with abnormal coloration. To the best of our knowledge, this is the first reported occurrence of albinism in *N. meridionalis*.

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***NOTOPHTHALMUS VIRIDESCENS* (Eastern Newt). PREDATION.** The skin of newts of the genus *Notophthalmus* contains tetrodotoxin (TTX), which blocks voltage-gated sodium channels, thus interfering with muscle and nerve function of potential predators (Brodie et al. 1974. Copeia 1974:506–511). Although the terrestrial eft stages of *Notophthalmus* have higher concentrations of TTX than do the aquatic adults (Spicer et al. 2018. J. Toxicol. 2018:9196865), the adults are known to be toxic and distasteful to a range of predatory fishes and other vertebrates, although they may be consumed by some amphibians and reptiles (Marion and Hay 2011. PLoS ONE 6:e27581).

On 22 April 2021, I observed an *Egretta caerulea* (Little Blue Heron) hunt, capture, and consume an adult *N. viridescens* (Fig. 1). The location was Brazos Bend State Park, ca. 50 km south of Houston, in Fort Bend County, Texas, USA. Air temperature was 20°C on a partly cloudy day. Brazos Bend State Park contains areas of coastal prairie, bottomland forest, and a wide range of wetlands including open and semi-open lakes and transitional marshlands. While I was photographing the *E. caerulea* wading in shallow water covered in duckweed (Lemnoideae), I watched as it lunged its beak into the marsh and came up with a prey item. I was at least 50 m away at the time on the edge of the marsh. Upon zooming in with my camera, I saw a *N. viridescens* squirming at the end of the *E. caerulea*'s beak. After I took the photograph of the capture (Fig. 1), I watched (via the camera) as the *E. caerulea* quickly swallowed the *N. viridescens*. I watched the *E. caerulea* for ca. 10 min intermittently and did not observe it regurgitate the *N. viridescens* or observe any signs of distress.

Fig. 1. *Egretta caerulea* consuming *Notophthalmus virdescens* at Brazos Bend State Park, Texas, USA.

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***PARAMESOTRITON DELOUSTALI* (Vietnam Warty Newt). FIGHTING BEHAVIOR.** In nature, animal aggression mainly relates to competition for food, mates, or both (Pakker 1974. J. Theor. Biol. 47:223–243). Sexual selection involving fighting behaviors may affect the evolution of a species by selecting for increased male body size (Raxworthy 1989. Ethology 81:148–170). Fighting behavior in salamanders and newts has been observed as threat displays, biting, and chasing activities in some species (Verrell 1989. Herpetologica 45:265–282). Here, we report an observation on the fighting behavior of *Paramesotriton deloustali*. On 2 January 2018 at 1100 h, we found two adult male *P. deloustali* fighting, one of the males used its body and tail to curl up around the neck of the rival male (Fig. 1A). The captured male attempted to escape by rolling its body and flailing its tail. The newts remained in this position for ca. ten minutes until we disturbed them by touching them with a stick, at which time they immediately separated and swam away in different directions. The behavior took place in shallow water near the bank in a pool of a small stream with rocks and boulders (depth ca. 0.1 m, width ca. 3–3.5 m; Fig. 1B) at Dai Dinh, Tam Dao, Vinh Phuc, Vietnam (21.47923°N, 105.61504°E; WGS 84; 446 m elev.). This is the first observation of fighting behavior in nature not only for *P. deloustali*, but also for the genus *Paramesotriton*. A similar behavior has been recorded in captivity (Sparreboom 2014. Salamanders of the Old World. KNNV Publishing, Zeist, The Netherlands. 431 pp.; Sparreboom 1984. Lacerta 43:28–35).

We would like to thank Sergé Bogaerts for providing supporting literature.

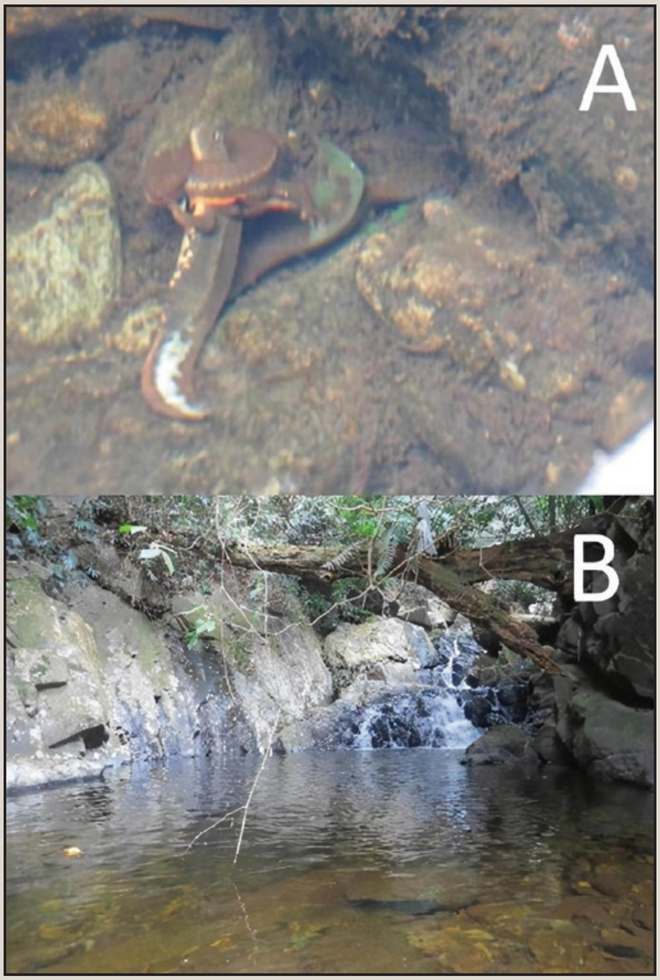

Fig. 1. *Paramesotriton deloustali* fighting at Dai Dinh, Tam Dao, Vinh Phuc, Vietnam: A) two adult males fighting; B) environment surrounding the observation.

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***PLETHODON CINEREUS* (Eastern Red-backed Salamander). HYPOMELANISM.** *Plethodon cinereus* is one of the most abundant vertebrates inhabiting eastern North American forests (Burton and Likens 1975. Copeia 1975:541–546; Mathis 1991. Oecologia 86:433–444). Across its range, *P. cinereus* is commonly found in two color morphs, the red-backed morph and the lead-backed morph, which are differentiated by the presence of a red-orange mid-dorsal stripe in the former (Moore and Ouellet 2014. Can. Field-Nat. 128:250–259). Several striped and unstriped color anomalies, including erythrism, iridism, albinism, leucism, amelanism, melanism, and hypomelanism, have also been described in this species (Moore and Ouellet 2014, *op. cit.*; Devos

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Fig. 1. A) Hypomelanistic unstriped morph of *Plethodon cinereus* from Piscataway, New Jersey, USA; B) comparison between the hypomelanistic *P. cinereus* and a lead-backed morph individual of similar size found in the same area; C) hypomelanistic striped morph of *P. cinereus* from Kingston, Rhode Island, USA.

2021. Herpetol. Rev. 52:109). Here, we report an occurrence of hypomelanism in the unstriped morph of *P. cinereus*.

At 1812 h on 9 April 2021, an anomalously colored *P. cinereus* was captured in Rutgers University Ecological Preserve, Piscataway, Middlesex County, New Jersey, USA (40.51571°N, 74.43844°W; WGS 84). The salamander was found underneath a small log next to a foot trail in a deciduous forest. Its dorsum was translucent burnished brown with white speckles. Its venter was translucent white with light-colored speckles. The salamander was photographed on-site (Fig. 1A) and then released at the capture location. Other *P. cinereus* of typical red-backed and lead-backed morphs were also found in the same area (Fig. 1B).

Hypomelanism in *P. cinereus* was first described from a single individual found in Kingston, Rhode Island, USA (Devos 2021, *op. cit.*; Fig. 1C). Through photo comparison between the Rhode Island, USA individual and the salamander described here, we found that both displayed a similar level of pigment reduction. However, the mid-dorsal stripe was not present on the latter, indicating that it was an unstriped morph individual. To the best of our knowledge, this is the first documentation of hypomelanism in *P. cinereus* of the unstriped morph.

We thank Tyler Devos for providing photos of the hypomelanistic *P. cinereus* from Rhode Island and permission to use the photos in this report.

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ANURA — FROGS

***ANAXYRUS FOWLERI* (Fowler's Toad). SAXICOLOUS BASKING.** Although primarily a nocturnal species, *Anaxyrus fowleri* may be active on warm, cloudy days. In addition, inactive toads tend to have higher body temperatures than active ones (Dodd 2013. Frogs of the United States and Canada. Vol. 1. Johns Hopkins University Press, Baltimore, Maryland. 460 pp.). *Anaxyrus americanus americanus* (Eastern American Toad) may also be active in daylight (Fitch 1956. Univ. Kansas Publ. Mus. Nat. Hist. 8:417–476). Some bufonid species, such as *A. boreas* (Western

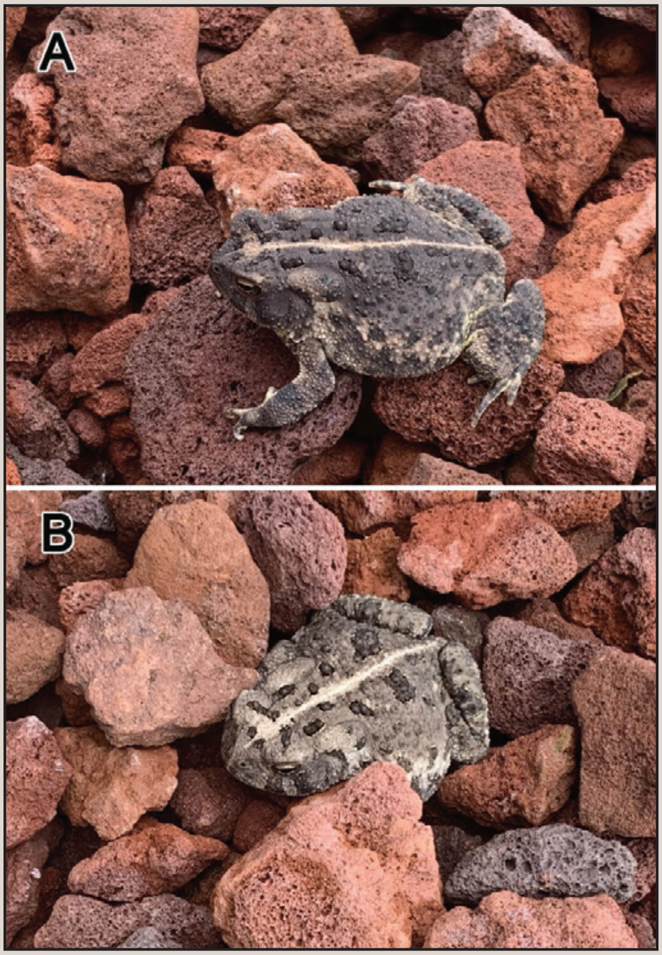

Fig. 1. Saxicolous basking by a female *Anaxyrus fowleri* at two different times on the same day in Arkansas, USA. Notice the variation in dorsal coloration from morning (A) to mid-afternoon (B).

Toad), will warm themselves by basking (Karlstrom 1962. Univ. California Publ. Zool:1–104). Here, I report on saxicolous basking in *A. fowleri*.

On 7 June 2021 at 0933 h, I first observed a female *A. fowleri* (55 mm SVL) lying in a prone posture atop lava rocks (Fig. 1A) adjacent to my residence, which is ca. 2 km north of the city of Morrilton, Conway County, in central Arkansas, USA (35.19166°N, 92.715°W; WGS 84; 108.3 m elev.). The *A. fowleri* remained motionless for the entire basking episode, which I observed for 20 min. I repeatedly walked past the *A. fowleri*, and I left the basking site without disturbing the animal. Later, at 1524 h, I revisited the basking site and found the *A. fowleri* slightly away from its original position, nestled among a cluster of surface rocks (Fig. 1B). The afternoon had been partly cloudy to overcast, and the surface temperature of the rocks was 27°C. I captured the *A. fowleri*, measured it, and released it at the site of capture.

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***ANAXYRUS HEMIOPHRYS* (Canadian Toad). DIURNAL FEEDING BEHAVIOR.** *Anaxyrus hemiophrys* is thought to be the most aquatic of the three toad species found in Minnesota (Moriarty and Hall 2014. Amphibians and Reptiles in Minnesota. University of Minnesota Press, Minneapolis, Minnesota. 370 pp.). However, similar to other toad species, *A. hemiophrys* primarily consumes terrestrial invertebrates (Moore and Strickland 1954. Am. Midl. Nat. 52:221–224). The diet of this species has been reported to almost exclusively consist of beetles and ants, likely captured at night (Clarke 1974. Am. Midl. Nat. 91:140–147), as well as the occasional snail, spider, or aquatic larval invertebrate (Moore and Strickland 1954, *op. cit.*).

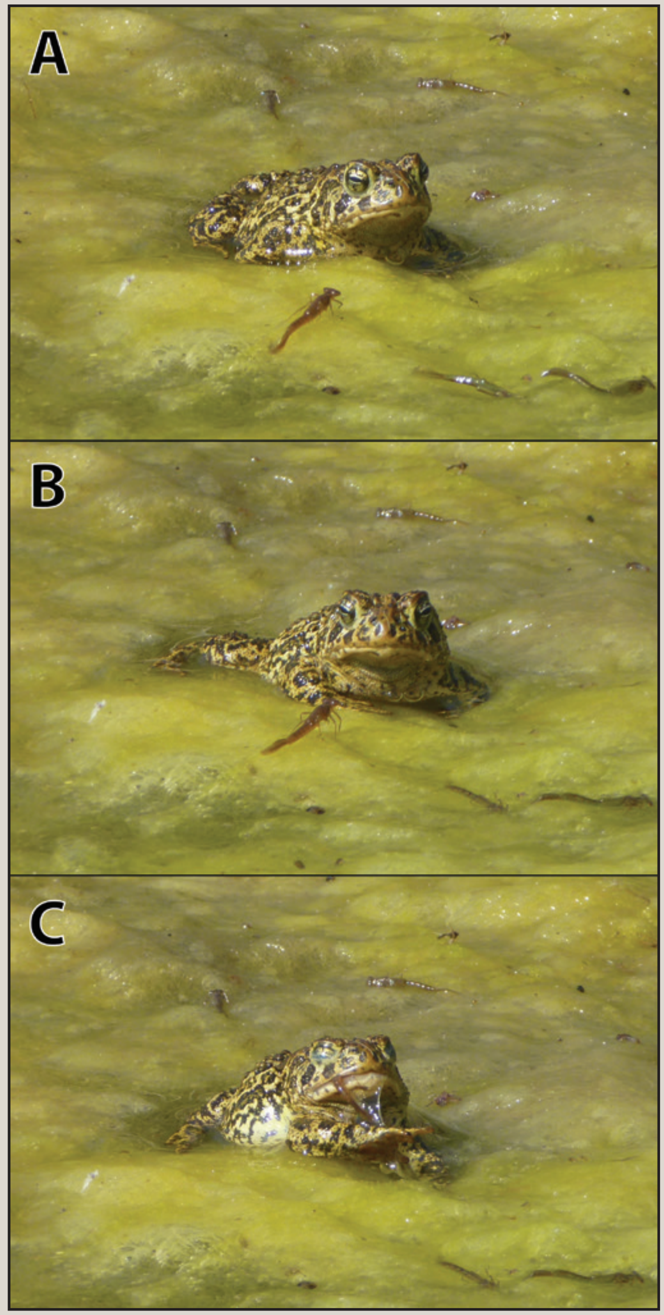

PHOTO BY H. L. WAYE

Fig. 1. A single *Anaxyrus hemiophrys* situated on top of filamentous algae, surrounded by zygopteran nymphs moving towards shore. This sequence illustrates the sit-and-wait nature of the observed feeding behavior.

Between 0930 and 1000 h on 5 June 2021, we observed a number of *A. hemiophrys* in a pond 15 km west of Morris, Minnesota, USA (45.61426°N, 96.05574°W; WGS 84). The local habitat consists of corn and soybean agriculture with pockets of tall-grass prairie pothole habitat. The surface of the pond was covered with thick mats of filamentous algae between the central open water and the surrounding belt of cattails. Toads were observed calling at this location on 3 June, and on 5 June numerous toads were visible floating at the water's surface, perched on the algal mat, or sitting in shallow water amongst the cattails. The weather at the time of observation was sunny with a slight breeze and an air temperature of 29°C, above average for this date.

We noticed many damselfly nymphs (suborder Zygoptera) emerging from the water. These aquatic nymphs crawled up onto the surface of the algae and made their way shoreward towards the cattails. Eight or 10 toads were visible in our corner of the pond, seated on top of the algal mat. Each toad was generally stationary, only roaming a few body lengths in one direction or another and would orient towards the closest moving zygopteran nymph and snap it up when it was close enough (Fig. 1). The toads appeared to incidentally ingest small amounts of the algae along with the invertebrate prey.

We believe this is the first record of adult *A. hemiophrys* feeding diurnally on aquatic invertebrates, albeit still in a mostly terrestrial context. Terrestrial invertebrates are likely to be the most important food items for this species, but as described for other species (Clarke 1974, *op. cit.*), toads can take advantage of local ephemeral increases in prey access and abundance to supplement their diet.

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BOANA PUGNAX **(Chirique-Flusse Treefrog). PREDATION**. The hylid frog *Boana pugnax* occurs in the open lowlands from southern Central America to northern South America (Frost 2021. Amphibian Species of the World: An Online Reference. Version 6.1; https://amphibiansoftheworld.amnh.org; 15 March 2021). In Colombia, it can be found in the Caribbean region, northern Chocó biogeographic region, in the Cauca and Magdalena river valleys, and in the Orinoco and Amazon drainages, at altitudes of 0 to 1200 m (Méndez-Narváez et al. 2014. Check List 10:409-410; Frost 2021, *op. cit.*). Despite *B. pugnax* being a widely distributed species, little is known about its predators. To date, the only known predator of *B. pugnax* is the river shrimp *Macrobrachium carcinus* (Mendoza-Roldán 2015. Rev. Colomb. Cienc. Anim. 7:84-87). Here, I present the first record of *Donacobius atricapilla* (Black-capped Donacobius) preying on *B. pugnax*.

Fig. 1. Predation of *Boana pugnax* by *Donacobius atricapilla* in Puerto Wilches, Colombia.

At 0900 h on 15 December 2020, I observed an adult *D. atricapilla* capturing and ingesting, headfirst, a juvenile *B. pugnax* (Fig. 1) in the Municipality of Puerto Wilches, Santander, Colombia (7.46811°N, 73.85032°W; WGS 84; 54 m elev.). This event lasted ca. 30 sec. Both species are known to inhabit riparian vegetation associated with lakes and rivers. Information on predator-prey interactions is key to understanding both the natural history of species and the flow of energy and nutrients in ecosystems (Westoby 1978. Am. Nat. 108:290-304; Wells 2007. The Ecology and Behavior of Amphibians. University of Chicago Press, Chicago, Illinois. 1148 pp.).

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DUTTAPHRYNUS HIMALAYANUS **(Himalayan Toad). PREDATION.** *Duttaphrynus himalayanus* is a widely distributed species along the Himalayas including Pakistan, India, Nepal, Bangladesh, Bhutan, China, and Myanmar (Frost 2021. Amphibian Species of the World: an Online Reference. Version 6.1. https://amphibiansoftheworld.amnh.org; 23 May 2021). It is a high-altitude species that occurs between an altitudinal range of 1000–3500 m (Schleich and Kästle 2002. The Amphibians and Reptiles of Nepal. Koeltz Scientific Books, Koenigstein, Germany. 1201 pp.). Despite being a nocturnal species it is often seen moving in search of prey in daylight (AmphibiaWeb 2021. *Duttaphrynus himalayanus*: Himalayan Toad. https://amphibiaweb.org/species/193; 23 May 2021), exposing themselves to a wide range of avian as well as other predators. Bufonids are known to secrete cardiac glycosides known as bufadienolides to defend themselves against predators (Flier et al. 1980. Science 208:503–505) but there have been instances of predation of bufonids by many vertebrate and invertebrate predators (Bastos and Haddad 1997. Amphibia-Reptilia 18:295–298; Banci et al. 2013. Herpetol. Notes 6:339–341; Muscat et al. 2018. Herpetol. Notes 11:449–450). *Duttaphrynus himalayanus* tadpoles have been reported as prey for birds, insects, anurans, and an unidentified colubrid snake (Spath 1990.

Fig. 1. *Spilornis cheela* holding an adult *Duttaphrynus himalayanus* at Mussoorie Wildlife Sanctuary, India.

PHOTOS BY PRANAV GOKHALE

Fig. 2. *Spilornis cheela* holding an adult *Duttaphrynus himalayanus* (different angles) at Mussoorie Wildlife Sanctuary, India.

PHOTO BY LETICIA KEIKO WATANABE

Fig. 1. *Phoneutria keyserlingi* predating an *Elachistocleis cesarii* in Espírito Santo, Brazil.

Zur Biologie und Verbreitung der Froschlurche in den Himalaya-Durchbruchtälern von Zentral-Nepal [Kali Gandaki, Marsyandi] - Diplomarbeit, Universität Freiburg, Deutschland, 98 pp.), but the predation of adults has not been reported. Here, I report a predation event of an adult *D. himalayanus* by a *Spilornis cheela* (Crested Serpent-eagle).

At 0850 h on 4 April 2021, while birdwatching near a stream in the Mussoorie Wildlife Sanctuary, Mussoorie, Dehradun District, Uttarakhand, India (30.4675°N, 78.0320°E; WGS 84; 1632 m elev.), I saw a *S. cheela* diving among the boulders in the stream to catch prey. Later, the eagle landed on the streamside where on closer inspection through my binoculars I saw that the eagle was holding an anuran in its talons. Holding the toad by its dorsal side, the eagle walked a distance of ca. 0.5 m. I quickly took some photos of the eagle with the toad (Figs. 1 and 2) before it took off and disappeared in an oak forest. I did not observe the *S. cheela* consume the toad but assumed it did so later inside the forest. The toad was later identified as *D. himalayanus*, based on its brown coloration, deeply concave occipital region with supra-orbital ridges, short and blunt snout and small-indistinct tympanum (AmphibiaWeb 2021, *op. cit.*). Although *S. cheela* is known to feed on a variety of prey including snakes and anurans (Gokula 2012. TAPROBANICA: J. Asian Biodivers. 4:77–82), this is the first report of *D. himalayanus* being preyed upon by *S. cheela*.

I thank Abhijit Das at the Wildlife Institute of India, Dehradun, India for identifying the toad and encouraging me to write this note.

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***ELACHISTOCLEIS CESARII*. PREDATION.** Predation on anurans can be carried out by a variety of vertebrates, such as snakes, lizards, mammals, and birds (Toledo et al. 2007. J. Zool. 271:170–177); as well as invertebrates such as chilopods, crustaceans, spiders, and aquatic hexapods, such as water cockroaches (Toledo 2005. Herpetol. Rev. 36:395–400). *Elachistocleis cesarii* (Microhylidae) has a wide geographical distribution in the Brazilian Atlantic Forest (Frost 2021. Amphibian Species of the World: An Online Reference. Version 6.1; https://amphibiansoftheworld.amnh.org; 19 March 2021). It is a terricolous species that inhabits open areas and forest (Thomé and Brasileiro 2007. Biota Neotrop. 7:27–33). *Phoneutria keyserlingi* (Armed Spider) feeds mainly on insects, such as crickets and cockroaches (Lucas 1988. Toxicon 26:759–772) but has also been reported preying on anurans (Sabagh et al. 2020. Herpetol. Notes 13:271–279). Herein, we report a predation event where an adult *P. keyserlingi* preyed upon an adult *E. cesarii*.

The observation took place at 2105 h on 16 February 2020, during a herpetological survey at the Reserva Particular do Patrimônio Nacional Águas do Caparaó (RPPNAC), Cachoeira Alta (20.61722°S; 41.890°W; WGS 84; 870 m elev.), state of Espírito Santo, southeast Brazil. Our research team was conducting an active search for amphibians and reptiles when the predation event was observed on vegetation about 60 cm above the substrate. The predation event was already in progress when first observed. The *P. keyserlingi* wove a few silk threads around the *E. cesarii*, which was immobilized with its venter facing upwards. The *P. keyserlingi* inserted its chelicerae into the abdomen of the *E. cesarii* to inject its venom. At that time, the anuran still showed signs of life by making movements to inflate its body (Fig. 1). Several hours later, the *E. cesarii* was reduced to a small, digested mass. This is the first record of *P. keyserlingi* preying upon *E. cesarii*. This record contributes to the knowledge of the trophic ecology and the natural history of both *P. keyserlingi* and *E. cesarii*.

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***HYLA VERSICOLOR* (Gray Treefrog) and *ANAXYRUS AMERICANUS* (American Toad). INTERSPECIFIC AMPLEXUS.** Interspecific male-female amplexus is reported regularly, often attributed to signal interference and pressure to reproduce (Beranek 2017. Herpetol. Rev. 48:411; Höbel 2005. Herpetol. Rev. 36:439–440; Shahrudin 2016. Herpetol. Bull. 135:30–31). Numerous costs are incurred in ways of predation risk, foraging opportunity, and reproductive success during interspecific mating encounters (Höbel 2005, *op. cit.*). The same costs are incurred in amplexus between males, but male-male interspecific amplexus is observed more sparsely (Costa-Campos et al. 2016. Acta Zool. Mex. 32:385–386) likely because males are more responsive to unwanted amplexus with release calls and vibrations (Blair 1947. Amer. Mus. Nov. 1344:1–7; Leary 1999. ASIH. 2:506–508). These release responses during male-male encounters may also work for interspecific attempts.

At 2200 h on 20 May 2021, we observed a male *Hyla versicolor* in amplexus with a male *Anaxyrus americanus*. Sex was identifiable because both species are sexually dimorphic: males have dark vocal sacs (Fig. 1). These species overlap geographically and temporally (Conant and Collins 1998. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third edition expanded. Houghton-Mifflin Company, Boston, Massachusetts. 616 pp.). The amplexus was observed atop foliage in a small, permanent pond in southern Wisconsin, USA (Saukville) during peak *H. versicolor* breeding season. There was no physical dispute nor release behaviors upon the initial observation, nor when witnessed undisrupted an hour later. At the time, the *H. versicolor* chorus was robust but there was no *A. americanus* chorus suggesting the toad breeding season had ended, which is typical for this location in late-May. *Hyla versicolor* are sexually dimorphic for body size (females are larger), so the larger body size of *A. americanus* may have resembled a large female *H. versicolor* resulting in the misconception of *A. americanus* as a potential mate (relative body sizes shown in Fig. 1). We did not observe whether there was a lack of release behaviors exhibited by the *A. americanus* or if the *H. versicolor* simply disregarded those behaviors.

PHOTO BY OLIVIA FEAGLES

Fig. 1. Male *Hyla versicolor* in interspecific amplexus with a male *Anaxyrus americanus* in Wisconsin, USA.

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***HYLODES NASUS.* COLORATION.** Color abnormalities in amphibians, particularly in anurans, have been widely reported, with most of the cases representing total or partial lack of pigments (albinism, leucism, and piebaldism; e.g., Carvalho et al. 2012. Herpetol. Rev. 43:468469; Keely and Maldonado 2013. Herpetol. Rev. 44:297; Hughes et al. 2019. Herpetol. Rev. 50:115; García-Padrón and Bosch 2019. Herpetol. Bull. 147:13; Pereira et al. 2020. Herpetol. Rev. 51:9899). Erythrism (excess of red pigmentation), on the other hand, has been reported very infrequently (Kolenda et al. 2017. Herpetol. Notes 10:103109; McAlpine and Gilhen 2018. Can. Field-Nat. 132:4345). Here, we report for the first time an instance of unusual coloration with an excess of red pigmentation in the Neotropical frog *Hylodes nasus*, a species endemic to the Brazilian Atlantic Rainforest biome. There is still confusion in the literature regarding the geographic distribution of this species: according to Frost (2021. Amphibian Species of the World: an Online Reference.

PHOTO BY T. A. DORIGO

Fig. 1. Adult *Hylodes nasus* with an excess of red pigmentation from Tijuca National Park, Brazil.

PHOTO BY T. A. DORIGO

Fig. 2. Adult *Hylodes nasus* with normal coloration from Tijuca National Park, Brazil.

Version 6.1; https://amphibiansoftheworld.amnh.org; accessed 2 May 2021) it ranges from the states of Rio de Janeiro to Santa Catarina (which would mean a latitudinal span of at least 3º), whereas some authors (Nascimento et al. 2001. J. Zool. 254:421428; Silva e Souza et al. 2019. Rev. Biol. Neotrop. 16:918) claim that it is restricted to the municipality of Rio de Janeiro, in the state of Rio de Janeiro, which is believed to be its type locality (Bokermann 1966. Lista Anotada das Localidades Tipo de Anfibios Brasileiros. São Paulo: Servicio de Documentacão, Universidade Rural São Paulo, São Paulo, São Paulo, 183 pp.).

On 27 February 2013, during a herpetological survey at the Tijuca National Park, a natural reserve encompassing a forest fragment within the metropolitan area of Rio de Janeiro city, one of us (TAD) found an abnormally colored adult *H. nasus* in a creek (22.94871°S, 43.28635°W; WGS 84). This individual was predominantly red on the dorsum and dorsal surfaces of the limbs, with yellowish dorsal blotches and a yellow snout with a red blotch; the lateral and ventral portions of the body, the hidden portions of the legs, and most of the digits were normally colored (Fig. 1). During subsequent surveys in the park in the same year, three more *H. nasus* with similar coloration were found (each in a different creek): the first one on 24 April 2013 (22.9527°S, 43.29369°W; WGS 84), the second on 4 May 2013 (22.95398°S, 43.29267°W; WGS 84) and the third on 11 July 2013 (22.94729°S, 43.29213°W; WGS 84). Normally colored individuals of this species are brownish or olive dorsally with lighter dorsal blotches and dark transverse bars on the legs and forearms (Fig. 2). Although none of the frogs were collected or marked and only the first one was photographed, we think it is highly probable that all four records represent different individuals. Indeed, the straight-line distance among the four points where the specimens were found varied from 175 m to 865 m, and adults of stream-dwelling anurans such as *Hylodes* spp. tend to have rather small home ranges (Narvaes and Rodrigues 2005. Phyllomedusa 4:147158).

During the 36-month period (January 2013–December 2015) of the herpetological survey at the park, a total of 601 records of *H. nasus* were annotated, of which four corresponded to the aforementioned reddish individuals. This suggests that this color morph/abnormality occurs in roughly 0.7% of the local population. Nevertheless, this should be considered as an approximated value and, possibly, an underestimation, given that, as said above, none of the animals were marked and, thus, the observer may have counted some individuals more than once. The present records represent, to our knowledge, the first report of this type of color anomaly in the family Hylodidae.

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***LITHOBATES CATESBEIANUS* (American Bullfrog). PREDATION.** Arthropods are known as occasional consumers of anurans, but this interaction remains relatively understudied (Nordberg et al. 2018. Food Webs 15:e00080). Crabs are recognized as predators of anuran eggs, tadpoles, and adults (McCormick and Polis 1982. Biol. Rev. 57:29–58; Toledo 2005. Herpetol. Rev. 36:395–400; Rosa et al. 2014. Crustaceana 87:890–894). Fong et al. (2012. Herpetol. Rev. 43:319–320) described the first records of predation of a Cuban anuran by a crab, documenting crabs to be opportunistic predators of anurans in Cuba. Here, I report the predation of the introduced and invasive *Lithobates catesbeianus* by an endemic freshwater crab (*Epilobocera gilmani*).

Fig. 1. Predation of a metamorphic *Lithobates catesbeianus* by an *Epilobocera gilmani* in the Manantiales River, Soroa, Artemisa, Cuba.

During a herpetological survey in Río Manantiales, Soroa, Artemisa (22.7942°N, 83.0087°W; WGS 84) at 2245 h on 19 June 2021, I observed an *E. gilmani* (ca. 40 mm carapace length; ca. 72 mm carapace width) feeding upon a metamorphic *L. catesbeianus* (ca. 52 mm SVL; Fig. 1). The crab was on dry land, 40 cm from the water's edge. The hind legs of the *L. catesbeianus* were mutilated and the spine appeared broken. The *L. catesbeianus* was alive when first observed and died approximately ten minutes later. Air temperature was 23.7°C, and relative humidity was 95.4%.

This is the first record of *L. catesbeianus* in the diet of *E. gilmani*. This record represents an example of "cross predation" as described by McCormick and Polis (1982, *op. cit.*): *E. gilmani* is the most important prey in the diet of *L. catesbeianus* in the study area (García-Padrón et al. 2021. Acta Cient. 32:26–32). Metamorphic and post metamorphic anurans are vulnerable to terrestrial and aquatic invertebrate predators (Toledo 2005, *op. cit.*). As prey they may provide several possible advantages for invertebrate predators: they are energetically valuable due to easier accessibility and/or subjugation, and their smaller prey size lowers the risk of the predator falling prey to the metamorph (see Toledo et al. 2007. J. Zool. 271:170–177). Future surveys in the study area are encouraged to determine the predation rate and impact of *E. gilmani* on the anuran community, especially the introduced and invasive *L. catesbeianus* populations.

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ODONTOPHRYNUS CARVALHOI **(Carvalho's Escuerzo). EYE MALFORMATION.** *Odontophrynus carvalhoi* is an explosive breeder inhabiting open fields amidst lotic and lentic environments with herbaceous vegetation at high altitudes in northeastern Brazil (Lisboa et al. 2010. Check List 6:493–494; Costa et al. 2017. Bol. Mus. Biol. Mello Leitão 39:95–115). Abnormalities reported for Brazilian anurans include a variety of chromatic aberrations (Souza et al. 2021. Herpetol. Notes 14:31–41), and a case of anophthalmia in a dead *O. carvalhoi* (Brito et al. 2011. Herpetol. Bull. 118:38–40). Abnormalities may hinder anuran development causing early mortality. Nevertheless, herein, we present a record of a female *O. carvalhoi* in amplexus with an eye opacity resembling a cataract (Fig. 1). The observation occurred during fieldwork on 1 April 2019, in the Baturité massif, Municipality of Guaramiranga, northeastern Brazil (WGS 84, 4.27044°S, 38.93858°W; WGS 84; 912 m elev.). This abnormality was classified according to Meteyer (2000. Field Guide to Malformations of Frogs and Toads: with Radiographic Interpretations. Biological Science Report USGS/BRD/BSR-2000-005, U.S. Department of the Interior, U.S. Geological Survey. 16 pp.). The voucher specimen was deposited in the Herpetological Collection of Universidade Regional do Cariri (URCA-H 16041), Crato, Brazil. Although similar eye opacities have been reported for tadpoles, attributed to intraocular infections (Kelehear et al. 2011. Herpetologica 67:378–385), we present the first record for an adult *O. carvalhoi*. Although morphological abnormalities affect few individuals in nature (Lannoo 2008. The Collapse of Aquatic Ecosystems: Malformed Frogs. University of California Press, Berkeley, California. 288 pp.), for example less than 2% of individuals (Ascoli-Morrete et al. 2019. Austral Ecol. 44:1025–1029), cases of amphibian abnormalities may be on the rise. In addition, in Brazil, the causes of most of the rapid declines in amphibians are still unknown (Alton and Franklin 2017. Clim. Chang. Resp. 4:1–6.). Thus, further studies investigating the increase and causes of these abnormalities are important, especially in the mountainous regions in the state of Ceará which are home to a rich and endemic amphibian fauna.

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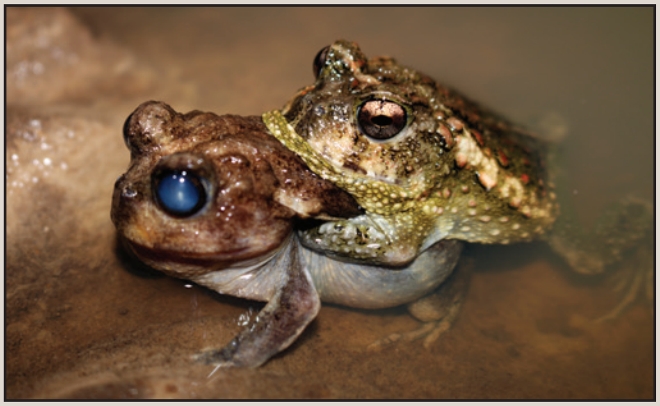

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Fig. 1. A female *Odontophrynus carvalhoi* with an eye opacity in amplexus, in the municipality of Guaramiranga, Ceará, northeastern Brazil. The right eye was normal.

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PRISTIMANTIS ACHATINUS **(Cachabi Robber Frog). PREDATION.** The anuran *Pristimantis achatinus* occurs from the lowlands of Panama through Colombia (Pacific lowlands, valleys of the Cauca and Magdalena rivers and in both foothills of the Western and Central Cordilleras) to southwestern Ecuador (Rojas-Rivera et al. 2013. Cat. Anf. Rept. Colomb. 1:35-44; Frost 2021. Amphibian Species of the World: An Online Reference. Version 6.1; https://amphibiansoftheworld.amnh.org; 10 May 2021). In Colombia and Ecuador, *P. achatinus* has been reported as prey for the arachnid *Heterophrynus armiger* (Wizen and González de Rueda 2016. Herpetol. Rev. 47:440-441), the viper *Bothrops asper* (Boada et al. 2005. Herpetozoa 18:77–79), and the frog *Leucostethus fraterdanieli* (Cárdenas-Ortega and Herrera-Lopera 2016. Herpetol. Rev. 47:438). Here, we report the first record of predation of *P. achatinus* by a bird, *Rupornis magnirostris* (Roadside Hawk; Accipitridae).

At 1300 h on 5 March 2021, we observed an adult *R. magnirostris* ingesting an adult *P. achatinus* headfirst while perched on a wooden fence (Fig. 1) in the urban area of the Municipality of Villamaría, Caldas, Colombia (5.04299°N, 75.50782°W; WGS 84; 1920 m elev.). After this initial event, three other similar predation events were observed. Each event lasted ca. 60 sec. Both species are commonly found in urban settings and low vegetation areas. The record reported here of *R. magnirostris* preying on a frog is not uncommon, since the consumption of anurans (e.g., *Boana pulchella*, *Leptodactylus ocellatus*, *Rhinella dorbignyi*) by this bird has been recorded in several places throughout its range (Dickey and Van Rossem 1938. Zool. Ser. Field Mus. Nat. Hist. 23:1–60; Panasci and Whitacre 2000. Wilson Bull. 112:555–558; Souz et al. 2003. Herpetol. Rev. 34:232; Baladrón et al. 2011. J. Raptor Res. 45:257–261).

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Fig. 1. Predation event of *Pristimantis achatinus* by an adult *Rupornis magnirostris* in Caldas, Colombia.

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***PSEUDACRIS CRUCIFER* (Spring Peeper). ENDOPARASITES.** *Pseudacris crucifer* occurs in eastern North America east of a line from eastern Texas, USA to Winnipeg, Canada, except for the southern half of the Florida Peninsula (Green et al. 2013. North American Amphibians, Distribution and Diversity. University of California Press, Berkeley, California. 340 pp.). We examined the body cavity of one female *P. crucifer* from Oklahoma (29 mm SVL) collected in March 2001 from Cherokee County (35.697°N, 98.871°W; WGS 84) and deposited in the Sam Noble Oklahoma Museum of Natural History, University of Oklahoma (OMNH) as OMNH 38753. The body cavity was opened by a mid-ventral incision and the interior was searched for helminths utilizing a dissecting microscope. Two cysts were found on the body wall. They were removed, cleared in lactophenol, and opened. Their contents were found to contain larval digeneans. They were regressively stained in hematoxylin, mounted in Canada balsam, cover-slipped, studied utilizing a compound microscope and identified as two metacercariae of *Clinostomum* sp. after comparison with Olsen (1974. Animal Parasites: Their Life Cycles and Ecology. Dover Publications, Inc., New York, New York. 562 pp.): "the oral sucker is surrounded by a collar-like fold and the testes are tandem with the ovary." *Clinostomum* sp. has an indirect life cycle, utilizing snails as first intermediate hosts, the cercariae leave the snail and penetrate animals serving as the second intermediate host, where they develop into metacercariae. *Clinostomum* sp. matures in birds that eat infected amphibians harboring mature metacercariae (Muzzall and Kuczynski 2017. Comp. Parasitol. 84:55–59). There are reports of unidentified metacercariae in *P. crucifer* from Michigan (Muzzall and Peebles 1991. J. Helm. Soc. Washington 58:263–265) and from Wisconsin (Yoder and Coggins 2007. J. Parasitol. 93:755–760). Voucher specimens were deposited in the Harold W. Manter Laboratory, University of Nebraska (HWML) as *Clinostomum* sp. (HWML 112238). *Clinostomum* sp. in *P. crucifer* is a new host record.

We thank Cameron D. Siler for permission to examine the *P. crucifer* and Jessa L. Watters for facilitating the loan.

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***RANA DRAYTONII* (California Red-legged Frog). COLORATION.** *Rana draytonii* has been described as brown, grey, olive, reddish, and/or yellow with dark patches dorsally, and having dark bands on the legs (Storer 1925. Univ. California Publ. Zoo. 27:1–342; Slevin 1928. Occas. Pap. California Acad. Sci. 16:1–152; Stebbins 2003. Western Reptiles and Amphibians, Houghton Mifflin Co., New York, New York. 533 pp.). This accurately describes the variety of the thousands of specimens we have encountered in the field. In October 2004, however, a post-metamorphic individual (45 mm SVL) of a completely atypical coloration was encountered. Herein, we describe an unusual color pattern in a *R. draytonii* that was found at the Lomita Canal in Millbrae, San Mateo County, California, USA.

Rather than the characteristic combination of tan, brown, and tomato red, this individual displayed brilliant orange across its body (Fig. 1). The specimen was encountered among thick cattails (*Typha* sp.), in a canal paralleling the western shoreline of the San Francisco Bay (37.61116°N, 122.39473°W; WGS 84). *Rana draytonii* typically have a white speckled venter, while this individual had a creamy orange ventral side, free of any dark coloration. The underlying mechanisms that led to the orange coloration of the individual described here are unknown, as it is the first description of such coloration in California. Riemer (1954. Copeia 1954:45–48), in referencing the coloration of *Masticophis lateralis euryxanthus* (Alameda Whipsnake) suggested that "a number" of species of terrestrial vertebrates found in the area of the San Francisco Bay appear to be more richly supplied with yellow, orange, and red pigments. Citing seven different species, six of which are sympatric with *R. draytonii*, Riemer (1954, *op. cit.*) was clearly referencing typical coloration of these species. It is unclear whether the morph seen here suffers from the loss of or under expression of certain pigments (i.e., amelanistic). Amphibians are reported to use carotenoids for skin pigmentation, and because carotenoids are only obtainable through the diet, color degradation could result from limited carotenoid availability (Ogilvy et al. 2012. Anim. Conserv. 15:480–488). It is also possible that this atypical coloration was developed through a genetic mutation. We believe this is the first report of atypical coloration in this threatened species.

Fig. 1. Atypical coloration in a *Rana draytonii* from San Mateo County, California, USA.

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***RANA ONCA* (Relict Leopard Frog). GROWTH, SEXUAL MATURITY, and SIZE.** Although *Rana onca* was once believed extinct, genetic analyses published in 2001 confirmed that the species had persisted (Jaeger et al. 2001. Copeia 2001:339–354). Since then, native populations (Bradford et al. 2004. Southwest. Nat. 49:218–228) have been supplemented by establishing populations at new sites as part of a multi-agency conservation effort (U.S. Fish and Wildlife Service 2016. Fed. Reg. 81:69425–69442). Following the translocation of recently metamorphosed *R. onca* into a pond refugium habitat within the Las Vegas Valley, Nevada (Saumure et al. 2021. *In* P.S. Soorae [ed.]. Global Conservation Translocation Perspectives: 2021. Case Studies from Around the Globe, pp. 76–81. International Union for the Conservation of Nature, Gland, Switzerland), four individuals grew rapidly,

PHOTO BY KEVIN GUADALUPE

FIG. 1. Adult female *Rana onca* #8958 (84 mm SVL, 60 g) about four months after metamorphosis recaptured on 3 October 2018 at the Springs Preserve, Las Vegas, Clark County, Nevada USA.

PHOTO BY RAYMOND A. SAUMURE

FIG. 2. Adult female *Rana onca* #8958 (97 mm SVL, >100 g) recaptured on 7 November 2019 at the Springs Preserve, Las Vegas, Clark County, Nevada USA.

reaching the size of large adults in just over four months. Two recaptured adult females and one male continued to grow and reached record sizes.

In early 2018, eggs from three *R. onca* egg masses were collected from Black Canyon, Lake Mead National Recreation Area, Clark County, Nevada, USA (see map in Bradford et al. 2004, *op. cit.*). Tadpoles were raised in a laboratory setting until metamorphosis was complete. On 29 May 2018, 100 of these recently metamorphosed frogs were released into a newly constructed 0.02-ha pond refugium at the 73-ha Springs Preserve in Las Vegas, Clark County, Nevada, USA (36.17463°N, 115.18406°W; WSG 84). Prior to 1962, this area was inhabited by the extirpated *R. fisheri* (Hekkala et al. 2011. Conserv. Genet. 12:1379–1385). The released juvenile *R. onca* averaged 32 mm SVL.

Mark-recapture efforts started on 3 October 2018, and four large adult *R. onca* (3 females and 1 male) were captured by dipnet, measured, weighed, and marked with passive integrated transponder (PIT) tags (Biomark, Inc., Boise, Idaho, USA). The largest female (#8958; Fig. 1) had a SVL of 84 mm and mass of 60.0 g. This female was recaptured on 7 November 2019 (Fig. 2) and had grown to 97 mm and a mass > 100 g, which exceeded the range of the Pesola spring scales being used. The next largest female (#9052) had a SVL of 81 mm and mass of 62.0 g. When recaptured on 29 September 2020, she had grown to 94 mm and a mass of 87 g. The third smaller female (#8972) had a SVL of 75 mm and mass of 46.0 g; she was not recaptured. The single adult male (#9047) had a SVL of 68 mm and mass of 35.5 g. This frog was recaptured on 27 March 2019, and had grown to 69 mm with a reduced mass of 31.5 g.

Few unambiguous data exist on the growth and size of *R. onca* because the species has been, at times, considered synonymous with *R. fisheri* or *R. yavapaiensis* (Jaeger et al. 2001, *op. cit.*). Wright and Wright (1949. Handbook of Frogs and Toads. Comstock Publishing Company, Ithaca, New York. 640 pp.) measured 78 *R. onca* specimens from within the historical range of the species collected by Linsdale (1940. Proc. Amer. Acad. Arts Sci. 73:197–257). They noted that adults in the collection measured 44–84 mm SVL, with males 44–68 mm and females 51–84 mm. Brennan and Holycross (2006. A Field Guide to Amphibians and Reptiles in Arizona. Arizona Game and Fish Department, Phoenix, Arizona. 150 pp.) listed the maximum SVL for *R. onca* as 89 mm. Thus, female #8958 and male #9047 reached the maximum size reported by Wright and Wright (1949, *op. cit.*) within their first post-metamorphosis year and record size during their second year of growth.

On 27 March 2019, male #9047 was heard calling. Although no egg mass was observed, *R. onca* tadpoles were subsequently documented in the refugium for the first time on 25 April 2019. Thus, time from metamorphosis to reproduction was just under one year for both sexes. The size when female *R. onca* reach sexual maturity is not known but can be reached in males at ≥42 mm SVL (Bradford et al. 2004, *op. cit.*). Based on limited observations at one historically occupied site (Blue Point Spring, Nevada), *R. onca* was thought to attain adult size during the first year (Bradford et al. 2005. *In* Lannoo [ed.]. Amphibian Declines. The Conservation Status of United States Species, pp. 567–568. University of California Press, Berkeley, California).

Although speculative, several factors may have contributed to the growth rates observed. First, the newly created refugium contained no amphibians until the initial release, and the 100 laboratory-raised *R. onca* that were released experienced an estimated 96% mortality in 2018 (Saumure et al. 2021, *op. cit.*). Consequently, limited competition for available resources (i.e., food, cover) among the surviving juveniles may have stimulated growth rates. Secondly, the riparian area around the ponds appeared to have an abundance of food resources for *R. onca*. Of potential importance at the Springs Preserve refugium was a near-continuous diurnal stream of *Apis mellifera scutellata* (Africanized Bees) acquiring water to cool their hives. The bees were readily consumed by juvenile *R. onca* (Bennett et al. 2020. Herpetol. Rev. 51:303–304).

The *R. onca* refugium at the Springs Preserve was established under Landowner Cooperative Agreement #LCA-R01 with the assistance of the Nevada Department of Wildlife (NDOW, Permit #489200) and US Fish and Wildlife Service under the programmatic Relict Leopard Frog Candidate Conservation

Agreement with Assurances. Support for the rearing of *R. onca* was acquired by JRJ at University of Nevada, Las Vegas (UNLV) by the Clark County Desert Conservation Program (Project 2015-UNLV-1550A) to further implement or develop the Clark County Multiple Species Habitat Conservation Plan. Protocols involving live animals were approved by the Institutional Animal Care and Use Committee at UNLV, and authorized under permits by NDOW, the National Park Service, and Lake Mead National Recreation Area.

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***RHINELLA MARINA* (Cane Toad) and *LITORIA CAERULEA* (Australian Green Tree Frog). INTERSPECIFIC AMPLEXUS.** *Rhinella marina* is an amphibian species native to parts of the Americas and has extended its range through human introduction to several different countries, including Australia (de Mello Mendes 2019. Herpetol. Rev. 50:551). Since their introduction in Australia in Northern Queensland, the range of *R. marina* now extends to include northern Western Australia, Northern Territory, northern New South Wales and a large part of Queensland (https://www.environment.gov.au/biodiversity/invasive-species/feral-animals-australia/cane-toads; accessed 9 January 2021). The arrival of *R. marina* can possibly result in detrimental outcomes for native species (e.g., Phillips et al. 2003. Conserv. Biol. 17:1738–1747; Letnic et al. 2008. Biol. Conserv. 141:1773–1782). Despite this, little is known regarding how *R. marina* influences the reproductive success of native amphibians where they have been introduced.

Fig. 1. *Rhinella marina* in amplexus with a *Litoria caerulea* in Queensland, Australia.

At 1930 h on the 3 January 2021, a male *R. marina* was observed in amplexus with a *Litoria caerulea* (Fig. 1). The observation occurred in Habana, Mackay, Queensland, Australia (21.03036°S, 149.05523°E; WGS 84) on a gravel driveway located ca. 70 m uphill from a manmade, ephemeral dam, where *L. caerulea* had been recorded calling in the previous month. Water was present in the dam at the time of the observation.

Interspecific amplexus, which may interfere with reproductive success, has been recorded by *R. marina* for species outside of Australia (Schuman and Bartoszek 2019. Herpetol. Rev. 50:757; de Mello Mendes 2019, *op. cit.*), however, this is the first reported case of interspecific amplexus involving *R. marina* and *L. caerulea*. Species within the genus *Litoria* have been recorded in amplexus with different species (e.g., *L. cooloolensis* with both *L. olongburensis* and *L. rubella*; Lowe and Hero 2011. Herpetol. Rev. 42:585–586). However, to the best of my knowledge, this is the first recorded case of *R. marina* in amplexus with a member of the genus *Litoria*. Future observations of *R. marina* displaying interspecific amplexus need to be documented in order to fully understand how *R. marina* may be interfering in the reproductive success of native Australian anurans.

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***SCINAX TRIPUI*. DEFENSIVE BEHAVIOR.** Anurans display a wide variety of defensive behaviors (Toledo et al. 2011. Ethol. Ecol. Evol. 21:1–25). One rare posture displayed by frogs is leg interweaving, being reported for only a few species (Ferreira et al. 2019. Behav. Ecol. Sociobiol. 73:1–21; Souza et al. 2020. Herpetol. Notes 13:667–669). This behavior consists of interlacing the limbs, sometimes over the dorsal surface, and is related to presenting aposematic coloration, secreting toxins, feigning injury, or disrupting the silhouette of the amphibian to avoid detection or avoid being swallowed by a predator (Channing and Howell 2003. Herpetol. Rev. 34:52–53; Toledo et al. 2011, *op. cit.*; Lourenço-de-Moraes et al. 2014. Herpetol. Notes 7:391–392; Rojas-Padilla et al. 2019. Herpetol. Rev. 50:113–114; Ferreira et al. 2019, *op. cit.*).

Scinax tripui is a hylid occurring in the Mantiqueira Mountain Range and the Quadrilátero Ferrífero's Mountain Complex, in

PHOTO BY LEANDRO A. OLIVEIRA

Fig. 1. A female *Scinax tripui* displaying leg interweaving as a defensive behavior at Serra do Brigadeiro, Municipality of Ervália, Minas Gerais, Brazil.

the states of Minas Gerais and Espírito Santo, southeastern Brazil (Silveira et al. 2019. Rev. Bras. Zoociências 20:1–23). There are no previous records of any defensive behaviors displayed by *S. tripui*. Therefore, we report the first observation of a defensive behavior for *S. tripui*.

At 1912 h on 8 October 2020 (air temperature 19°C), we encountered a female *S. tripui* on a shrub within a forest, ca. 0.7 m above the ground, during field work in Serra do Brigadeiro in the Municipality of Ervália, Minas Gerais, Brazil (20.8846°S, 42.5364°W; WGS 84; 1173 m elev.). While we were handling the specimen, it remained almost motionless. The moment we placed the animal on a rock, it displayed the legs interweaving behavior, twisting its legs over each other (Fig. 1), remaining completely motionless and not responding to any contact. Then, we gently touched the animal several times and it quickly returned to a normal posture. Soon after, the *S. tripui* was released at the site of capture.

Leg interweaving is a rare type of defensive behavior with most records coming from hylids (Ferreira et al. 2019, *op. cit.*). Therefore, our observation is not only the first defensive behavior reported for *S. tripui*, but it also adds to the occurrence of this rare, antipredator mechanism. While this behavior may be related to aposematic or disruptive coloration and the release of toxins (Toledo et al. 2011, *op. cit.*), we do not believe this is the case for *S. tripui*. Although the species is diagnosed by having spots with a different and flashy pattern on the flanks and inguinal region (Lourenço et al. 2010. Herpetologica 65:468–479; Silveira et al. 2019, *op. cit.*), this part was not shown during the display, and no skin secretion or secretion spreading behavior was observed. Therefore, we believe it was related to feigning injury, disrupting the silhouette of the body, avoiding detection, or to avoid being swallowed.

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***SMILISCA BAUDINII* (Mexican Treefrog). ANOPHTHALMIA.** Deformities are likely to be a result of multiple causes, commonly related to human-induced environmental damage (Blaustein and Johnson, 2003. Ecol. Soc. Amer. 1:87–94). Anophthalmia is the absence of one or both eyes and appears to be a common deformity in anurans (Meteyer. 2000. Field Guide to Malformation of Frogs and Toads. Biological Science Report USGS/BRD/BSR-2000-005, U.S. Department of the Interior, U.S. Geological Survey. 16 pp.). Anuran anophthalmia has been reported in South American hylids (Ramalho et al. 2017. Herpetol. Bull. 139:43–44; Cortes-Suárez 2018. Rev. Lat. Herpetol. 1:53–54), but in México, there is only one recent report of this type of deformity (*Incilius occidentalis*; Castro-Torreblanca and Blancas-Calva 2021. IRCF Reptil. Amphib. 28:22–23).

On 31 August 2020 at 2315 h, in secondary vegetation surrounding the "Lorenzo Vazquez" dam in the Municipality of Tlaquiltenango, Morelos, México (18.45819°N, 99.04315°W; WGS 84; 1006 m elev.), we observed an adult male *S. baudinnii* (68 mm SVL) with anophthalmia of the left eye (Fig. 1). The frog was on a branch close to a pond containing other individuals of *S. baudinii*. The dam is surrounded by agricultural fields and at least two old silver mines, so we assume the cause of the deformity in this individual is related to the environmental impacts of the agricultural activity and/or past impacts from the mines. This is the second report of anophthalmia in Mexico and the first report for *S. baudinnii*.

Fig. 1. An adult male *Smilisca baudinii* with anophthalmia, from "Lorenzo Vazquez" Dam, Tlaquiltenango, Morelos, México.

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***TRACHYCEPHALUS TYPHONIUS* (Veined Treefrog). PREDATION.** Anurans are preyed upon by a variety of invertebrates and vertebrates (Pombal-Jr 2007. Rev. Bras. Zool. 24:841–843; Costa-Pereira et al. 2010. Biota Neotrop. 10:469–472). There are reports of predation of frogs by several orders of mammals, including Carnivora, Insectivora, Didelphimorphia, Primates, Rodentia, and Chiroptera (Toledo et al. 2007. Jour. Zool. 271:170–177). On 11 October 2010, at a residence located in the forested Serra de Maranguape (3.90324°S, 38.72028°W; WGS 84; 720 m elev.), we observed a female *Glossophaga soricina* (Pallas's Long-tongued Bat; UFPB 7304) drop a *Trachycephalus typhonius* carcass (CHUFC A 6474). The skin of the *T. typhonius* had been completely removed, except for the portion that covered the eyes and nostrils, and the entrails and parts of the muscles had been eaten (Fig. 1). When threatened, *Trachycephalus* spp. usually secrete an abundance of alkaline and

Fig. 1. *Trachycephalus typhonius* carcass partially consumed by the bat *Glossophaga soricine* in Ceará, Brazil.

toxic skin secretions that are an effective defense against predation and parasitic activity (Solé et al. 2010. Salamandra 46:101–103). Moreover, experiments have shown that the adhesive secretion assumes, in some cases, a consistency that keeps the mouth of predators completely glued for several days (Toledo et al. 2007, *op. cit.*). *Glossophaga soricina* is a small phyllostomid, whose diet consists of insects, fruit, pollen, nectar, and floral parts (Gardner 1977. *In* Baker et al. [eds.], Biology of Bats of the New World Family Phyllostomatidae, part II, pp. 293–350. Special Publications, The Museum, Texas Tech University, Lubbock, Texas) and although it is regarded as a nectarivore, its diet may vary geographically and seasonally (Alvarez et al. 1991. Mamm. Spec. 379:1–7). Previously it was suggested that this species might also be carnivorous (Arata et al. 1967. J. Mammal. 48:653–655), but Gardner (1977, *op. cit.*) disagreed and suggested that this observation could have been an "occasional episode of cannibalism." Thus, this is the second report of *G. soricina* predating a vertebrate and the first report of *T. typhonius* as a prey item of *G. soricina*. This episode was probably related to the reproductive period of *G. soricina* since the captured individual was a lactating female, whose stomach was filled with the flesh of the *T. typhonius*. The inclusion of meat in the diet of *G. soricina* may be related to a higher need for nutrients such as nitrogen in breeding females, as observed for frugivorous bat species (Delorme and Thomas 1996. J. Comp. Physiol. 166:427–434). We thank ICMBio for granting the collecting permit (In. 22909-1).

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TESTUDINES — TURTLES

***CHELONIA MYDAS* (Green Sea Turtle). DIET.** Green Sea Turtles (*Chelonia mydas*) are currently classified as Endangered by the IUCN Red List. Among the Galapagos Islands, located 1000 km west from mainland Ecuador, this species is fully protected from fishing by the Galapagos Marine Reserve (GMR) and its population is in a relatively healthy state. Studies in the Galapagos (stomach contents and isotopic analyses) show that the Green Sea Turtles feed largely on algae species, with invertebrates such as cnidarians, crustaceans, molluscs, and tunicates making up about 8% of the diet (Carrión-Cortez et al. 2010. J. Mar. Biolog. Assoc. U.K. 90:1005–1013). However, the presence of cephalopods in their diet has not yet been confirmed. It has been argued that Green Sea Turtles could feed opportunistically on dead or injured squids, but it would be very difficult for a turtle to chase down and hunt these fast-moving animals. Alternatively, Morais et al. (2012. Herpetol. Rev. 43:47–50) suggested that as deep-water squids move into shallow-water environments during nocturnal vertical migrations, Green Sea Turtles might actively hunt them.

Our observation took place at 1000 h on 15 May 2019 at the northernmost island of the GMR, Darwin Island (1.6787°N, 92.0041°W; WGS 84). Water temperature was 26°C above the thermocline. As we were surfacing from a scuba dive, we spotted an adult female Green Sea Turtle feeding on a vampire squid (*Vanpyroteuthis infernalis*; Fig. 1). The turtle was eating the squid's mantle, while the rest of the body appeared to be intact. The turtle was firmly holding the squid with its front flippers. At one point, the turtle ate both of the squid's eyes.

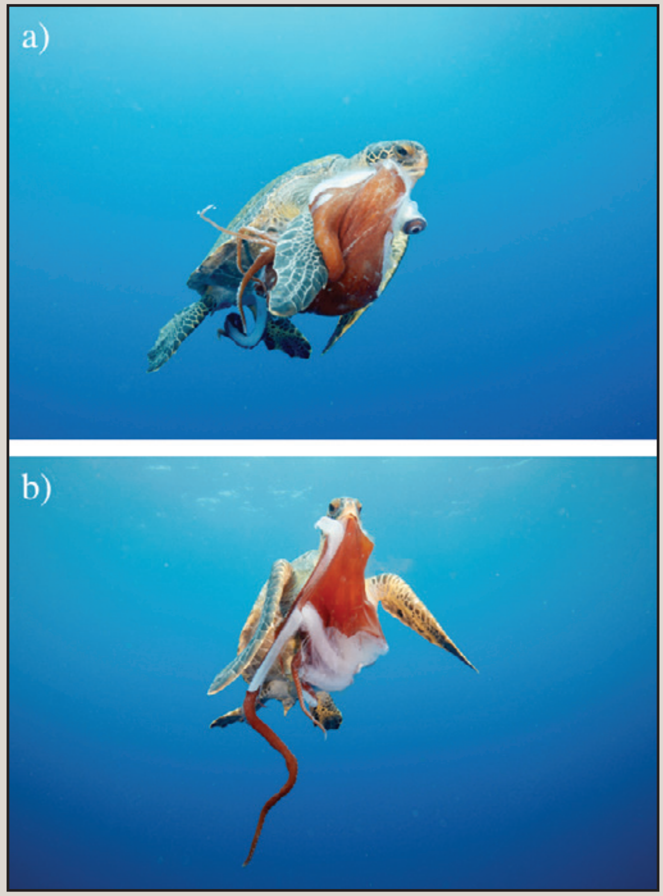

PHOTO BY KEITH ELLENBOGEN

Fig. 1. Female Green Sea Turtle (*Chelonia mydas*) feeding on a vampire squid (*Vampyroteuthis infernalis*) at Darwin Island, Galapagos Islands.

Unlike other cephalopods, the vampire squid does not undertake daily vertical migrations, remaining at a relatively constant depth throughout its life. This trait makes it very unlikely that the predator-prey interaction described here occurred during a night encounter while the squid ventured into shallow-waters. A more plausible explanation for this encounter may be that the squid carcass drifted to the surface, perhaps after being regurgitated by a cetacean, when the turtle opportunistically found and consumed it. The vampire squid's occurrence among the Galapagos Islands was first reported in 2017 by a group of tourists and naturalists during a Lindblad Expeditions-National Geographic Islander tour, around Chinese Hat–Santiago Island. The squid appeared floating at the surface as the group of tourists were returning to the boat (Galapagos naturalist guide, pers. comm.). Considering the key ecological role of cephalopods in marine ecosystems, where they can play a major role in the flow of energy across trophic levels, further studies should be conducted to elucidate the complex food webs of the GMR and the connection between surface waters and deep-sea ecosystems.

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***CHELYDRA SERPENTINA* (Snapping Turtle) and *CHRYSEMYS PICTA* (Painted Turtle). NESTING HABITAT.** Nest site selection is an important factor that contributes to successful reproduction

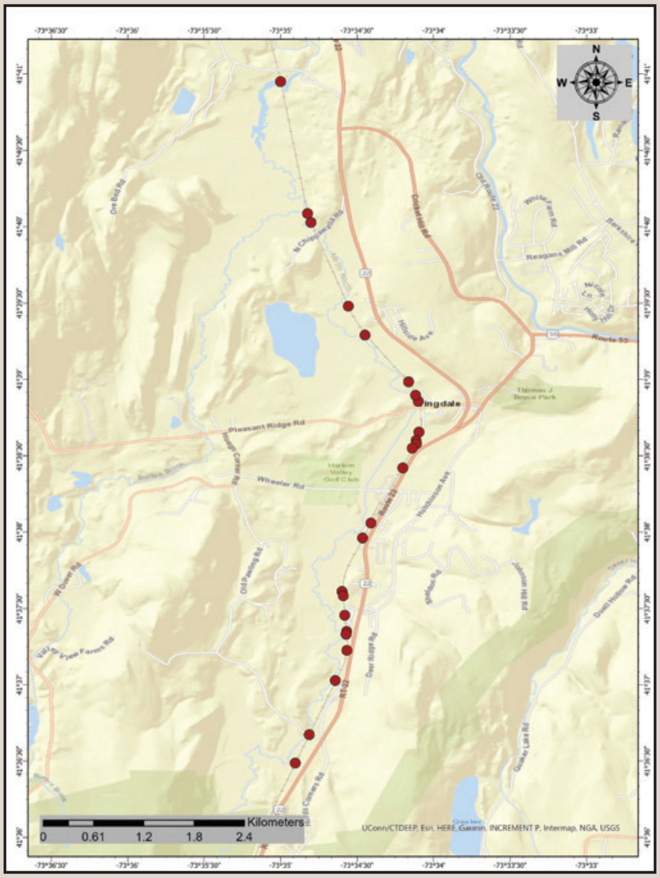

Fig. 1. Locations of turtle (*Chelydra serpentina* and *Chrysemys picta*) nesting areas found along the Metro-North Railroad in Dutchess County, New York, USA. Each red dot denotes a single nesting area (1 to 16 turtle nests).

in oviparous reptiles, including turtles (Refsnider 2015. Avian Biol. Res. 9:76–88). The choice of nesting habitat by female turtles can determine survival of the parent, hatching success, and the sex and survival probabilities of the offspring (Refsnider 2015, *op. cit.*). At a finer scale, the substrate at the nest site influences predation rates (Oldie et al. 2015. Can. J. Zool. 93:299–305), hydric environment and temperatures within the nest, and ultimately incubation period and offspring sex ratios (Bodensteiner et al. 2015. Funct. Ecol. 29:710–717; Mitchell and Janzen 2019. Herpetologica 75:57–62). We here describe the nesting habitat and substrate used by *Chelydra serpentina* and *Chrysemys picta* along a railroad embankment in the Great Swamp of Dutchess County, New York, USA.

The Great Swamp encompasses 30,000 ha of rivers, creeks, floodplains, swamp forest, marsh, and fen in Putnam and Dutchess counties, and as such, constitutes the largest freshwater wetland in New York (Siemann 1999. The Great Swamp: A Watershed Conservation Strategy. The Nature Conservancy, Pawling, New York. 78 pp.; Holt et al. 2006. Northeast. Nat. 13:353–374). Approximately 20 km of railroad tracks traverse the Great Swamp on a north–south axis (Siemann 1999, *op. cit.*). Our study area was located along the Metro-North Railroad between the towns of Pawling and Dover Plains. Construction of this section of railroad was completed in 1848, linking Manhattan with the rural counties north of New York City.

We searched for turtle nesting areas along 16.5 km of railroad between River Road (Pawling) and State Highway 22 (Dover Plains) on 28 and 31 July 2017. This section of railroad roughly parallels the Swamp River and traverses a mosaic of permanent wetlands and upland forest. We identified turtle nesting areas by the presence of excavated nests and eggshells left by predators (e.g., Geller 2012. Chelon. Conserv. Biol. 11:206–213). At each nesting area, we counted the number of depredated nests, measured the approximate linear distance of the nesting area along the railroad embankment, determined the aspect (east or west), estimated tree canopy coverage (0, 25, 50, 75, or 100%) directly above the nesting area, noted the presence and composition of ground vegetation, and collected a sample (200–300 g) of the substrate for grain-size analysis (Boggs 1987. Principles of Sedimentology and Stratigraphy. Merrill Publishing Co., Columbus, Ohio. 784 pp.).

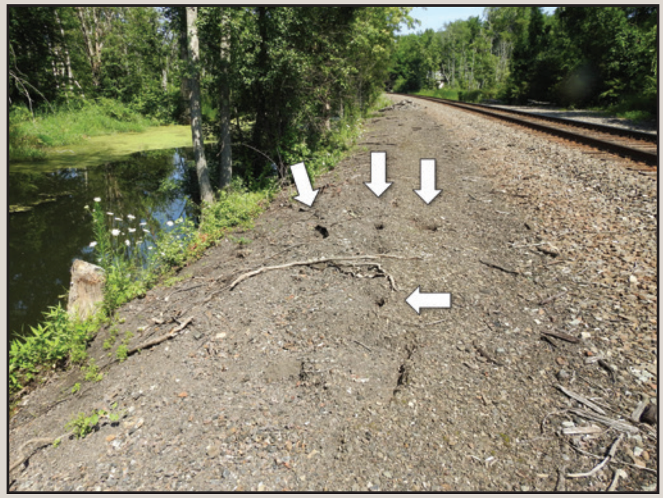

Fig. 2. Turtle nesting area on the Metro-North Railroad, New York, USA embankment adjacent to the Swamp River. White arrows indicate some of the turtle nests destroyed by predators.

We identified 25 turtle nesting areas along the railroad (Fig. 1) and counted 78 turtle nests that had been destroyed by predators (Fig. 2). Our observations of nesting females made during previous years together with dead turtles (including hatchlings) that we found at the nesting areas in 2017, led us to conclude the depredated nests were those of *Chelydra serpentina* and *Chrysemys picta*, both of which are common in the Great Swamp and nest during June, and June–July, respectively, in New York (Gibbs et al. 2007. The Amphibians and Reptiles of New York State. Oxford University Press, Inc., Oxford. 422 pp.). The number of depredated clutches at each nesting area ranged from 1 to 16 and was highly variable (mean ± 1 SD: 3.1 ± 3.4 clutches). We attribute most predation to Raccoons (*Procyon lotor*), but note that other potential nest predators (e.g., *Canis latrans* [Coyote], *Neovison vison* [Mink], *Urocyon cinereoargenteus* [Gray Fox]; see Ernst and Lovich 2009. Turtles of the United States and Canada. Second Edition. Johns Hopkins University Press, Baltimore, Maryland. 827 pp.) also occur in the area (Platt et al., unpubl. data). We found the remains of six *Chelydra serpentina* and four *Chrysemys picta* near the nesting areas; the former had been crushed by passing trains when crossing the railroad tracks, while the latter appeared to have been killed by predators, presumably while nesting.

The linear distance of each nesting area along the railroad embankment ranged from 4–106 m (mean ± 1 SD: 33.8 ± 30.3 m). Seven (28.0%) and 18 (72.0%) of the nesting areas were oriented to the east and west, respectively. Twenty-one (84.0%)

nesting areas had no overhead tree canopy cover, and four (16.0%) nesting areas were partially shaded (ca. 25% canopy cover). Sparse ground vegetation (primarily *Equisetum* sp.) was present at eight (32.0%) nesting areas, while the remaining areas were characterized by bare substrate. The substrate samples we collected (N = 25) were black, coarse-grained (average grain size ≥2 mm) and consisted mostly of coal residue (slag). Coal slag was a near-universal form of railroad ballast in the past because this material was a by-product of coal furnace combustion and therefore widely available. To briefly summarize our results, turtle nests along the Metro-North Railway were excavated in a uniformly dark substrate of sparsely vegetated coal slag, had a mostly west-facing aspect with minimal or no shading by overhead vegetation.

Similar to our observations, others have reported *Chelydra serpentina* (Hulse et al. 2001. Amphibians and Reptiles of Pennsylvania and the Northeast. Cornell University Press, Ithaca, New York. 419 pp.) and *Chrysemys picta* (Schwarzkopf and Brooks 1987. Copeia 1987:53–61) using railroad embankments as nesting habitat. *Trachemys scripta elegans* (Cagle 1950. Ecol. Monogr. 20:31–54) and *Clemmys guttata* (Vermont Fish and Wildlife Department 2019. Vermont Spotted Turtle Recovery Plan. Agency of Natural Resources, Essex Junction, Vermont. 49 pp.) are also known to nest along railroads. Railroad embankments are probably attractive nesting habitats for turtles for several reasons. First, railroad embankments offer elevated, well-drained nesting sites, often near wetlands, but unlikely to flood. Second, embankments are open, sparsely vegetated, and warm substrates, which are important environmental cues used by females when selecting nest sites (Schwarzkopf and Brooks 1987, *op. cit.*). Finally, the coal slag that comprises many embankments is a friable substrate that can be readily excavated by female turtles during nest construction (Nagle and Congdon 2016. Herpetol. Conserv. Biol. 11:232–243).

That said, turtles likely incur costs when nesting on railroad embankments. First, railroad embankments are in effect, linear edge habitats where nest predation rates are typically high (Lathi 2001. Biol. Conserv. 99:365–374). Because many predators engage in area-focused searching behavior (Marchand et al. 2002. Wildl. Soc. Bull. 30:1092–1098), concentrations of turtle nests along railroad embankments would seem especially vulnerable to predation. Second, the barren, unvegetated substrates typical of railroad embankments provide little or no concealment for nests, and reduced crypsis is an important driver of nest predation rates (Wirsing et al. 2021. Oecologica 168:977–988). Indeed, Robinson and Bider (1988. J. Herpetol. 22:470–473) found that *Chelydra serpentina* nests in a vegetated substrate had a much greater survival rate (60%) than those constructed in substrates with little or no vegetative cover (11%). Third, our finding of dead turtles along the railroad tracks suggests that females are vulnerable to predators while nesting and also risk being killed by passing trains. Fourth, clutches deposited in the coal slag substrates of railroad embankments experience extremely high incubation temperatures that may prove lethal to developing embryos or result in strongly female-biased sex ratios (Nagle and Congdon 2016, *op. cit.*). Moreover, female turtles nesting on these hot substrates can succumb to lethally high body temperatures or become physiologically incapacitated, thereby increasing their vulnerability to predators (Nagle and Congdon 2016, *op. cit.*). Finally, turtle eggs buried in coal slag risk potential chemical insults from low pH and exposure to heavy metals (Nagle et al. 2018. J. Herpetol. 52:59–66). Given these potential costs, we suggest that railroad embankments may function as "ecological traps" for nesting turtles. Ecological traps are defined as low quality habitats that organisms prefer over other available, but higher quality habitats, and arise when animals make errors in habitat assessment due to a mismatch between the environmental cues used to select habitats and the actual quality of the habitat (Battin 2004. Conserv. Biol. 18:1482–1491).

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***CHRYSEMYS PICTA* (Painted Turtle). OVERWINTERING.** Dams modify riverine habitats by altering flow, temperature, water chemistry, and sedimentation, and are an important contributor to habitat fragmentation for resident species (McCartney 2009. Water Policy 11:121–139). Damming can also cause behavioral changes that may alter species' distributions, feeding, and reproduction (Alho 2011. Oecologia Australis 15:593–604). Dam removal has become increasingly popular due to their loss of function, economic value, or environmental impact (Pohl 2002. J. Am. Water Res. Assoc. 38:1511–1519). Little is known about the response of aquatic herpetofauna to the process of dam removal and resulting rapid habitat change.

This study aimed to document distribution and overwintering site selection in Midland Painted Turtles (*Chrysemys picta marginata*) to provide baseline data for a planned dam removal. Painted Turtles prefer slow or stagnant water to open rivers (Anderson et al. 2002. J. Freshwater Ecol. 17:171–177). Habitat use of adult Painted Turtles is temperature dependent and varies seasonally (Congdon 1989. Physiol. Zool. 62:356–373). Hatchling *C. picta* often overwinter in the nest (i.e., in shallow subterranean locations; Packard and Packard 2001. BioScience 51:199–207), while juvenile and adult *C. picta* overwinter aquatically, in sand or mud pond bottoms, and uptake oxygen from the surrounding water (Ernst 1972. Copeia 1972:217–222; Ultsch 2006. Biol. Rev. 81:339–367). Although they may avoid crossing dams (Marchand et al. 2019. Can. Field-Nat. 132:108–119), we do not know how *C. picta* respond to the habitat modification created by either damming or undamming a river.

Turtles were caught from the Peninsular Paper dam impoundment of the Huron River in Ypsilanti, Michigan, USA (Fig. 1; EMU IACUC 2019-093). After an individual was captured, we recorded sex, mass, carapace length, and any distinguishing features. We attached a VHF transmitter (R1860, Advanced Telemetry Systems, Inc.) to the carapace of eight female Painted Turtles using PC7 epoxy putty and thin wire. We ensured the device was less than 5% of their body mass, following recommended protocols of the manufacturer. Individuals were relocated daily when possible, throughout the summer, and twice in the fall to

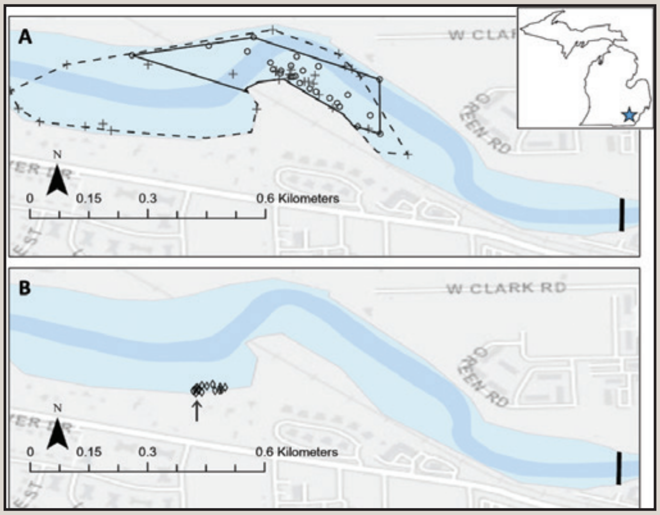

Fig. 1. Study site in Ypsilanti, Michigan, USA. Water flows west to east, and the dam targeted for removal is shown at the east end of each panel: A) minimum convex polygons for two turtles during the active season are shown as dashed and solid lines, representing the smallest and largest home ranges observed, respectively; B) winter locations for all eight individuals (diamonds) shown on the current river (light blue) and predicted river (dark blue). The black arrow indicates the location of the storm sewer outfall.

assess overwintering locations. If visual confirmation was not possible, we selected the location that gave us the highest signal on the lowest gain.

Turtles were tracked on 48 days between 30 June and 4 September 2019 and found 26–46 times. Each of our eight turtles was found once on 28 October 2019 and again on 4 November 2019. All of the turtles overwintered outside of the predicted future river boundary (Fig. 1; www.hrwc.org, 1 April 2021). A major finding from our work was that each of the eight turtles overwintered near the same location. This cluster of overwintering turtles was near the storm sewer outfall flowing into the river (Fig. 1; www.washtenaw.org, 1 Apr 2021). The water near this pipe is likely warmer than the average river temperature since it comes from underground sewers and may also include groundwater input. While dam removal often has positive ecological outcomes by improving habitat and restoring connectivity (www.washtenaw.org, 1 Apr 2021), our findings suggest that *C. picta* could be negatively impacted due to the predicted loss of currently used habitat, particularly overwintering sites. In order to minimize the potential for negative impacts associated with dam removal, we recommend removing the dam in spring or summer during the turtles' active season. This will prevent turtle mortality due to exposure to cold temperatures when the overwintering site is dewatered. We also propose that *C. picta* and other lentic-associated turtle species (e.g., *Chelydra serpentina*) be considered for relocation to minimize negative impacts. There are multiple other dammed sections of the Huron River that could serve as appropriate sites for relocation, at which time further tracking could be used to assess the success of this management action.

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***CHRYSEMYS PICTA* (Painted Turtle). REPRODUCTIVE OUTPUT.** The Painted Turtle is one of the best-studied turtles in the world (Lovich and Ennen 2013. Amphibia-Reptilia 34:11–23), and detailed data on reproductive output are available for a number of populations (e.g., Iverson and Smith 1993. Copeia 1993:1–21). However, this data appears to be unreported for Indiana, USA populations, with the nearest well-studied population being in Michigan, USA (42.5°N, 84.01°W; WGS 84; Tinkle et al. 1981. Ecology 62:1426–1432; Congdon and Tinkle 1982. Herpetologica 38:228–237). As part of a long-term demographic study of Painted Turtles at Dewart Lake, Kosciusko County, Indiana, USA (41.37°N, 85.78°W; WGS 84; Iverson et al. 2019. J. Herpetol. 53:297–301, ca. 150 km south of the Michigan population by latitude), on 12 June 1996 we randomly selected ten adult females from our capture sample, and induced oviposition with oxytocin (Ewert and Legler 1979. Herpetologica 34:314–318). Females were weighed (BM in g) and measured (CL in mm) upon capture, as were oviposited eggs (Table 1). Females were returned to the capture site following oviposition. Given mid-June timing of our sample, these data very likely represent second clutches for this population (Iverson and Smith 1993, *op. cit.*).

As for most populations of Painted Turtles (Iverson and Smith 1993, *op. cit.*), clutch size (CS; $r^2 = 0.61$; $p = 0.008$), and clutch mass (CM; $r^2 = 0.62$; $p = 0.004$) were positively correlated with body size in Indiana; however, unlike most other populations, egg mass (EM) was not positively correlated with body size (CL; $r^2 = 0.003$; $p = 0.88$), and relative clutch mass (RCM = CM/[BM – CM]) decreased with increasing CL ($r^2 = 0.55$; $p = 0.014$). Relative clutch mass was not related to body size in the two other studies providing those data: Nebraska, USA (Iverson and Smith 1993, *op. cit.*) and Idaho, USA (Lindeman 1988. M.S. Thesis, University of Idaho, Moscow, Idaho. 102 pp.).

Table 1. Reproductive data from ten adult female *Chrysemys picta* from Dewart Lake, Indiana, USA. Abbreviations are CL (maximum carapace length in mm), BM (gravid body mass in g), CS (clutch size), EL (egg length in mm), EW (egg width in mm), EM (egg mass in g), CM (clutch mass in g), and RCM (relative clutch mass, CM/[BM-CM] in %). Michigan means refer to data from Tinkle et al. (1981, *op. cit.*) and Congdon and Tinkle (1982, *op. cit.*) Published means refers to the mean of population means (N = 11–14) reported in Table 1 of Iverson and Smith (1993, *op. cit.*).

	CL	BM	CS	EL	EW	EM	CM	RCM
	121.6	235	5	32.60	16.60	5.72	28.60	13.86
	128.0	298	6	32.08	17.53	6.17	37.04	14.19
	135.2	400	8	30.65	17.01	5.60	44.81	12.61
	136.5	382	7	30.60	18.13	5.99	41.95	12.33
	136.8	337	6	33.43	17.88	6.58	39.50	13.27
	142.9	417	8	36.49	17.88	6.44	51.48	14.10
	145.7	418	7	32.28	17.57	6.17	43.17	11.52
	146.3	420	8	28.06	17.74	5.25	41.96	11.11
	147.7	415	7	33.30	17.23	6.22	43.56	11.72
	150.8	455	8	31.86	17.44	5.94	47.51	11.66
Mean:	139.2	377.7	6.9	32.14	17.50	6.01	41.96	12.64
Michigan means:	140	395	7.6	29	16.6	4.14	31.3	8.61
Published mean:	159.5	548.6	9.2	30.55	18.28	6.17	58.41	11.45

Females in Indiana were smaller than the average across 14 other populations but similar to that in the nearest population in Michigan (Table 1). Similarly, clutch size in Indiana was smaller than average but comparable to that in nearby Michigan. Average egg mass (EM) in Indiana was similar to that found in other populations (Table 1), although eggs were slightly shorter (EL) but wider (EW) than average. For 59 eggs in our sample with complete measurements, EM = 0.236EL + 0.52EW - 10.575 ($r^2 = 0.95$; $p < 0.0001$). Relative clutch mass was greater than 11 of 14 populations reviewed by Iverson and Smith (1993, *op. cit.*) and considerably greater than the closest studied population in Michigan (Table 1). Although the study site on Dewart Lake is highly productive, it is not polluted nor eutrophic. Hence, we have no clear hypothesis as to why RCM was so high.

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***ELSEYA IRWINII* (Johnstone River Snapping Turtle). NEST DISTURBANCE, EGG SUBMERGENCE, and EGG VIABILITY.** The Johnstone River Snapping Turtle is a relatively large (female max CL: 380 mm) aquatic turtle confined to upland and lowland sections of the Johnstone River drainage of tropical northeast Queensland, Australia (Turner 2006. Herpetofauna 36:41–56; Freeman 2018. Summary of results of a multi-year monitoring program for an upland population of the Johnstone River Snapper, *Elseya irwinii*, in the Wet Tropics, North Queensland. Department of Environment and Science, Atherton. 22 pp.). There is disagreement concerning the species' taxonomic status, as it is regarded by some authors as a disjunct population of *E. irwinii* and by others as a distinct species, *E. sterlingii* (Georges and Thompson 2010. Zootaxa 2496:1–37; Cann and Sadlier 2017. Freshwater Turtles of Australia. ECO Wear & Publishing, Rodeo, New Mexico. 448 pp.; Cogger 2018. Reptiles and Amphibians of Australia, Seventh Edition. CSIRO Publishing, Clayton, Australia. 1060 pp.). In the lower reaches of the Johnstone River the species nests typically in response to winter rain and deposits eggs at sites that are a relatively short distance from water, such as elevated banks and islands, often below wet season (summer) flood levels which can make them vulnerable to flooding if significant rainfall occurs (Turner 2004. Herpetofauna 34:48–58; pers. obs.). Herein, I report on the successful artificial incubation of two clutches of eggs, and a single egg from a third clutch, that were subjected to an extended period of immersion in water as a result of nest disturbance by depredation.

Eggs were located in water adjacent to nest sites at three separate locations. All except two eggs lacked opaque patches (attachment area of the underlying vitelline sac); these two eggs had small and incomplete opaque patches (<5% surface area) indicating that nest disturbance very likely occurred within 2–3 d of eggs being laid (since development of the opaque band in fertile *Elseya* sp. eggs is relatively rapid, within 1 week; pers. obs.). All eggs were covered in a slippery, transparent film and some were additionally coated in silt indicating that they had been submerged for an extended time. Water temperature varied from 19–23°C. Retrieved eggs were packed in moist sand (with the uppermost surface exposed and pencil marked) in a small plastic container for transport, then placed in an incubator maintained between 23–28°C (mean ca. 26°C) where they were mist sprayed weekly. All hatchlings were released at collection sites soon after

PHOTO BY G. S. TURNER

Fig. 1. The submerged and scattered eggs of *Elseya* sp. from a depredated nest located on the bank (top arrow); a cluster of six eggs are visible in shallow water just below the bank (middle arrow) while a seventh egg is in the foreground (bottom arrow).

hatching. Straight carapace length (SCL) was measured along the mid-line and straight carapace width (SCW) at M7. All mean values are quoted ± 1 SD. All GPS datum is WGS 84.

At 2000 h on 19 September 2001, a single egg was located in 0.2 m water at the edge of a set of rapids of the North Johnstone River (17.51447°S, 145.98679°E). It appeared to have originated from a recently (ca. 1 week old) depredated nest located six m away and up a steep embankment. It was the only intact egg located with the remains of two other eggs located up a near-vertical bank 3.5 m away but the nest could not be located. Egg dimensions were: 45 mm long, 27.5 mm wide, and 20.3 g. A narrow opaque band had developed within 4 d when kept in a container at room temperature. The egg hatched on 17 December after a period of 88 d and hatchling measurements were: 40.6 mm SCL, 37.3 mm SCW, and 11.1 g.

At 1340 h on 12 June 2010, six intact eggs were located completely submerged in 0.10–0.15 m of water of a secondary anabranch of the North Johnstone River (17.53371°S, 145.91379°E). Mean egg dimensions were: 49.4 ± 3.51 mm long, 27.7 ± 0.59 mm wide, and 22.9 ± 3.09 g. Approximately 1.5 m from the water's edge was an empty excavated nest with no egg remains nearby. The most recent rain (6 mm) occurred eight days earlier and eggs were likely deposited at this time. Opaque patches had begun to develop in all eggs within 48 h of being placed in the incubator and after an incubation period of 99–101 d all eggs hatched between 19–21 September. Mean hatchling measurements were: 42.4 ± 2.13 mm SCL, 39.0 ± 1.46 mm SCW, and 11.8 ± 2.19 g.

At 1030 h on 28 June 2012, seven intact eggs were located completely submerged in 0.2 m of water in a small side pool of the South Johnstone River (17.59722°S, 145.95464°E). Six of the eggs were in close proximity to each other (<0.15 m) and to the water's edge while the seventh egg was ca. 2 m from these (Fig. 1). Mean egg dimensions were: 46.7 ± 0.54 mm long, 27.6 ± 0.18 mm wide, and 21.9 ± 0.37 g. The nest was located 1.2 m from the water's edge, elevated 0.8 m above the water, and was likely to have been deposited at most 3 d earlier. Eggs had evidently been removed from the nest and rolled down the sloping bank into the water. Within one week of collection all eggs had developed broad opaque bands and after an incubation period of 108–109 d, all eggs hatched between 14–15 October. Mean hatchling measurements were: 42.0 ± 0.22 mm SCL, 38.4 ± 0.61 mm SCW, and 1.3 ± 0.28 g.

Incubation temperature is known to affect the phenotype of turtle hatchlings and in particular influences hatchling morphology, size, locomotor performance, and behavior (Booth 2006. Physiol. and Biochem. Zool. 79:274–281; Eiby and Booth 2011. Aust. J. Zool. 59:18–25). Inundation of turtle eggs typically results in egg mortality or phenotypic abnormalities in hatchlings (Miller and Dinkelacker 2008. *In* Wyneken, Godfrey and Bels [eds.], Biology of Turtles. CRC Press, Boca Raton, Florida. xii + 389pp.; Holman et al. 2013. Herpetol. Rev. 44:132). Hatchlings were carefully inspected for the presence of abnormal scutes, signs of lethargy, lack of motor coordination when swimming and when walking on land and all exhibited the responses typical of hatchlings from undisturbed nests. All neonates were normal in terms of their size (all were within previously determined size limits for the species; unpub. data) and appearance with no individuals possessing anomalous scutes or obvious asymmetries. They exhibited the usual protective responses (i.e., retracting into their shells or biting) when handled and their movements both in the water and over land and were coordinated and rapid.

The effect of egg inundation has been experimentally studied in only one Australian chelid and results showed significant egg mortality, particularly when inundation occurs within the first 24 h (Hollier 2012. M.Env. Thesis, University of Melbourne, Parkville, Victoria). The observations noted here for the Johnstone River Snapping Turtle suggest a certain level of tolerance to both physical movement and submersion in water of recently laid eggs. Water likely provided a stable thermal and physical environment as eggs were in still water that was connected to the main flow. The fact that all clutches had been recently laid (as indicated by the absence of opaque patches), and therefore embryonic development minimal, would in part account for the eggs' viability. The presence of moist material touching the outside of the egg is known to retard the development of opaque patches (Ewert 1979. *In* Harless and Morelock [eds.], Turtles: Perspectives and Research. Krieger Publishing, Malabar, Florida. xiv + 695 pp.) and this would account for the lack of opaque patches on these submerged eggs. Turtle species for which stimulus to nest is significant rainfall, face the obvious danger of nests being inundated at the time of, or soon after, nesting. Tolerance to submergence has an obvious survival value and may mean that eggs temporarily inundated soon after oviposition are still able to develop normally and produce phenotypically normal hatchlings particularly in a wet tropical environment.

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***EMYDOIDEA BLANDINGII* (Blanding's Turtle). HABITAT USE.** *Emydoidea blandingii* (Blanding's Turtle) is a semi-aquatic emydid with a distribution centered on the Great Lakes region of the United States and southern Canada. *Emydoidea blandingii* inhabit bogs, fens, swamps, marshes, lakes, ephemeral pools, and rivers (Ernst and Lovich 2009. Turtles of the United States and Canada. Johns Hopkins University Press, Baltimore, Maryland. 230 pp.; Cannizzaro et al. 2021. Herpetol. Rev. 52:390). Habitat preferences of *E. blandingii* are strongly correlated with the presence of palustrine emergent marsh complexes. These complexes consist of shallow depth and vegetation dominated by cattails (*Typha* spp.) and sedges (*Carex* spp.; Rowe and Moll 1991. J. Herpetol. 25:178–185). The use of aquatic mammal burrows and refugia as habitat by *E. blandingii* is sparsely documented in the literature, although a variety of chelonian taxa use beaver dams and lodges as basking platforms. Furthermore, the Snapping Turtle (*Chelydra serpentina*) has been observed to overwinter within beaver lodges (Miller and Bloudin 2011. J. Herpetol. 45:370–378, Dupuis-Desormeaux et al. 2018. PeerJ 6:5423). The American Beaver (*Castor canadensis*) is a well-studied ecological engineer whose presence in wetlands alters hydrology, geomorphology and species diversity (Metts et al. 2001. Amer. Midl. Nat. 145:54–65; Rosell et al. 2005. Mammal Rev. 35:248–276). Beaver flowages are important herptile habitat and are used to fulfill life history cycles (Metts et al. 2001, *op. cit.*). Additionally, *E. blandingii* has been observed utilizing beaver-flooded forests, as habitat corridors to access otherwise discontinuous wetland complexes (Markle and Chow-Fraser 2014. Chelon. Conserv. Bio. 13:216–226). The observation detailed below is, to the best of our knowledge, the first documented use of a beaver lodge as burrowing habitat for *E. blandingii.*

Fig. 1. Two m diameter beaver lodge occupied by *Emydoidea blandingii* located in Kane County, Illinois, USA.

On 24 June 2021, JSC IV and WHG III located, via very high frequency (VHF) radio telemetry, an adult female *E. blandingii* (228 mm SCL, 1661 g,). The turtle was buried 0.5 m in a 0.4 m-wide crevice between branches within the internal living space of an abandoned beaver lodge (Fig. 1) The lodge was constructed partly upon a live willow tree (*Salix* sp.) and was deemed abandoned due to a lack of fresh vegetation and the absence of recent signs of beaver activity. Occupancy of the beaver lodge by the turtle was confirmed by hand capture.

This observation occurred during a period of extended drought in Illinois, USA, and we postulate that this female utilized the lodge as a cool, moist habitat in response to low water levels and high ambient temperatures. Additionally, the lodge could have acted as a refugium from predators. During this period of drought, regional wildlife managers observed increased levels of predation across both juvenile and adult classes of *E. blandingii* (R. B. King, G. Glowacki, pers. comm.). During periods of low water levels, terrestrial predators are able to access wetlands more readily and prey on turtles usually separated by water barriers (JSC IV, pers. obs.; G. Glowacki, pers. comm.). This use of a beaver lodge by *E. blandingii* represents novel mammal burrow use by an enigmatic emydid turtle. All animals were handled in accordance with Illinois Department of Natural Resources regulations and permitting (collection permit HSCP 19-14 and 5426).

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***EMYDOIDEA BLANDINGII* (Blanding's Turtle). MATING.** Courtship and mating in *Emydoidea blandingii* have been observed in every month from March to November, but most often occur from March to July (Ernst and Lovich 2009. Turtles of the United States and Canada. Second Edition. The Johns Hopkins University Press, Baltimore, Maryland. 827 pp.). The following observation of late season mating was made along the Upper Wapsipinicon River, Bremer County, Iowa, USA.

On 25 October 2008 at 1300 h, a pair of large adult *E. blandingii* was observed in ca. 38 cm of water in a flooded ditch with no aquatic vegetation and a mud and cobble substrate. When first observed the male was mounted on the female with his carapace protruding from the water. Over a period of several minutes, the pair moved slowly along the substrate and the male was observed gulping and chinning as described by Baker and Gillingham (1983. Herpetologica 39:166–173). On two occasions, both individuals were observed raising their heads above the surface to breathe (i.e., snorkeling; Baker and Gillingham 1983, *op. cit.*). After ca. 15 min, the male dismounted, and the two turtles moved in opposite directions down the ditch.

This late season mating activity may have been the result of unseasonably warm weather that allowed the turtles and other reptiles to be active longer into the fall than is typical in this part of Iowa. Air temperature had regularly been above 15.6°C in the weeks preceding the observation. Weather conditions at the time of the observation were sunny with an air temperature of 13.9°C and a water temperature of 10.6°C. To my knowledge, this is the latest reported mating of *E. blandingii* in Iowa.

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***ERETMOCHELYS IMBRICATA* (Hawksbill Sea Turtle). HATCHLING ORIENTATION WITH ARTIFICIAL LIGHT.** Photopollution is a serious problem faced by sea turtles in the coastal zone (Niloy 2019. Nature Digest 5:108–111). The presence of artificial lighting directed towards the seashore can alter the ability of sea turtle hatchlings to find the ocean, as they instinctively orient towards the brightest point on the horizon (Mrosovsky et al. 1985. Z. Tierphysichol. 67:237–256; Robertson et al. 2016. Wildl. Res. 43:27–37). Disoriented hatchlings may move away from the sea and can become trapped in vegetation, dehydrated, vulnerable to predation, or killed by vehicles on roads (Simões et al. 2017. Zoologia 34:1–6). Coastal northeastern Brazil contains extensive nesting areas for sea turtles, with Paraíba being one of the main nesting regions for the species *Eretmochelys imbricata* (Mascarenhas et al. 2003. Mar. Turtle Newsl. 101:18–20). However, coastal urbanization offers numerous threats to nesting females and hatchlings (Sayegh et al. 2020. Revista Ibero Americana de Ciências Ambientais. 11:89–101), including photopollution (Vandersteen et al. 2020. Remote Sens. 12:1–19). Here, we report on an observation of disorientation in *E. imbricata* hatchlings that emerged from the nest and moved towards artificial lighting on the beach.

On 10 May 2020 at 2000 h, we discovered a nest of emerging hatchling *E. imbricata* during a survey on Cabo Branco Beach, in the Municipality of João Pessoa (7.12749°S, 34.82228°W; WGS 84). This area is highly urbanized, with artificial lighting directed towards the sea. We collected 54 living individuals. In examining the nest, we counted those that hatched (N = 124), infertile eggs (N = 13), those that died after hatching (N = 1), and those that died inside the egg (N = 1). Of the live animals collected, 15 were randomly selected and placed on the beach to examine any disorientation behavior caused by artificial lighting. Four hatchlings headed toward the sea, while eleven individuals headed away from the sea, towards the artificial light. These were then collected and transported to a safe location (Bessa Beach: 7.08951°S, 34.83332°W; WGS 84), where there is little artificial lighting, enabling the correct orientation of the hatchlings. To verify if weak lighting could disorient the newborns, we turned on a cell phone's white light flash feature. This caused an immediate "shutdown" behavior (ceasing of movement) in some individuals who were still on the sand, as they raised their heads in apparent reorientation towards the light. Upon observing the change in the turtles' actions, we turned off the light and the hatchlings continued their journey to sea. To mitigate this problem, we note the importance of increased local monitoring, determining levels of disorientation, and instituting new public policies for improved placement of artificial lighting on Cabo Branco Beach during the turtle's reproductive season. This is the first case report of the disorientation of Hawksbill Sea Turtle hatchlings due to the presence of artificial lighting in João Pessoa.

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***GOPHERUS FLAVOMARGINATUS* (Bolson Tortoise). MORTALITY.** *Gopherus flavomarginatus* is an endemic tortoise from the Bolsón de Mapimí in Northern México and is the largest species of North American tortoise. During the last three decades this species has received a lot of attention due to the dramatic decrease of its population caused largely by human predation,

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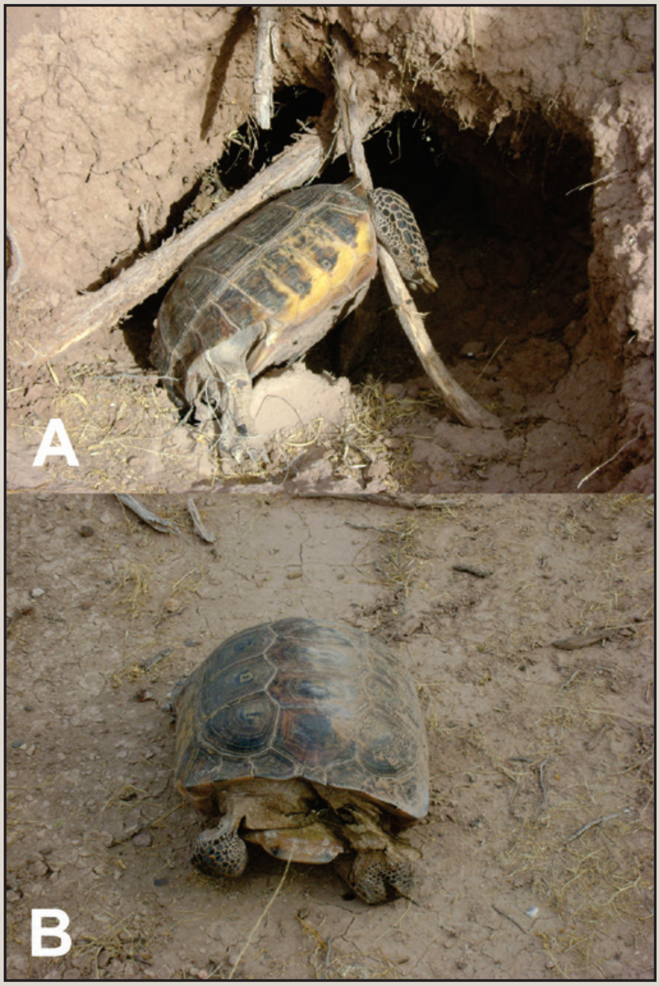

Fig. 1. A) Adult specimen of *Gopherus flavomarginatus* stuck between roots at the entrance of a burrow; B) frontal view of the tortoise corpse after it was unblocked from the burrow, showing the head missing from the body.

wildlife trafficking, and the destruction of its habitat by the expansion of agriculture (Ureña-Aranda et al. 2015. PLoS ONE 10:e0131452). In addition to the population decline, this species shows a marked lack of genetic diversity; these factors motivated its inclusion as a critically endangered species (CR) on the Red List of Threatened Species of the IUCN (Ureña-Aranda and Espinosa de los Monteros 2012. Amphibia-Reptilia 33:45–53).

There appears to be limited information on potential or documented natural predators for this species in the wild. Here, I report an unusual case of predation of *G. flavomarginatus*, presumably by a medium-sized carnivorous mammal. On 9 March 2009, during a field course at the Laboratorio del Desierto of the Instituto de Ecología in the Reserva de la Biósfera de Mapimí in Durango, México (26.6862°N, 103.7473°W; WGS 84; 1157 m elev.), I found an adult *G. flavomarginatus* trapped at the entrance of a burrow. When we tried to remove the specimen, we noticed that it was already dead, yet the body was still fresh, indicating that it had been dead no more than a few hours. The tortoise was in a left lateral position, and it was firmly stuck between two exposed roots, suggesting the improbability that the tortoise got trapped that way by itself. Consequently, we inferred that the tortoise was likely dragged by force to the entrance of the burrow by another animal, but the carapace, the right axillary region of plastron, and the right arm, became stuck against the exposed roots. It must be noted that the burrow did not have the arched shape at ground level characteristic for a burrow of *G. flavomarginatus*, supporting the assumption that the specimen was not trapped while trying to enter its own burrow. When we removed the tortoise's body, we noted that the specimen was beheaded, but no visible bite marks were present on the limbs or carapace, suggesting that the tortoise was seized by the head or neck, and then dragged by the predator to the burrow entrance. The burrow was illuminated and unsuccessfully searched for the head. The tortoise's body was not collected and was left a few meters from the burrow.

Among the native mammalian predators that could have killed the Bolson Tortoise, the Puma (*Puma concolor*) seems unlikely because of the lack of puncture marks on the shell and the small size of the burrow; however, medium-sized carnivores inhabiting the Bolsón de Mapimí include the Coyote (*Canis latrans*), Gray Fox (*Urocyon cinereoargenteus*), Kit Fox (*Vulpes macrotis*), Bobcat (*Lynx rufus*), and American Badger (*Taxidea taxus*; Elizalde-Arellano et al. 2014. Therya 5:793–816). The Gray Fox and Kit Fox mainly feed on small mammals such as rodents and lagomorphs and seem unlikely predators for a large tortoise. A Coyote or Bobcat appear to be plausible predators, but the size of the burrow appeared too narrow for them. On the other hand, a few days after the discovery of the dead tortoise, other attendees to the field course observed a large American Badger digging in the nearby area; this species seems a more likely tortoise predator, taking into account the badger's fossorial habits, and its ability to prey on a wider range of animals (Kagel et al. 2020. West. N. Am. Nat. 80:345–350).

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***GRAPTEMYS OCULIFERA* (Ringed Sawback). ABERRANT SCUTE PATTERNING.** The patterning of carapacial scutes is a primary attribute used to differentiate species in the genus *Graptemys* (map turtles and sawbacks). However, intraspecific and interspecific variability of scute patterning can cause difficulty with species identification, especially when an individual's river origin is unknown (i.e., most *Graptemys* are endemic to single river drainages; Lindeman 2013. The Map Turtle and Sawback Atlas: Ecology, Evolution, Distribution, and Conservation. University of Oklahoma Press, Norman, Oklahoma. 460 pp.). For example, Selman (2017. Herpetologica 73:105–112) described the intraspecific variability of carapace scute patterning in *Graptemys flavimaculata* (Yellow-blotched Sawback), where yellow or orange blotches are the "normal" character state in the species, but rings were a character state also observed across the populations studied. However, the "ring" character state is predominant in the sister species, *G. oculifera* (Ringed Sawback). Herein, I describe two wild-caught *G. oculifera* individuals with an aberrant character state of blotches, the pattern most commonly observed in the sister species *G. flavimaculata*.

On 13 September 2006 at 1430 h, an adult female *G. oculifera* (13 cm midline plastron length [PL], 440 g) was captured at an undisclosed location in the Pearl River system of Mississippi, USA (specific locations withheld due to conservation concerns). Of the eight pleural scutes, seven scutes exhibited incomplete rings (R1, R3–4; L1–4) and a blotch was observed on a single pleural scute (R2; Fig. 1A). This female was the only individual captured at this location with the blotch character state (N = 198). On 20

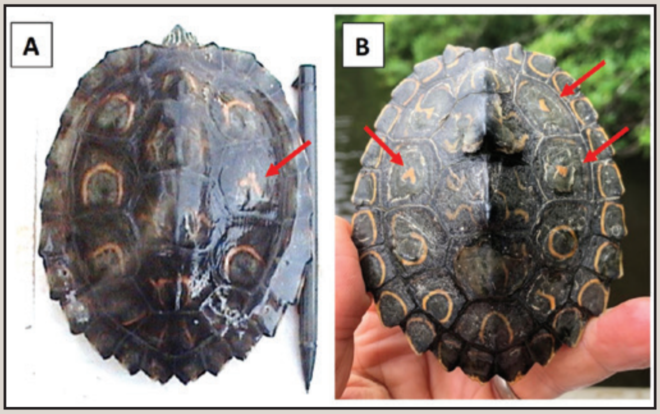

Fig. 1. Aberrantly patterned *Graptemys oculifera* female (A) and male (B) from the Pearl River system of Mississippi and Louisiana, USA, respectively. Red arrows indicate blotch character states on pleural scutes as discussed in text.

May 2021 at 1235 h, an adult male *G. oculifera* (7.5 cm MCL, 100 g) was captured in the lower Pearl River system in southeastern Louisiana, USA. This turtle displayed several different character states of the pleural scutes: three scutes with blotches (R1–2, L2), two with vertical bars (R4, L1), two with incomplete rings (L3–4), and one with a complete ring (R3; Fig. 1B). This individual was the only one captured with the blotch character state from several Louisiana sampling sites (N = 111).

In a prior study, Ennen et al. (2013. J. Herpetol. 44:544–554) did not observe rings in 55 *G. oculifera* museum specimens. In ca. 400 live captures of *G. oculifera* at multiple sites in the Pearl River drainage in Mississippi and Louisiana, the two individuals noted here represent the only individuals observed with blotches. Thus, the aberrant condition of blotches on *G. oculifera* appears to be a rare condition (<1%) relative to the presence of rings in *G. flavimaculata* (4–35.5%: Selman 2017, *op. cit.*). If either of these individuals was examined without the knowledge of the river system (e.g., at a port of entry, pet trade show, etc.), it would be difficult to determine a correct species identification, even for an expert, due to the blending of traits characteristic in both *G. oculifera* and. *G. flavimaculata*.

These individuals were captured under Mississippi Administrative Scientific Collecting Permit (WS_2006) and Louisiana Scientific Collecting Permit (WDP-21-066), and both individuals were handled and processed under animal care and use permits for WS approved by The University of Southern Mississippi (#07032201) and Millsaps College (#WS041717).

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***GRAPTEMYS OCULIFERA* (Ringed Sawback). SHELL DEFACEMENT.** The defacement of turtle shells is a relatively common practice by humans. It can be used by researchers to mark a turtle for future identification; some field researchers make small paint marks on the carapace using non-toxic spray paint for re-identification purposes, typically associated with mark-resight population estimates (e.g., Jones and Hartfield 1995. J. Herpetol. 29:426–436; Selman and Qualls 2009. Herpetol. Conserv. Biol. 4:171–184). However, malicious turtle shell defacement is occasionally perpetrated by people for idle amusement or decoration. Marking, painting, or decorating turtle shells has often been associated with turtle races (Dodd 2001. North American Box Turtles: A Natural History. University of Oklahoma Press, Norman, Oklahoma. 231 pp.). The recreational painting of turtle shells can be harmful to individuals because toxic chemicals can be absorbed through the scutes overlaying the shell (Bishop et al. 2010. Ecotoxicol. Env. Safety 73:565–571). At times, painting may cause loss of natural camouflage (i.e., by obscuring shell color and markings), making turtles more visible to predators. There is little information in the scientific literature regarding the painting of turtle shells. However, an online search for “turtle painted shell” or “tortoise painted shell” indicates that most reported incidences of turtles with painted shells are either box turtles (genus *Terrapene*) or North American tortoises (genus *Gopherus*). Herein, I describe an unusual shell defacement observation of an aquatic turtle, *Graptemys oculifera* (Ringed Sawback), in southeastern Louisiana, USA.

Fig. 1. A basking female *Graptemys oculifera* that has been painted by humans using spray paint, St. Tammany Parish, Louisiana, USA.

On 24 May 2021 at 1500 h, while conducting visual surveys in the lower Pearl River system in St. Tammany Parish, Louisiana, USA (specific locality withheld due to conservation concerns), I observed an adult female *G. oculifera* basking on a large, downed tree. Upon closer inspection, the female’s entire carapace had been spray-painted a fluorescent orange color. The individual was photographed for documentation using a Nikon Coolpix p900 (Fig. 1). The female was basking with other turtles on the log (e.g., other *G. oculifera*, *Pseudemys concinna*), and she was more reluctant than the others to depart from her basking location when I approached in my motorboat. After she jumped off the log and entered the water, I made several attempts to capture the female to assess her health but was unsuccessful. Compared to other turtles, after diving in the water the spray-painted female was quite visible; I could see her 1–1.5 m below the surface of the water due to the fluorescent coloration.

Because female *Graptemys* are difficult to capture (WS, pers. obs.), it is unknown how a person was able to capture the female to apply the paint. It is possible that the female was encountered and painted while nesting terrestrially on private property adjacent to the waterway. Alternatively, she may have been captured by a local angler, as this location is a popular fishing location. The spray-paint could possibly impair her health in the short term. It is noteworthy that the painted female was unusually reluctant to leave her basking location, perhaps because she was trying to keep her body temperature elevated. Basking is a common behavior employed by turtles when they are ill, and elevated body temperatures physiologically create a "behavioral fever" (Monagas and Gatten 1983. J. Thermal Biol. 8:285–288). Depending on how thick the paint was sprayed onto the carapace, it could also hinder the ability for the scutes to be shed in the future (and the paint to be shed with them). In ca. 16 years of surveying for *Graptemys* species and thousands of individuals observed, this is the first turtle that I have seen with the shell defaced via painting by humans (not including more subtle painted marks applied for research purposes). Fortunately, such defacement appears to be a rare occurrence for this difficult-to-capture aquatic species.

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***GRAPTEMYS PEARLENSIS* (Pearl River Map Turtle). BASKING AGGREGATION.** Basking aggregations are common among emydid turtles, whereby multiple individuals may occupy the same log or other emergent object. Sometimes these aggregations can be quite large (e.g., 170 Northern Map Turtles on a single log: Lindeman 2020. Chelon. Conserv. Biol. 19:291–297). Basking aggregations are believed to be beneficial to groups of turtles, perhaps allowing them to better detect and quickly respond to potential predators or threats; often the entire group will quickly leave the basking structure when threatened (Shealy 1976. Bull. Florida State Mus. 21:47–111). The occurrence of large basking aggregations has been observed in some *Graptemys* species, but it has not been commonly reported in members of the Gulf Coastal megacephalic clade (i.e., *G. barbouri*, *G. ernsti*, *G. gibbonsi*, *G. pearlensis*, *G. pulchra*). The basking ecology of some of these species is well understood (e.g., *G. gibbonsi* [Selman and Lindeman 2015. Herpetol. Conserv. Biol. 10:781–800], *G. ernsti* [Shealy 1976, *op. cit.*]), while for others, like *G. pearlensis* (Pearl River Map Turtle), it is relatively unknown. Herein, I describe an unusually large basking aggregation of *G. pearlensis*.

While surveying for *Graptemys* species in southeastern Louisiana on 22 June 2021 at ca. 1300 h (specific location withheld due to conservation concerns), I observed an aggregation of 30 *G. pearlensis* individuals in ca. 100 m of stream. This aggregation was female dominated (26 females, 4 males), and part of the aggregation included 18 females on a single sunlit log (Fig. 1). The location was a relatively small tributary (ca. 5–15 m across) in the lower Pearl River drainage, and the stream was relatively cool, swift flowing, and had a gravel-bottom substrate. It was also ca. 160 m from a larger river in the system, and the surrounding area was a closed canopy riparian forest that included mostly Bald Cypress (*Taxodium distichum*) and large Sweetgum (*Liquidambar styraciflua*) trees. Upon my approach to ca. 100 m, all turtles dropped off the log and reentered the water.

Over ca. 8 years of conducting research on *G. pearlensis*, the largest basking aggregation of the species previously seen has been 4–5 individuals. Thus, the size of this basking aggregation was noteworthy. Along with my previous observations during that time, the size of this basking aggregation was unexpected for other reasons. First, because it was in late June. Typically, basking frequencies of megacephalic species begin to decline with warmer months compared to the cooler spring/fall months (Selman and Lindeman 2015, *op. cit.*). Second, the stream was small, and one would not expect densities to be this high in such a small stream. It is not entirely clear why an aggregation of this size was observed in such an unexpected location. Because the stream appeared to be mostly spring fed, it seems possible that the cooler water temperatures (i.e., more comparable to spring basking conditions) may have promoted basking behavior greater than a warmer, surface runoff-fed stream (Selman and Qualls 2011. Chelon. Conserv. Biol. 10:188–197). Also, this location showed high water quality (i.e., clear, low sediment loads), and food items for females, especially mollusks, may have been plentiful at this location (Vuenovi and Lindeman 2021. Herpetologica 77:121–127). Because this area was away from the main river channel, it would also be lower in potential predators inhabiting deeper waters (e.g., alligators) and/or offer refuge from high levels of recreational boating.

Fig. 1. A large basking aggregation of female *Graptemys pearlensis* in southeastern Louisiana.

Regardless of the factors that induced an aggregation of this size, this is a notable observation of aggregated basking behavior, and indicative of a locally dense population. As this species is rare and currently petitioned for federal protection under the Endangered Species Act, this population may be important for future recovery efforts as a potential source population for neighboring waterways (e.g., if a chemical spill occurred on the main river) or to bolster a captive breeding population if such an effort was warranted.

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***KINOSTERNON ABAXILLARE* (Central Chiapas Mud Turtle). DIET.** *Kinosternon abaxillare* is a poorly known aquatic turtle endemic to the Grijalva River Basin, in the Central Depression of Chiapas, Mexico and northwestern Guatemala (Reyes-Grajales et al. 2020. Chelonian Conserv. Biol. 20:18–26). It is considered an omnivorous species, but mainly carnivorous, as is typical for kinosternids (Alvarez del Toro 1982. Los Reptiles de Chiapas. Instituto de Historia Natural. Tuxtla Gutiérrez, Chiapas, México. 247 pp.). As reported for other turtles of its genus, the diet of this species would predictably include fish, amphibians (eggs, tadpoles, adults), mollusks, arthropods (e.g., insects and crustaceans), earthworms and other annelids, carrion, and some plant material (e.g., algae, seeds, flowers, fruits; Rueda-Almonacid et al. 2007. Serie de Guías de Campo Tropicales 6. Conservación Internacional, Bogotá, Colombia. 538 pp.). Here, we document a case of predation of tadpoles and fish by *K. abaxillare*.

On 21 March 2021, around 2025 h, we observed an adult *K. abaxillare* at the Escuela Preparatoria Emiliano Zapata, 0.6 km N of the town center of Ejido Tierra y Libertad, Jiquipilas, Chiapas, Mexico (16.3859°N, 93.8605°W; WGS 84; 680 m elev.) in a shallow area of an artificial pond, feeding on tadpoles and small fish. We identified two species of tadpoles present at the site, *Lithobates forreri* and *Rhinella horribilis*. As for the prey fish, we only observed *Poeciliopsis fasciata* in the pool. Both species of tadpoles and fish were abundant in the pool. To the best of our knowledge, this is the first report of tadpoles (likely both *L. forreri* and *R. horribilis*), as well as the fish *Poeciliopsis fasciata* in the diet of *K. abaxillare*.

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***MACROCHELYS SUWANNIENSIS* (Suwannee Alligator Snapping Turtle). KYPHOSIS.** Kyphosis is a rare, dorsal-ventral contortion of the spine producing a humped back that is thought to be a congenital anomaly (Wyneken et al. [eds.] 2007. Biology of Turtles: From Structures to Strategies of Life. CRC Press, Boca Raton, Florida. 408 pp.). Kyphosis has been reported in at least seven families and many species of chelonians (Plymale 1978. Southwest. Nat. 23:457461; Stuart 1996. Bull. Chicago Herpetol. Soc. 3:6061; Rothschild et al. 2013. *In* Brinkman et al. [eds.], Morphology and Evolution of Turtles, pp. 501–534. Springer, New York). Pritchard (1989. The Alligator Snapping Turtle: Biology and Conservation. Milwaukee Public Museum, Milwaukee, Wisconsin. 104 pp.) claimed that kyphotic *Macrochelys* spp. (alligator snapping turtle) are occasionally found but reported only two instances. He included a photograph of a stuffed juvenile *M. temminckii* (Alligator Snapping Turtle) with a "strikingly domed" carapace but apparently normal scutellation. An adult *M. temminckii* had a distinct unilateral hump near the first and second left costal scutes (Pritchard 1989, *op. cit.*). Ligon et al. (2014. Herpetol. Conserv. Biol. 9:146155) reported that a captive-hatched *M. temminckii* from Oklahoma exhibited significant kyphosis. The kyphotic 8-year-old female (154.3 mm SCL) had a mass of 1937 g, whereas a non-kyphotic 5-year-old male with a similar CL (155.9 mm) had a mass of 900 g.

We captured an adult female *M. suwanniensis* (Suwannee Alligator Snapping Turtle) exhibiting severe kyphosis on 6 November 2020 in the Suwannee River near Rock Bluff Spring, Gilchrist County, Florida, USA (Fig. 1). This is the first reported instance of this deformity specifically for this species. This individual weighed 22.5 kg and had measurements of 397 mm CL, 363 mm maximum CW, 225 mm PL, and 151 mm maximum head width. Non-kyphotic females in this population with similar masses measured 447463 mm CL. The kyphotic female had a domed carapace, with the posterior vertebral scute oriented almost vertically, exceptionally wide pygal scutes, and three malformed, overlapping marginal scutes on the posterior of the carapace (Fig. 1).

We have captured 248 individual *M. suwanniensis* throughout the Suwannee River basin (Enge et al. 2021. Chelon. Conserv. Biol. 20:184199), yielding a 0.40% incidence of kyphosis, which is comparable to that found in other turtle populations. Incidences of kyphosis in turtle populations are invariably low: 0.07% for 11,876 *Trachemys scripta elegans* (Red-eared Slider) in Illinois, USA (Tucker et al. 2007. Herpetol. Rev. 38:337), 0.10% for 3830 *Graptemys oculifera* (Ringed Map Turtle) in Mississippi, USA (Selman and Jones 2012. Chelon. Conserv. Biol. 11:259261), 0.13% for 2283 *Pseudemys suwanniensis* (Suwannee Cooter) in Florida, USA (Mitchell and Johnston 2016. Herpetol. Rev. 47:127128), 0.23% for 429 *Chrysemys picta* (Painted Turtle) in New Mexico, USA (Stuart 1996. Bull. Chicago Herpetol. Soc. 31:60–61), 0.36% for 833 *Emydura macquarii krefftii* (Krefft's River Turtle) in Australia (Trembath 2009. Chelon. Conserv. Biol. 8:9495), 0.50% for 201 *Clemmys guttata* (Spotted Turtle) in Pennsylvania, USA (Ernst 1976. J. Herpetol. 10:25–33), and 0.54% for 929 *C. picta* in Pennsylvania (Ernst 1971. J. Herpetol. 5:216220).

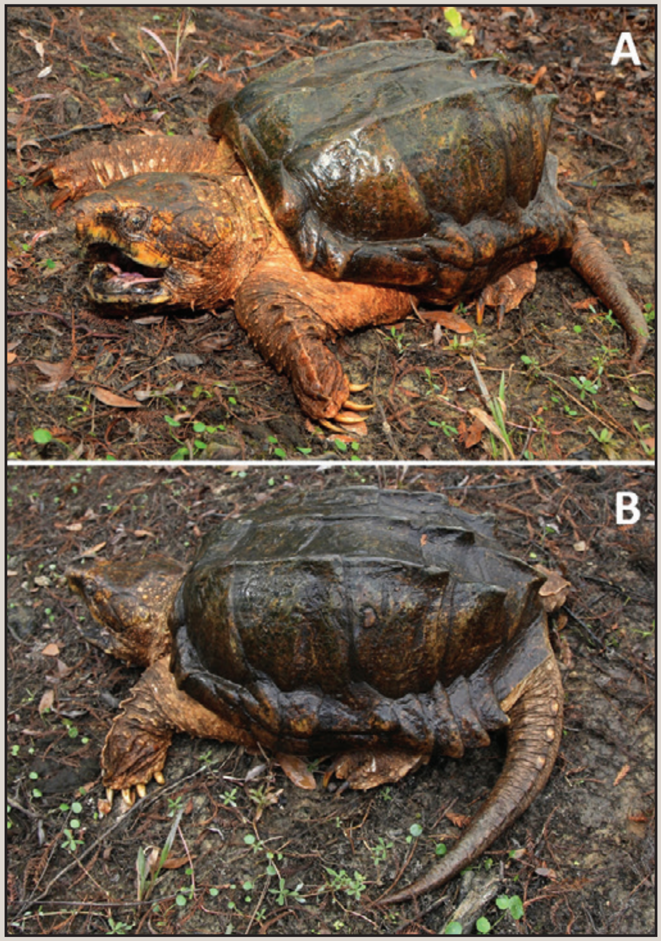

Fig. 1. Anterior (A) and lateral (B) views of the carapace of a kyphotic adult female *Macrochelys suwanniensis* captured in the Suwannee River, Florida, USA.

The female *M. suwanniensis* appeared to be healthy and possessed a mass typical of other adult females (Johnston et al. 2015. Chelon. Conserv. Biol. 14:73–81). A kyphotic female *C. picta* had somatic growth, body size, age at sexual maturity, and reproduction similar to those of non-kyphotic females in a long-term population study by Moldowan et al. (2015. Chelon. Conserv. Biol. 14:157160). A kyphotic juvenile *Chelydra serpentina* (Snapping Turtle) exhibited more rapid mass gain, resulting in a better overall body condition than non-kyphotic clutch mates raised in captivity (Wilhoft 1980. HERP: Bull.

New York Herpetol. Soc. 15:15–26). In contrast, some studies found that kyphotic turtles apparently had slower growth rates (Harding and Bloomer 1979. HERP: Bull. New York Herpetol. Soc. 15:9–26; Selman and Jones 2012, *op. cit.*). Although kyphosis might not have affected the reproductive fitness of the female *M. suwanniensis*, the abrupt truncation and protruding keel of the vertebral scute on the posterior of its carapace (Fig. 1B) might present mechanical obstacles to successful copulation. We thank Daniel Parker and Jake Scott for photos.

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***MACROCHELYS TEMMINCKII* (Alligator Snapping Turtle). AGONISTIC INTERACTIONS and NESTING.** *Macrochelys temminckii* is a large aquatic chelydrid turtle endemic to the Gulf of Mexico river drainages of the southeastern United States. Females lay a single clutch of eggs per year and typically nest annually or every other year. It is a species of conservation concern throughout its range, and a national fish hatchery in southern Oklahoma (Tishomingo National Fish Hatchery, Tishomingo, Oklahoma USA; 34.35362°N, 96.71121°E; WGS 84) established a propagation and head-start program to aid in restoring populations. We conducted an observational study of reproductive behavior in a population of captive but formerly wild animals. Our study animals were confined to two ponds (1.0 and 0.85 ha) that contained 22 females and 7 males, many of which were marked with a unique number on the carapace to facilitate visual identification.

On 14 May 2012 we observed a series of agonistic interactions between two female turtles. At 0221 h we observed turtle #12 (462 mm CL, 23.6 kg) physically displace turtle #5 (455 mm CL, 20.78 kg) from her nesting site and immediately began the nesting process in the same location. Turtle #5 had come ashore at 0207 h and was engaged in the body-pit phase of the nesting process for 6 min at the time of displacement. Post-displacement, turtle #5 continued to search the bank of the pond for ca. 30 min before returning to the water. At 0340 h, 79 min after being displaced, turtle #5 returned to the location where turtle #12 was nesting, approached her from behind and twice audibly bit the nesting female on the posterior edge of her carapace. The agonistic actions of turtle #5 did not produce a detectable response from turtle #12; at that time, turtle #12 had been excavating a cavity for 64 min. Turtle #5 briefly engaged in nesting behavior before returning to the water at 0345 h. It is worth noting that a third female, turtle #10 (417 mm CL, 16.55 kg), was nesting adjacent to turtle #12 at the time of the attack by turtle #5 but remained undisturbed during the interaction. Turtles #10 and #12 both successfully nested that night; however, turtle #5 did not nest until 19 May 2012.

Nesting *M. temminckii* were commonly on shore at the same time and often on the same bank. We observed 12 interactions between nesting females between 12 May and 3 June 2012, some of which resulted in displacement from nesting sites; however, the interactions described above were the only occurrences we observed that included physical aggression. Female *M. temminckii* prefer to nest on steep banks near the water with little ground cover (Miller et al. 2014. Southwest. Nat. 59:188–192), all of which are characteristics associated with the ca. 30 m of shoreline where our observation occurred. To the human observer, it was unclear how the nest site turtle #5 had originally selected differed from adjacent locations.

Agonistic interactions and displacements during nesting have been documented across several reptilian taxa among species that nest in common areas. One potential adaptive explanation for such behavior is that females may save time and energy by reducing costs associated with locating a nest site, assessing the relative quality of a nest site, and excavating a cavity (Doody et al. 2021. The Secret Social Lives of Reptiles. Johns Hopkins University Press, Baltimore, Maryland. 400 pp.). Investigation of the energetic costs associated with all phases of nesting activity and a comparison of costs between turtles that identify new nest sites and those that select "used" nest sites are needed to evaluate this hypothesis.

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***MAUREMYS JAPONICA* (Japanese Pond Turtle). OVERWINTERING SITE.** Selecting an appropriate overwintering site is a vital strategy for freshwater turtle survivorship in seasonally cold climates, given that the mortality of these reptiles increases during the winter season due to the influence of both biological factors, such as predation, and physiological conditions, such as the freezing, drying, and anoxic conditions of water at hibernation sites (Ultsch 1989. Biol. Rev. 64:435–515; Buhlmann and Gibbons 2001. Chelon. Conserv. Biol. 4:115–127; Ultsch 2006. Biol. Rev. 81:339–367). In Japan, since ca. 2008, mass mortalities of *Mauremys japonica* (Japanese Pond Turtle), a freshwater turtle species endemic to Japan, have been reported, and are believed to be attributable to predation by alien *Procyon lotor* (Raccoon) during the winter season (Kosuge and Kobayashi 2015. Bull. Herpetol. Soc. Japan 2015:167–173). Consequently, in order to establish appropriate conservation measures for these turtles, it is important to identify overwintering environments in which the turtles can evade high predation pressure. Although it has been established that *M. japonica* overwinters under rocks and fallen leaves in ponds or small streams (Yasukawa et al. 2008. Chelon. Res. Monogr. 5:003.1–003.6), the overwintering environment of *M. japonica* in areas colonized by alien *P. lotor* has yet to be clarified. Herein, we report the first observations of a group of overwintering *M. japonica* in shallow water with a cover of thorny-branched rose plants (*Rosa* sp.) in an area of Japan that has been invaded by *P. lotor*.

On 3 February 2019 at ca. 1050 h and 9 February 2020 at ca. 1120 h, respectively, we captured 29 (3 males and 26 females) and 23 (1 male and 22 females) *M. japonica* in a small creek (along a stretch of ca. 20 m), which flows into a tributary of the Sunomiyagawa River, Boso Peninsula, Chiba Prefecture, Japan. Almost all captured turtles (with the exception of five individuals that overwintered in hollows in the riverbank in 2020) were found overwintering on a mud bottom of shallow water covered with rose (Fig. 1). All individuals that were captured from beneath the rose branches overwintered in a shallow environment where either their entire body was immersed in water or part of their carapace was exposed to the air (Fig. 2). The mean carapace lengths of the turtles captured in 2019 and 2020 were 141.5 mm (range: 101.06–182.6) and 147.79 mm (68.4–182.55), respectively. Notably, we observed that 20 individuals captured in 2019 and 11

PHOTO BY SHAWICHI KAGAYAMA

FIG. 1. Roses (solid arrow) covering shallow water (dotted arrow) in which *Mauremys japonica* overwinter in Chiba Prefecture, Japan.

PHOTO BY MASUMI OZAKI

FIG. 2. *Mauremys japonica* overwintering on the mud bottom of shallow water covered with roses in Chiba Prefecture, Japan. The gloved hand points to an overwintering *M. japonica* with a part of its carapace exposed to the air.

captured in 2020 had some amputated limbs, similar to reports in previous studies, which are assumed to be attributable to alien *P. lotor* predation (Kosuge and Kobayashi 2015, *op. cit.*; Suzuki et al. 2015. Bull. Herpetol. Soc. Japan 2015:15–17). However, the wounds of all individuals were old, and the scars had healed. In addition, no dead turtles were discovered. In the connected Sunomiyagawa River, increases in the number of limb-amputated turtles and reductions in the size of turtle populations have coincided with an increase in invasive *P. lotor* numbers (Kagayama et al. 2021. Current Herpetol. 40:22–39), and numerous injured turtles found in this study are suspected of having been attacked by *P. lotor*.

Although large numbers of turtles appear to suffer injuries as a consequence of *P. lotor* predation, sites with a coverage of rose bushes may serve as an overwintering environment that indirectly reduces predation pressure, as almost all individuals reported here were found overwintering in shallow waters with rose coverage. Accordingly, in future studies we will seek to quantitatively evaluate whether common rose vegetation functions as a shelter that contributes to protecting hibernating freshwater turtles against alien predators.

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***TERRAPENE BAURI* (Florida Box Turtle). ECTOPARASITE.** Ticks are common ectoparasites across vertebrate taxa, and both hard ticks (Ixodidae) and soft ticks (Argasidae) have been documented parasitizing reptile species (Durden and Knapp 2005. Med. Vet. Entomol. 19:326–328; Chinnadurai and Devoe 2009. Vet. Clin. Exot. Anim. 12:583–596), including turtles (Qiu et al. 2021. Ticks. Tick Borne. Dis. 12:1–9). Here we describe an observation of a hard bodied tick in the genus *Amblyomma* parasitizing the carapace of a Florida Box Turtle (*Terrapene bauri*) in coastal southwest Florida, USA.

On 25 August 2020 in Collier County, Florida, USA, an adult male Florida Box Turtle (143 mm SCL) was captured in coastal dunes habitat as a part of on-going population surveys. Physical examination for shell deformities and damage led to the observation of a tick embedded between marginal scutes on the turtles left side (Fig. 1). The tick was photographed but was not collected and released with the turtle after processing. Images of the tick were shared with multiple parasitologists who confirmed the tick as a male from the *Amblyomma* genus, though identification to species level could not be ascertained without microscopic observation.

No additional ticks were observed in this population after nearly three years of surveys, and the same individual turtle has been recaptured multiple times with no signs of additional tick parasitism. As a whole, tick parasitism in the genus *Terrapene* seems to be rare or underreported based on the literature, with several studies documenting no observations of ticks in populations of Florida Box Turtles (Dodd 2001. North American Box Turtles: A Natural History. University of Oklahoma Press, Norman, Oklahoma. 142 pp.) or Woodland Box Turtles (*T. carolina carolina*; Lavender and Oliver 1996. J. Med. Entomol. 33:224–231; Rose and Allender 2011. J. Herpetol. Med. Surg. 21:107–112). Though Allen and Neill (1952. Florida Wildl. 5:16–38) described ticks on Florida Box Turtles, we cannot confirm the species they observed due to lack of descriptions. The majority of reports of tick parasitism come from species native to Mexico (*T. mexicana* and *T. yucatana*; Guzmán-Cornejo et al. 2011. Zootaxa 2998:16–38; Rodríguez-Vivas et al. 2016. Vet. Parisitol. 215:106–113). In these studies, both of the aforementioned species of box turtles were found to be hosts to multiple species of the *Amblyomma* genus, similar to what is seen in turtles from the genus *Rhinoclemmys* (Rodríguez-Vivas, *op. cit.*).

The North American Tortoise Tick *Amblyomma tuberculatum* commonly parasitizes Gopher Tortoises (*Gopherus polyphemus*) across its distribution (Clifford et al. 1961. Ent. Soc. Amer. 2:215–244) and is a likely suspect given the proximity of Gopher Tortoises to this population of box turtles. However, invasive reptile ticks such as *Amblyomma sabanerae* have been documented in South Florida on imported tortoises of the *Chelonoidis* genus (Burridge et al. 2000. J. Parasitol. 86:700–704), and thus the species cannot be confirmed without further examination. The observation

FIG. 1. Florida Box Turtle (*Terrapene bauri*) parasitized by an *Amblyomma* sp. tick on a marginal scute of its carapace in Florida, USA.

of this interaction is a seemingly rare occurrence in most of the range of the genus *Terrapene*. Future surveys focused on collection, identification, and sequencing of ticks of all life stages occurring in the same habitat or directly parasitizing box turtles could further explicate the relationships between the turtles and these ectoparasites, especially in regards to the potential spread of tick-borne disease within populations.

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TERRAPENE CAROLINA **(Eastern Box Turtle). BEHAVIOR IN FLOOD.** Floods are important natural phenomena with the potential to impact populations of aquatic and terrestrial chelonians. Flooding can drown turtles (Rose and Small 2014. Southwest. Nat. 59:231–336), cause turtles to abandon flood prone areas (Dodd et al. 2006. Ecol. Appl. 16:1936–1944), force turtles from overwintering refugia (Roe et al. 2018. Herpetol. Conserv. Biol. 13:711–725), physically transport turtles (Roe et al. 2018, *op. cit.*; Spangler et al. 2021. Herpetol. Conserv. Biol. 16:461–470), and displace terrestrial turtles from established home ranges (Stickel 1950. Ecol. Monogr. 20:351–378). Flood-related mortality can result in long-term population declines (Stickel 1978. Copeia 1978:221–225) and turtles displaced by flooding are presumably at greater risk from exposure to unfavorable environmental conditions and predation (Roe et al. 2018, *op. cit.*). How turtles navigate floodwaters and behaviorally respond to flooding remains largely unknown (Rose and Small 2014, *op. cit.*). Herein, we present novel behavioral observations of *Terrapene carolina* during a flood.

Our observations were made in a wooded area near Siegen Lane at Interstate Highway 12 in Baton Rouge, East Baton Rouge Parish, Louisiana, USA. At the time of our observations this area was largely forested, but natural habitat has since been eliminated by urbanization. The habitat was characterized by various oaks (*Quercus* spp.), American Beech (*Fagus grandifolia*), and Southern Magnolia (*Magnolia grandiflora*), with scattered openings dominated by herbaceous and woody vegetation in various successional stages. Much of the area was prone to flooding after heavy rainfall, partly as a result of several American Beaver (*Castor canadensis*) dams that occluded the small watercourses draining the site.

While traversing the site on 4 May 1991 (1430–1730 h), we encountered an adult female and male *T. carolina* in an area inundated by backwater flooding resulting from heavy rains during the previous week. The female turtle (152 mm CL) was concealed in a tangle of sticks and vegetation about 10 cm above the water's surface, while the male (120 mm CL) was resting atop a partially submerged log. Unlike aquatic chelonians, neither turtle attempted to flee into the water as we approached. Water depth at the locations where we found the turtles was ca. 10–20 cm, but deeper (to ca. 45 cm) elsewhere on the site; there was no perceptible current within the flooded area. The site had likely been flooded for at least 4 d (possibly longer) prior to our visit. The carapace of each turtle was dry, suggesting the turtles had been out of the water for >30 min.

Our observations, albeit based on a small number of individuals, suggest that *T. carolina* avoid floodwaters by seeking elevated refugia (e.g., logs, other woody debris, and vegetation), and may remain at these microsites for several days until waters recede. Given this avoidance behavior coupled with the fact that *T. carolina* are strong swimmers (Dodd 2001. North American Box Turtles: A Natural History. University of Oklahoma Press, Norman, Oklahoma. 231 pp.), flooding is probably not a serious threat to most populations, except during events of extreme magnitude (e.g., Stickel 1978, *op. cit.*). Indeed, *T. carolina* remain common to abundant in other flood-prone habitats surrounding Baton Rouge (Platt and Rainwater 2020. Herpetol. Rev. 51:838–839) and bottomland forests elsewhere often support high density populations (Stickel 1950, *op. cit.*; Roe et al. 2018, *op. cit.*). That said, turtles forced by flooding onto refugia may experience adverse thermal regimes (e.g., prolonged exposure to direct solar radiation), and be more conspicuous and therefore at greater risk of predation.

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TERRAPENE CAROLINA CAROLINA **(Eastern Box Turtle). SAME-SEX MOUNTING BEHAVIOR.** Many animal species are known to exhibit sexual behaviors oriented towards members of the same sex, and a growing body of work seeks to understand the evolutionary context for the occurrence of same-sex sexual behavior (Monk et al. 2019. Nat. Ecol. Evol. 3:1622–1631). In turtles and tortoises, most cases of same-sex mounting have been observed in captivity, leading to one hypothesis that this behavior is a maladaptive response to captive conditions (Rodrigues and Liu 2016. J. Ethol. 34:133–137). One of these records comes from penned Eastern Box Turtles (*Terrapene carolina carolina*), in which males would "frequently" mount each other in a manner similar to male-female mounting (Ewing 1933. Copeia 1933:95–96; Ewing 1935 Copeia 1935:102). Herein, I report an observation of male-male mounting behavior in wild, free-ranging *T. c. carolina*.

On 5 October 2021, I located an adult male *T. c. carolina* using a radiotransmitter that had been attached to its carapace on 7 September 2021 in Allee Memorial Woods, Parke County, Indiana, USA (39.86580°N, 87.28330°W; WGS 84). Along with this male turtle, there was another male in a typical mounting position: nearly upside down and at an angle such that the posterior margins of the two turtles' shells met, with the claws of both hindlimbs wedged in the gap between the plastron and carapace of the mounted male (Fig. 1). The pair was gently raised and repositioned to confirm the identity of the mounting male, using notches on the margins of the carapace that marked turtles in this population. During this process, one leg of the mounting male was released while the other remained in position between the other male's plastron and carapace. The pair was returned to its position and left in place.

This observation does not support the hypothesis that same-sex mounting is a maladaptive response to captivity (Rodrigues and Liu 2016, *op. cit.*), and perhaps the frequency with which such observations are made under captive conditions reflects a bias in general towards observations of chelonian mounting behavior under captive conditions. Other hypotheses put forward by Rodrigues and Liu (2016, *op. cit.*) include mistaken identity or dominance behavior. While sexing of some individuals of *Terrapene* spp. can be ambiguous, the turtle being mounted had been identified confidently by the author as clearly male on the basis of sexually dimorphic characteristics including iris color (bright pink), forelimb color (bright yellow), plastron concavity, and the shape of the hindlimb claws, carapace, and head (Dodd 2001. North American Box Turtles: A Natural History. University of Oklahoma Press, Norman, Oklahoma. 231 pp.). Moreover, it was a relatively large adult (144 mm CL, 640 g) with a count of >15 annuli (i.e., growth rings, generally added for each year of life while growth occurs). The mounting male was also an adult (141 mm CL, 640 g, >15 annuli). Despite the apparent clarity of sexual identification in the turtle that was mounted, it is possible that the mounting male mistakenly identified it as a female using non-visual cues. Alternatively, *T. c. carolina* is known to engage in dominance behaviors (Boice 1970. Anim. Behav. 18:703–710) and the present observation cannot be ruled out as reflecting such a social interaction. Finally, indiscriminate sexual behavior may simply be ancestral and, due to lack of significant costs, has not been subject to strong selection (Monk et al. 2019, *op. cit.*).

Fig. 1. Same-sex mounting behavior observed in two male Eastern Box Turtles (*Terrapene carolina carolina*) in Indiana, USA.

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***TERRAPENE ORNATA* (Ornate Box Turtle). SAME-SEX MOUNTING.** On 31 May 2020 at 1110 h, in Douglas County, Lawrence, Kansas, USA, we found two adult male *Terrapene ornata* exhibiting same-sex mounting behavior. Using radio telemetry, we located a male turtle (115.3 mm CL, 113.5 mm PL, 347.7 g) equipped with a radiotransmitter and immediately saw a second male (118.4 mm CL, 121.5 mm PL, 399.6 g) that was in the process of dismounting from the radio-tagged male. The radio-tagged turtle was originally identified as a male based on a suite of characteristics including plastron concavity, extended inner claw for clasping females, and distally located vent (Dodd 2001. North American Box Turtles: A Natural History. University of Oklahoma Press, Norman, Oklahoma. 231 pp.). This new and previously unknown male was initially observed in a mounted position on the radio-tagged male. The turtles separated once we approached, and at this point, we noticed the mounting male's penis was engorged and extended from its cloaca. Upon handling the new male to record measurements, he ejaculated on the observer, suggesting that this same-sex mounting behavior we observed was a sexual encounter in what appeared to be a copulation attempt.

Same-sex mounting in turtles is rare, but at least 13 different species have been observed exhibiting this behavior; most of these observations occurred in captivity (Rodrigues and Liu 2016. J. Ethol. 34:133–137). In one study from an island population of free-ranging *Testudo hermanni*, 295 instances of same-sex mounting were observed over seven years which was higher than heterosexual mounting and was attributed to a male-biased sex ratio (Bonnet et al. 2016. Behav. Ecol. 27:1206–1215). In Emydidae, *Glyptemys insculpta* (Kaufmann 1992. Herpetol. Monogr. 6:1–25) and *Emys orbicularis* (Rovero et al. 1999. J. Herpetol. 33:258–263) are the only two species for which same-sex mounting has been previously observed in free-ranging individuals the wild. In the genus *Terrapene*, *T. carolina* in a captive setting has been seen to exhibit same-sex mounting behavior (Ewing 1935. Copeia 1935:102). To the best of our knowledge, this observation represents the first record of same-sex mounting in free-ranging *T. ornata*.

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***TRACHEMYS SCRIPTA ELEGANS* (Red-eared Slider). DISEASE.** Emerging diseases are a major threat to global herpetofauna and there is a need for increased surveillance to better understand how populations are affected. Turtle ulcerative shell disease has been documented in a variety of aquatic species and can affect a substantial percentage of a population, reaching as high as 74% in a population of *Pseudemys concinna* (River Cooter) and *Trachemys scripta* (Pond Slider; Garner et al. 1994 J. Wildl. Dis. 32:259–265). Clinical disease signs predominantly include lesions/ulcers on the carapace and/or plastron that degrade the epidermis and form subcutaneous nodules, with more severe cases afflicting the bone (Woodburn et al. 2021. Vet. Pathol. 28: 578–586). While a causative agent remains unclear, recent evidence has proposed that a newly described fungal pathogen is strongly associated with the disease in several species (Woodburn et al. 2019. J. Clin. Microbiol. 57:e00628–18).

An adult female *Trachemys scripta elegans* (Red-eared Slider) was located on the shore of a lake on the Southern Illinois University Carbondale campus, Illinois, USA (37.710°N, 89.226°W; WGS 84) at 1350 h on 27 December 2021. The air temperature was unseasonably warm at 21.1°C. It did not exhibit a flight response upon approach and was hand captured. Estimated body measurements of the turtle were 268.5 mm CL, 213.2 mm PL, and 191.4 mm CW. Initial observations revealed extensive lesions were present on the posterior half of the plastron originating from the midline (Fig. 1). Lesions varied in severity, ranging from minor damage to the plastral keratin to large regions with bone exposed and damaged. Lesions of lesser severity were also present on the posterior half of the carapace, resulting in scute degradation. The findings seem to follow the patterns observed in other cases, with more pronounced lesions present on the plastron, progressing to the point at which scutes slough off, exposing extensive bone damage and, potentially, secondary infection. There were also four leeches, *Placobdella parasitica*, attached to unaffected regions of the plastron. After photographing the turtle, it was released at the site of capture.

PHOTO BY JASON W. DALLAS

Fig. 1. A female *Trachemys scripta elegans* exhibiting signs of turtle shell disease on its plastron in Illinois, USA.

This is the second female of this population to exhibit such extensive lesions and a similar lethargic response to handling (Dallas 2020. Herpetol. Rev. 51:585–586). The relatively warm air temperature suggests that the lethargic response was not temperature dependent, particularly since other basking *T. s. elegans* had flight initiation distances like those observed in spring and summer. These findings suggest that turtle shell disease is present within this lake and that further monitoring in conjunction with tissue sampling should be conducted to determine its prevalence and what causative agent(s) are affecting the population.

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CROCODYLIA — CROCODILIANS

***ALLIGATOR MISSISSIPPIENSIS* (American Alligator). FRUGIVORY.** *Alligator mississippiensis* are opportunistic predators of aquatic habitats of the southeastern United States (Elsey and Woodward 2010. In Manolis and Stevenson [eds.], Crocodiles. Status Survey and Conservation Action Plan. Third Edition, pp. 1–4. Crocodile Specialist Group, Darwin, Australia) that consume a diverse array of aquatic, semi-aquatic, and terrestrial invertebrates and vertebrates (Neill 1971. The Last of the Ruling Reptiles. Alligators, Crocodiles, and Their Kin. Columbia University Press, New York, New York. 486 pp.; Wolfe et al. 1987. Northeast Gulf Sci. 9:1–8; Elsey et al. 1992. Proc. Annu. Conf. Southeast Assoc. Fish Wildl. Agencies 46:57–66). Crocodilians are generally assumed to be obligate carnivores (Neill 1971, *op. cit.*), but recent studies have shown many crocodilians, including *A. mississippiensis*, may exhibit frugivory (Platt et al. 2013. J. Zool. 292:87–99; Platt et al. 2014. Herpetol. Rev. 45:120–121; Rainwater et al. 2017. Herpetol. Rev. 48:430–431). We herein report a novel example of frugivory recovered from *A. mississippiensis.*

From 31 August through 4 September 2017 we collected stomach samples from 12 *A. mississippiensis* taken in the state-sanctioned harvest in Louisiana, USA for a food habits study on a regional invasive species (Elsey et al. 2018. Herpetol. Rev. 49:532–534). These *A. mississippiensis* were trapped on privately owned wetlands in Terrebonne Parish and brought to a processing shed in Houma, Louisiana, USA. The entire viscera or only the stomach was dissected from each carcass and frozen for later analysis, which were subsequently thawed and stomach contents sorted.

Of the 12 stomachs, one adult *A. mississippiensis* (328 cm total length) contained four fruits of *Liquidambar styraciflua* (American Sweetgum) as well as 333 *Pomacea maculata* (Giant Apple Snail) opercula, bones thought to be *Apalone* sp. (W. Selman, pers. comm.), or perhaps fish bones, an unidentified insect part (possibly Coleoptera), large pieces of woody vegetation, and four Nematodes (roundworms; Fig. 1). Also in the stomach contents of the 328 cm TL alligator were miscellaneous alligator parts and ten web tags from six individual alligators which had been released from commercial alligator farms as juveniles (sizes at release ranged from 122–152 cm TL; two were released on 22 May 2014, three released 17 April 2017, and one released on 31 May 2017) as part of the egg ranching program in Louisiana (Elsey et al. 2020. Herpetol. Rev. 51:117).

Fig. 1. Stomach contents of an adult *A. mississippiensis* collected in autumn 2017 (exact date unknown, between 31 August and 4 September) in Louisiana, USA. Four fruits of *Liquidambar styraciflua* are encircled in yellow.

Fig. 2. Typical *Liquidambar styraciflua* fruit showing size and hard spinose exterior. Scale is in cm.

Liquidambar styraciflua fruits are spinose balls (ca. 2.5–3.5 cm in diameter) of fused twin-seeded capsules and each ball contains 20–30 small seeds (Kormanik 1990. *In* Burns and Honkala [eds.], Silvics of North America, Vol. 2: Hardwoods, pp. 400–409. U.S. Dept. Agric., For. Serv., Agric. Handbook 654. Washington, D.C.). The hard, spiked fruits of *L. styraciflua* (Fig. 2) seem as if they would be unpalatable and offer minimal nutritional value, but are high in crude protein, crude fat, phosphorus, and calcium (Halls 1977. Southern fruit-producing woody plants used by wildlife. USDA Forest Service, General Technical Report SO-16, Washington, D.C.), and thus some energetic gains might result from consumption. It's unclear if these fruit were consumed deliberately or incidentally during capture and ingestion of other prey.

This observation is noteworthy as it provides yet another example of frugivory in a species that is generally considered to be carnivorous, despite studies showing effective utilization of fruits and plant products by *A. mississippiensis* (Rainwater et al. 2017, *op. cit.*; Reigh and Williams 2018. J. World Aquacult. Soc. 49:1014–1018). To our knowledge this fruit has not previously been identified in an alligator stomach (Platt et al. 2013, *op. cit.*) and adds a 25th species to the prior review documenting consumption of fruit and seeds of at least 24 plant species by *A. mississippiensis* (Platt et al. 2013, *op. cit*; Rainwater et al. 2017, *op. cit.*). The ability of alligators to ingest such a wide variety of organisms and adapt to novel prey items may be a factor influencing their long-term success over a diverse range of habitats.

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***ALLIGATOR MISSISSIPPIENSIS* (American Alligator). MATERNAL CARE.** *Alligator mississippiensis* is one of the few species of reptiles to exhibit maternal care, with mothers being known to protect multiple clutches at a time for several years (Hunt et al. 1982. J. Herpetol. 16:235–239). Commonly, in other crocodilians, juveniles feed themselves by cornering small prey against a bank or by corralling prey using their tail, a behavior observed both during and prior to the period of maternal care (Grigg 2015. Biology and Evolution of Crocodylians. University of Cornell Press, Ithaca, New York. 649 pp.). In tidal habitats, adult Saltwater Crocodiles (*Crocodylus porosus)* assume a floating posture that allows more passive and opportunistic capture of prey that are moving with the water flow (Britton and Britton 2013. J. Herpetol. 44:312). On the afternoon of 19 June 2019 between 1400 h and 1500 h, game cameras placed along a water-level boardwalk within the Okefenokee Swamp Park (a non-tidal, fresh "blackwater" swamp), Ware County, Georgia, USA (31.05675°W, 82.27415°N; WGS 84; 39 m elev.) captured a mother *A. mississippiensis* facilitating foraging by her pod of yearlings. Specifically, this observation is novel in that the mother was using her hind feet and tail to direct small prey to her pod. The mother *A. mississippiensis* was captured on the afternoon of 5 June 2019 between 1300 h and 1400 h and had a total length of 267 cm and an SVL of 136 cm. The yearlings were estimated to be ca. 10 months old, hatching during the last week of August 2018, which we inferred from previous capture data of some of the individuals shortly after hatching.

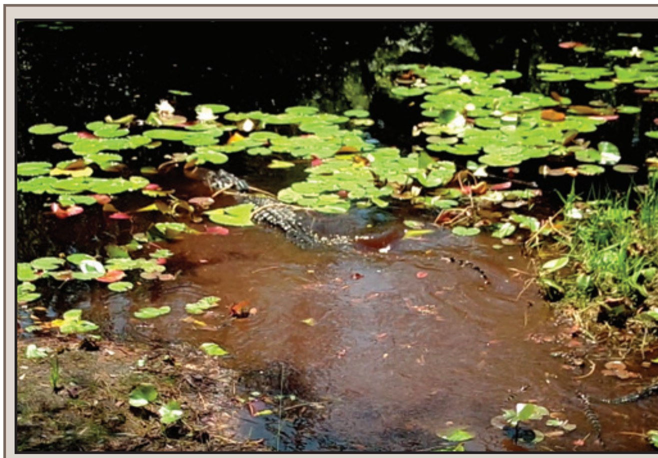

Fig. 1. Mother *Alligator mississippiensis* facilitating feeding of her yearlings by disturbing the mud and pushing contents back towards hatchlings for prey capture and consumption in Georgia, USA.

Along with the still images, a game camera captured several videos in which the tagged mother *A. mississippiensis* was 1 m from the bank facing the center of the canal (video: http://dx.doi.org/10.26153/tsw/30527). At least four yearlings were seen in an area slightly dug out and maintained by the mother as a nursery site, in shallow water against the bank directly behind her on 19 June 2019. The mother *A. mississippiensis* proceeded to use her hind legs to stir up the mud at the bottom of the canal. She then pushed the mud and water back towards the bank with her tail, and towards the yearlings behind her. They swam closer and were actively foraging on what we presume to be small prey items that were stirred up with the mud (Fig 1). This behavior was documented on 12 separate occasions over 15 days (13–28 June 2019) on game camera videos of the same female and her offspring. To our knowledge this is the first documentation of a female *A. mississippiensis* facilitating feeding of her young in such a manner and could be a common behavior that simply is difficult to observe. This observation also highlights the utility of game cameras in studying difficult to observe, or rare, behaviors that can greatly further the natural history of alligators.

This behavior also was observed and verbally relayed to the authors by Chip Campbell, founder and lead interpretive naturalist of the Okefenokee Adventures Entrance, Charlton County, Georgia, USA for 20 years.

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SQUAMATA — LIZARDS

***ANOLIS CAROLINENSIS* (Green Anole) and *HEMIDACTYLUS FRENATUS* (Common House Gecko). DIET and PREDATION.** *Anolis carolinensis* is native to the southeastern United States but established invasive populations are present on many Caribbean and Pacific Islands, including Guam, USA (Rodda et al. 1991. Micronesica 24:195–210; Kraus 2009. Alien Reptiles and Amphibians: A Scientific Compendium and Analysis. Springer, Dordrecht, Netherlands. 563 pp.; Guyer et al. 2018. Lizards and Snakes of Alabama. University of Alabama Press, Tuscaloosa, Alabama. 397 pp.). The diet of *A. carolinensis* is primarily composed of invertebrates, particularly arthropods (Guyer et al. 2018, *op. cit.*); however, possible sap feeding (Huerta and Henke 2020. Herpetol. Rev. 50:324), cannibalism in laboratory experiments (Gerber and Echternacht 2000. Oecologia 124:599–60), and saurophagy or attempted saurophagy of heterospecifics (Hilliard et al. 2012. Herpetol. Rev. 43:640–641; Button et al. 2017. Herpetol. Rev. 48:633–634) have been noted. As a group, saurophagy within *Anolis* appears to be rare but has been observed for multiple species (e.g., Campbell and Gerber 1996. Herpetol. Rev. 27:200; de Queiroz and Losos 2017. Herpetol. Rev. 48:184; Mothes 2020. Herpetol. Rev. 51:325). Here, we report an observation of *A. carolinensis* predating a juvenile *Hemidactylus frenatus*.

On 25 June 2021 at 1500 h, we observed an adult female *A. carolinensis* (50.9 mm SVL, 2.8 g) in the process of consuming a juvenile *H. frenatus* on a small Coconut Palm (*Cocos nucifera*) in a landscaped area near a suburban building on the Pacific Island of Guam (13.2842°N, 144.4507°E; WGS 84; 4 m elev.). When first observed, only the tail and lower portions of the hind legs of the *H. frenatus* were protruding from the mouth of the *A. carolinensis* (Fig. 1). We infer the predation event occurred shortly before we came upon the event because the hind limbs and tail of the *H. frenatus* were moving, suggesting it was still alive. We captured and held the *A. carolinensis* for data collection and after several minutes, before processing, the visible portions of the *H. frenatus* ceased moving. We then started to process the *A. carolinensis* and after ca. 15 min of handling, the lizard began exhibiting stress related coloration changes and regurgitated the dead *H. frenatus*. To our knowledge, this is the second record of saurophagy, and first record of predation of a gecko species by *A. carolinensis*. Although the *H. frenatus* was regurgitated prior to complete ingestion the regurgitation response was most likely due to the stress incurred during processing (Warwick et al. 2013. In Pract. 35:123–131).

PHOTO BY SCOTT M. GOETZ

FIG. 1. An invasive adult female *Anolis carolinensis* predating a juvenile *Hemidactylus frenatus* on the Pacific island of Guam, USA.

All animal procedures were reviewed and approved by the U.S. Geological Survey's Fort Collins Science Center Institutional Animal Care and Use Committee, under IACUC protocol number [FORT IACUC 2021-05].

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***ASPIDOSCELIS COSTATUS BARRANCORUM* (Barranca Whipail). SEXUAL SIZE DIMORPHISM**. *Aspidoscelis costatus* populations and subspecies studied to date all show male-biased sexual size dimorphism (SSD) in SVL (*A. costatus*: Brooks and Mitchell 1989. Southwest. Nat. 34:541–546; *A. c. costatus*: Aguilar-Moreno et al. 2010. Rev. Chilena Hist. Nat. 83:585–592) and head size (*A. c. costatus*: Aguilar-Moreno et al. 2010, *op. cit.*). However, we are not aware of any previous studies on SSD on the subspecies *A. c. barrancorum*. Here, we report on SSD in body and head size in *A. c. barrancorum* from the vicinity around Chínipas, Chihuahua, Mexico (27.39221°N, 108.53611°W; WGS 84; 469 m elev.).

We examined lizards collected in 2003 (Lemos-Espinal et al. 2004. Bull. Chicago Herpetol. Soc. 39:164–168) and sexed each specimen by examining gonads after dissection and measured SVL, head width (HW), and head length (HL) using digital calipers. We compared SVL between males and females using an ANOVA and used an ANCOVA, with SVL as the covariate, to compare HW and HL, between sexes. If the interaction of SVL and sex was not significant (i.e., if slopes were homogeneous) we did not include the interaction term in the final model.

We found male and female *A. c. barrancorum* did not differ in mean SVL (males: 94.3 ± 2.6 mm, N = 14; females: 91.2 ± 3.2 mm, N = 5; $F_{1,17}$ = 0.42, p = 0.52) , head width (males: 13.1 ± 0.8 mm, N = 14; females: 12.0 ± 0.9 mm, N = 5; $F_{1,16}$ = 0.24, p = 0.63), or head length (males: 18.3 ± 1.0 mm, N = 14; females: 17.2 ± 1.9 mm, N = 5; $F_{1,16}$ = 0.05, p = 0.83). Both head width and head length increased with SVL (HW: $F_{1,16}$ = 74.3, p < 0.0001; HL: $F_{1,16}$ = 7.6, p = 0.014).

Our results suggest there is no SSD in SVL or head dimensions in *A. c. barrancorum*, in contrast with the previously studies reporting male-biased SSD in in these traits from other populations and subspecies of *A. costatus* (Brooks and Mitchell 1989, *op. cit.*; Aguilar-Moreno et al. 2010, *op. cit.*). The lack of SSD we observed may be a function of the small sample size in our study (total N = 19) compared to the sample sizes in Brooks and Mitchell (1989, *op. cit.*; total N = 99) and Aguilar-Moreno et al. (2010, *op. cit.*; total N = 158). However, the difference in mean SVL between males and females in our sample was 3.1 mm which is much smaller that the difference observed in the other two studies (19.6 mm and 12.3 mm, respectively), suggesting there is a difference in the extent of SSD in our sample compared to the others. Further study on additional populations of *A. costatus* is needed to better understand the extent and cause of such potential variation in SSD among populations and subspecies of *A. costatus*.

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***BRACHYLOPHUS VITIENSIS* (Fijian Crested Iguana). SEED DISPERSAL.** The arboreal and herbivorous Fijian Crested Iguana is only abundant on the small uninhabited island of Yadua Taba, Fiji (16.83523°S, 178.27740°E; WGS 84; 120 m elev.). The Island's tropical dry forest is dominated by False Sandalwood Trees (*Vavaea amicorum*; Meliaceae), by far the highest abundance of this species recorded in Fiji (Harlow and Biciloa 2001. Biol. Conserv. 98:223–231). The leaves, flowers and berries of this medium-sized tree are a major component in the diet of *Brachylophus vitiensis* and were recorded in 62% of scats collected from 233 iguanas across all habitats and seasons on Yadua Taba (Morrison et al. 2008. Aust. J. of Zool. 55:341–350). During times of heavy fruiting, *B. vitiensis* appear to be entirely frugivorous, eating only the fleshy fruit of False Sandalwood Trees. Each 8–12 mm fruit typically contains one to four globular, yellow seeds, which are 3–6 mm in diameter. Here we report germination trials from iguana scat to determine if *B. vitiensis* are seed dispersers.

We conducted germination trials on Yadua Taba in March 2006 to compare False Sandalwood Trees seed germination rates from two treatment types: hand-harvested seeds from ripe collected fruit and those collected from fresh iguana scats. Fifty seeds were removed by hand from berries we obtained from three False Sandalwood Trees (N = 150 seeds) by spreading a cotton sheet on the ground and shaking branches to dislodge ripe fruit. The seeds from iguana scats were obtained by rinsing the scats collected from five wild adult iguanas (>180 mm SVL) held in cloth bags overnight (50, 50, 19, 15 and 15 seeds; N = 149 seeds). Seeds removed from scats were kept dry for two days before trials began, while seeds removed from ripe fruit were immediately moistened, i.e. day 0 of the trial. The seeds from the two treatments were each spread on an individual tray and kept at ambient shade temperatures (24–28°C) and were continually moistened with a water spray bottle.

The trial started on 3 March and ended 18 days later. We checked seeds daily for sprouting and as seeds germinated, they were counted and removed. By day 18, all seeds had either germinated or were decomposing and moldy. We found that 97.3% (N = 146) of seeds directly collected from ripe fruit germinated, whereas 59.1% (N = 88) from the iguana scats germinated, the remaining seeds in each treatment failed to germinate and became moldy.

Our findings show that almost 60% of False Sandalwood Tree seeds germinate after passing through the gut of *B. vitiensis* and suggests these iguanas are an efficient seed disperser of this species. *Brachylophus vitiensis* may in part be responsible for the high abundance of *V. amicorum* trees found only on Yadua Taba Island. Comparing all lizard families, frugivory is most common in the Iguanidae, with at least 54% (24 species) known to eat fleshy fruits (Valido and Olesen 2019. Front. Ecol. Evol. 7:49). Iverson found that the seeds of one plant species recovered from the scats of rock iguanas had similar germination rates to control seeds (at around 40%: Iverson 1985. J. Herpetol. 19:292–293), but in contrast the mean germination rate for the seeds of 10 plant species recovered from Galapagos Land Iguana scats was 4% (range 2.9–13.5%: Traveset et al. 2016. Integra. Zool. 11:207–213).

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***BUFONICEPS LAUNGWALAENSIS* (Laungwala Toad-headed Agama). DEATH-FEIGNING.** Death-feigning, also called as thanatosis, is a widespread behavior in squamates (Bels and Russell [eds.]. 2019. Behavior of Lizards: Evolutionary and Mechanistic Perspectives. CRC Press, Bota Raton, Florida. 428 pp.) but is still being reported in new species. *Bufoniceps laungwalaensis* is a diurnal agamid endemic to the Thar Desert in India and is restricted to barren sand dunes or shifting dunes (Sharma 1978. Bull. Zool. Surv. India 1:291–294; Agarwal 2009. ein Endemit aus der Wüste Thar. 37–48). When threatened, this species exhibits multiple anti-predator behaviors, including escape, quickly burying itself in sand, or arching its back with the tail pointing downwards (Agarwal 2009, *op. cit.*), but death-feigning has not been observed. Here we report on death-feigning in *B. laungwalaensis* from India.

At 0830 h on 28 September 2020, we observed an adult *B. laungwalaensis* exhibit death-feigning on a barren dune in Jaisalmer district of Rajasthan, India (26.8977°N, 70.5663°E; WGS 84; 185 m elev.). After initially observing the lizard foraging at a distance of ca. 4–5 m, we approached it to take photographs. When we approached within ca. 1–2 m of the lizard, it flipped over onto its back with its ventral surface facing upwards and limbs outstretched, and it remained motionless in the sand. We could see the lizard was breathing quickly and heavily while in this pose (video: http://dx.doi.org/10.26153/tsw/24543). After ca. 1–2 min, the lizard quickly rolled over on its feet but remained motionless for some time while looking in our direction before it ran away. While it exhibited this behavior, we did not try to get closer to lizard and continued our observation until it fled. To our knowledge, death-feigning has not been reported in the genus *Bufoniceps* and this is the first report in *B. laungwalaensis.*

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CYCLURA CYCHLURA FIGGINSI **(Exuma Island Rock Iguana). POLYDACTYLY.** Polydactyly is a physical anomaly reported frequently in mammals (Moore et al. 2007. Am. J. Primatol. 69:1105–1118), birds (Huang et al. 2006. Gene 374:10–18), and amphibians (Piha et al. 2006. Copeia 2006:810–817) but is considered rare among lizards. Reports of polydactyly in lizards continue to grow and has been reported in chameleons (Cuadrado 1996. Bol. Asoc. Herpetol. Esp. 7:23–24), iguanids (Minoli et al. 2009. Cuader. Herpetol. 23:89–92), iguanines (Ineich and Miralles 2014. Herpetol. Rev. 45:322–323), geckos (Bauer et al. 2009. Herpetol. Notes 2:243–246; Chukwuka et al. 2021. Front. Ecol. Environ. 19:85) and lacertids (Kaliontzopoulou et al. 2013. Acta Herpetologica 8:75–78). Here, we report the first case of polydactyly in *Cyclura cychlura.*

On 19 May 2021, we captured an Exuma Island Rock Iguana, *C. cychlura figginsi*, from Gaulin Cay in the Exuma Island chain, The Bahamas (24.12284°N, 76.40180°W; WGS 84; 2 m elev.) with a preaxial polydactyly (radial side; first digit) condition. The adult male rock iguana (24.6 cm SVL, 605 g) had six digits on the right front manus (Fig. 1) and the digit was clawed 4-mm in length. This, and other, Exuma Island Rock Iguana populations have been under continuous study since 1998 (Knapp et al. 2013. Conserv. Physiol. 1:1–12) and this is the first reported case of polydactyly in 1,915 measured individuals.

PHOTO BY JILL JOLLAY

FIG. 1. Front right manus of a male *Cyclura cychlura figginsi* from the Bahamas with preaxial polydactyly condition.

Polydactyly is among the most common congenital limb anomaly observed immediately at birth, manifesting in a variety of forms, ranging from complete or incomplete duplication of digits (Umair et al. 2018. Front. Genet. 9:447). Interestingly, this rock iguana was captured originally as a subadult on 22 May 2013 (17.4 cm SVL, 240 g) without this condition being recorded. It may be that the condition was missed in the original morphometric handling process or that it developed as the animal matured (Browning et al. 2020. Vet. Rec. Case Rep. 2020:6407847). The extra digit may be an offshoot from an existing phalanx bone (without an additional metacarpal) or may have originated from a separately formed metacarpal bone.

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FOJIA BUMUI **(Fojia Skink). REPRODUCTION.** *Fojia bumui* has a limited distribution in the southeastern Huon Peninsula and adjacent Papuan Peninsula, Morobe Province, Papua New Guinea where it is terrestrial, scansorial and associated with small, rocky streams (Greer and Simon 1982. J. Herpetol. 16:131–139). Previous information on *F. bumui* reproduction is in (Greer and Simon 1982, *op. cit.*). In this note we add additional information on the reproductive cycle of *F. bumui.*

We examined 17 *F. bumui* collected from 2003–2008, all from Morobe Province, Papua New Guinea, which are deposited in the vertebrate collection of the Bishop Museum (BPBM), Honolulu, Hawaii, USA. The series consists of 8 males (mean SVL = 52.6 mm ± 5.2 SD, range = 42–58 mm; collection months; June: BPBM 31752, 31753; July: BPBM 31759, 34849; August: BPBM 31369, 31370; October: BPBM 18820, 18843), 6 females (mean SVL = 52.7 mm ± 4.8 SD, range = 45–59 mm; collection months; March: BPBM 25945; June: BPBM 31751, 31755; July: BPBM 34848; October: BPBM 18837, 18842), and three unsexed juveniles (SVLs = 27, 34, 38 mm; collection month; July: BPBM 31756, 31758, 34847). Lizards were initially preserved with 10% neutral buffered formalin and later maintained in 70% ethanol. We removed a gonad from each lizard by making an incision in the abdomen to prepare them for histological examination. Gonads were embedded in paraffin, sections were cut at 5 µm and stained by Harris hematoxylin followed by eosin counterstain. Histology slides were deposited at BPBM.

All males exhibited spermiogenesis (sperm formation) in which the lumina of the seminiferous tubules were lined by rows of metamorphosing spermatids or sperm and the epididymides also contained sperm. The presence of males exhibiting spermiogenesis covered a four-month span (June, July, August, October) suggesting a prolonged period of spermiogenesis. The smallest reproductively active male (spermiogenesis) measured 42 mm SVL (BPBM 18820) and was collected in October. Examination of additional *F. bumui* males is needed to ascertain a more precise monthly distribution of stages in the testicular cycle.

For females, two enlarged yolking follicles (>5 mm) were found in lizards collected in March (BPBM 25945), July (BPBM 34848) and October (BPBM 18837, 18842). One female collected in June contained two oviductal eggs (BPBM 31751). One female from June (BPBM 31755, 45 mm SVL) was not reproductively active (no yolk deposition). Greer and Simon (1982, *op. cit.*) found two females with two yolking ovarian eggs from April and one from September, and one female with two oviductal eggs from April. Clutch size was an invariant two. The smallest reproductively active female in our series measured 50 mm SVL (BPBM 25945), in contrast to the 55 mm minimum size for reproductive maturity found by Greer and Simon (1982, *op. cit.*). The presence of reproductively active females from widely separated months (March and October) suggests an extended ovarian cycle, but as was the case for males, additional *F. bumui* females need to be examined to elucidate the monthly distribution of stages in the ovarian cycle.

Our data for both sexes suggest extended sexual activity in *F. bumui* that may last year-round but spans at least the period from March to October. This is consistent with the small clutch size of this species which appears fixed at two eggs. Tropical and subtropical species with small, fixed clutch sizes typically have extended breeding periods (Mesquita et. al. 2016. Amer. Nat. 187:689–705.), are typically small-bodied (adults collected by FK varied up to 4.05 g), and often scansorial (Meiri et al. 2020. Global Ecol. Biogeog. 29:1515–1530.). It appears that *F. bumui* also fits this general pattern of fixed clutch size in species inhabiting warm and tropical areas (Mesquita et al. 2016, *op. cit.*; Meiri et al. 2020, *op. cit.*). *Folia bumui* is unusually thin and long-limbed, highly atypical among skinks, but similar to *Anolis* species from the Neotropics which also have this same suite of features.

We thank Molly E. Hagemann (BPBM) for permission to examine specimens.

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***GERRHONOTUS INFERNALIS* (Texas Alligator Lizard). NESTING BEHAVIOR.** *Gerrhonotus infernalis* brooding occurs between February and June, and nesting sites have been documented to occur under boulders and in crevices (Greene et al. 2009. *In* Jones and Lovich [eds.], Lizards of the American Southwest, pp. 492–495. Rio Nuevo Publishers, Tucson, Arizona). Long term parental behavior has been observed in captivity for *G. infernalis*, wherein the egg-laying female will stay either in or in proximity of the nest for the duration of the incubation period (Greene et al. 2006. S. Am. J. Herpetol. 1:9–19), yet there appear to be no extended observations of free-ranging lizards. Here, we provide observations of two female *G. infernalis* sharing an egg laying site under natural conditions and we report on an egg predation event.

At 1455 h on 24 May 2021, we radio-tracked an adult female *G. infernalis* located underneath a small boulder at Selah, Bamberger Ranch Preserve, Blanco County, Texas, USA (30.19929°N, 98.44246°W; WGS 84; 452 m elev.). Upon lifting the boulder, we discovered that two female *G. infernalis* were laying coiled around two separate clutches of eggs roughly 17 cm apart (Fig. 1). The radioed female was tending to 18 eggs and the second female to 15 eggs. The radioed female was previously captured (14.9 cm SVL, 25.6 cm TL, 60.5 g); we did not capture the unknown female as to minimize disturbance to the nest. The habitat was oak-hardwood slope forest, 10%–30% slope, with dense canopy cover and the specific nest characteristics consisted of a northerly aspect, 18% slope, 94.68% canopy cover, and clay loamy soil beneath the 49 cm long, 38 cm wide, 8 cm thick boulder.

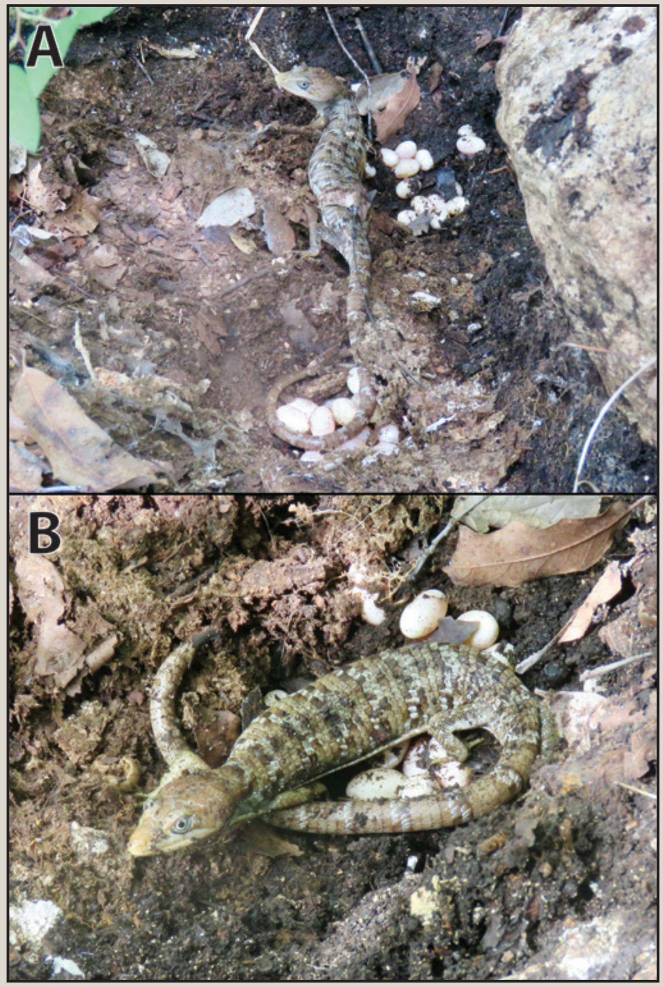

FIG. 1. Radio tracked female (A) and unknown female *Gerrhonotus infernalis* (B) sharing an egg laying site in Blanco County, Texas, USA.

After discovering the nest, we positioned a game camera (RECONYX HyperFire™) to cover both the nest and its immediate surroundings in an attempt document parental ingress and egress from the nest and monitor for potential predation events. The game camera was set to motion activation and took a picture every thirty seconds from 24 May 2021–13 July 2021. The camera captured the radioed female entering or exiting the nest six times and the unknown female four times at different periods between 24 May 2021 and 6 June 2021. We continued to track the radioed female during this period and when not in the nest, the female was discovered to be anywhere from 2–8 m away from the nest before returning to it. After 6 June 2021, the radioed female left the general area of the nesting site and never returned.

On 13 July 2021, we lifted the boulder and discovered only 5 eggs, all rotten, and no presence of other egg fragments were seen in the nest. The lack of egg debris in the nest suggests that of the original 33 eggs discovered, 28 eggs had been taken by a predator. Two potential predators were captured on camera in the vicinity of the nest, an Eastern Patch-nosed Snake (*Salvadora grahamiae*) and a Broad-banded Copperhead (*Agkistrodon laticinctus*). *Salvadora grahamiae*, a known egg predator, was the only predator photographed entering and exiting the nest site, and this occurred on five separate occasions between 11 June 2021 and 11 July 2021. While in the nesting site, the *S. grahamiae* would spend anywhere from 5–35 minutes under the boulder per visit and was often photographed basking in the general area after exiting.

Shared egg-laying sites in female Southern Alligator Lizards (*Elgaria multicarinata*) have been observed in the wild (Lemm 2006. Field Guide to Amphibians and Reptiles of the San Diego Region. University of California Press, Oakland, California. 344 pp.), but no similar observations have been published for other Gerrhonotinae species. To our knowledge, this is the first documented observation of two female *G. infernalis* sharing an egg laying site. Long term parental behavior of *G. infernalis* females is a relatively undocumented activity in the wild because both the female and their respective nesting site can be difficult to discover. It is unclear if the abandoning of these two female's egg clutches was a result of our tampering with the nest site or the presence of the *S. grahamiae* in the area drove them away. *Salvadora grahamiae* has been documented to predate Texas Spiny Lizard (*Sceloporus olivaceus*) eggs (Blair 1960. The Rusty Lizard: A Population Study. University of Texas Press, Austin, Texas. 185 pp.), but no predation specifically of *G. infernalis* eggs has been published. It is unknown if the *S. grahamiae* had encountered one of the females in the nest, but these observations suggest that, if afforded the opportunity, *S. grahamiae* will predate *G. infernalis* eggs. This work was conducted under the Texas A&M University animal care permit number IACUC 2021-0053.

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***HELODERMA SUSPECTUM* (Gila Monster). ATTEMPTED PREDATION.** At 2300 h on 7 August 2021 on the road to the Alamo Canyon Campground in Organ Pipe Cactus National Monument, Arizona, USA, DP observed a *Heloderma suspectum* and a juvenile *Canis latrans* (Coyote) lying next to each other in the road, less than half a meter apart. Based on the observations detailed below, we believe this to be the aftermath of an antagonistic interaction, likely a predation attempt (Fig. 1A). The *H. suspectum* was motionless, while the *C. latrans* was in a dazed state and continuously rolled its head back and forth with its eyes closed, only briefly pausing and opening its eyes to look in DP's direction before continuing the movement. The *C. latrans* had blood on its front left paw (Fig. 1B), possibly from being bitten by the lizard, but otherwise had no other obvious injuries. The head of the *H. suspectum* appeared injured and blood was covering the head and had smeared down its body and tail, along with what appeared to be an injury on its dorsum near the hind legs (Fig. 1C).

After observing the two animals for ca. 5 min, DP continued slowly driving down the road and returned to the location at 2355 h, ca. 50 min later. Upon return he found only the *C. latrans* still

PHOTO BY DANIEL PEACOCK

Fig. 1. A) *Heloderma suspectum* and *Canis latrans* lying down next to each other in the road; B) closeup of front left paw of *C. latrans*; C) closeup of *H. suspectum*. Observations from Arizona, USA.

lying in the road in approximately the same position, but the *H. suspectum* was no longer present. This time, while approaching in a vehicle, the *C. latrans* stood and slowly walked off the road. We believe this was an attempted predation event and that the *H. suspectum* bit and envenomated the juvenile *C. latrans* in defense, temporarily immobilizing the predator. Venom from *H. suspectum* has previously been found to cause hypotension and breathing difficulty in dogs (Patterson 1967. Toxicon 5:5–10), possibly explaining the initial lack of responsiveness from the *C. latrans* and its slow response during the later observation.

We believe the possibility of the animals being hit by a vehicle is highly unlikely due to the fact that Alamo Canyon Road is driven infrequently at night, especially during the summer months, and no vehicles were seen on the road or at the campground during the time DP was there. The injuries appear more consistent with the juvenile *C. latrans* attempting to predate the *H. suspectum* because they appeared isolated on the lizard's head and coyote's paw. We would expect much more widespread and severe damage to both animals if they were struck by a vehicle, even at a low velocity.

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***LIPINIA LONGICEPS* (Long Lipinia). REPRODUCTION.** *Lipinia longiceps* (Scincidae; Fig. 1) is found on Papua New Guinea occurring on Fergusson, Misima, Woodlark, and Gawa Islands west, across the north coast of Papua New Guinea, and looping around south of the central mountain ranges in Irian Jaya near Etna Bay (Mys 1988. Bull. Instit. Roy. Sci. Natur. Belgique 58:127–184; Kraus and Allison 2004. Herpetol. Rev. 35:413–418; Uetz et al. 2021. The Reptile Database, http://www.reptile–database.org, 4 Nov 2021). There is no information on the ecology of *L. longiceps* and herein I present data on the reproductive cycle of this species.

I examined 14 *L. longiceps* specimens collected between 1979 and 2011 from Milne Bay Province (10.1742°S, 149.9441°E; WGS 84; 905 m elev.), Morobe Province (6.9239°S, 146.8215°E; WGS 84; 829 m elev.), and East Sepik Province (4.3555°S, 143.2325°E; WGS 84; 24 m elev.), Papua New Guinea, all of which are deposited

PHOTO BY FRED KRAUS

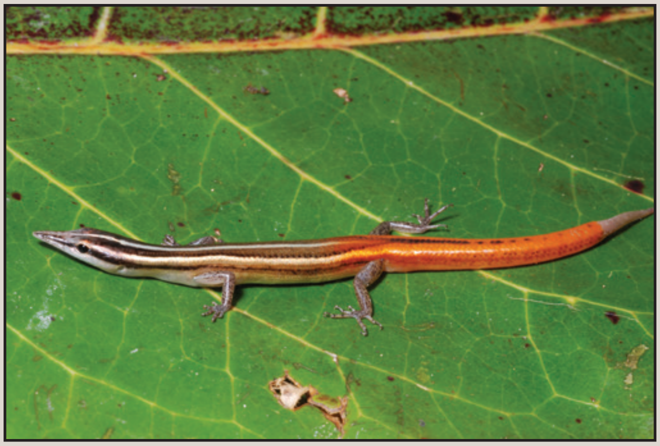

Fig. 1. *Lipinia longiceps* Woodlark Island, Milne Bay Province, Papua New Guinea, 20 October 2010.

in the vertebrate collection of the Bishop Museum (BPBM), Honolulu, Hawaii, USA. The series consisted of eight males (mean SVL = 40.6 mm ± 3.1 SD, range = 34–43 mm; Milne Bay, January: BPBM 16834, 16836 and October: BPBM 39903, 39904, 39907, 39908; East Sepik, September: BPBM 34693; Morobe, November: BPBM 19042); three females (mean SVL = 40.3 mm ± 0.58 SD, range = 40–41 mm: Milne Bay, February: BPBM 17587 and October: BPBM 39139, 39906), and three unsexed juveniles, (SVL = 26 mm, Milne Bay, January: BPBM 16835 and SVL = 20 mm , October: BPBM 39905, SVL = 17 mm, Morobe, April: BPBM 40273). Lizard were initially preserved with 10% neutral buffered formalin and later maintained in 70% ethanol. A slit was made on the abdomen and a gonad was removed from each lizard for histological examination. Gonads were embedded in paraffin, sections were cut at 5 µm and stained with Harris hematoxylin followed by eosin counterstain. All histology slides were deposited at BPBM.

All males exhibited spermiogenesis (sperm formation) in which the lumina of the seminiferous tubules were lined by rows of metamorphosing spermatids or sperm. The presence of males exhibiting spermiogenesis was found in specimens collected in January, September and October suggesting a prolonged period of spermiogenesis. The smallest reproductively active male *L. longiceps*, i.e., exhibiting spermiogenesis, measured 38 mm SVL (BPBM 19042) and was collected in November.

For females, two yolking ovarian follicles (4 mm diameter) were found in lizard BPBM 39906 (SVL = 41 mm) which represent the first clutch reported for *L. longiceps*. I did not observe embryos, so it is not known if *L. longiceps* exhibits viviparity as does the congener *L. noctua* (Goldberg and Kraus 2012. Curr. Herpetol. 31:58–60). Approximately half of the *Lipinia* species are viviparous (Rodda 2020. Lizards of the World Natural History and Taxon Accounts. Johns Hopkins University Press, Baltimore, Maryland. 801 pp.). Another female, BPBM 17587 (40 mm SVL) was undergoing yolk deposition in February, whereas BPBM 39139 (40 mm SVL) collected in October was not reproductively active. Two *L. longiceps* of presumably neonate size from widely separated months, one from April (BPBM 40273) and one from October (BPBM 39905) might suggest an extended period of egg production; and the third slightly larger subadult was from January (BPBM 16835). To my knowledge this is the first report on any aspect of the reproductive ecology of *L. longiceps* and suggests a prolonged reproductive period. This study warrants further examination in order to document monthly stages in the testicular cycle in males and elucidate the monthly distribution of stages in the ovarian cycle in females.

I thank Molly E. Hagemann (BPBM) for permission to examine *L. longiceps* and Fred Kraus, (University of Michigan) for Fig. 1.

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PHRYNOSOMA CORNUTUM **(Texas Horned Lizard). BEHAVIOR.** The ability for headstarted and reintroduced animals to emulate natural behaviors upon release from human care is essential for survival. In *Phrynosoma cornutum*, behaviors related to successful cold season brumation are critically important for lizards to survive through difficult winter weather conditions and extreme temperatures (Sherbrooke 2003. Introduction to Horned Lizards of North America. University of California Press, Berkeley, California. 177 pp.; Vesy et al. 2021. J. Wildl. Manage. 85:1267–1279). Therefore, headstarted and reintroduced *P. cornutum* must be able to exhibit brumation behavior in the wild. We raised 34 headstart *P. cornutum* at the Oklahoma City Zoo and Botanical Garden (OKZ) originally sourced as eggs or hatchlings in 2019 and 2020 from Tinker Air Force Base (TAFB; 35.41578°N, 97.41097°W; WGS 84; 375 m elev.) near Oklahoma City, Oklahoma, USA. While in human care, lizards were reared at stable temperatures (24°C ambient, 37°C basking) and light cycles (11:13 h day night cycle) for either one or two years depending on original collection cohort prior to reintroduction onto TAFB in June 2021. Because the husbandry conditions were constant while these *P. cornutum* were under human care, they were not exposed to natural, annual cooling periods and it is unknown if reintroduced *P. cornutum* would undergo successful brumation behaviors like their wild counterparts. In June 2021, we attached harmonic radar diodes and used a RECCO radar-emitting detector (RECCO R9 Detector; Lindholm, Sweden) to track 34 headstarted, reintroduced sub-adult and juvenile *P. cornutum* at TAFB.

On 12 October 2021, we found one of the harmonic tagged headstarted *P. cornutum* (#849-11), a sub-adult, burrowed into clay substrate, seemingly in preparation for the coming winter. We relocated this individual again on 19 October 2021 and confirmed this individual remained at the same site and in the same position (Fig. 1A). On 19 October, we located a second sub-adult (#849-1) exhibiting a similar behavior to the first, buried beneath plant litter and into clay soil (Fig. 1B). Both lizards were left undisturbed at their brumation sites, though visible tracking diodes protruding from the ground allowed for identification of each animal.

Both lizards were part of the 2019 cohort from the multi-partner collaborative reintroduction program between the OKC Zoo, TAFB, the University of Oklahoma, and the Oklahoma Department of Wildlife Conservation. They spent the first two years of their lives in human care at the OKC Zoo prior to reintroduction in June 2021. To our knowledge, this is the first reported account of headstarted, naïve, *P. cornutum* exhibiting brumation behaviors in the wild post-reintroduction. This has been an open question in *P. cornutum* conservation and headstarting programs, and our observations suggest that lizards raised in human care retain their natural proclivity to successfully enter brumation and go dormant for the winter. Our findings support the use and viability of headstarting programs as conservation tools for state imperiled *P. cornutum*

Fig. 1. Photographs of headstarted *Phrynosoma cornutum* burrowed into natural substrate for brumation through winter: A) lizard 849-11 buried in open clay substrate with attached harmonic radar diode visible; B) lizard 849-1 dormant under clay substrate and plant litter with harmonic radar diode and solar-powered CTT LifeTag (Cellular Tracking Technologies; Rio Grande, New Jersey, USA) visible above ground.

populations.

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***PHRYNOSOMA CORNUTUM* (Texas Horned Lizard). PREDATOR ATTACK SURVIVAL.** Ocular sinus squirting of systemic blood by *Phrynosoma cornutum* can clearly function as a deterrent to predation by some canid and felid mammalian predators in experiments (Middendorf and Sherbrooke 1992. Copeia 1992:519–527; Sherbrooke and Middendorf 2001. Copeia 2001:1114–1122, Sherbrooke and Middendorf 2004. Copeia 2004:652–658; Sherbrooke and Mason 2005. Southwest. Nat. 55:216–222; Sherbrooke et al. 2012. Herpetol. Rev. 43:386–391), but no clear examples of its functioning as a life-saving event in nature have been published. Field encountered deaths of *P. cornutum* (Munger 1986 Copeia 1986:820–814) and of *P. solare* (Sullivan and Sullivan 2017 Sonoran Herpetol. 30:54–57) have been attributed to coyotes but is often difficult to confirm. Here, I report on injuries to a female *Phrynosoma cornutum* (98 mm SVL, 44.2 g) collected live 11 July 1994 by Gretchen LeBuhn (1 mi north Portal Road, by San Simon [foothills] Road, Cochise County, Arizona, USA, on the Crown Dancer Ranch of John P. Caron.

The lizard was brought to an outdoor enclosure on the date of capture for feeding and care. Wounds were not examined and photographed until 23 July 1994 after rains in the outdoor enclosures cleared any dried blood and adhering debris from the wounds, or around the eyes that would have confirmed a blood-squirting defense. There were two ventral skin surface puncture wounds medial-posteriorly to both forelimb axilla, 27 mm apart from the outer edges, and 4 mm and 5 mm diameter; short tear wounds extended from the punctures towards the forelimbs. These appeared quite symmetrical and were interpreted as inflicted by ventral incisor teeth punctures of a predator. Dorsally there was a patch of hanging skin, 7 mm across at its base, in the middle of the lizard's back, exposing a healing area along the line of the middorsal white stripe. Possibly this injury resulted from grasping upper-jaw incisor teeth.

Following examination on 23 July, the lizard was released 7 September 1994 where it was captured. The following year it was recaptured near release area on 12 June 1995 and appeared in good health and all of the puncture wounds and tears were healed (Fig. 1). The lizard was preserved and deposited at the American Museum of Natural History (AMNH R-144475 [WCS 5990]) for X-ray examination, which showed no obvious damage

Fig. 1. Live adult female Texas Horned Lizard (*Phrynosoma cornutum*) showing two healed wounds in its ventral integument spaced at 27 mm apart, suggesting a successful escape from a coyote attack the previous year. Most probably this escape was due to a blood-squirting defensive response by the horned lizard during a natural predator attack. Lizard collected from Cochise County, Arizona, USA.

to skeletal elements.

During the interval between captures, I took canine measurements from skulls of potential predators in the Mammalogy Collection, Department of Ecology and Evolutionary Biology, at the University of Arizona, Tucson. These were of four potential predators, *Vulpes macrotis* (Kit Fox), *Urocyon cinereoargentens* (Gray Fox), *Lynx rufus* (Bobcat), and *Canis latrans* (Coyote), that may have inflicted the wounds noted on the female *P. cornutum,* which was apparently repulsed from the attack by the squirting of its blood from ocular sinuses. Distances between tips of upper and lower canine teeth were measured, but due to the dorsal/ventral arrangement of wounds, only lower canines were analyzed; measurements were as follows: *Vulpes macrotis*, 13.0–15.0 mm (N = 6); *Urocyon cinereoargentens,* 14.0–16.0 mm (N = 12); *Lynx rufus*, 17.0–21.0 mm (N = 13); *Canis latrans,* 25.0–27.5 mm (N = 8). In addition, lower canine measurements were made of three dogs living on the local ranch inhabited by the lizard. Lower canine measurements had a range of 31.0–34.0 mm, and accordingly, the best lower canine estimate for the 27 mm wound distance would be that of a coyote. Therefore, I conclude that this *P. cornutum* was attacked and bitten from the front of the head by a Coyote in such a way as to inflict the wounds noted, but the lizard was able to repel the attack by its defensive blood squirting response that allowed the lizard to escape, heal from its wounds, and carry on an apparently normal life.

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***PLESTIODON FASCIATUS* (Five-lined Skink). MORTALITY.** Pitcher plants in the family Nepenthaceae exhibit botanical carnivory by passively capturing and digesting mainly invertebrates, but occasionally vertebrate prey in their pitcher-shaped modified leaves (Fish and Hall 1978. Am. Nat. 172:183; Moldowan et al. 2019. Ecology 100:e02770). In North America, only one species, the purple pitcher plant (*Sarracenia purpurea*), is widespread and is associated with bogs and wetlands (Ellison et al. 2004. Am. J. Bot. 91:1930–1935). At least two amphibian species have been reported to fall prey to this plant species, *Notophthalmus viridescens* (Butler et al. 2005. Northeast. Nat. 12:1–10) and *Ambystoma maculatum* (Moldowan et al. 2019, *op. cit.*), but to my knowledge there are no reports of reptile prey in North American pitcher plants. Here I report on a lizard falling prey to a carnivorous plant in an open bog in Marquette County, Michigan, USA (46.60026°N, 87.46956°W; WGS 84; 198 m elev.).

On 5 September 2009, while examining the contents of dozens of *S. purpurea* from a sphagnum bog, I found a dead juvenile *Plestiodon fasciatus* (28 mm SVL, 35 mm tail length) in one of the plants. The lizard showed no sign of enzymatic digestion and appeared to have died soon before the discovery. A granite bedrock glade is located directly east of the bog and contained numerous *P. fasciatus.* It seems most likely that the young skink originated from this bedrock glade and wandered into the bog, where it was found 50 m from the edge of the glade. I deposited the dead skink at the University of Michigan Museum of Zoology (UMMZ 243248). In addition to the *P. fasciatus*, two live *Pseudacris crucifer* were removed from the pitcher plants. This is the first instance of a lizard falling prey to a pitcher plant in North America, although Nerz and Koch (2018. Russ. J. Herpetol. 25:147–150) found partially digested geckos in *Nepenthes* pictcher plant in New Guinea.

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***PODARCIS MURALIS* (Wall Lizard). ELEVATION.** Wall lizards are widespread in the northern hemisphere, well beyond their native range in southern Europe, and are currently spreading in North America (Engelstoft et al. 2020. Northwest. Nat. 101:50–55) and northwestern Europe (While et al. 2015. Proc. R. Soc. Lond. B 282:20142638). Hundreds of new populations have stemmed from deliberate introductions (Kolbe et al. 2013. Biol. Invasions 15:775–783), but also as accidental introductions associated with cargo carried by plane, boat, or truck (Michaelides et al. 2015. Molec. Ecol. 24:2702–2714). Up-slope range extension is also known to occur as a consequence of climate change in mountainous environments. In the Pyrénées for instance, *Podarcis* records nowadays abound above 1800 m and exist up to at least 2400 m (G. Pottier, pers. com.).

At 1240 h on 12 October 2021, we observed a male subadult *P. muralis* (Fig. 1) on the observation platforms at Pic du Midi de Bigorre Observatory, France (42.93558°N, 0.14258°E; WGS 84; 2809 m elev.). Although *P. muralis* are abundant in all areas surrounding the summit where the Pic du Midi de Bigorre is located, they have not been found above 2340 m, despite extensive surveys conducted in 2020 and 2021. This observation is a 469 m elevational extension for this species, and we suspect this was a human-mediated dispersal. This area is experiencing commercial development and receives helicopter delivered construction materials and it is likely the lizard hitch-hiked on construction related shipments.

Upward colonization of *P. muralis* in the Pyrénées, likely driven by climate warming, has been reported (Pottier 2012. Ministère de l'Écologie, du Développement durable et de l'Énergie, Bagnères de Bigorre, France), the species may also benefit from accidental human introductions since they are tolerant of urban habitats (Pottier 2012, *op. cit.*; Gherghel and Tedrow 2019. Acta Oecol. 101:103479). We hypothesize our observation is a potential founding event, and it is possible more

PHOTO BY FABIEN AUBRET

Fig. 1. Juvenile male *Podarcis muralis* found at location Pic du Midi de Bigorre, France at 2809 m elevation.

lizards are in the area, or others may be inadvertently delivered in future construction supply shipments. It remains to be seen whether this founding event will lead to a self-sustaining population at this record elevation, but due to their habits of overwintering near heated facilities at the Pic du Midi, 469 m lower in elevation, it is likely (i.e., reptiles have been reported to hibernate inside or under buildings [Schulz 1996. A Monograph of the Colubrid Snakes of the Genus *Elaphe* Fitzinger. Koeltz Scientific Books, Havlickuv Brod. 439 pp.]). Further monitoring is needed to confirm our hypothesis.

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***SCELOPORUS CHRYSOSTICTUS* (Yellow-spotted Spiny Lizard). ESCAPE BEHAVIOR.** *Sceloporus chrysostictus* is a common, small bodied (49–56 mm SVL) lizard endemic to the Yucatan Peninsula (Lee 1996. The Amphibians and Reptiles of the Yucatán Peninsula. Cornell University Press, Ithaca, New York. 500 pp.). The species occupies a wide range of habitats, but is particularly abundant in thorn forest, forest edge, savannas, and disturbed areas, where it is often observed perched on rock outcrops, logs, or at the bases of trees (Lee 1996, *op. cit.*; Campbell 1998. Amphibians and Reptiles of Northern Guatemala, the Yucatán and Belize. University of Oklahoma Press, Norman, Oklahoma. 380 pp.). Unlike other small sceloporines, *S. chrysostictus* is unusually wary and elusive, thus difficult to capture, although it is easy to observe (Lee 1996, *op. cit.*). Their escape behaviors include running to rock refuges, hiding between rock fissures, or among cacti, and spend an inordinately long time in these retreats before emerging again (Maslin 1963. Univ. Col. Stud. Ser. Biol. 9:1–20; Penner 1973. Bull. Maryland Herpetol. Soc. 9:6–7). Herein, we report a previously unreported escape behavior for *S. chrysostictus.*

At 1130 h on 25 August 2016, we observed an adult male *S. chrysostictus* in the Ejido X-Kobenhaltún, Municipality of Oxkutzcab, Yucatán, Mexico (20.0724°N, 89.5303°W; WGS 84; 117 m elev.). We were on a footpath in secondary semi-humid tropical forest surrounded by patches of farmland, and first noticed the lizard at a distance of ca. 10 m from us, on the ground. The lizard immediately perceived our presence and ran ca. 2 m towards a large *Mimosa bahamensis* tree and quickly climbed the trunk to a height of 3 m above the ground (Fig. 1). Observing that behavior, we slowly approached to within 2 m of the lizard to take photographs and, as we got closer, it climbed

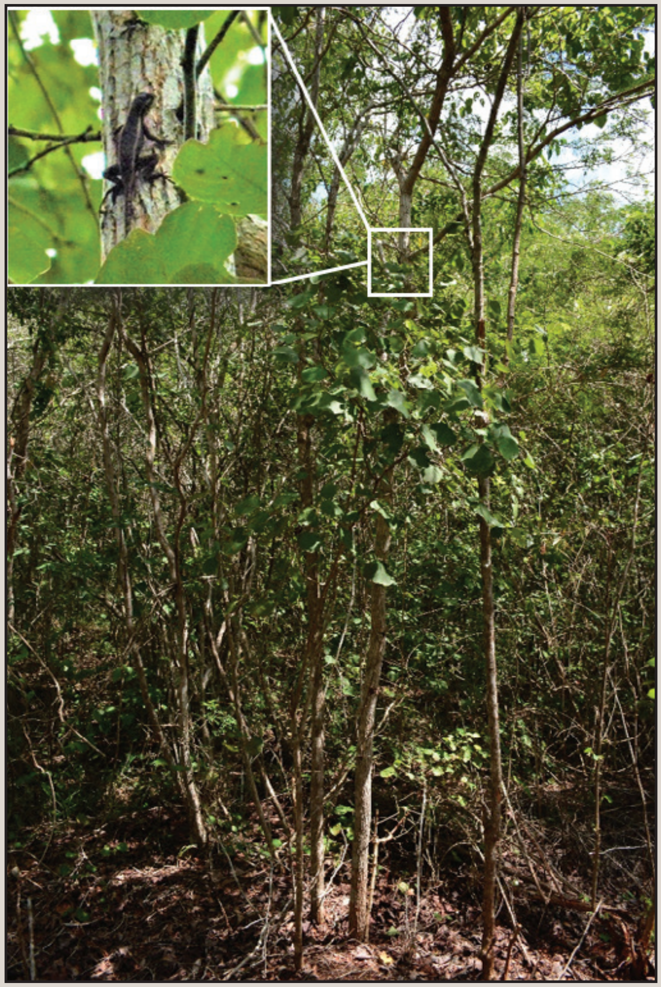

Fig. 1. Adult male *Sceloporus chrysostictus* climbing a tree of *Mimosa bahamensis* 3 m above the ground in Yucatán, Mexico.

Fig. 2. Adult male *Sceloporus chrysostictus* climbing a tree of *Lysiloma latisiliquum* ca. 1 m above the ground in Yucatán, Mexico.

ca. 30 cm higher and moved towards the opposite side of the trunk. After this movement, the lizard remained motionless with a tense body posture, the head and arms lifting the body from the trunk and looked at us. We remained within 2 m to observe and take photographs, and during this time the lizard remained motionless. After 45 minutes, we left and do not know how long after it remained there.

To our knowledge this is the first report of arboreal escape behavior or use in *S. chrysostictus*. A previous study on the habitat preferences of *S. chrysostictus* did not find use of arboreal perches (Penner 1973, *op. cit.*) and in our combined almost 40 years of lizard sampling we have only observed limited arboreal behavior. In these rare instances of tree use as an escape refuge occurred when rocks or other typical ground refuges were not nearby, and in one previous observation from 19 July 2012, one individual climbed a *Lysiloma latisiliquum* tree trunk to a height of ca. 1 m (Fig. 2). Thus, it appears this tree climbing behavior is rare in *S. chrysostictus*.

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***SCELOPORUS UNDULATUS* (Eastern Fence Lizard) and *SCELOPORUS MEGALEPIDURUS* (Largescale Spiny Lizard; Espinosa Corredora). MATING HEADBOB DISPLAYS.** Headbob displays are common in lizards and involve species-specific up and down motions of the head or body, conveying information about the individual, sex, or species identity (Carpenter 1978. Contr. Biol. Geol. Milw. Publ. Mus. 18:1–71; Martins 1993. Am. Nat. 142:994–1018). Headbobs can be performed by both sexes and be directed towards either sex, but generally males and females do not headbob simultaneously. Here, we report on male and female headbobbing behavior associated with breeding in two *Sceloporus* species, *S. undulatus* in Indiana, USA, and *S. megalepidurus* in Veracruz, Mexico.

During the breeding season of *S. undulatus*, on 15 June 2021, we observed a pair of *S. undulatus* mating on rocks along the shore of Lake Monroe in Bloomington, Indiana, USA (39.01790°N, 86.46055°W; WGS 84; 232 m elev.). We were 5 m away from the two lizards and watched them mating for ca. 6 min before the lizards moved ca. 10 cm parallel to the water and began performing a tandem, post-copulatory headbob display. During this duet, which was also filmed, the male performed a single headbob display (17 up and down motions using the front two legs for 10 sec) while the female simultaneously performed a single headbob display (five up and down motions using the front two legs for 3 sec). After 65 sec the male then performed a series of rapid up and down motions commonly used during courtship, known as a shudderbob (Tinkle 1967. Misc. Publs. Mus. Zool. Univ. Mich. 132:1–182) and moved away from the female before performing a second headbob display, this time moving towards her (11 up and down motions using the front two legs for 7 sec). The female then moved out of view, and we stopped filming.

During the breeding season of *S. megalepidurus* in Mexico, we made two observations of separate pairs of *S. megalepidurus* displaying. The first observation was on 2 September 2013, when we observed a pair of *S. megalepidurus* displaying on a green agave plant at the Alchichica Lagoon, Puebla (19.40662°N, 97.40647°W; WGS 84; 2345 m elev.), 25 km W of Perote, Mexico. Over the course of the 14 min and 33 sec observation, which we filmed at a distance of 5 m, the lizards performed a series of seven headbob duets. The female performed two to four up and down motions for each headbob display, whereas the male performed four to five up and down motions for each headbob display, preceded by shudderbobs in five out of the seven cases. These duets lasted 4–8 sec, and after the final duet, the female ran off and this courtship did not result in successful mating. The male remained on the agave plant after the female ran off, and we stopped filming at this point.

Our second observation took place on 16 September 2013, when we observed another pair of *S. megalepidurus* displaying on a green agave also at the Alchichica Lagoon. This observation occurred further along the hillside, several meters away from the first observation. Over the course of our 11 min and 13 sec observation period, filmed at a distance of 5 m, we observed 2 headbob duets between a male and female. The first duet occurred at 2 min and 56 sec into our observation; the male performed a series of 5 up and down motions with his front two legs for 9 sec, while the female simultaneously bobbed her head twice for 4 sec with her legs remaining stationary. The second duet occurred 1 min and 3 sec after the first display and the male shudderbobbed and then performed 5 headbobs using the front two legs for 12 sec while the female simultaneously bobbed her head twice for 6 sec, and again her legs remained stationary. Similar to our first *S. megalepidurus* duet display, courtship did not result in successful mating during this timeframe, though in this case both lizards remained next to each other on the agave pad and we stopped filming.

There are several similarities and differences between these two species in terms of communication and basic ecology. Both are territorial, polygamous lizard species that perform multimodal signaling behaviors (visual and chemical) for inter- and intrasexual communication (e.g., Romero-Diaz et al. 2021. Proc. R. Soc. B. 288:20210256). However, *S. undulatus* are oviparous lizards with a summer breeding season, whereas *S. megalepidurus* are viviparous lizards that breed in the fall.

Though general headbob displays have been well documented in *Sceloporus* lizards, particularly *S. undulatus* (e.g., Rothblum and Jenssen 1978. Anim. Behav. 26:130–137; Smith and Alder 1999. Horm. Behav. 36:39–52), to our knowledge, this is the first documented occurrence of males and females headbobbing simultaneously during courtship or immediately after mating in the field. Though these kinds of intersexual duet displays have rarely been observed in the field, similar behaviors have been observed in captivity in other species of lizards. For example, male *Calotes versicolor* (Oriental Garden Lizard) have been observed in semi-natural enclosures performing a series of headbobs followed by the female headbobbing in response (Pandav et al. 2007. Curr. Sci. India. 93:1164–1167). These behaviors are also similar to post-mating behaviors in *Amphibolurus barbatus* (Bearded Dragons) in a semi-natural enclosure, whereby males will headbob after mating while the female performs a head roll behavior (Brattstrom 1971. Copeia 1971:484–497).

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***STENOCERCUS GUENTHERI* (Günther's Whorltail Iguana). PREDATION.** *Stenocercus guentheri* occurs in the Andes of northern Ecuador and southern Colombia (Torres-Carvajal 2007. Herpetol. Monogr. 21:76–178). Known predators of *S. guentheri* are birds of prey such as Barn Owls (*Tyto alba*; Cadena-Ortiz et al. 2019. Ornitol. Colomb. 17:eNB03), Short-eared Owls (*Asio ammeus*; Pozo-Zamora et al. 2017. REO. 1:1–7), Burrowing Owls (*Athene cunicularia*; Cadena-Ortiz et al. 2016. Rev. Bras. Ornitol. 24:122–128), American Kestrels (*Falco sparverius*; Pozo-Zamora et al. 2017. Rev. Peru. Biol. 24:145–150), Carunculated Caracaras (*Phalcoboenus carunculatus*; de Vries et al. 1983. Historia natural del curiquingue (*Phalcoboenus carunculatus*) en los páramos del Antisana y Cotopaxi del Ecuador. Ediciones de la Universidad Católica de Quito, Ecuador. 83 pp.), and the Golden-bellied Snakelet (*Erythrolamprus epinephelus*; Cadena-Ortiz et al. 2017. Herpetozoa 30:93–96). Here we report on a snake, *Mastigodryas pulchriceps*, preying on *S. guentheri* from Ecuador.

On 18 September 2021, at 0837 h, we observed and photographed an adult *M. pulchriceps* preying on an adult *S. guentheri* (ca. 150 mm SVL) in a dry inter-Andean forest near the town of Tababela, Pichincha Province, Ecuador (0.1070°S, 78.3670°W; WGS 84; 2300 m elev.). When we first made our observation, the snake was in the process of swallowing the lizard and had the head and one arm of the *S. guentheri* inside its mouth (Fig. 1). The lizard did not move and appeared dead at this time. As we approached the snake, it stopped swallowing, likely due to our movement and presence. To avoid further disturbance, we left a cell phone 2 m away from the snake to record the event as we slowly moved away and completely left the site (video: http://doi.org/10.15781/9m61-qx84).

PHOTO BY MARÍA CRISTINA RÍOS

Fig. 1. Predation of *Stenocercus guentheri* by *Mastigodryas pulchriceps* in an inter Andean dry forest, Tababela, Ecuador.

After we left, the phone recorded the snake completing the ingestion process; 1 min 20 sec after we left the snake started ingesting the lizard again and completely ingested the lizard after 12 min. The snake remained in the site for 1 min 30 sec, with jaw and neck movements, frequently sticking out its tongue, then it began to move slowly until it left the frame of the camera. After 30 min, we returned and found no evidence of the snake, we searched the surroundings without success.

After *Erythrolamprus epinephelus* (Cadena-Ortiz et al. 2017. Herpetozoa 30:93–96), this is the second non-avian predator feeding on *S. guentheri*, and the first prey item recorded for *M. pulchriceps*. Nevertheless, *M. boddaerti* and *M. melanolomus* are known to prey mainly on lizards (Montingelli et al. 2019. J. Zool. Syst. Evol. Res. 57:205–239). Lack of data on *M. pulchriceps* is likely due to the unsolved taxonomy of *Mastigodryas* in Ecuador (Montingelli et al. 2011. S. Am. J. Herpetol. 6:189–197).

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***TILIQUA NIGROLUTEA* (Blotched Bluetongue Skink). PRECOCIOUSNESS.** While mammals and birds attract much research attention for exhibiting complex parental care, reptiles are mainly precocious. For example, >95% of lizards abandon their eggs, and the remaining species do not feed their young, leaving the offspring to fend for themselves from birth or hatching (Shine 1988. *In* Gans and Huey [eds.], Biology of the Reptilia, Vol. 16. pp. 275–330. Alan R. Liss, New York, New York; Somma 2003. Parental Behavior in Lepidosaurian and Testudinian Reptiles. Krieger Publishing, Malabar, Florida. 174 pp.). Within precocious reptiles, at one end of the continuum many reptiles provision their young with yolk reserves than can be used for weeks (Ar et al. 2004. *In* Deeming [ed.], Reptilian Incubation: Environment, Evolution and Behaviour, pp. 143–185. Nottingham University Press, Nottingham, UK), and in at least some of these species the young apparently do not feed for days to weeks (e.g., Waters and Burghardt 2005. Anim. Behav. 69:363–374). Herein, I describe an example from the opposite ('superprecociousness') end of the continuum: *Tiliqua nigrolutea* neonates fed on their birth day.

On 5 February 2003, I found a pregnant *T. nigrolutea* feeding on flies attracted to horse dung at Blue Water Holes in Kosciusko National Park, New South Wales, Australia (35.62598°S, 148.68279°E; WGS 84; 1195 m elev.). I captured the lizard for photographs given its striking coloration and its obvious pregnant condition and housed it overnight in a tub with some vegetation. The following morning, upon checking the lizard at ca. 0900 h, I discovered the lizard had given birth to one neonate. As the first neonate wiggled free of its fetal membranes the mother gave birth to a second neonate, quickly followed by three more neonates over the next two hours. After watching the birth of the second and third young and having read that the young *T. nigrolutea* sometimes consume their fetal membranes at birth, I became interested in whether they would feed immediately.

I conducted a quick and crude experiment and quickly retrieved some packaged (refrigerated) sliced ham, and offered the fourth and fifth neonate small pieces as soon as they were free of their mother but before they were free of their fetal membranes. The two neonates tongue-flicked the ham and consumed it vigorously within seconds. I did not offer ham to the first three neonates. I did not observe the neonates to ingest their fetal membranes as observed by others (e.g., Bartlett 1984. Brit. Herpetol. Soc. Bull. 10:34–35; Edwards and Jones 2004. Herpetofauna 34:113–118).

My crude experiment and observations demonstrated not only that *T. nigrolutea* neonates feed on their birth day, but will also feed before they were completely freed from their fetal membranes. Moreover, although not in their natural diet, neonates recognized the refrigerated ham offerings as food, indicating a strong chemosensory feeding response very early in life, although it is possible that the neonates likened the ham to their fetal membranes. There is evidence of early feeding in neonate reptiles including lizards, but the vast majority of studies did not attempt to feed neonates from birth/hatching because successful experiments often require sufficient sample sizes of individual feeding responses; neonates are often tested later when sufficient numbers of young would feed. For example, Burghardt (1973. Copeia 1973:178–181) induced feeding in oviparous 6-d-old neonate skinks (*Plestiodon fasciatus*) in a study testing differential responsivity to various prey chemicals.

Although it may occur in the wild, we can find no observations of lizards or other reptiles feeding on their day of birth. Some reptiles are known to delay feeding out of necessity; for example, hatchlings of ground-nesting reptiles can spend several days to a week excavating their way out of the nest and dispersing to feeding grounds (e.g., Kraemer and Bennett 1981. Copeia 1981:406–411; Troyer 1982. Science 216:540–542). In the laboratory, hatching Chuckwallas (*Sauromalus hispidus*) did not feed until 6–11 days old (Carl and Jones 1979. J. Herpetol. 13:293–296), and Crested Geckos (*Leptodactylus lugubris*) did not begin feeding until after their first molt at age 2–3 days (Hamper 2005. Crested Geckos in Captivity. Professional Breeders Series. ECO Herpetological Publishing and Distribution, Rodeo, New Mexico. 102 pp.). In a case that is likely atypical, hatchling Green Iguanas (*Iguana iguana*) must spend their first few weeks locating older conspecifics and consuming their fecal material to obtain microbes best adapted for their hindgut fermentation system, prior to feeding on vegetation (Troyer 1982, *op. cit.*). One possibility is that viviparous reptiles feed sooner than oviparous species due to birthing in, or very near, feeding habitat, rather than having to escape a subterranean nest. Similarly, early feeding could be related to the consumption of fetal membranes, which although I did not observe, occurs in this species (Bartlett 1984, *op. cit.*).

The provision of residual yolk, which can influence neonatal growth rates, presumably allows neonates to survive and grow without obtaining food immediately upon hatching (Clutton-Brock 1991. The Evolution of Parental Care. Princeton University Press, Princeton, New Jersey. 367 pp.). Such provision may mislead researchers to assume a delay in the age at first feeding exists, when in some species it may not. Neonates feeding on their birthday can be described as "superprecocious", a term used by some researchers for birds and mammals that are particularly precocious (e.g., Dekker and Brom 1992. Zoologische Verhandelingen 278:19–31). A noteworthy example of superprecociousness in reptiles is early hatching, whereby, in particular, lizards hatch early in response to the threat of predation (reviewed in Doody 2011. Integr. Comp. Biol. 51:49–61). A framework of precociousness for reptiles, vertebrates or animals has not been offered, however. Precociousness could include a number of behaviors at an early age such as foraging, feeding, moving, dispersing, hiding, escaping from or overwintering in the nest, or choosing a shelter/sleeping site. Age at first feeding and other traits of precocious offspring represent critical life history parameters that are underappreciated and understudied, both within life history studies of populations and comparative evolutionary studies across taxa. While this lack of study might be attributed to the heavy research bias on mammals and birds, the secretive nature of hatching and birthing in reptiles in nature and the pursuit of more experimental approaches with older neonates in the laboratory have also likely contributed.

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TROPIDURUS TORQUATUS **(Amazon Lava Lizard). PREDATION.** *Tropidurus torquatus* is a medium-sized South America lizard with a wide distribution, occurring in open and disturbed habitat areas and are often in urban environments (Rodrigues 1987. Arq. Zool. 31:105–230). It has a generalist diet and is known to feed on arachnids, flowers, fruits, gastropods, insects (De Carvalho et al. 2007. Rev. Bras. Zool. 24:222–227) and occasionally lizards, snakes (Sazima and D'Angelo 2011. Rev. Bras. Ornit. 19:150–452; Siqueira et. al. 2013. Herpetol. Nat. Hist. 3:15–27) and mammals (Mafia et. al. 2014. Rev. Bras. Ornit. 22:410–412).

On 13 January 2021, at 1220 h, I observed a Pale-breasted Thrush (*Turdus leucomelas*), perched on a school windowsill ca. 2 m above the ground at the Universidade Federal do Espírito Santo (UFES), in the town Vitória, Espírito Santo, in southeastern Brazil (20.27620°S, 40.30522°W; WGS 84; 10 m elev.). The bird caught the lizard midbody and beat is against the floor near student desks. During the first attack, the lizard's tail autotomized and it fled under nearby chairs 1 m away, while the bird immediately swallowed the tail. After swallowing the tail, the bird continued to pursue the lizard and repeatedly caught and beat the lizard on floor eight times. After 12 min, the lizard was subdued and was no longer moving the bird swallowed it headfirst.

In this observation, the tail autotomy defense strategy was not successful for this *T. torquatus*. Instead, the predator handled and consumed the autotomized body part, then continued pursuing the lizard, rather than handle and consume the autotomized body part and not continue to pursue the prey (Emberts et al. 2019. Biol. Rev. 94:1881–1896.) To my knowledge, this is the first report of a *T. torquatus* being predated on by a songbird.

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SQUAMATA — SNAKES

AGKISTRODON BILINEATUS **(Common Cantil). DIET.** *Agkistrodon bilineatus* is a medium-sized (adults commonly exceed 800 mm in total length) pitviper that occurs at low and moderate elevations along the Pacific versant from southern Sonora, Mexico, southward through southern Guatemala to central El Salvador, and the extreme western Honduras on the Caribbean versant (Campbell and Lamar 2004. The Venomous Reptiles of the Western Hemisphere. Cornell University Press, Ithaca, New York. 870 pp.; Porras et al. 2013. Amphib. Rept. Conserv. 7:48–73).

FIG. 1. Partially digested *Heloderma horridum* and one squamate egg regurgitated by an *Agkistrodon bilineatus* from Colima, Mexico.

This species is considered a generalist predator that feeds on a wide variety of vertebrates (Gloyd and Conant 1990. Snakes of the *Agkistrodon* Complex: A Monographic Review. Society for the Study of Amphibians and Reptiles, Contributions to Herpetology, No. 6, Ithaca, New York. 614 pp.). However, reports on specific natural prey items for *A. bilineatus* are scarce. These include the Central American Tree Snake (*Imantodes gemmistratus*; Bogert and Oliver 1945. Bull. Amer. Mus. Nat. Hist. 81:285–360), Pocket Mouse (*Liomys pictus*; Duellman 1954. Occas. Papers Mus. Zool. Univ. Michigan 560:1–24), Rice Rat (*Oryzomys palustris*; Gloyd and Conant 1990, *op cit.*), Western Spiny-tailed Iguana (*Ctenosaura pectinata*; Loc-Barragán and Carbajal-Márquez 2016. Mesoam. Herpetol. 3:733–734), and Clouded Anole (*Anolis nebulosus*; Nieto-Toscano and Martínez-Coronel 2021. Herpetol. Rev. 52:415). Herein, we document a new prey item in the diet of *A. bilineatus*.

At 2330 h on 19 July 2021, in the Municipality of Manzanillo, Colima, Mexico (19.1776°N, 104.0753°W; WGS 84; 224 m elev.), we found an adult male *A. bilineatus* (725 mm SVL, 190 mm tail length, 482.7 g [without prey]) crossing a road through tropical deciduous forest. The snake had a pronounced bulge at midbody indicating a recent meal, and after capture, it regurgitated a partially digested juvenile *Heloderma horridum* (95 mm total length, 13.6 g [half of body missing]) and one squamate egg (17 mm long, 10 mm wide, 0.85 g; Fig. 1). Although helodermatid lizards have many potential predators, reports of these events are rare in the literature. Previous confirmed predators for *H. horridum* include the Central American Boa (*Boa sigma*) and indigo snakes (*Drymarchon* sp.; Beck 2005. Biology of Gila Monsters and Beaded Lizards. University of California Press, Berkeley, California. 247 pp.). To our knowledge, this is the first predation record on a helodermatid by an *Agkistrodon* species.

We deposited a photograph of the specimen *A. bilineatus* in the digital collection of University of Texas at Arlington (UTADC 9729). Collecting permits were provided by Dirección General de Vida Silvestre SEMARNAT (SGPA/DGVS/13338/19) issued to Juan Miguel Borja Jiménez with an extension to JMJ.

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***AHAETULLA PRASINA* (Oriental Vine Snake). DIET.** *Ahaetulla prasina* is a common diurnal, arboreal snake in southeast Asia that reaches a total length of 1.97 m and frequents forest edges, as well as open areas such as parks and gardens. Its diet is reported to comprise lizards and birds (Henderson and Binder 1980. Contrib. Biol. Geol. Milwaukee Public Mus. 38:1–38; Das 2010. A Field Guide to the Reptiles of South-east Asia. New Holland Publishers [UK], Ltd., London. 376 pp.), with geckos, skinks, and agamid lizards being part of its dietary spectrum (Leviton 1968. Philippine J. Sci. 96:73–90; Dunbar and Dunbar 2015. Herpetol. Rev. 46:264–265; Lalbiakzuala et al. 2019. Herpetol. Rev. 50:796–797; Will 2018. Singapore Biodiv. Rec. 2018:9–10). Records of frogs in the diet of the species (e.g., Mertens, 1930. Abh. Senckenberg. Nat. Ges. 42:115–344) may refer to individuals in captivity.

On 20 July 2021, at 1541 h, an adult (ca. 1.5 m total length) *A. prasina* was observed at the edge of a disturbed mixed dipterocarp forest, near buildings of the Camp Permai Resort (1.75286°N, 110.31892°E; WGS 84; ca. 60 m elev.), in the foothills of Gunung Santubong, Sarawak, East Malaysia (Borneo). It had just grasped an adult (ca. 60 cm SVL) *Cnemaspis kendallii*

FIG. 1. An *Ahaetulla prasina* at an early stage of predation on *Cnemaspis kendallii* at the base of Gunung Santubong, Sarawak, Malaysia.

(Kendall's Day Gecko) by the left axillary region while the prey was resting on a leaf. The snake was observed in a head-down position on a narrow sapling (2.5 cm diameter), ca. 34 cm from the ground (Fig. 1), and proceeded to swallow the lizard head-first. The process of ingestion, until most of the lizard's tail disappeared, took ca. 6 min. The prey species was identified based on dark transverse bars on a brown dorsum; tail banded dorsally as well as ventrally; rounded pupils; radiating marks from the orbit of eyes; and non-expanded lamellae of fingers and toes. *Cnemaspis kendallii* is a mid-sized (up to 80 mm SVL), day-active gecko, encountered in lowland forests of western Borneo, and a single species occurs on the Santubong massif (Nashriq and Das 2021. J. Threat. Taxa 13:18792–18799). It is a new prey item for *A. prasina.*

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***BOA CONSTRICTOR* (Boa Constrictor). DIET.** *Boa constrictor* is widely distributed throughout South America and on the islands of Trinidad and Tobago and Margarita Island in the southern Caribbean (Reynolds and Henderson 2018. Bull. Mus. Comp. 162:1–58). This species inhabits a variety of habitats and biomes, including anthropized areas (Barbosa et al. 2006. Rev. Biol. Ciênc. Terra. 2:1–18), having terrestrial, arboreal and, in some cases, even aquatic habits (Pereira-Junior et al. 2011. NEPAS 1–7). It is predominantly nocturnal, but can also be active during the day, and feeds mostly on mammals, birds, and lizards (Reinert et al. 2021. Herpetol. Conserv. Biol. 16:211–224). This note reports the first predation record on the bat *Artibeus planirostris* by *B. constrictor.*

The Universidade Católica do Salvador in Salvador, Bahia, Brazil (12.94851°S, 38.41373°W; SIRGAS 2000; 44 m elev.) is surrounded by an urban remnant of Atlantic Forest and wild animals occasionally occur on campus. These animals have been monitored since 2008 by the Herpetofauna of the North Coast of Bahia project (Tinôco 2019. Restinga: Herpetofauna do Litoral Norte da Bahia. Barro de Chão, Salvador, Bahia, Brazil. 571 pp.). On 27 March 2021, a specimen of *B. constrictor* was found on the Pituaçu campus of the Universidade Católica do Salvador (female, 32.9 mm head width, 46 mm head length, 780 mm SVL, 92.8 mm tail length, 508 g). After being handled for capture, it regurgitated a specimen of *A. planirostris* (22.3 mm head width, 79.3 mm total length, 58 g; Fig. 1). *Artibeus planirostris* is a bat belonging to the family Phyllostomidae, which includes frugivorous species that play important roles in seed dispersal (Reis et al. 2017. História Natural dos Morcegos Brasileiros: Chave de Identificação de Espécies. Technical Books Editora, São Paulo, São Paulo. 256 pp.). Bats in the family Phyllostomidae are widespread in the Americas, inhabiting forested areas and forest fragments and are characterized by their leaf-shaped nose, which varies in shape according to the species (Brusco et al. 2009. FAP. 3:19–29).

PHOTOS BY CAUÃ MEDRADO DE ARAÚJO

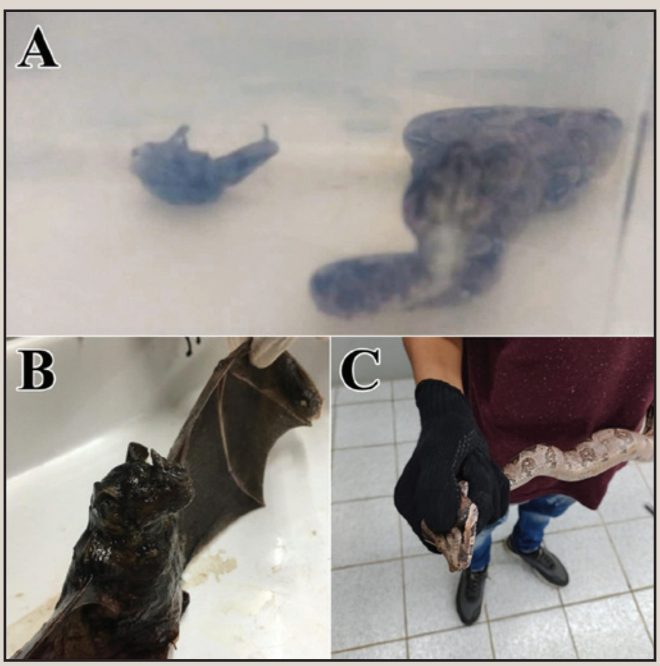

Fig. 1. A) *Boa constrictor* after regurgitating an *Artibeus planirostris* from Bahia, Brazil; B) closeup of *A. planirostris*; C) closeup of *B. constrictor.*

Bats, in general, are common items in the diet of arboreal boid species (Pizzato et al. 2009. Amphibia-Reptilia 30:533–544; Carvalho et al. 2019. Acta Amazon. 49:24–27; Reinert et al. 2021, *op. cit.*). However, in Brazil, the only boid recorded preying on bats of the genus *Artibeus* was *Corallus hortulana* in the Amazon Forest (Carvalho et al. 2019, *op. cit.*). Despite the importance of predation in the dynamics of wildlife populations, predation on bats can be difficult to observe (De-Moraes-Costa et al. 2016. Bol. Soc. Bras. Mastozool. 77:131–142). Our observation expands our understanding of bat–snake interactions in the Neotropics.

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***BOTHROPS ATROX* (Lancehead). HABITAT USE.** *Bothrops atrox* (Crotalidae) is a common snake in central Amazonia. It is primarily nocturnal and can be found in flooded areas during the rainy season (Turci et al. 2009. Bio. Neotrop. 9:197–206). Adults are normally found foraging on the ground, at the margins of small ponds or near swamps. Juveniles tend to be more arboreal and are commonly found hiding among vegetation, probably as a strategy to avoid terrestrial predators while being close to preferred habitats for anurans, which are their primary prey (Oliveira and Martins 2001. Herpetol. Nat. Hist. 8:101–110).

At 2240 h on 2 March 2021, in the Tacana Indigenous Territory (13.90811°S, 67.54119°W; WGS 84), La Paz Department, Bolivia, we found a juvenile *B. atrox* sitting on top of a leaf of *Eichornia* sp. (Fig. 1). The site was ca. 100 m from dry land, with 1 m depth of water, within a large mass of floating vegetation that also included unidentified graminoid macrophytes. We also found a group of three small lizards (*Cercosaura schreibersii*) near the snake that were likely potential prey.

To our knowledge, this is the first report of a juvenile *B. atrox* found on top of aquatic vegetation, since all previous reports mention sightings of adult individuals near the edge of swamps or ponds (Oliveira and Martins 2001, *op. cit.*; Turci et al. 2009,

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Fig. 1. Juvenile *Bothrops atrox* among *Eichornia* sp. in Bolivia.

op. cit.).

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***CROTALUS ADAMANTEUS* (Eastern Diamond-backed Rattlesnake). REPRODUCTION.** Breeding behavior in most temperate crotalid species occurs in a continuous mating season between late summer and early fall (Aldridge and Duvall 2002. Herpetol. Monogr. 16:1–25). For *Crotalus adamanteus*, courtship and copulation are suggested to follow similar patterns (Timmerman and Martin 2003. SSAR Herpetol. Circ. 22:1–74). However, it has also been suggested that *C. adamanteus* might have a bimodal breeding cycle, with snakes mating in fall and again in early spring, interrupted by a retreat to and emergence from hibernacula to escape cool temperatures. Palis et al. (2012. Herpetol. Rev. 43:657–658) noted copulatory behavior in February and March in Georgia, USA, which suggests the possibility of an extended breeding season in the northern part of the *C. adamanteus* range. At the southern extent of their range, *C. adamanteus* may breed into December and January (Timmerman and Martin 2003, *op. cit.*), as this region experiences more stable year-round temperatures. However, limited data are available on breeding timing and life history for this species, particularly in the southernmost part of their distribution.

We conducted a radio-telemetry study on ten adult *C. adamanteus* (6F:4M) from Dec 2015 to Mar 2018 on the campus of Florida Gulf Coast University, Fort Myers, Florida, USA (26.4637°N, 81.7753°W; WGS 84). Over the course of this study, we observed multiple copulation events (N = 19; Table 1), with at least one event per month between the months of October and April. We observed additional instances of potential mating events, such as two known snakes within a few meters of each other yet report here only events where visual confirmation of copulation was obtained.

The data provided here provides a more comprehensive understanding of the mating phenology of *C. adamanteus* in southern Florida. The sub-tropical climate of southern Florida is defined by wet (May–October) and dry (November–April) seasons. The breeding season for *C. adamanteus* in South Florida coincides with the dry season, and reproduction may be influenced more by precipitation than by temperature. Without the need to seek hibernacula for prolonged cold weather, snakes and other ectotherms in southern Florida remain active throughout the year. This more persistent breeding season differs from previous, albeit sparse, observations of mating behavior for this species. More research is needed to investigate behavioral and physiological characteristics of *C. adamanteus* throughout its range, including the timing of spermatogenesis, vitellogenesis, gestation, and parturition.

Table 1. Confirmed copulation events of *Crotalus adamanteus* on the Florida Gulf Coast University campus, Fort Myers, Florida, USA, 2015–2018. Snake ID labeled "FGCU-#" were radio-tagged snakes, while "P-#" represent PIT-tagged but not radio-tagged snakes. "Unk" is given for any rattlesnake neither PIT-tagged nor radio-tagged.

Month	Day	Time	Temp (°C)	Female ID	Male ID
October	10	1208 h	28	FGCU-5	FGCU-4
	15	1626 h	29	FGCU-5	Unk
	19	1238 h	27	Unk	FGCU-4
	26	1257 h	28	FGCU-5	FGCU-4
November	4	1504 h	27	P-2	FGCU-4
	7	1219 h	26	FGCU-5	FGCU-4
	9	1223 h	23	FGCU-1	FGCU-8
	16	1314 h	26	P-5	FGCU-8
	28	1134 h	27	FGCU-1	FGCU-8
December	7	1153 h	26	Unk	FGCU-8
January	9	1600 h	25	FGCU-1	FGCU-2
February	16	1340 h	24	FGCU-5	FGCU-4
	21	1114 h	25	P-1	FGCU-7
March	11	1111 h	28	Unk	FGCU-8
	14	1429 h	23	Unk	FGCU-4
April	4	1511 h	25	FGCU-6	Unk
	11	1540 h	29	Unk	FGCU-7
	14	1502 h	29	P-1	FGCU-7
	29	1039 h	27	Unk	FGCU-1

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***CROTALUS ATROX* (Western Diamond-backed Rattlesnake). PREDATION.** Rattlesnakes in the genus *Crotalus* have various vertebrate predators, including Red-tailed Hawks (*Buteo jamaicensis*) and Coyotes (*Canis latrans*; Klauber 1982. Rattlesnakes. Their Habits, Life Histories, and Influence on Mankind. Abridged Edition. University of California Press. Berkeley, California. 350 pp). *Buteo jamaicensis* is known to prey on *Crotalus viridis* in Idaho, USA (Steenhof and Kochert 1985. Oecologia. 66:6–16) and *Crotalus cerastes* (Sidewinder) near the border of United States and Mexico. In some harsh environments, reptiles are the most abundant potential prey and can make up the bulk of the diet of *B. jamaicensis* (Babb 2017. Southwest. Nat. 62:284–285). Shaw and Campbell (1974. Snakes of the American West, Alfred A. Knopf, Inc., New York, New York. 330 pp.) included *C. latrans* as potential predators of rattlesnakes. *Crotalus enyo* and *C. ruber* have been reported as prey items of *C. latrans* in winter (1996–1997) in the Vizcaino region Baja California Sur, México

Fig. 1. *Crotalus atrox* predated by a *Buteo jamaicensis* (Red-tailed Hawk) in Chihuahua, México.

Fig. 2. *Canis latrans* (Coyote) scat with a rattle segment of *Crotalus* sp. in Durango, México.

(Grajales-Tam et al. 2003. Acta Zool. Mex. 89:17–28). Here, we document two cases of predation on rattlesnakes in two natural protected areas in the Chihuahuan Desert in México.

At ca. 1100 h on 26 September 2020, we observed a *B. jamaicensis* at ground level devouring a *C. atrox* (Fig. 1) in a pecan field in the Natural Protected Area Médanos de Samalayuca, in the Municipality of Juárez, Chihuahua, México (31.20110°N, 106.47699°W; WGS 84; 1300 m elev.). We spent ca. 20 min filming and photographing the event. On 16 July 2011, at the Natural Protected Area of Mapimí, Durango, México (26.68730°N, 103.74071°W; WGS 84; 1160 m elev.), at ca. 1225 h, we discovered a scat of *C. latrans* with a rattle of *Crotalus* sp., composed of three segments and a final button (Fig. 2), the largest segment measured 8.5 × 5.1 × 3.3 mm in length, width, and height, respectively. Photos are deposited at the Colección Científica de Vertebrados UACJ (CCV-UACJ). Four *Crotalus* species are reported in the Natural Protected Area (*C. atrox*, *C. lepidus*, *C. scutulatus*, and *C. molossus*; Programa de Conservación y Manejo Reserva de la Biosfera Mapimí, México. 2006. CONANP. 179 pp.). Natural history observations of rattlesnake species are important because they contribute to the criteria that assigns the risk category in México.

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***CROTALUS OREGANUS HELLERI* (Southern Pacific Rattlesnake). DIET.** *Crotalus oreganus helleri* is considered a dietary generalist, consuming lizards when young and transitioning to a mammalian diet at ca. 0.55 m total length (Mackessy 1988. Copeia 1988:92–101). Avian prey are rarely taken, and field observations of predation on birds are uncommon (Klauber 1972. Rattlesnakes: Their Habits, Life Histories, and Influence on Mankind. University of California Press, Berkeley, California. 1533 pp.; Dugan 2011. Ph.D. Dissertation, Loma Linda University, Loma Linda, California. 143 pp.).

On 15 July 2021, at 1300 h, a subadult *C. o. helleri* (575 mm total length) was observed consuming a *Chondestes grammacus* (Lark Sparrow) within native vegetation at a residence in Fallbrook, San Diego County, California, USA (33.38731°N, 117.25441°W; WGS 84). When initially observed, the snake had consumed the head and neck of the sparrow. The snake completed consuming the bird and was subsequently collected for relocation at the request of the homeowner. This observation represents the first record of *Chondestes grammacus* in the natural diet of *Crotalus o. helleri* and adds to the short list of documented avian prey species.

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***CROTALUS PRICEI* (Twin-spotted Rattlesnake) and *CROTALUS TRANSVERSUS* (Cross-banded Mountain Rattlesnake). REVERSE CRYPSIS BEHAVIOR.** Snakes employ a variety of antipredator tactics to evade predation, ranging from crypsis to elaborate threat displays. Among this diversity of antipredator tactics, reverse crypsis relies on breaking up the outline of a moving individual, and this is often achieved by an erratic pattern of movement deviating from normal modes of locomotion employed by snakes. Reverse crypsis behavior has been described in several species of colubrid snakes (Fleishman 1985. Copeia 1985:242–245; Ryerson 2017. Copeia 105:363–367) and is characterized by punctuated and jerky movements of the individual's head and neck while net movement of the animal continues in a forward trajectory.

At 1151 h on 15 July 2019, NRB and CPV encountered an adult male *Crotalus pricei* moving across a gravel road in Cochise County, Arizona, USA. The snake moved in a straight-line path across the road while alternately projecting the head anteriorly and retracting the head posteriorly (Fig. 1). A video recording of this observation is available here: http://dx.doi.org/10.26153/tsw/23346. The snake appeared unperturbed by our distant presence and continued to move in this fashion until we approached closely, at which point it ceased this behavior (and movement as a whole) at ca. 36 sec into filming. In total, we observed the rattlesnake moving for ca. 60 sec in a fashion consistent with reverse crypsis. Noticeable wind was not apparent, and the snake was active concurrent with the end of a light rain in partly cloudy conditions.

At 1600 h on 25 July 2021, RVM encountered an adult male *Crotalus transversus in situ* south of Mexico City, Mexico. Ambient temperature was ca. 18°C and the snake was observed in upland pine forest habitat prior to a storm event. The snake was handled and manipulated for photographs upon observation. After this disturbance, the individual commenced movement consistent with reverse crypsis behavior, alternately projecting the head

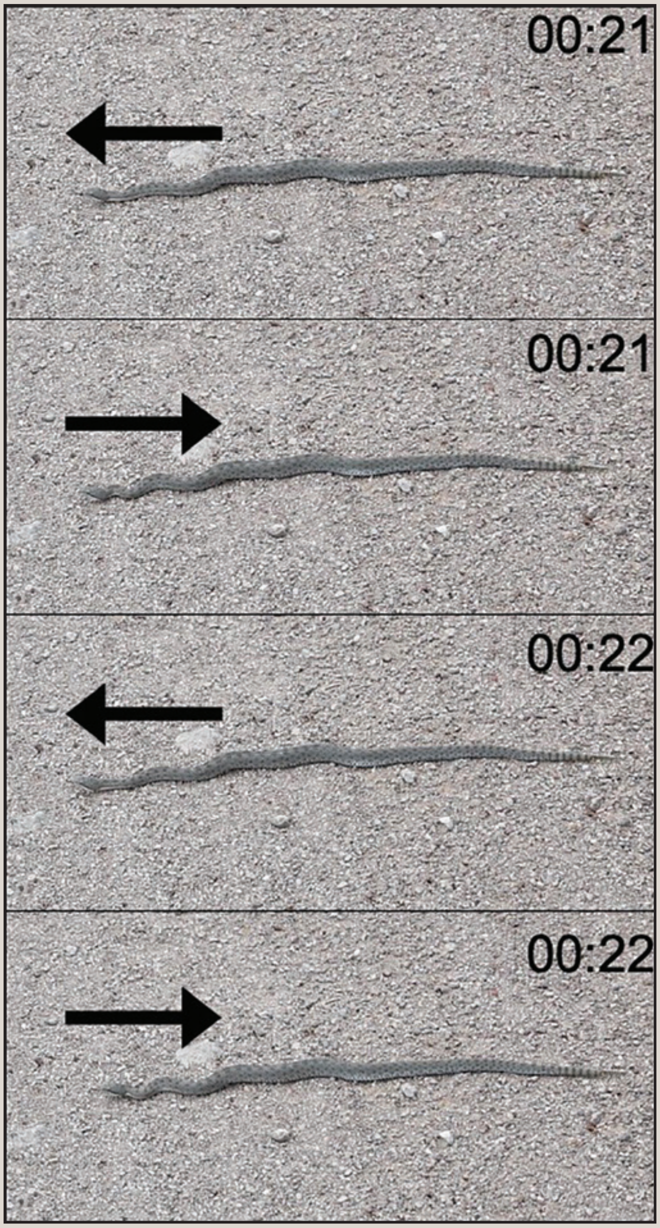

Fig 1. Four sequential frames pulled from video clip of *Crotalus pricei* from Arizona, USA carrying out presumed reverse crypsis behavior. Arrows represent direction of cranial movement in each frame, with accompanying video timestamp.

anteriorly and retracting the head posteriorly. A video recording of this observation is available here: http://dx.doi.org/10.26153/tsw/23346. The snake continued to display this behavior intermittently for ca. 10 min. The rattlesnake exhibited no other defensive behavior and did not rattle throughout the duration of the interaction. Reproductive and courtship behavior has been observed in this population in July and August but is inconsistent with the behavior described herein.

This note represents, to our knowledge, the first published account of presumed reverse crypsis behavior in viperid snakes. It is surprising, given the charismatic nature of rattlesnakes among researchers and observers, that this behavior has not been observed previously in more widespread rattlesnake species. It is possible that the habitat and ecology of the species described herein lend themselves to displaying unique antipredator behaviors. Both *C. pricei* and *C. transversus* are small-bodied montane rattlesnakes inhabiting high-elevation conifer-dominated habitat. Both species may rely on cryptic body patterns to affect camouflage amongst their substrates, and reverse crypsis may further protect against recognition from avian predators that are sensitive to movement (Hämäläinen et al. 2015. Anim. Cogn. 18:1059–1068). Additionally, recent phylogenetic analyses place *C. pricei* and *C. transversus* as being closely related within the same clade of small montane rattlesnake (Holding et al. 2021. Proc. Natl. Acad. Sci. U.S.A. 118:e2015579118). Reverse crypsis behavior may be conserved within this clade, and absent in other *Crotalus* lineages, where selective pressures may not necessitate such antipredator behavior. Additional observation in a field setting is needed to determine if reverse crypsis behavior is more prevalent among rattlesnakes (and broadly other vipers) than previously thought. Other small montane *Crotalus* species (e.g., *C. intermedius*, *C. willardi*, *C. lepidus*) may potentially use similar antipredator behavior given their similarity in habits and ecology.

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***CROTALUS SCUTULATUS* (Mohave Rattlesnake). CLIMBING BEHAVIOR and THERMAL REFUGIUM.** *Crotalus scutulatus* occupies a range of flatland habitats, including grasslands and arid scrublands throughout the Chihuahuan, Mohave, and Sonoran deserts of the USA and Mexico (Werler and Dixon 2000. Texas Snakes: Identification, Distribution, and Natural History. University of Texas Press. Austin, Texas. 437 pp.; Cardwell 2016. *In* Schuett et al. [eds.], Rattlesnakes of Arizona, Vol. 1, pp. 563–605. ECO Publishing, Rodeo, New Mexico). Arboreal and climbing behaviors in *Crotalus* have been attributed to foraging, escape behavior from predators and floodwaters, and thermoregulation (Cunningham 1955. Herpetologica 11:217–220; Klauber 1972. Rattlesnakes: Their Habits, Life Histories, and Influence on Mankind, Vol. 1. University of California Press. Berkeley and Los Angeles, California. 740 pp.; Rudolph et al. 2004. Texas J. Sci. 56:395–404) and were recently described in *C. scutulatus* by Davis and Cardwell (2017. Herpetol. Rev. 48:670–671). Though speculatory, Davis and Cardwell (2017, *op. cit.*) attribute their observations of *C. scutulatus* off the ground to foraging behaviors. Here, we report a potential instance of climbing by *C. scutulatus* as a thermal refugium.

On 11 August 2020 at 1620 h, one of us (BM) observed an adult male *C. scutulatus* positioned ca. 1.5 m above the ground on a fencepost at C. E. Miller Ranch, Jeff Davis County, Texas, USA (30.59624°N, 104.64659°W; WGS 84; Fig. 1). The adult was entwined with wire along the top of the fence line and was stationary when observed. At the time of this observation the air temperature was 36.1°C and the snake was in the shade of the fencepost. The adjacent gate was opened and closed without the individual rattling. Though we are uncertain of exactly why this individual climbed up this exposed post in the middle of the afternoon, we do not suspect it is part of a foraging behavior or that this individual was moving to a location to ambush prey. Instead, it is possible that this individual was attempting to reach a thermal refugium by positioning itself off the ground.

PHOTO BY BILL MILLER

Fig. 1. Adult *Crotalus scutulatus* found on 11 August 2020 at 1620 h, ca. 1.5 m up a fencepost and entwined in wiring in Jeff Davis County, Texas, USA.

Although we are unaware of the body temperature of this *C. scutulatus* or the ground temperature at the time of this observation, many individuals have documented use of arboreal habitats by several species of reptiles during periods of elevated temperature (e.g., Carpenter 1952. Ecol. Monogr. 22:235–258; Heatwole 1970. Ecol. Monogr. 40:425–457), including in viperid snakes (e.g., Ramos and Cardenete 2013. Bol. Asoc. Herpetol. Esp. 24:45–47). For example, during the warm summer months of July and August, in Michigan, USA, three species of *Thamnophis* exhibited their greatest arboreal tendencies, as temperatures recorded in vegetation were 5°C cooler than ground temperatures and 2°C cooler than ambient air temperatures (Carpenter 1952, *op. cit.*). Additionally, arboreality observed in *Vipera latastei*, a species normally associated with rock piles, was believed to be due to individuals seeking a thermal refuge, rather than foraging or antipredator behaviors (Ramos and Cardenete 2013, *op. cit.*). For *C. scutulatus*, body temperatures were rarely recorded above 33.3°C and the maximum reported body temperature was 36.1°C (Cardwell 2020. The Mohave Rattlesnake and How it Became an Urban Legend. ECO Publishing, Rodeo, New Mexico. xii + 140 pp.). Given the time of day (1620 h), location, and position of this individual, we surmise that it was seeking a thermal refugium off the ground to avoid potentially lethal temperatures. While this observation is not the first to document climbing behavior in *C. scutulatus*, the paucity of information surrounding these instances in *C. scutulatus* suggests that it is not a frequent behavior, and the motivation for these occurrences require further investigation.

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***DENISONIA MACULATA* (Ornamental Snake). ARACHNID BURROWS AS HABITAT.** *Denisonia maculata* is an elapid snake that occurs within the Brigalow Belt in Queensland, Australia. The species prefers gilgai (ephemeral wetland) areas with cracking clay soil and typically uses soil cracks as diurnal refugia, owing to its cryptic nature (Wilson 2015. A Field Guide to Reptiles of Queensland. Second Edition. Reed New Holland Publishers Pty Ltd, Sydney, Australia. 258 pp.). Currently, there is little information describing the use of other sub-terranean features as refuge sites by this species.

Between 2055 and 2110 h on 27 March 2021, ca. 18 km south of Baralaba, Queensland, Australia, we observed two *D. maculata* occupying spider burrows. The snakes were initially noted as having their heads and neck protruding from the entrance to the

PHOTO BY NICHOLAS ROYAL

Fig. 1. *Denisonia maculata* within a tarantula burrow.

PHOTO BY KATELYN GIBSON

Fig. 2. *Denisonia maculata* within a tarantula burrow.

burrow in what appeared to be an ambush position. Each snake was observed retracting its head into the burrow upon being disturbed. One snake was observed occupying a burrow that was out in the open (Fig. 1) whilst the second was occupying a burrow situated under a piece of ground timber (Fig. 2). The burrows were identified as being those of *Slenoptys plumipes* (Australian Featherleg Spider), one of the largest spiders in Australia (R. Raven, pers. comm.). Burrows for this species can range from ca. 40 to 100 cm deep (https://australian.museum/learn/animals/spiders/australian-tarantulas/; 10 Nov 2021). Little to no literature has documented the opportunistic use of *S. plumipes* burrows by other species.

While the site had gilgai formations, heavy trampling by cattle was evident and deep soil cracks were not observed at the site. It is possible that *D. maculata* opportunistically uses alternative subterranean refuge such as spider burrows in degraded areas where suitable cracking clay microhabitat is limited. To our knowledge, these records represent the first report of *D. maculata* using invertebrate burrows, specifically those of *S. plumipes*, for refugia and potential ambush sites.

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***DRYMARCHON COUPERI* (Eastern Indigo Snake). DEATH ASSOCIATED WITH *RAILLIETIELLA ORIENTALIS*.** On 2 December 2020, an adult female *Drymarchon couperi* was collected from a development site in Hendry County, Florida, USA, and brought to the Orianne Center for Indigo Conservation to increase the genetic diversity of a captive breeding colony; it died four months later. When the individual was first acquired, it tested negative for multiple infectious agents including *Cryptosporidium*, paramyxovirus, adenovirus, and nidovirus. However, it was anorectic and lost 20% of its body weight even though it was tube fed regularly. Necropsy revealed multiple worm-like parasites (i.e., pentastomes) in the lung and air sac (Fig. 1). Histologic evaluation of representative tissues revealed multiple abscesses and microgranulomas associated with pentastomes and subsequent sepsis. Gross and histological examinations revealed adequate adipose storage, despite the anorexia. We suggest the pentastomes were at least a contributing factor in the snake's death, if not the primary cause.

PHOTO BY JAMES E. BOGAN, JR.

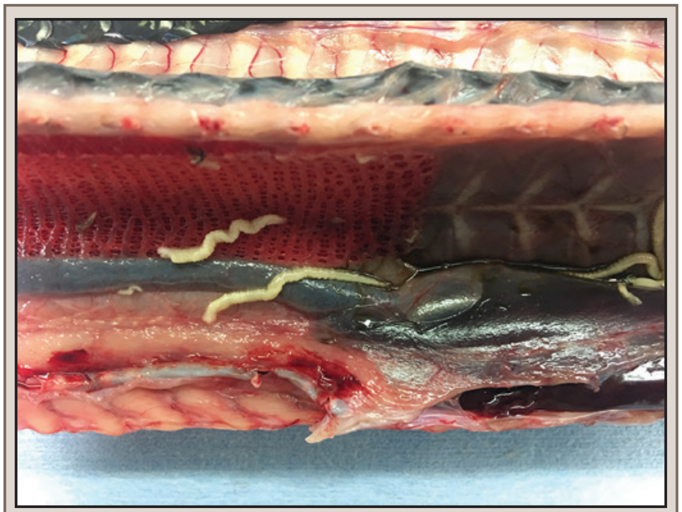

FIG. 1. Multiple *Raillietiella orientalis* visible in the lung and air sac on gross necropsy of an adult female *Drymarchon couperi* from Florida, USA.

Gross morphologic evaluation of the parasite's anterior hooks, buccal cadre, and male spicules was consistent with *Raillietiella orientalis*. Nucleic acids were extracted from an ethanol fixed female pentastome. PCR amplification and DNA sequencing of the parasite confirmed it was *R. orientalis* (Brookins et al. 2009. Vet. Path. 46:460–463). The sequence was submitted to GenBank under accession #MZ518822.

Raillietiella orientalis is commonly found throughout southeastern Asia and Australia and believed to have entered southern Florida with *Python bivittatus* (Burmese Python). This parasite has now been identified in multiple snake species native to Florida (Miller et al. 2020 Ecosphere 11:e03153) as well as in at least one non-native lizard species (Fieldsend et al. 2021. IRCF Rept. Amphib. 28:255–256), is apparently expanding its range throughout the state, and has been a likely contributing factor in the death of at least two *Sistrurus miliarius* (Pygmy Rattlesnake; Farrell et al. 2019. Herpetol. Rev. 50:73–76) and a *Nerodia fasciata* (Southern Watersnake; Walden et al. 2020. Front. Vet. Sci. 7:467). This is the first description of a death in *D. couperi* (a federally protected species) associated with *R. orientalis*.

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***DRYMARCHON MELANURUS* (Central American Indigo Snake). DIET.** The distribution of *Drymarchon melanurus* includes areas from sea level to 1900 m along the coast of the Gulf of Mexico and Caribbean Sea from central Texas, USA, to northwestern Venezuela and along the coast of the Pacific Ocean from southern Sonora, Mexico, to northern Peru, including lowlying inland areas in the Isthmus of Tehuantepec and in Costa Rica and Panama (Wallach et al. 2014. Snakes of the World: A Catalogue of Living and Extinct Species. CRC Press, Boca Raton, Florida. 1209 pp.; Heimes 2016. Herpetofauna Mexicana. Vol. 1. Snakes of Mexico. Edition Chimaira, Frankfurt am Main, Germany. 571 pp.). This snake is recognized for its generalist and opportunistic diet. It is known to consume amphibians, small turtles, lizards, birds and their eggs, fishes, mammals, and other snakes, including venomous viperids (Dixon and Lemos-Espinal 2010. Amphibian and Reptiles of the State of Querétaro, Mexico. CONABIO, México. 428 pp.). Here, we report two *in situ* predation events by *D. melanurus* which, to our knowledge, both represent novel prey items in the natural diet of this species.

At 1320 h on 7 July 2020, in tropical forest at the Reserva Estatal de Sierra Vallejo (20.86053°N, 105.30300°W; WGS 84; 211 m elev.), Municipality of Bahia de Banderas, Nayarit, Mexico, VHL observed an adult *D. melanurus* eating an *Incilius marmoreus* (Wiegmann's or Marbled Toad; Fig. 1) during a reproductive frenzy of several species of hylid and bufonid frogs following a torrential rain, marking the beginning of the rainy season in the region. Other amphibians previously reported in the diet of *D. melanurus* include *Incilius alvarius* (Villa et al. 2015. Mesoamer. Herpetol. 2:378–380), *Incilius mazatlanensis*, *Smilisca baudinii*, and *Triprion spatulatus* (pers. obs.).

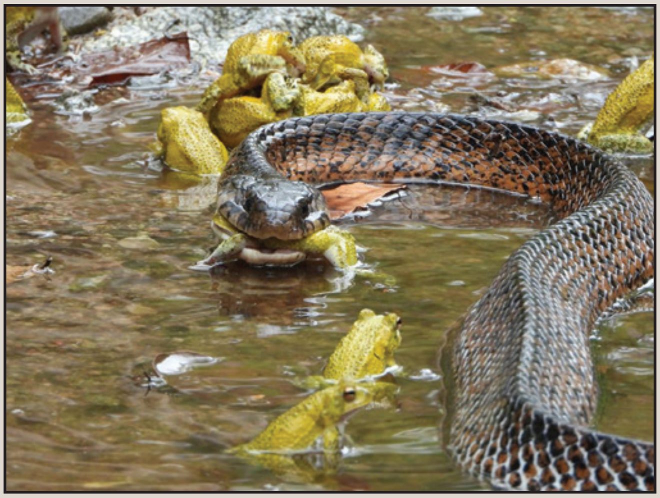

FIG. 1. Fig. 1. An adult *Drymarchon melanurus* eating an *Incilius marmoreus* on Sierra Vallejo, Bahia de Banderas Nayarit, Mexico

FIG. 2. A juvenile *Drymarchon melanurus* eating *Manolepis putnami* on urban area Punta de Mita, Bahia de Banderas, Nayarit, Mexico.

A second novel predation event was recorded at 1015 h on 11 May 2021, in an urban area of Punta de Mita (20.78112°N, 105.52774°W; WGS 84; 9 m elev.), municipality Bahia de Banderas, Nayarit, Mexico. We observed a *D. melanurus* (apparently a juvenile) that had caught and was ingesting a *Manolepis putnami* (Ridgehead Snake; Fig. 2). Other snake species previously reported in the diet of *D. melanurus* include *Atropoides occiduus* (García-Padilla 2015. Mesoamer. Herpetol. 2:376–377), *Crotalus simus* (Neri Castro et al. 2012 Herpetol. Rev. 43:659), *Crotalus atrox* (Swanson et al. 2015. Herpetol. Rev. 46:272), *Spilotes pullatus* (Hernández-Ríos et al. 2013. Herpetol. Rev. 44:690), *Mastigodryas pleei* (Daza 2005. Herpetol. Rev. 36:457), and *Pliocercus elapoides salvinii* (Stuart 1948. Misc. Pub. Univ. Michigan Mus. Zool. 69:1–109).

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***EUNECTES MURINUS* (Green Anaconda). DIET.** *Eunectes murinus* is the largest snake species in the Neotropics and is widely distributed in South America (Nogueira et al. 2020. S. Am. J. Herpetol. 14:1–274). It is a generalist predator that feeds upon a large variety of animals, including mammals, birds, fishes, reptiles, and invertebrates (Rivas 2016. Natural History of the Green Anaconda: With Emphasis on Its Reproductive Biology. CreateSpace Independent Publishing Platform, Scotts Valley, California. 235 pp.). Besides cannibalism (Rivas and Owens 2000. Herpetol. Rev. 31:45–46), there is only one record of predation on aquatic snakes (*Helicops angulatus*; Infante-Rivero et al. 2008. Herpetotropicos 4:39). Herein, we report predation by *E. murinus* on another species of aquatic snake.

On 23 November 2021, a juvenile *E. murinus* (837 mm SVL, 544 g; Fig. 1A) was collected during lake management activities at the Parque Estadual do Utinga Camillo Vianna (1.42158°S, 48.41902°W; WGS 84; 14 m elev.), Belém, Municipality, Pará, Brazil. While being measured in the lab, the individual regurgitated a partially digested adult *Helicops trivittatus* (Fig. 1B). *Helicops trivittatus* is a nocturnal aquatic snake species, which preys mainly upon fishes (Cunha and Nascimento 1993. Bol. Mus. Par. Emílio Goeldi 9:1–191; Santos-Costa et al. 2015. Herpetol. Notes 8:69–98). *Eunectes murinus* is an opportunistic predator (Pizzato et al. 2009. Amphibia-Reptilia 30:533–544), and predation on syntopic aquatic snake species may happen more frequently than reported in the literature.

We are grateful to the Parque Estadual do Utinga managers for the partnership.

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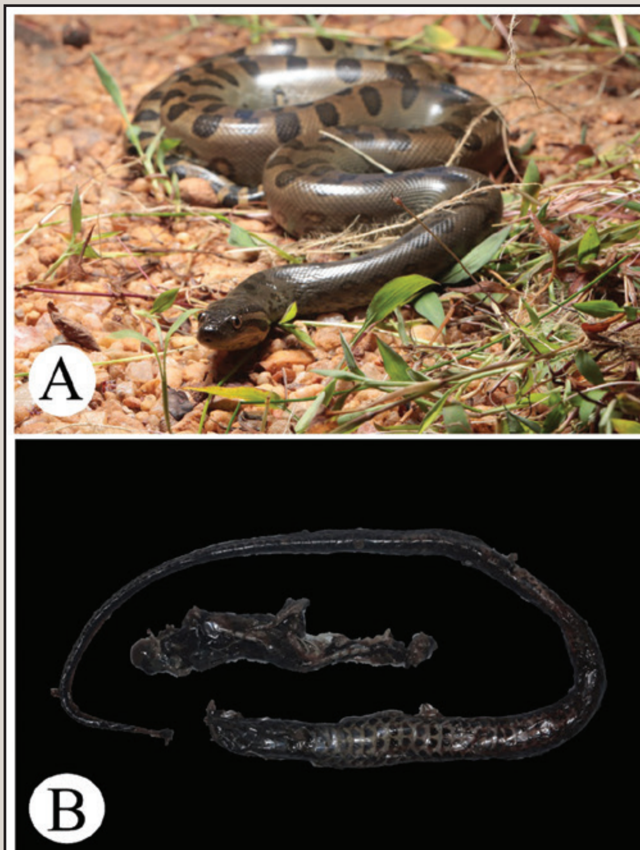

PHOTOS BY AFONSO S.O. MENESES

FIG. 1. A) *Eunectes murinus*; B) partially digested prey: *Helicops trivittatus.*

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***FARANCIA ABACURA* (Red-bellied Mudsnake). REPRODUCTION.** *Farancia abacura* is a semi-aquatic colubrid of the southeastern United States. Due to the secretiveness of *F. abacura*, little is known about the species' reproductive behavior. In Missouri, near the northernmost distributional limit of *F. abacura* in the Mississippi River watershed, the species is presumed to breed from April through June (Briggler and Johnson 2021. The Amphibians and Reptiles of Missouri. Revised and Expanded Third Edition Missouri Department of Conservation, Jefferson City, Missouri. 520 pp.). M. Nickerson observed a pair mating during an afternoon in mid-June in Stoddard Co., Missouri (Briggler and Johnson 2021, *op. cit.*).

On 27 May 2015, at 2110 h, in Stoddard County, Missouri, USA, I encountered three adult *F. abacura* on a gravel road adjacent to a large wetland pool. Due to the protected status of *F. abacura* in Missouri (state listed as a species of conservation concern), the snakes were not captured for sexing or measurements. However, based on body girth and length, I concluded that the trio consisted of a female and two slightly smaller males (TL of each male estimated to be ca. 90% of the TL of the female). The female was in a late stage of ecdysis and had already shed the posterior half of her skin.

When first encountered, both males were loosely intertwined with the female. One male was biting the female between her head and mid-body, while the second was looped around her posterior and nudging her tail with his snout (Fig. 1A). As the female slowly crawled forward, the biting male retained his grip and repositioned his body on top of hers (Fig. 1B, C). The other male moved away, possibly disturbed by my presence, but remained nearby. He returned after 5 min and began to investigate the head and neck of the female (Fig. 1D). In total, I observed and photographed the snakes for ca. 10 min until all three retreated into the water. It is unknown whether courtship continued after the individuals entered the water. During the observation period, agonistic behavior between the males was not apparent, and neither male successfully copulated with the female.

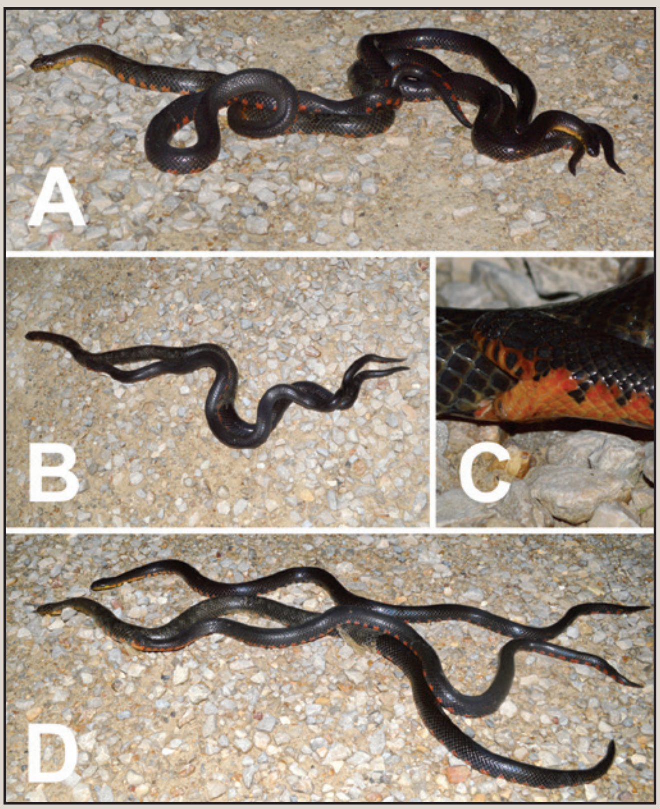

Fig. 1. Courtship of *Farancia abacura* at 2110 h during late May in Missouri, USA: A) two males intertwined with a female; B) one of the males biting and repositioning as the female slowly moved; C) closeup of the male biting the female; D) the second male returning after a brief interlude.

To date, only two other descriptions of courtship in *F. abacura* have been published. These observations took place in southern Alabama, USA (Langford and Borden 2004. Herpetol. Rev. 35:400–401) and eastern North Carolina, USA (Parden 2015. Herpetol. Rev. 46:450). In both cases, the courtship involved a male biting and intertwining around a female, consistent with the behavior that I observed. In contrast to my observation, the presence of only a single male was documented during both episodes. Like the instance that I observed, courtship occurred on land in North Carolina, USA (Parden 2015, *op. cit.*), but it happened in shallow water in Alabama, USA (Langford and Borden 2004, *op. cit.*).

Both previously reported cases of courtship in *F. abacura* occurred during the afternoon in mid-June (Langford and Borden 2004, *op. cit.*; Parden 2015, *op. cit.*). The only prior record of mating in Missouri, which did not describe courtship, took place at a similar time of day and year (Briggler and Johnson 2021, *op. cit.*). Schepis (2013. M.S. Thesis, Missouri State University, Springfield, Missouri. 58 pp.) found that males in Missouri moved greater distances in the spring, suggestive of mate searches during this season. The timing of the courtship described herein agrees with this pattern, and it also corresponds with the cycles of testicular and follicular development found in *F. abacura* collected from Arkansas (Robinette and Trauth 1992. J. Ark. Acad. Sci. 46:61–64). In addition to confirming that reproductive behavior in *F. abacura* occurs before mid-June, my observation demonstrates that courtship is not restricted to the daytime. In fact, as individuals are thought to be largely nocturnal (Schepis 2013, *op. cit.*; Briggler and Johnson 2021, *op. cit.*), courtship and breeding at night are likely more typical, but less likely to be observed.

I thank Jeffrey Briggler and Justin Elden for reviewing an earlier draft of this manuscript.

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***GLOYDIUS BLOMHOFFII* (Japanese Mamushi). DIET.** *Gloydius blomhoffii* is a terrestrial pit-viper widely distributed in the main islands of Japan and its adjacent islands. The species lives in forest and surrounding rice fields, and especially prefers riparian habitats (Sengoku et al. 1996. Encyclopaedia of Animals in Japan: Vol. 5: Amphibian, Reptile, Chondrichthyes. Heibonsha, Tokyo, Japan. 189 pp.). This snake is a generalist, feeding on wide range of animals, such as invertebrates, amphibians, reptiles, birds, and mammals (Mori and Moriguchi 1988. The Snake 20:98–113; Hamanaka et al. 2014. Bull. Herpetol. Soc. Japan 2014:167–181). At 2120 h on 21 July 2020, at Nishiiya, Miyoshi City, Tokushima Prefecture, Japan, a juvenile *G. blomhoffii* (181 mm SVL, 39 mm tail length; Graduate School of Human and Environmental Studies, Kyoto University [KUHE] 62205) and a freshly dead juvenile *Buergeria buergeri* (Kajika Frog) were found after a light rain on a paved road near a stream. The air temperature was 19.9°C. The distance

Fig.1. *Buergeria buergeri* and *Gloydius blomhoffi*, *in situ* on the road at Nishiiya, Tokushima Prefecture, Japan. The frog was already dead.

between the snake and the frog was ca. 3 cm. The road had no traffic except for ours. The dead frog was not damaged except for its left arm, which was probably envenomated by the snake. We collected the snake and frog and kept them in the same case for a night. The next morning, we found that the snake had preyed on the dead frog. This is the first record of consumption by *G. blomhoffii* on *B. buergeri*.

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***HELICOPS LEOPARDINUS* (Leopard Keelback). PREDATION.** Snakes of the genus *Helicops* are semi-aquatic dipsadines that inhabit South America (Nogueira et al. 2019. J. Herpetol. 14:1–274). *Helicops leopardinus* is widespread, nocturnal, and frequently found in flooded areas associated with floating vegetation (Hoogmoed 1993. *In* Ouboter [ed.], Freshwater Ecosystems of Suriname, pp. 199–213. Kluwer Academic Publishers, Dordrecht). The diet of *H. leopardinus* consists of a wide variety of frogs and fishes (Ávila et al. 2006. J. Herpetol. 40:274–279), but few details about foraging behavior have been reported (Sturaro and Gomes 2008. Bol. Mus. Para. Emílio Goeldi 3:225–228).

Caenophidian snakes are well-known for infrequent feeding on large prey (Gans 1961. Amer. Zool. 1:217–227). Prey with defensive structures (e.g., spines) require some maneuvering prior to swallowing, and head-first ingestion is probably especially important when feeding on large prey or prey with spines (Aguiar and Di-Bernardo 2004. Stud. Neotrop. Fauna Environ. 39:7–14; Sturaro and Gomes 2008, *op. cit.*). Fish-eating snakes have a stronger tendency towards head-first ingestion than generalists, and the difference in handling efficiency is greater between young and adults of generalist than specialist species (Halloy and Burghardt 1990. Behaviour 112:299–317). This might be true for *Helicops* species as well (Sazima and Martins 1990. Mem. Inst. Butantan 52:73–79). Herein, we report the unsuccessful predation of an adult *Callichthys callichthys* (Siluriformes: Callichthyidae) by an adult *H. leopardinus*, which resulted in the death of both the snake and its prey.

At 0848 h on 3 February 2021, we collected an adult *H. leopardinus* (72 cm total length) caught in a baited aquatic funnel trap that had been installed in à perennial pond in the Fazenda Milagres, Conde, Bahia, Brazil (11.94651°S, 37.61043°W; WGS 84). The specimen was found dead, trapped in the mesh of the

Fig. 1. Adult *Helicops leopardinus* as found, dead and trapped in the mesh of an aquatic funnel trap that had been installed in a perennial pond in the Fazenda Milagres, Conde, Bahia, Brazil.

Fig. 2. Close-up of *Helicops leopardinus* with half-ingested *Callichthys callichthys* prey still in the mouth.

funnel-trap and with its entire body submerged in water. The snake had ingested the prey in the anteroposterior direction up to the middle of the fish's body (Fig. 1) and died with the fish still in its mouth. Both specimens were deposited at the Coleção Herpetológica Centro de Ecologia e Conservação Animal (CHECOA 3930, 3931), at the Universidade Católica do Salvador, Municipality of Salvador, Bahia, Brazil.

Callichthys callichthys is an armored catfish widely distributed throughout subtropical South America, and like most Siluriformes, it has a pectoral spine located in the anterior part of each pectoral fin, which is used in defense against predators (Kirchheim and Goulart 2010. Oecologia Australis. 14:550–568). While the specifics of this report likely represent a rare observation, the unsuccessful feeding behavior that caused the death of both specimens may shed light on selective pressures that shape prey preference and feeding behavior in aquatic snakes. Whether or not entanglement in the mesh of the trap might have played a role is difficult to assess.

We are grateful for the support from the Centro de Ecologia e Conservação Animal (ECOA), Programa científico iGUi ecologia, Lacerta Ambiental Ltda., and thank Paulo Roberto Duarte Lopes (Laboratório de Ictiologia na Universidade Estadual de Feira de Santana) for identification of the fish.

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INDOTYPHLOPS BRAMINUS **(Brahminy Blindsnake). PREDATION.** *Indotyphlops braminus* is a small, fossorial species thought to be originally from the Indo-Malayan region (Mateo et al. 2011. Bol. Asoc. Herpetol. Esp. 22:135–137). It is the most widely distributed snake species in the world and is found on every continent except Antarctica. The main reason for its spread around the globe is the ornamental plant trade. As a result, *I. braminus* is most often found in human altered environments such as gardens, greenhouses, and areas of high plant introductions. Within these environments they can be found under objects such as potted plants, mulch, stones, or other anthropogenic items (Bartlett et al. 1999. Field Guide to Florida Reptiles and Amphibians. Gulf Publishing, Houston, Texas. 280 pp.). The cosmopolitan distribution of *I. braminus* can also be attributed to the fact that it is the only known snake species to reproduce solely through parthenogenesis (McDowell 1974. J. Herpetol. 28:1–57), which allows just one individual to establish a new population (Nussbaum 1980. Herpetologica 36:215–221). While this species is widespread, there is limited information on how *I. braminus* impacts areas where it is introduced. For example, it is unclear if this snake is used a food source by local predators.

On 18 April 2021 at 1934 h, an adult *Sturnus vulgaris* (European Starling) was observed chasing, catching, and consuming an *I. braminus* on a street in a suburban area in Naples, Florida, USA (26.17980°N, 81.79294°W; WGS 84). To my knowledge, this is the first recorded incidence of predation upon *I. braminus* by *S. vulgaris* and the first evidence of an invasive bird foraging on introduced *I. braminus*. It is unclear how many species of birds feed on this snake. A *Carpococcyx renauldi* (Coral-billed Ground Cuckoo) consumed a blindsnake species that may have been *I. braminus* in northeastern Thailand (Pobprasert et al. 2010. Wilson J. Ornithol. 122:173–177). There has also been evidence of *Athene brama* (Spotted Owlets) using *I. braminus* as a food source in Anand, Gujarat (Jadhav et al. 2003. Zoos Print J. 18:1163–1165). In both cases, the birds were native to the area and foraged on the snake that may have also been native to the region. Many other species of vertebrates and invertebrates are known to forage on *I. braminus* (Meshaka et al. 2004a. Exotic Amphibians and Reptiles of Florida. Krieger Publishing, Malabar, Florida. 155 pp.).

Indotyphlops braminus was first observed in Florida in 1979 and is currently established in 11 counties and presumed to be spreading (www.myfwc.com; 1 Oct 2021). It is unclear what if any impact this species is having on urbanized and natural areas, including whether non-native or native species are utilizing this introduced species as part of their regular diet. However, both native (Godley et al. 2008. Herpetol. Rev. 39:473–474) and nonnative (Meshaka 2011. Herpetol. Conserv. Biol. 6:1–101) species have been observed using *I. braminus* as a prey source in Florida.

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LAMPROPELTIS GETULA **(Eastern Kingsnake). ABERRANT PHENOTYPE.** The typical pattern of the *Lampropeltis getula* (Eastern Kingsnake) consists of 1932 narrow (1.52.5 dorsal scales wide), light-colored crossbands that widen or divide laterally, resulting in a chainlike pattern (Krysko and Judd 2006. Zootaxa 1193:1–39). In 1997, HFC collected an adult female *L. getula* on Edisto Island, Charleston County, South Carolina, USA, with an unusual "mosaic" pattern consisting of black, rectangular markings on the dorsum and a body primarily covered with white scales tipped with black posteriorly (Fig. 1A). In 2002, RW collected an adult male near Cottageville, Colleton County, South Carolina, USA, with an aberrant pattern consisting primarily of wide, light crossbands (Fig. 1B). Breeding of this pair in 2002 produced five offspring with a typical pattern of narrow crossbands, three offspring partially speckled with white or orange on the sides and with a row of black spots partially fused into a dorsal stripe (Fig. 1C), two white-colored females with a black dorsal stripe (Fig. 1D), one male with a mosaic pattern like the mother (Fig. 1E), and one offspring with irregular black dorsal blotches bordered with intense orange. The striped pattern of the two females apparently represents the ultimate expression of the mosaic phenotype, similar to patternless and striped phenotypes of the Apalachicola Kingsnake (*L. meansi*) found in the eastern Apalachicola

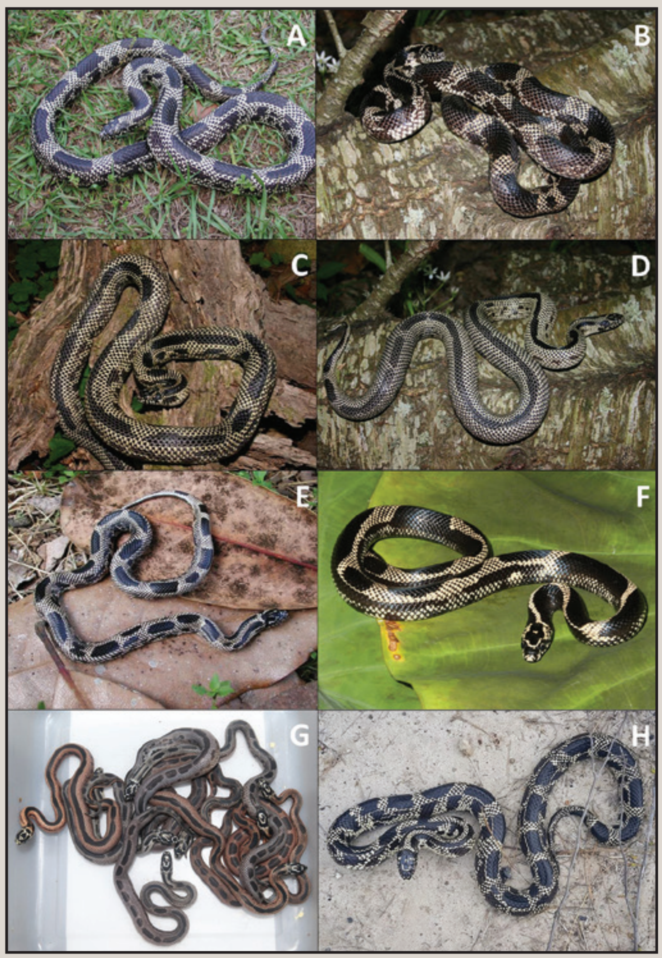

Fig. 1. *Lampropeltis getula* with the "mosaic" phenotype caught in the wild in Charleston County (A) and Colleton County (B), South Carolina, USA; F1 progeny from this pair at 13 years of age (CE); asymmetrical mosaic pattern (F); hatchlings from a 2021 clutch with oval-blotched or striped mosaic patterns (G); and a mosaic phenotype *L. getula* observed in the wild in Tyrrell County, North Carolina, USA (H).

Lowlands of the Florida Panhandle (Krysko and Judd 2006, *op. cit.*). Ventral patterns of *L. meansi* are uniquely bicolored or have a loose checkerboard with interspersed bicolored scales, unlike the loosely checkered pattern typical of *L. getula* (Krysko and Judd 2006, *op cit.*). Some mosaic *L. getula* also have light, bicolored venters, but most have primarily or completely black venters. Years of selective breeding have produced hundreds of progeny that consistently exhibit the mosaic phenotype, which is apparently a variable recessive trait that can usually be assigned to one of four patterns: striped (only seen thus far in captivity), oval-blotched (e.g., Edisto Island female), asymmetrical, and wide-banded. Striped individuals have a black, usually broken, dorsal stripe on a mostly light background that may have small, black blotches or dashes on the side of the body. Oval-blotched individuals have black ovals or rectangles on a light background. This pattern is essentially a wide, black dorsal stripe divided by wide, light crossbands that typically connect on the lower sides of the body; the dorsal markings may be arranged regularly or meander across the spine. Asymmetrical individuals have light, irregular-shaped markings that swirl down the uniformly dark body, rarely forming complete crossbands (Fig. 1F). Wide-banded individuals have wide, light crossbands (often with irregular borders) that often connect on the lower sides; the crossbands sometimes contain dark donuts or have short extensions of narrow, light dorsolateral stripes. This is the pattern most frequently found in the wild and was exhibited by the male from Colleton County (Fig. 1B). Wild individuals carrying the mosaic trait may have only a single, one-scale-wide, light dorsolateral stripe extending from a wide crossband; a wide crossband sharply truncated high on the side the body; or a short, light dorsal stripe behind the head. Captive breeding has determined that female *L. getula* are more likely than males to have striped or oval-blotched patterns, although this tendency has disappeared over generations of breeding only snakes with these patterns. In contrast, male *L. meansi* are much more likely in the wild to be patternless or striped (Means and Krysko 2001. Contemporary Herpetol. No. 5:19). Unlike *L. meansi*, mosaic *L. getula* hatchlings do not undergo ontogenetic lightening of the dark interband scales and appear similar to adults, except orange or red pigmentation changes to beige or yellow (Fig. 1G).

On 23 May 2021, JA observed an *L. getula* with the oval-blotched mosaic phenotype on a sandy berm along a canal in Tyrrell County, North Carolina, USA (Fig. 1H). Three days later, a slightly smaller snake with an almost identical pattern was seen in the area. This pattern phenotype has also been found in Berkeley County, South Carolina, USA. All areas in the Carolinas where mosaic *L. getula* have been found are located in the Atlantic Coastal Plain near the coast, and this phenotype may represent a relict pattern adapted to beach or tidal marsh habitat. The overall lighter appearance of this phenotype may have helped camouflage snakes in open, sandy habitats, and snakes with striped patterns are typical of grassy habitats (Neill 1963. Q. J. Florida Acad. Sci. 26:194216; Wolf and Werner 1994. Biol. Rev. 69:599610). The similar-patterned *L. meansi* apparently evolved in isolation on a barrier island or the coastal strand of a peninsula during one of the many higher stands of sea in the Pleistocene (Means and Krysko 2001, *op. cit.*). Light-colored *L. meansi* would be less conspicuous to visually orienting predators against white sands and may have been less prone to overheating (Means and Krysko 2001, *op. cit.*). *Lampropeltis getula* from the Outer Banks of North Carolina, USA exhibit interband lightening of the dorsal pattern and were once considered a separate subspecies, *L. g. sticticeps* (Lazell and Musick 1973. Copeia 1973:497503). In captivity, the mosaic phenotype has also appeared in inbred *L. getula* stock from southern Georgia and in Florida Kingsnakes (*L. floridana*).

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***LEPTODEIRA ANNULATA* (Banded Cat-eyed Snake). DIET.** *Leptodeira annulata* is a nocturnal dipsadid with semi-arboreal habits (Martins and Oliveira 1998. Herpetol. Nat. Hist. 6:78–150) and a wide geographic distribution in South America. This species preys mainly on anurans, but also feeds on small lizards and other snakes (Cantor and Pizzatto 2008. Herpetol. Rev. 39:462–463). Here we present two specimens of *L. annulata* which preyed on the anurans, *Leptodactylus fuscus* and *Scinax x-signatus*. We dissected two specimens of *L. annulata* that were captured in northeastern Brazil, and deposited in the collection of the Museu Cearense de História Natural Prof. Dias da Rocha: MCHNR 404 (male, 790 mm SVL, 192 mm TL, 61 g) ingested an *L. fuscus* (South American White-lipped Grass Frog; 3 g), which was ingested head-first, and despite being semi-digested, it could be identified by the color pattern and fingers (Fig. 1A, B). The specimen MCHNR 409 (female, 575 mm SVL, 120 mm TL, 26 g) presented a *S. x-signatus* (Snouted Treefrog; 2 g) which was ingested by the rear and was intact (Fig. 1C, D). Both snakes were collected in the same area, in the Municipality of Crateús, Ceará, Brazil (5.20291°S, 40.66111°W; WGS 84; 274 m elev.), in a farmland area dominated by open shrubby caatinga, thorny deciduous forest,

Fig. 1. A) *Leptodeira annulata* (MCHNR 404); B) *Leptodactylus fuscus* from stomach of *L. annulata* (MCHNR 404); C) *Leptodeira annulata* (MCHNR 409); D) *Scinax x-signatus* from stomach of *L. annulata*. Both records from Crateús, Ceará, Brazil.

and sub-deciduous forest. *Scinax x-signatus* has already been recorded as a prey of *L. annulata* (Santos-Silva et al. 2014. Herpetol. Notes 7:123–126); despite being very common, this is the first time *L. fuscus* is recorded as a prey of this snake.

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***LEPTOPHIS AHAETULLA* (Neotropical Parrot Snake). DIET.** *Leptophis ahaetulla* is a medium size snake that is widespread in Central and South America (Albuquerque 2009. Biota Neotrop. 9:293–296). It is diurnal and arboreal, foraging in vegetation, and feeds mostly on hylid frogs, and in rare cases, other vertebrates (Chaloupka and Rodríguez 2021. Herpetol. Notes 14:209–213). Here, we report two novel prey items in the diet of *L. ahaetulla*: a hylid frog (*Boana albomarginata*) and a gecko lizard (*Phyllopezus pollicaris*).

On 30 June 2021, we observed an adult *L. ahaetulla* preying on an adult *P. pollicaris* in the sand dune habitat of Klaus Peters Park in the Municipally of Mata de São João, Bahia, Brazil (12.57318°S, 38.00866°W; WGS 84). The second event occurred on 15 September 2021, with a predation of the hylid frog *B. albomarginata* in the Atlantic Forest, Municipality of Mata de São João, Bahia, Brazil (12.46619°S, 38.18626°W; WGS 84). In the first case, the specimen of *P. poliicaris* was ca. 25% swallowed, initiated by the tail of the lizard, which appeared to already be dead. In the case of the *B. albomarginata*, the ingestion started at the head. The snakes were not disturbed in either case, as it was possible to identify both species without interfering in the predation act.

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***LYGOPHIS FLAVIFRENATUS* (Fronted Groundsnake). REPRODUCTION.** *Lygophis flavifrenatus* is an uncommon medium-sized dipsadid that occurs in subtropical South America, more precisely in northeastern Argentina, Paraguay, Uruguay and southern Brazil (Nogueira et al. 2019. S. Am. J. Herpetol. 14:1–274). *Lygophis flavifrenatus* is a predominantly terrestrial species, found mainly in natural grasslands and swamps (Ghizoni et al. 2009. Biotemas. 22:129–141). Because it is rarely encountered, several aspects of its natural history are poorly known. This species exhibits sexual size dimorphism (females are larger than males) and seasonality in the female reproductive cycle. Quintela and Loebmann (2019. Iheringia Ser. Zool. 109:e2019010) found eggs in females collected in October and November. Hence, this species probably copulates around September.

At 1730 h on 3 September 2019, during fieldwork in Rio Grande City, southern Brazil (32.14066°S, 52.15054°W; WGS 84; 5 m elev.), we found a mating pair of *L. flavifrenatus*. The site is composed of grasslands and flooded areas. The specimens were found under a wooden plate near a road and tried to escape when discovered. We noticed that they were mating when we caught the specimens. The copulation lasted around 30 min. This is probably the first record of mating in this species and corroborates the seasonality of the reproductive cycle reported in the studied region (Quintela and Loebmann 2019, *op. cit.*). The female was released on site and no data were collected to avoid stress, but it was conspicuously larger than the male. The male was collected, measured (293 mm SVL), and deposited in the FURG Herpetological Collection (CHFURG-6103).

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***MASTIGODRYAS BODDAERTI* (Boddaert's Tropical Racer). MELANISM.** *Mastigodryas boddaerti* is widespread in northern South America, occurring in Bolivia, Brazil, Colombia, French Guiana, Guyana, Suriname, and Venezuela (Nogueira et al. 2019. South Am. J. Herpetol. 14:1–274). This species presents an ontogenetic change in coloration, showing a pattern of transverse spots in newborns and juveniles, while adults show a smooth back with a uniform brown or olive-green coloration in living individuals, and bluish in preserved specimens. Adults feature a whitish side stripe on each side of the body and the belly is generally immaculate in adults, with the exception of the gular region of some specimens, which maintains the pattern of newborn or juveniles in the adult stage. Melanism occurs when an animal expresses abnormally high amounts of the black pigment melanin (Bechtel 1978. J. Herpetol. 4:521–532). Here, I present the first record of melanism in *M. boaddaerti*.

At 1655 h on 29 August 2019, in the Municipality of Choachí, Department of Cundinamarca, Colombia (4.57992°N, 73.92530°W; WGS 84; 1940 m elev.), I observed an adult *M. boddaerti* crossing a secondary road, next to fragmented forest. The individual presented unusual coloration for the species, showing a completely black back from anterior to posterior region, whitish side stripes on each side of the body faintly marked; only the supralabial scales were not completely black (Fig. 1). The belly was whitish and immaculate as is characteristic of the species. The individual (ca. 800 mm total length) was photographed and captured for review of taxonomic characters but was not collected. Given the apparent rarity of the melanistic condition in *M. boddaerti*, I attribute this case to either a congenital anomaly or a rare ontogenetic shift. However, given the lack of studies in this region, it is unclear whether this is an isolated record of a unique individual or a population-level difference that might represent local adaptation.

FIG. 1. Melanistic *Mastigodryas boddaerti*, Municipality of Choachí, Department of Cundinamarca, Colombia.

I thank Albert Cardenas for his unconditional support during the field trips throughout the department of Cundinamarca.

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***MICRURUS FULVIUS* (Harlequin Coralsnake). ARBOREALITY.** Only 4% of 362 species of Elapidae are considered arboreal or semi-arboreal (Harrington et al. 2018. Biol. J. Linnean Soc. 125:61–71). Arboreal snakes typically have more slender, laterally compressed bodies and longer tails than terrestrial snakes (Pizatto et al. 2007. Ecology 88:359–366; de Alencar et al. 2017. Proc. Royal Soc. B: Biol Sci. 284:20171775). *Micrurus* spp. are typically terrestrial or fossorial and, although slender, lack laterally compressed bodies and long tails. But climbing has been reported in several tropical species: *M. altirostris* (Alberton Gatelina et al. 2018. Herpetol. Notes 11:337–439), *M. circinalis* (Sadjak 2000. Herpetol. Rev. 31:105), *M. diastema* (Valencia-Herverth et al. 2016. Mesoamerican Herpetol. 3:501502), *M. distans* (Suazo-Ortuño et al. 2004. Herpetol. Rev. 35:276), *M. nigrocinctus* (Schmidt and Smith 1943. Publ. Field Mus. Nat. Hist. Zool. Ser. 12:129–134; Campbell and Lamar 2004. The Venomous Reptiles of the Western Hemisphere. Cornell University Press, Ithaca, New York. 528 pp.), and *M. surinamensis* (Hartdegen and Anucone 2001. Herpetol. Rev. 32:264).

Few literature records exist of arboreal behavior in *M. fulvius* from the southeastern USA. A large adult was observed eating an Eastern Ratsnake (*Pantherophis quadrivittaus*) 6 m above the ground in the top of a Cabbage Palm (*Sabal palmetto*) in Alachua County, Florida, USA (Carr 1994. A Naturalist in Florida: A Celebration of Eden. Yale University Press, New Haven and London, Connecticut. 264 pp.). The boots (old frond bases) present on Cabbage Palm trunks would have facilitated climbing. On Sanibel Island, Lee County, Florida, USA, adult *M. fulvius* were regularly observed above the ground, particularly in the moist, humus-filled pockets formed by Cabbage Palm boots (LeBuff and Lechowicz 2013. Amphibians & Reptiles of Sanibel & Captiva Islands. Ralph Curtis Publishing, Sanibel, Florida. 279 pp.).

We report observations of *M. fulvius* climbing tree trunks and branches, which represent more challenging feats of arboreality than ascending Cabbage Palms. On 24 July 2014, at 1800 h, in a yard in Alachua County, Florida, USA, MTF observed an adult *M. fulvius* for 20 min while it ascended the trunk of a Water Oak (*Quercus nigra*; Fig. 1A) to a height of about 3 m and then crawled among the twigs of an acutely angled branch (Fig. 1B). It coiled its tail around a twig as an anchor before returning to the trunk. Based on its deliberative behavior while climbing, which included frequent tongue flicking and pauses, the snake appeared to be following the scent odor of a snake or lizard. *Micrurus fulvius* have been observed preying on *P. quadrivittatus* at this site. On 9 July 2021 at 1900 h near Jasper, Hamilton County, Florida, USA, GC and GB observed an adult *M. fulvius* about 1.5 m above the ground climbing horizontally on the trunk of a Laurel Oak (*Q. hemispherica*) festooned with Greenbrier (*Smilax* sp.) and Trumpet Creeper (*Campsis radicans*) vines that may have aided climbing. In Broward County, Florida, USA, *M. fulvius* are sometimes found among the fronds of various palm species, including Canary Island Date (*Phoenix canariensis*), Chinese Fan (*Livistona chinensis*), Christmas (*Adonidia merrillii*), and Queen (*Syagrus romanzoffiana*) palms (JPL, pers. obs.). On 1 April 2020, Jennifer Heller posted a photograph on Facebook of a *M. fulvius* on the trunk of a hardwood tree near Frostproof, Polk County, Florida, USA, and Randa Anderson reported seeing one climb an oak tree in Lady Lake, Lake County, Florida, USA. A video posted by Evangeline Cummings on Twitter on 17 October 2019 showed an *M. fulvius* with ca. half of the anterior portion of its body dangling from the branches of a Rose (*Rosa* sp.) bush and attempting to eat a dead, hanging *P. quadrivittatus* while being stung by a wasp in Gainesville, Alachua County, Florida, USA. The *M. fulvius* was previously observed climbing into the rose bush and later attempted to eat the snake by elevating ca. half of its body from the ground and grabbing the head. Anecdotal reports exist of *M. fulvius* climbing walls of buildings, being found in nonnative Punk Trees (*Melaleuca quinquenervia*) in southeastern Florida and sheltering under the bark of dead pine trees (*Pinus* spp.). Although *M. fulvius* is primarily fossorial (Ernst and Ernst 2003. Snakes of the Eastern United States and Canada. Smithsonian Books, Washington, D.C. 668 pp.), it occasionally climbs shrubs and trees, presumably in search of squamate prey.

FIG. 1. *Micrurus fulvius* climbing a *Quercus nigra* in Alachua County, Florida, USA.

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***NAJA NAJA* (Indian Cobra). LEUCISM.** *Naja naja*, the only cobra species found in Sri Lanka, is well known for its wide geographic distribution. Cobras with different ground color patterns, such as grey, yellowish, tan, reddish, or black, have been previously described (Wüster 1998. Hamadryad-Madras 23:15–32). Several albino *N. naja* has been reported in several locations of Sri Lanka (Dharmarathne and Wijesinghe 2020. WILDLANKA 8:206–214). But a leucistic *N. naja* has not been recorded in the literature. Here we report the first case of a leucistic *N. naja* from Sri Lanka.

A leucistic *N. naja* (161 cm SVL, 27 cm tail length) was observed on 13 February 2021, in Vidataltivu, Mannar District, Sri Lanka (9.0215°N, 80.0509°E; WGS 1984; 8 m elev.). The body was almost white in color and the eyes were black. A distinct unusual spectacle mark was present on the dorsal side of the hood demarcated by a black outline with a white interior (Fig. 1). A broad black patch was observed right below the spectacle mark resembling the English capital letter 'V'. Another narrow non-continuous black band was observed just below the 'V' shaped thick black band and this line was thicker towards the edges. An unevenly spread black patch was visible right below the narrow non-continuous black band. The majority of head scales were white but uneven black patches were observed

Fig. 1. Leucistic *Naja naja* observed in Vidataltivu, Mannar District, Sri Lanka. Left to right: frontal, lateral, and dorsal views of individual.

Fig. 2. Head scales with black markings on leucistic *Naja naja* observed in Vidataltivu, Mannar District, Sri Lanka.

covering several head scales, as well as in the first scale row of the body (Fig. 2). Left and right ocular scales had black markings which extended down to the 4th supra labial scale. The ventral surface of the hood was covered with three distinct black patches and the middle scale raw with unevenly spread black patch. A horizontal black band from ventral scales joining lowest two black patches on either side of the hood with two less prominent black bands on the ventral side of the snake was observed. The remainder of the ventral aspect was white in color with unevenly spread small blackish markings. The dorsal surface of the snake was almost white except for a few very small dark black spots spread unevenly along the surface. The snake was photographed, measured, and handed over to the initial collectors. Though *N. naja* is widely distributed in various geographic regions, this chromatic anomaly has not been encountered in Sri Lankan herpetological collections and is believed to be the first record of such a color pattern.

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***NERODIA SIPEDON* (Common Watersnake). FEEDING BEHAVIOR and LINGUAL LURING.** *Nerodia sipedon* is ubiquitous in lentic and lotic water bodies throughout its range in the eastern United States and southeastern Canada, occurring and thriving even in highly disturbed and manmade aquatic ecosystems. It is a dietary generalist that eats mainly fishes and amphibians and has been documented employing a number of strategies for feeding, including active foraging in vegetation and rocky substrates while submerged, active foraging on the surface of bodies of water, and sit-and-wait strategies (Gibbons and Dorcas 2004. North American Watersnakes: A Natural History. University of Oklahoma Press, Norman, Oklahoma. 496 pp.). It may also have been observed lingual luring in a lab setting (Czaplicki and Porter 1974. J. Herpetol. 8:132–133). This note describes the first field observation of effective attraction and predation of piscine prey by *N. sipedon* via lingual luring.

At 1515 h on 10 August 2021, I watched a juvenile *N. sipedon* (ca. 40 cm SVL) successfully attract and catch a *Gambusia affinis* (Western Mosquitofish) via lingual luring in an artificial pond located near the French Broad River in Knox County, Tennessee, USA (35.93748°N, 83.75061°W; WGS 84). When I first encountered the snake, it was in a "periscope" position, with the bottom half of its body under the cobble substrate of the pond, the top half of its body almost vertical in the water, and its head protruding just above the surface of the water. It disappeared into the substrate of the pond when I approached. After ca. 5 min, it emerged from the substrate ca. 1.5 m away from its original location and took the same "periscope" posture. Once the snake reemerged it remained almost completely still, its only movement being a subtle bobbing in the ripples of the surface of the pond. I noticed that numerous *G. affinis*, abundant in the pond, appeared to keep their distance from the snake after it initially emerged. Eventually, after ca. 5 min, they began to swim closer to the snake. After around ca. 10 min of remaining completely still, it began rapidly tongue flicking, disturbing the surface of the water. Approximately 10–15 *G. affinis* approached the disturbance. The snake immediately captured one with a lateral lunge and submerged into the cobble bedrock, presumably to consume it.

Lingual luring of piscine prey has been observed in four or five species of snakes, *Nerodia rhombifer* (Diamondback Watersnake) and/or *N. sipedon*, *Thamnophis atratus* (Pacific Coast Aquatic Garter Snake), *Nerodia clarkii compressicauda* (Mangrove Saltmarsh Snake), and *Thamnodynastes strigatus* (Coastal House Snake; Mario-da-Rosa et al. 2020. Salamandra. 56:45). The first recorded observation of *N. rhombifer* and/or *N. sipedon*, took place in a lab setting in an experiment testing the role of visual cues in prey selection (Czaplicki and Porter 1974, *op. cit.*). The experimenters did not specify which of their study snakes (only *N. sipedon*, only *N. rhombifer*, or both) engaged in what they called "fly-casting" behavior and observed that the snakes in their study lingual-lured from a full-body floating position. Welsh and Lind (2000. J. Herpetol. 34:67–74) observed and described juvenile *T. atratus* in the field utilizing distinctive tongue-flicks (longer in duration than chemosensory tongue-flicking) from the banks of streams to attract salmonid prey but did not witness any successful captures. Hansknecht (2008. J. Herpetol. 42:10–11) observed and described *N. clarkii* utilizing a distinctive tongue posture of protruding and looping to attract fishes in a lab setting. Finally, *T. strigatus* has been observed lingual-luring while hanging from riparian vegetation with their heads held just above the surface of the water (Mario-da-Rosa

2020, *op. cit.*). To my knowledge, this note represents the first report of successful capture of piscine prey by lingual luring for any species of snake in the wild. It is also the first report of a natricine snake utilizing such a strategy in a "periscoping" posture.

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***PHILODRYAS NATTERERI* (Paraguay Green Racer). DEFENSIVE BEHAVIOR/DEATH FEIGNING.** *Philodryas nattereri* is a dipsadid snake that is widely distributed in South America. In Brazil, this species occurs in arid and semi-arid regions being quite widespread in northeastern Brazil (Calixto and Morato 2017. Check List 13:647–657; Navarro-Cornejo 2020. Cuad. Herp. 34:329–331). Death feigning (thanatosis) is a common anti-predatory behavior among animals, displayed when they are threatened or apprehended by a predator (Toledo et al. 2011. Ethol. Ecol. Evol. 23:1–25; Zañartu and Urra 2020. Herpetol. Notes 13:731–732). We present here the first case of death feigning in *P. nattereri*.

At 0415 h on 21 June 2021, we rescued an adult *P. nattereri* (118 cm total length) in a residential area of the Pedro II Municipality, Piauí, northeastern Brazil (4.39600°S, 41.45552°W; WGS 84; 656 m elev.). The individual was properly transported and during handling for release in a preserved forest area far from the site of capture, the animal showed a defensive behavior of thanatosis, remaining immobile, slightly coiled with the dorsal side facing upwards and the muscles tense (Fig. 1). Thanatosis remained even after the animal was released onto the ground. It was not possible to estimate how long the snake remained immobile.

Similar defensive behaviors have been reported for other species in the genus, including *P. patagoniensis* (Patagonia Green Racer), *P. aestiva* (Brazilian Green Racer), *P. olfersii* (Lichtenstein's Green Racer), *P. viridissima* (Common Green Racer), and more recently in a juvenile *P. chamissonis* (Chilean Green Racer; Natera-Mumaw et al. 2008. Herpetotropicos. 4:40; Tozetti et al. 2012. Herpetol. Rev. 43:661; Abegg et al. 2018. Herpetol. Rev. 49:349–350; Banci et al. 2018. Herpetol. Rev. 49:137–138; Zañartu and Urra 2020, *op. cit.*).

PHOTO BY ALAN PABLO A. G. C. DE SOUSA

Fig. 1. Death feigning in an adult *Philodryas nattereri*, observed in the Pedro II Municipality, Piauí, northeastern Brazil.

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***PORTHIDIUM YUCATANICUM* (Yucatán Hog-nosed Pitviper). DIET.** *Porthidium yucatanicum* is a small pitviper (up to 600 mm total length [TL]) endemic to the Mexico's Yucatán Peninsula (Heimes 2016. Herpetofauna Mexicana Vol. 1, Snakes of Mexico. Edition Chimaira, Frankfurt am Main, Germany. 572 pp.). Based on stomach contents of snakes from Pisté (Yucatán, Mexico) and Pueblo Nuevo X-Can (Quintana Roo, Mexico), McCoy and Censky (1992. *In* Campbell and Brodie [eds.], Biology of the Pitvipers, pp. 216–222. Selva Publishing, Tyler, Texas) reported that *P. yucatanicum* feeds mainly on lizards (*Coleonyx elegans* and *Sceloporus chrysostictus*), the largest individuals consume mammals and small birds (passerine) and frogs (*Leptodactylus fragilis*). Small snakes (*Epictia vindumi*) are also preyed upon to a lesser extent. However, to date the specific identity of mammal prey items of *P. yucatanicum* have not been identified. Herein, we report the Yucatan Small-eared Shrew (*Cryptotis mayensis*) as prey of *P. yucatanicum*.

At 1300 h on 26 November 2019, ca. 5 km south of the Maya Archeological Zone of Kabáh, Municipality of Santa Elena, Yucatán (20.2025°N, 89.6469°W; WGS 84; 86 m elev.), we observed an adult male *P. yucatanicum* (370 mm SVL, 430 mm TL; Fig. 1) coiled under a small bush in sub-deciduous tropical forest. We took a fecal sample through gentle palpation of the posterior third of the snake´s body, then the snake was released. The fecal sample was stored in 70% ethanol for subsequent identification

Fig. 1. An adult male *Porthidium yucatanicum* from Santa Elena, Yucatán, Mexico, and (inset) enlargement of the medullary pattern in the spatular section of the guard hair of its prey, *Cryptotis mayensis* (Yucatan Small-eared Shrew).

at the laboratory. Dorsal guard hairs removed from the feces were prepared according to the method described by Monroy-Vilchis and Rubio-Rodríguez (2003. Guía de Identificación de Mamíferos Terrestres del Estado de México, a Través del Pelo de Guardia. Cuadernos de Investigación. Universidad Autónoma del Estado de México, México. 115 pp.). We determined that the prey remains correspond to *C. mayensis* by comparing with reference pre-mounted guard hairs of small mammals of the Yucatán Peninsula obtained from the mammal collection of El Colegio de la Frontera Sur (ECOSUR) at San Cristóbal de la Casas, Chiapas (ECO-SC-M).

Collecting permit was provided by Dirección General de Vida Silvestre SEMARNAT (SGPA/DGVS/02523/19) issued to JRCV.

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***SALVADORA GRAHAMIAE GRAHAMIAE* (Mountain Patch-nosed Snake). PREDATION.** *Salvadora grahamiae grahamiae* is a subspecies of *S. grahamiae* (Eastern Patch-nosed Snake), a slender, fast-moving, diurnal snake that inhabits rocky montane environments from western Texas, USA, westward through southern New Mexico, USA and into central Arizona, USA and northern Mexico (Degenhardt et al. 1996. Amphibians and Reptiles of New Mexico. University of New Mexico Press, Albuquerque, New Mexico. 431 pp.; Owens et al. 2020. *In* Holycross and Mitchell [eds.], Snakes of Arizona, pp. 328–336. ECO Herpetological Publishing, Rodeo, New Mexico). *Spilogale gracilis* (Western Spotted Skunk) is a nocturnal, small-sized opportunistic omnivore that has a diet primarily comprised of insects and small mammals, but also includes seeds, berries, fruits, lizards, frogs, and carrion (Verts et al. 2011. Mamm. Species 674:1–10). Recent molecular evidence suggests that *S. gracilis* is represented by three major lineages, of which the east-central clade (*S. g. leucoparia*) occurs from New Mexico, USA to western Texas, USA and south into central Mexico (Ferguson et al. 2017. Eco. Evol. 7:4229–4240). Herein, we report a predation event of *S. g. grahamiae* by *S. gracilis leucoparia*.

At 0103 h on 12 October 2020 in the Aguirre Springs Recreation Area on the east side of the Organ Mountains, Doña Ana County, New Mexico, USA (32.3666°N, 106.5617°W; WGS 84; 1806 m elev.), a remote camera captured two images of a *S. gracilis* holding a *S. g. grahamiae* in its mouth (Fig. 1). The motion triggered camera (Reconyx HyperFire Professional; set to capture bursts of three photographs 1 second apart) was part of an array of remote camera traps to investigate the distribution and landscape-scale habitat selection of the endemic *Neotamias quadrivittatus australis* (Organ Mountains Colorado Chipmunk). The photographs documented the skunk carrying a portion of the body of the snake. We confirmed the snake's identification as *S. g. grahamiae* by the cream-colored vertebral stipe bordered by bold, clean-edged, and wide black dorsolateral stripes (Fig. 1B; Degenhardt et al. 1996, *op. cit.*).

Salvadora grahamiae is thought to be preyed on by diurnal avian and mammalian predators and snakes (Owens et al. 2020, *op. cit*), but to our knowledge, there are only three documented cases of predation on *S. grahamiae*. Cazares et al. (2020. Herpetol. Rev. 51:616) described a *Diadophis punctatus regalis* (Regal Ringneck Snake) preying on *S. g. grahamiae* in Arizona, USA. Montoya-Ferrer et al. (2020. Herpetol. Rev. 51:863) described a *Drymarchon melanurus* (Middle American Indigo Snake) preying on *S. grahamiae* in Nuevo Leon, Mexico. Kopeny (1988. *In* Glinski et al. [eds], Proceedings of the Southwest Raptor Management Symposium and Workshop. National Wildlife Federation, Scientific and Technical Series Number 11, Washington, DC. 97–104) described a *Geranoacetus albicaudatus* (White-tailed Hawk) preying on a *S. grahamiae* in Texas. This note presents the first record of predation on this snake species by *S. gracilis*.

Fig. 1. A camera trap image of predation on *Salvadora grahmiae grahamiae* by *Spilogale gracilis* (Western Spotted Skunk) in the Organ Mountains, Dona Ana County, New Mexico, USA: A) ventral side of the prey is visible; B) ventral and dorsal side of the prey is visible.

Both *S. g. grahamiae* and *S. gracilis* are infrequently encountered in the field. During herpetological surveys, *S. g. grahamiae* is rarely detected (Bogart and Degenhardt 1961. Am. Mus. Novit. 2064:1–15; Jorgensen and Demarais 1998. Southwest. Nat. 43:441–448; Flesch et al. 2010. Southwest. Nat. 55:240–253). *Spilogale gracilis* is nocturnal and thought to be secretive (Verts et al. 2011, *op. cit.*). Remote cameras are particularly valuable for monitoring species that are not easily detected, because remote cameras can run continuously for weeks, are non-invasive with minimal human disturbance, and are easily programmed to achieve accurate data. Ultimately, remote sensing cameras can be useful for observing new phenomena of difficult to observe and secretive species, such as a nocturnal carnivore preying on a diurnal snake.

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***SISTRURUS CATENATUS* (Eastern Massasauga). OVER-WINTERING MORTALITIES.** *Sistrurus catenatus* ranges from Ontario, Canada, to southern Illinois, USA, and primarily uses crayfish burrows to hibernate during the winter months in Illinois. Dreslik and Jellen (1999. Final Report to the Illinois Wildlife Preservation Fund Small Grants program. 78 pp.) reported that *S. catenatus* in the Carlyle Lake, Illinois, USA area typically enter their hibernacula mid-October (ingress) and exit from mid-March through May (egress), but that they were also known to exhibit surface activity when the snakes' internal temperatures reach ca. 12°C (Dreslik et al. 2002. Report to the Illinois Department of Natural Resources. 78 pp.). Little research has investigated *S. catenatus* behavior from ingress to egress, although some past research has characterized hibernacula selection (Harvey and Weatherhead 2006. J. Herpetol. 40:66–73), the importance of access to unfrozen portions of the water table (Johnson 1995. Ph.D. Dissertation, State University of New York, Syracuse. xvii + 142 pp.), and winter thermal ecology (Dreslik et al. 2002, *op. cit.*). High rates of direct mortality during this period or shifts in behavior that influence future survival could contribute to continued declines in this species.

Sistrurus catenatus at this site are also known to be infected with *Ophidiomyces ophiodiicola,* the causative agent of snake fungal disease (SFD), and to exhibit high morbidity and mortality from the disease (Allender et al. 2018. Sci. Rep. 8:12147). There have been reported behavioral differences between infected and uninfected individuals in a wild *S. catenatus* population in Michigan (Tetzlaff et al. 2017. Herpetol. Conserv. Biol. 12:624–634). Infected individuals moved less, were less visible, and remained on the soil surface longer than uninfected snakes. It is not known to what extent SFD threatens the survival of the Carlyle Lake *S. catenatus* population, but, at the very least, is likely an additional stressor to the health of individuals within this population.

Between 12 December 2019 and 4 January 2020, a total of six *S. catenatus* were observed and reported by hunters (Table 1), including two live and four deceased individuals. The two live *S. catenatus* were observed by hunters on 29 December 2019 and 2 January 2020. The four mortalities were observed on 12 December 2019 (N = 2), 2 January 2020 (N = 1), and 4 January 2020 (N = 1). The four deceased individuals were collected by Illinois Department of Natural Resources staff and sent to the Wildlife Epidemiology Lab at the University of Illinois, Urbana-Champaign, to be necropsied and swabbed for *O. ophiodiicola.*

One of the two specimens collected on 12 December 2019 tested positive for *O. ophiodiicola*, the specimen collected on 4 January 2020 tested positive, and the specimen collected on 2 January 2020 tested negative, but granulomas were found in the liver, which are consistent with *O. ophiodiicola* infection. Previous research on this population of *S. catenatus* identified a prevalence rate of 14–22% for *O. ophiodiicola* infection (Allender et al. 2016. J. Wildl. Disease 52:258–269).

Research conducted by the Illinois Natural History Survey in 2000–2011 documented only nine mortalities during the winter period (December–February). Of these nine documented mortalities, one snake was euthanized, two were related to illness, one was unknown, and five were recorded as "other" (meaning something other than automobile, predation, died in captivity, euthanized, illness, management, persecution, stillborn, or surgical complication). Baker et al. (2016. Herpetol. Conserv. Biol. 11:335–343) found that automobiles, followed by predation, were the primary causes of mortality for *S. catenatus* at Carlyle Lake during all seasons. Unfortunately, we were unable to determine the cause of mortality for the four *S. catenatus* carcasses found between 12 December 2019 and 4 January 2020, but vehicle-related mortality was not suspected in these cases.

Previous research (Tetzlaff et al. 2017, *op. cit.*) has indicated that *S. catenatus* infected with *O. ophiodiicola* exhibit increased surface basking compared to uninfected individuals. Thus, it is important to better understand if and how *O. ophiodiicola* influences overwintering behaviors of infected *S. catenatus* and whether those behaviors increase mortality in the Illinois population. Previous research (Crawford et al. 2020. Diversity 12:177–194) identified that both substrate and mean three-day minimum air temperature influenced detection probability (among other variables) during the spring egress period. Specifically, the researchers recommend that searching in the spring when substrate temperatures are between 16.7°C and 30.2°C and mean minimum 3-day temperatures are between 15.9°C and 19.7°C increases detection probability. The 3-day minimum and maximum temperature, along with historical temperatures during these periods, are listed in Table 1.

Table 1. Individual data associated with each *Sistrurus catenatus* located at Eldon Hazlet State Park, Carlyle, Illinois, USA, during the winter of 2019–2020. Numbers in parenthesis represent historical averages taken from www.usclimatedata.com for Carlyle, Illinois, USA

Date	Snake ID	Live/Dead	Submitted for necropsy/testing	Sex	SFD results	3-day mean min temp [°C]	3-day mean max temp [°C]
12 Dec 2019	EHSP_12122019_1_DEAD	Dead	Yes	Unknown	Positive	-4.8 (-4.0)	7.4 (5.3)
12 Dec 2019	EHSP_12122019_2_DEAD	Dead	Yes	Male	Negative	-4.8 (-4.0)	7.4 (5.3)
29 Dec 2019	EHSP_12292019_1_LIVE	Live	N/A	N/A	NA	5.6 (-5.8)	15 (3.1)
2 Jan 2020	EHSP_01022020_1_DEAD	Dead	Yes	Unknown	Negative[a]	0.6 (-6.0)	8.2 (2.9)
2 Jan 2020	EHSP_01022020_2_LIVE	Live	N/A	N/A	NA	0.6 (-6.0)	8.2 (2.9)
4 Jan 2020	EHSP_01042020_1_DEAD	Dead	Yes	Female	Positive	2.4 (-6.1)	12.4 (2.9)

[a] Negative *Ophidiomyces ophiodiicola* test result, but granulomas detected in the liver are consistent with infection.

The number of *S. catenatus* submitted for *O. ophiodiicola* analysis is small, and we do not yet know if the fall and winter observations at Carlyle Lake are influenced by *O. ophiodiicola* infection, other variables, or interactions between disease and other variables. Thus, a better understanding of the variables that trigger *S. catenatus* at Carlyle Lake to emerge during the fall and winter period will help land managers determine where and when to focus habitat management efforts. We caution land managers that the variables that explain *S. catenatus* ingress, temporary egress, and egress may change over time and/or be altered by disease. Particularly at the southern extent of the species' range, *S. catenatus* may become more active during the winter months, which can impact planned management activities, including prescribed burning, invasive woody or exotic species control, and mowing. This will also potentially increase the possibility that the public will interact with this species, as the fall and winter seasons are when most park visitors are in the places that *S. catenatus* inhabit.

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***STORERIA DEKAYI* (Dekay's Brownsnake). MASS MOVEMENT and ROAD MORTALITY.** *Storeria dekayi* is a common colubrid snake species with a wide distribution across eastern and central North America and parts of Central America. It is considered to be a habitat generalist and can be found in a broad range of habitat types across its range. Despite its abundance and wide distribution, many aspects of this species' natural history and ecology remain unknown or poorly studied.

On 11 December 2016, at ca. 2142 h, I observed (for ca. 30 min) and recorded the mass movement and mortality of *S. dekayi* on a public roadway in Brazoria County, Texas, USA (29.27773°N, 95.72295°W; WGS 84). Approximately 40 *S. dekayi* individuals of various ages (i.e., juveniles and adults) were observed actively crossing the roadway on County Road 18 near the intersection of Highway 36, 1.76 km south of Damon, Texas, USA. I recorded 24 individual road mortalities in addition to the ca. 40 live individuals (ca. 64 individuals total) that were observed actively attempting to cross the roadway. Ambient temperature at this site was 21.1°C, and the area had received 0.15 cm of rainfall in the 3-h prior to this observation. I have conducted numerous road surveys in this area for reptiles and *S. dekayi* is among the most common and abundant species observed. However, this is the only time that I have observed a mass movement of this species.

Storeria dekayi, like many snake species, is known to form large aggregations of individuals and exhibit communal denning and burrowing behaviors, especially during winter months (Noble and Clausen 1936. Ecol Monogr. 6:269–316). However, few reports of the mass movement of large aggregations of *S. dekayi* exist in the scientific literature. Although definitive causes of this event are unknown, I hypothesize that the warm weather and rainfall likely prompted the movement of the observed individuals. Previous studies have discovered that environmental cues such as increased ambient temperature and rainfall can stimulate emergence and influence movement of *S. dekayi* (Noble and Clausen 1936. Ecol Monogr. 6:269–316; Gray 2014. J. N. Am. Herpetol. 2014:28–39). This suggests that abnormal weather events have the potential to disturb large aggregations of individuals and result in early or sporadic emergence patterns of *S. dekayi* and other species that utilize denning and burrowing behaviors during winter months. This observation demonstrates the risk of large mortality events that can occur because of the mass movement of individuals across or near roadways, a common and well-documented cause of herpetofaunal mortality. Although populations of *S. dekayi* are considered stable (Hammerson et al. 2013. IUCN Red List of Threatened Species 2013:e.T63928A3131331), population level effects from events such as these are important to consider for vulnerable species or species of concern.

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***THAMNOPHIS SIRTALIS PALLIDULUS* (Maritime Gartersnake). COLORATION.** Understanding pigment variation in postglacial populations of *Thamnophis sirtalis* has been identified as one means of better understanding the predicted loss of genetic variation in populations expanding northward in response to climate change (Westphal et al. 2011. PloS ONE 6:e24199). Although recognized as one of the most color-variable of North American snakes (Rossman et al. 1996. The Garter Snakes: Evolution and Ecology. University of Oklahoma Press, Norman, Oklahoma. 332 pp.), much of the current taxonomy for *T. sirtalis* continues to rely on coloration. Eckel (1902. Amer. Nat. 36:481–490) noted that the features of coloration defining *T. s. pallidulus* occurred widely outside the northeast, and that even within the subspecific geographic range, some snakes lacked defining patterns of coloration. Later, Ruthven (1908. Bull. U.S. Nat. Mus. 61:1–201) reported a lack of geographic limits on color phases within the species. Mooi et al. (2011. Copeia 2011:187–200) documented extreme color variation in populations of *T. sirtalis* in Manitoba, Canada and Michigan, USA and likewise questioned the validity of subspecies within *T. sirtalis* based on coloration. However, Bleakney (1959. Copeia 1959:52–56) resurrected the subspecies *T. s. pallidulus*, stating that the color form (with conspicuous spots, and only occasionally with a light gray dorsal stripe) was consistent (with three color morphs – cinnamon brown, yellowish olive, and olive-grey ground colors [color based on Ridgeway 1912. Color standards and color nomenclature. Washington, D.C., 53 pp + LIII],) over an area centred on Maritime Canada, but extending westward into New Hampshire, USA, northward to James Bay, and east along the north shore of the Gulf of St. Lawrence. Gilhen (2010. Can. Field-Nat 124:93–103), Gilhen and Scott (2014. Can. Field-Nat.128:63–71), and McAlpine et al. (2019. Herpetol. Rev. 50:815–816) added a variety of melanistic and erythristic colour morphs to *T. s. pallidulus* in Maritime Canada. Although Rye (2000. Ph.D. Dissertation, University of Guelph, Guelph, Ontario. 107 pp.) identified a Maritime lineage of *T. sirtalis* based on allozyme and mtDNA data, she also noted discordance between coloration and evolutionary history within the species. Here we add two striking color variants (colors follow Smithe 1981. Naturalist's Color Guide. American Museum of Natural History, New York, New York. Parts 1–3, 86 plates + 229 + 37 pp.) to a growing list of color patterns documented in *T. s. pallidulus*, further supporting early 20th century and more recent evidence that coloration within *T. s. pallidulus* is far more polymorphic than evident in the sample of 376 snakes that

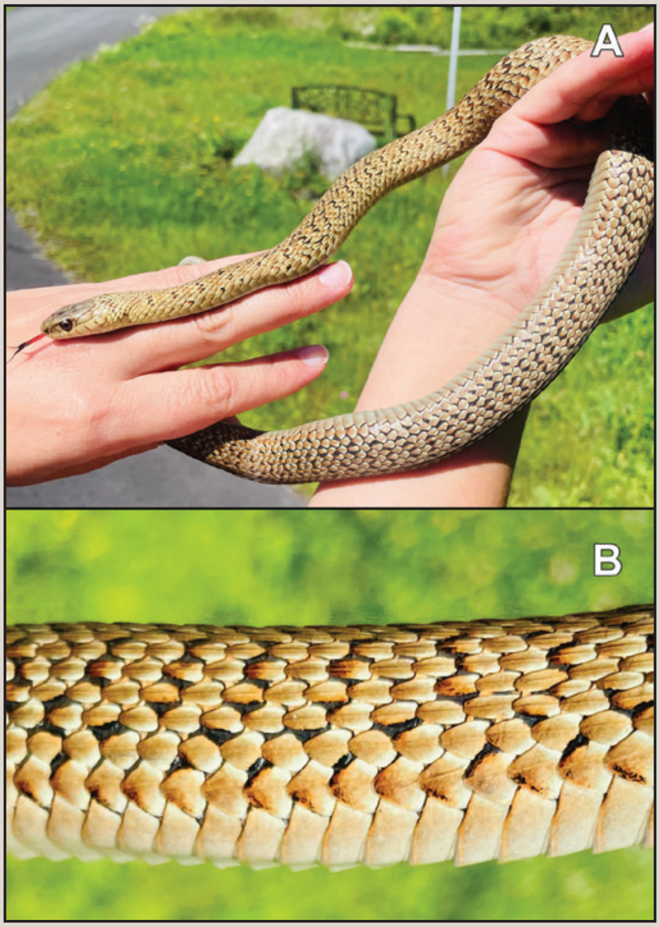

Fig. 1. Photographs of *Thamnopis sirtalis pallidulus* color variant 1 from New Brunswick, Canada, including whole body view (A) and detail of lateral scalation (B).

Fig. 2. Photographs of *Thamnopis sirtalis pallidulus* color variant 2 from New Brunswick, Canada, including lateral (A) and frontal-ventral (B) views.

Bleakney (1959, *op. cit.*) examined.

Color variant 1: an unspotted, unstriped morph. Dorsal scales drab. Lateral scales drab distally and centrally, occasionally ferruginous distally; proximal margins pale horn. Interscale skin jet black or warm buff, producing an irregular pattern. Prefrontals, frontals and parietals drab. Superior surface of supra and infralabials buff dorsally, inferior surface cream to buff-yellow bordered with mahogany red distally. Ventrals pale horn; distal margins of ventrals salmon. Examined live and photographed (728 mm total length; Fig 1A, B) by DFM on 25 July 2021 at Rusagonis, York County, New Brunswick, Canada (45.8151°N, 66.5927°W; WGS 84). Photo vouchers and shed skin deposited in the New Brunswick Museum (NBM-AR-12760).

Color variant 2: a spotted morph with a narrow, broken, pearl grey stripe anteriorly. Most notable for a wash of intense turquoise blue on the anterior- lateral third of the body (Fig 2A–B). Turquoise blue most prominent on the supralabials and dorsal-lateral scale rows, but also spreading to the margins of the ventrals. Infralabials white. Similar in appearance to some specimens of *T. sirtalis similis* (restricted to northwestern peninsular Florida, USA), although lacking the better-defined "dull tan" vertebral stripe reported as present in *T. s. similis* (Rossman 1965. Proc. Louisiana Acad. Sci. 26:67–73). Adult snake observed and photographed 3 July 2021 along the Restigouche River, 15.9 km N of Kedgwick, Restigouche County, New Brunswick, Canada (47.78461°N, 67.38505°W; WGS 84). NBM photo voucher file NBM-Ts-2021-001.

Smyers et al. (2014. Herpetol. Rev. 45:8–12) present images of a variety of color variants from coastal islands off Massachusetts, USA from populations that Lazell (1976. This Broken Archipelago. Demeter Press Quadrangle/The New York Times Book Co., New York, New York. 260 pp.) suggested may be relict populations of *T. s. pallidulus* (distinct from adjacent mainland populations assigned to *T. s. sirtalis*). While genetic data will be required to confirm this hypothesis, we note that all of the variants illustrated are spotted and none show blue scales or blue interscale skin. Ruthven (1908, *op. cit.*) refers to dull greenish or bluish stripes in *T. s. pallidulus* and Barnes et al. (2006. Northeast. Nat. 13:73–82) mentions blue-margined ventrals or occasional blue spots, but none of these descriptions approach color variant 2 above. The blue coloration reported in *T. s. similas* has been attributed to the influence of salt-marsh habitat, or some "presently unexplained [aspect] of the Gulf Hammock (hardwood) region" (Rossman 1965, *op. cit.*). Bleakney (1959, *op. cit.*) reports ground colors of brown, olive, or grey, but makes no reference to blue or unspotted- unstriped morphs in his redescription of *T. s. pallidulus.* Likewise, with the exception of unpatterned melanistic snakes, neither Gilhen (2010, *op. cit.*) or Gilhen and Scott (2014, *op. cit.*), reference blue-hued or light colored, unspotted-unstriped, morphs of *T. s. pallidulus.*

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***TRIMORPHODON TAU* (Mexican Lyresnake). DIET.** *Trimorphodon tau* is a nocturnal colubrid that occupies semi-arid to seasonally dry habitats and is widely distributed in Mexico, along the coastal slopes and foothills of the Sierra Madre Oriental, Sierra Madre Occidental, and Sierra Madre del Sur, and across the Mexican Plateau and the Mesa de Oaxaca (Heimes 2016. Herpetofauna Mexicana. Vol. 1 Snakes of Mexico. Chimaira, Frankfurt am Main, Germany. 572 pp.). The diet of this snake is composed mainly of lizards of the genera *Aspidoscelis* and *Sceloporus*, although frogs and mammals (McDiarmid and Scott 1970. Los Angeles Co. Mus. Nat. Hist. 179:1–43), fishes (Hernández-Árciga et al. 2018. Los anfibios y reptiles de Guanajuato. SEMAOT and Herpetario de la Sierra Gorda, Guanajuato, México. 284 pp.), geckos (Lazcano-Villareal et al. 2010. Serpientes de Nuevo León. UANL, Nuevo León, México. 502 pp.), ground-nesting birds and their eggs (Woolrich-Piña et al. 2005. Anfibios y reptiles del Valle de Zapotitlán Salinas, Puebla. UNAM and CONABIO, México. 54 pp.) are also probably eaten. However, only four *Sceloporus* species have been reported: *S. cyanogenys* (Contreras-Lozano et al. 2007. Herpetol. Rev. 38:82–83), *S. grammicus* (Quintero-Díaz et al. 2020. Herpetol. Rev. 51:881), *S. horridus* (Canseco-Márquez and Gutiérrez-Mayén 2010. Anfibios y Reptiles del Valle de Tehuacán-Cuicatlán. CONABIO, CUICATLÁN A.C., and BUAP, México. 302 pp.), and *S. spinosus* (Luría-Manzano et al. 2020. Herpetol. Rev. 51:159).

We found a juvenile male specimen (355 mm SVL, 426 mm total length, 8 g) of *T. tau* on 22 August 2021, at 2018 m elev., at 3.2 airline km SW from Cacaloapan, Municipality of Tepanco de López, Puebla, México (18.56893°N, 97.61364°W; WGS 84). After gentle palpation the snake regurgitated a partially digested juvenile female *Sceloporus jalapae* (1 g) which was ingested head-first. The specimen and the stomach content were deposited at the Colección Zoológica, Universidad Autónoma de Aguascalientes (UAAREP 833). We captured the snake with permit SGPA/DGVS/08831-20, issued by the Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT).

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