

# NATURAL HISTORY NOTES

## CAUDATA — SALAMANDERS

**AMBYSTOMA JEFFERSONIANUM** (Jefferson Salamander). **PREDATION BY THAMNOPHIS SIRTALIS.** *Ambystoma jeffersonianum* is primarily a fossorial species, seldom seen outside of a brief spring breeding season (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Inst. Press, Washington, DC. 587 pp.). Most knowledge of their predators concerns the developing larvae; there is limited documentation of predation upon juveniles and adults (Petranka 1998, *op. cit.*). They are particularly vulnerable when migrating to and from the ponds in which they breed (Petranka 1998, *op. cit.*). The Eastern Garter-snake (*Thamnophis sirtalis sirtalis*) is a generalist predator that would be expected to commonly co-occur with these salamanders, based upon geographic range and habitat preference (Ernst and Ernst 2003. Snakes of the United States and Canada. Smithsonian Books, Washington, DC. 668 pp.; Petranka 1998, *op. cit.*). They are known to feed on other ambystomatids, including *A. opacum*, *A. laterale*, and *A. maculatum* (Ernst and Ernst 2003, *op. cit.*). At 2100 h on 10 April 2013 in the State Game Lands No. 176, Centre Co., Pennsylvania, USA (40.77170°N, 77.95856°W; WGS 84) a *T. s. sirtalis* was observed in the process of swallowing an adult *A. jeffersonianum* tail first, which it ultimately completely consumed (Fig. 1). This occurred within 1 m of a vernal pool breeding pond used by *A. jeffersonianum*. To our knowledge, this is the first record of predation by *T. s. sirtalis* on *A. jeffersonianum*.

Funding for this research was provided by NSF 428-15 (#60YW) Global Change REU to Tracy Langkilde.

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**AMBYSTOMA OPACUM** (Marbled Salamander). **LARVAL AGGREGATION.** Over several years and at several small-pond breeding sites in Wayne and Jennings counties, Indiana, USA, we observed larval Marbled Salamanders associated with recently laid egg masses of Wood Frogs (*Lithobates sylvaticus*) during March (Fig. 1). Although larval Marbled Salamanders are known to feed on embryos and tadpoles of Wood Frogs in the laboratory and the field (Cortwright and Nelson 1990. *Oecologia* 83:123–131; Walters 1975. *J. Herpetol.* 9:267–279), the only published statement intimating aggregation behavior in Marbled Salamander larvae is that by Walters (1975, *op. cit.*) who observed that a “clump of about 30 freshly laid masses [of *sylvaticus*] was surrounded by over 50 larval *A. opacum*.”

On the night of 19 March 2013, nine days after the local peak of Wood Frog breeding at an ephemeral pond in old-growth forest (ca. 38.96555°N, 85.62527°W) on the Crosley Wildlife Management Area, Jennings Co., Indiana, USA, we undertook visual surveys around the entire pond margin to test the hypothesis that Marbled Salamander larvae in this pond were concentrated at the site of Wood Frog egg deposition. With only a single LED headlight, we identified two adjacent clusters of Wood Frog egg masses centered about 0.75 m from the shore. We turned on the light for about 15 seconds at the first cluster and quickly counted the number of larvae in a quadrat area of ca. 0.75 m x 0.75 m. In the dark we moved clockwise around the pond, stopping every



FIG. 1. *Thamnophis sirtalis sirtalis* ingesting an adult *Ambystoma jeffersonianum* tail first, Centre Co., Pennsylvania.



FIG. 1. Larval *Ambystoma opacum* (white circles) in association with egg masses of *Lithobates sylvaticus*, Jennings Co., Indiana.

ca. 2 m (about three paces) to repeat the count, centered on the same distance from the shoreline. All sample sites were similar in microhabitat, but varied in depth from ca. 5 to 15 cm. The second count was located over the second Wood Frog egg cluster, but eggs were found at no other site around the pond. Our larval counts were 25, 25, 2, 0, 0, 0, 4, 3, 3, 5, 9, and 7. The mean larval count away from the egg masses (3.3;  $N = 10$ ) was nearly an order of magnitude fewer than at the egg masses, confirming that Marbled Salamander larvae were strongly associated with Wood Frog eggs. Although we did not sample quantitatively the distribution of Marbled Salamander larvae before Wood Frogs began laying eggs, during our general amphibian surveys at this pond (and others) during November, December, and early March over more than a decade we never found Marbled Salamander larvae concentrated at particular sites along the shoreline prior to Wood Frog breeding. We presume that this larval concentration is facilitated by olfactory cues, and that the association is diet related (references above).

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**CRYPTOBRANCHUS ALLEGANIENSIS ALLEGANIENSIS (Eastern Hellbender). TERRESTRIAL MOVEMENT.** In the Toccoa River (Ocoee River) drainage, a tributary to Blue Ridge Lake, Fannin Co., Georgia, USA, a larval hellbender (evident external gills present; 7 cm TL) was observed moving terrestrially over fine sand and gravel substrate along the margin of a stream ca. one hour before sunset on 16 July 2012. This individual appeared to be emerging from a cover rock (55 cm x 25 cm) with a small, shallow (barely deep enough for submergence) puddle underneath. The cover rock was located adjacent to a riffle of a 5-m-wide stream and was 50 cm from flowing water and 30 cm from open standing water. Terrestrial movement of adult hellbenders has been observed in captivity and in the wild, but to our knowledge this is the first observation of the terrestrial movement of a larval hellbender. Diurnal terrestrial movements have been observed by captive hellbenders at Riverbanks Zoo and Gardens (Columbia, South Carolina) on several occasions, where hellbenders are maintained in captivity within a 2.5 m x 1.5 m x 3 m exhibit that contains a coldwater-flowing stream as well as planted, dry land areas with a soil and leaf litter substrate. Multiple individual hellbenders have been observed exiting the stream and walking along the rear wall of the exhibit and then reentering the water. All of these observations have been made during daylight hours and the hellbenders could be moving on land at night without being observed. In North Carolina, local fishermen have reported observing hellbenders moving on land some distance from the water. Beck (1965. *Field and Stream* 69:64–66, 109–113.) reported catching hellbenders < 1 m from the water's edge with meat-baited mammal traps on more than one occasion along the Allegheny River in Pennsylvania. Terrestrial movement may support biogeographic theory in explaining the distribution of hellbender populations within portions of drainages upstream of apparent barriers to movement (e.g., a hellbender population found upstream of a ca. 35 m waterfall within the Nottely River watershed in Georgia).

Species identification of the larval specimen from this observation was verified from a voucher photograph (K. Krysko and M. Nickerson, University of Florida, Florida Museum of Natural History).

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**CRYPTOBRANCHUS ALLEGANIENSIS ALLEGANIENSIS (Eastern Hellbender). CANNIBALISM.** Although cannibalism in *Cryptobranchus alleganiensis* has been previously reported (Nickerson and Mays 1973. *The Hellbenders: North American Giant Salamanders*. Milwaukee Public Mus. Press; 106 pp.; Petranks 1998. *Salamanders of the United States and Canada*. Smithsonian Institution Press, Washington, D.C. 587 pp.; Phillips and Humphries 2005. *In Lannoo [ed.], Amphibian Declines: The Conservation Status of United States Species*, pp 648–651. Univ. California Press, Berkeley, California), additional cases are worthy of note, since only a few specific reports of this behavior have been recorded from wild caught hellbenders, and there has been no discussion on the possible causes of this behavior. Cannibalism was first reported in *C. a. alleganiensis* by Reese (1903. *Sci. Monthly* 62:526–531). In captivity, he observed a larger hellbender consuming a smaller conspecific. He was able to remove the ingested smaller specimen with forceps, and it swam away unharmed when released in its enclosure. Smith (1907. *Biol. Bull.* 13:5–39) reported a two year-old hellbender in northwestern Pennsylvania, that when placed in quiet water after capture, regurgitated a partly digested 6-cm larval conspecific. The size of the larger specimen was between 12.0 cm and 12.3 cm. The only other reported observation of cannibalism in this species from a wild specimen is that of Humphries et al. (2005. *Herpetol. Rev.* 36:428) who reported that a larger, wild caught, adult male *C. a. alleganiensis* (37.2 cm TL) regurgitated a smaller individual (18.5 cm TL) in the field. The North Carolina population where this occurred is very dense and comprised of all size classes (J. Humphries, pers. comm. and L. Williams, pers. obs.). Here we report another field case of cannibalism from a North Carolina population.

On 29 June 2010, an adult female (39 cm TL) *Cryptobranchus a. alleganiensis* was collected from a fast riffle, in a section of the French Broad River, Transylvania Co., North Carolina, USA (specific locality is recorded with the North Carolina Wildlife Resources Commission and is withheld to protect the population). After data collection, the specimen was held in a mesh bag and lowered into the water in strong, swift current in preparation for its release. During this process and after being subjected to the strong current, it regurgitated a smaller hellbender (21 cm TL) while still in the mesh bag. The consumed hellbender was decaying, and there was a strong odor of rotten flesh (Fig. 1). From our observations and photographs of the carcass, it appears that the adult hellbender grasped the smaller hellbender laterally on its right side (tooth marks identified on dorso-lateral surface of body confirmed by North Carolina Zoo pathologist, Brigid Trovan). Unfortunately, this regurgitated hellbender was not saved due to its advanced state of decay. The locality where this observation was made contains a robust, reproductively active population of hellbenders of all age classes.

In a similar example, Max A. Nickerson (pers. comm. 2012) informed us of wild-caught Ozark Hellbenders (*C. alleganiensis bishopi*) eating smaller conspecifics from the North Fork of the White River in Missouri when they were placed in coolers under crowded conditions. On 12 March 1972, two Ozark Hellbender gilled larvae (9.5 and 13.0 cm TL) were cannibalized when placed



FIG. 1. Cannibalized juvenile *Cryptobranchus alleganiensis*, Transylvania Co., North Carolina.

and pers. obs.). Hellbenders are opportunistic foragers and scavengers and are attracted to food by visual, chemical, and tactile stimuli (Nickerson and Mays 1973, *op. cit.*). It is possible that cannibalism in this species is a density-dependent behavior, primarily related to population size. Denser populations may provide adults with more opportunity to find younger, smaller hellbenders during foraging activities. All reported cases of hellbender cannibalism have come from dense populations (Smith 1907, *op. cit.*; Humphries et al. 2005, *op. cit.*) or in the confines of captivity. Another possible contributing factor to hellbender cannibalism is that in denser populations less food may be available and cannibalism may increase due to fewer or more dispersed food resources. A similar explanation of this behavior has been suggested for other salamanders (Duellman and Trueb 1986. *Biology of Amphibians*. McGraw Hill, New York. 670 pp.). Our observations and reports from other field biologists working with hellbenders suggest that crayfish are less abundant in denser hellbender populations than in smaller or possibly declining hellbender populations.

We thank Max Nickerson for sharing his observations of cannibalism in hellbenders and for allowing us to publish them. Thanks to Brigid Trovan for examining our photographs. We also thank the many volunteers who worked with us throughout our hellbender surveys for their time and efforts.

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**PLETHODON CINEREUS (Eastern Red-backed Salamander).**

**MORPHOLOGY.** *Plethodon cinereus* is the most common woodland salamander in the northeastern United States (Conant and Collins 1998. *A Field Guide to Reptiles and Amphibians of Eastern and Central North America*. Houghton Mifflin Co., Boston, Massachusetts. 616 pp.) This species is polymorphic, and three color variations are commonly recognized and described. The striped or “red-backed” morph is black with a deep red dorsal stripe, the unstriped or “lead-backed” morph is black and lacks a dorsal stripe, and the “erythristic” morph is red with varying degrees of dark mottling. There is also a “leucistic” morph, which is far less common across the range of *P. cinereus*. This morph has general reduction in pigmentation, but retains regular black



FIG. 1. Leucistic individuals of the Eastern Red-backed Salamander, *Plethodon cinereus*, from Geauga Co., Ohio. A) Adult female (33.9 mm SVL) observed 14 Sept 2011. B) Subadult (sex unrecorded; 25.9 mm SVL) observed 14 October 2012.

eyes and is not considered albino. Across the range of *P. cinereus*, three leucistic individuals have been reported from Maryland (Mitchell and Mazur 1998. *Northeast. Nat.* 5[4]:367–369), two individuals from Nova Scotia (Moore and Gilhen 2011. *Can. Field Nat.* 125:58–60) and Massachusetts (Lotter and Scott 1977. *Copeia* 1977:681–690; Mendyk et al. 2010 *Herpetol. Rev.* 41[2]:189–190), and one individual each from West Virginia (Pauley 1974. *The Restart* 42:104), Ontario (Rye 1991. *Can. Field Nat.* 10:573–574), New York (Mendyk et al. 2010, *op. cit.*), Quebec (Moore and Gilhen 2011, *op. cit.*), and New Brunswick (Jongsma 2012. *Herpetol. Rev.* 43[3]:460). Two leucistic individuals from Ohio were discovered on 14 Sept 2011 and 14 October 2012 at the West Woods in Russell Township, Geauga Co. The first individual, an adult female, was found under a partially decomposed hardwood log fragment and the second individual, a subadult, was found under an artificial cover object (slate floor tile). Striped and erythristic phenotypes have also been observed at this site.

These are the first two confirmed records of leucistic *P. cinereus* for Ohio and it is notable that both specimens were observed at the same locality. These individuals were not collected; however photo vouchers (Fig. 1) were deposited in the herpetology collection of the Cleveland Museum of Natural History (CMNH 14071, 14072).

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#### ANURA — FROGS

**CRAUGASTOR LATICEPS. POSSIBLE OVOVIVIPARITY.** All species of *Craugastor* (Craugastoridae) are thought to be direct developers (Hedges et al. 2008. *Zootaxa* 1737:1–182). However, we report an instance in which indirect evidence suggests that *C. laticeps* is ovoviviparous. We collected an adult female *C. laticeps* (MVZ 269388) on the ground about 1–2 h after nightfall on 25 April 2011 in the vicinity of San Isidro (15.11666°N, 88.93333°W, datum WGS 84; elev. 1350 m), Copán, Honduras. The frog was placed alone in a plastic collecting bag. The next morning, upon inspection, the female, together with 44 eggs, each of which included a froglet in an advanced stage of development (tails nearly completely resorbed, limbs well developed, etc.), but still within the egg membranes (with the exception of one, which had emerged from its still present membranes), were present in the bag (Fig. 1A).

The female measures 66 mm SVL. The oviducts of the female are highly contracted and only slightly convoluted, rather than dilated and flaccid as we had anticipated (based on the MHW's experience with recently post parturient viviparous caecilians). The ovaries are contracted and compressed dorsally. A large compacted dark gray mass of presumably undigested dirt in the terminal part of the intestine suggests that the female had been feeding; her stomach was compressed dorsally and the large coelomic space is open and evacuated.

The froglet that had emerged from its egg membrane (MVZ 269391; not illustrated owing to positional distortion) is 14.0 mm SVL. A tiny egg tooth is present; it is bifid, each side terminating as a black tip. Its tail is fully resorbed. The SVL of a froglet freed from its membrane (MVZ 269390) is 13.5 mm; that of two slightly smaller ones (included in MVZ 269389; the 42 other eggs/froglets in the clutch), still in their membranes (but with curvature accounted for) are 12.8 mm and 13.8 mm (the latter featured in Fig. 1B). These dimensions appear to approximate the SVL range for the 44 froglets. One of the two smaller froglets in membranes just mentioned has an irregularly shaped, somewhat flattened, approximately 1.8 x 1.2 mm mass of unresorbed yolk in its gut. All of the froglets appear to retain some yolk. External egg diameters range from 9.5 to 12.0 mm. All of the unemerged froglets (MVZ 269389) are in the same position in their membranes; the hind limbs are folded such that the tibio-femoral joint and feet are near the face; the forelimbs are tucked below the jaw so that the froglets are nearly round objects inside the egg membranes. As seen through the membranes at 60x, most of the froglets have resorbed their tails, but a few appeared to have a small fragment remaining and it is attached to the egg membrane. The bifid black-tipped egg tooth appears to be present in all of the froglets. The pigmentation of the froglets is quite uniform in pattern, and strongly resembles that of the adult female. They have a brown dorsum and a cream venter; the hind legs have bars of

brown on the cream ground color laterally, and the forearms have laterodorsal brown bars. The head is darker brown and more densely pigmented. All along the upper jaw, the brown pigment is interrupted by short, vertical, cream bars; there are two prominent white bars medially over each premaxilla. The bars are prominent and close together, then followed laterally by a broad brown bar. These color data demonstrate the advanced stage of development in the froglets.

The presence of the advanced, egg-membrane-bound froglets in the collecting bag a few hours after the introduction of a single adult female suggests that the species might be ovoviviparous. Furthermore, JRM has never found a clutch of *C. laticeps* eggs during his years of extensive collecting in Honduras. Given the single adult specimen and the circumstances of the discovery, however, a number of presumptions and questions require additional data to verify and resolve. For example, we assume that fertilization in the species is internal, likely by cloacal apposition as in *Eleutherodactylus coqui* (Eleutherodactylidae), although females of that species very shortly ovulate their fertilized eggs whereupon direct development ensues (Townsend et al. 1980. *Science* 212:469–471), in order for developing embryos to be retained in the oviducts of the female. We wonder whether

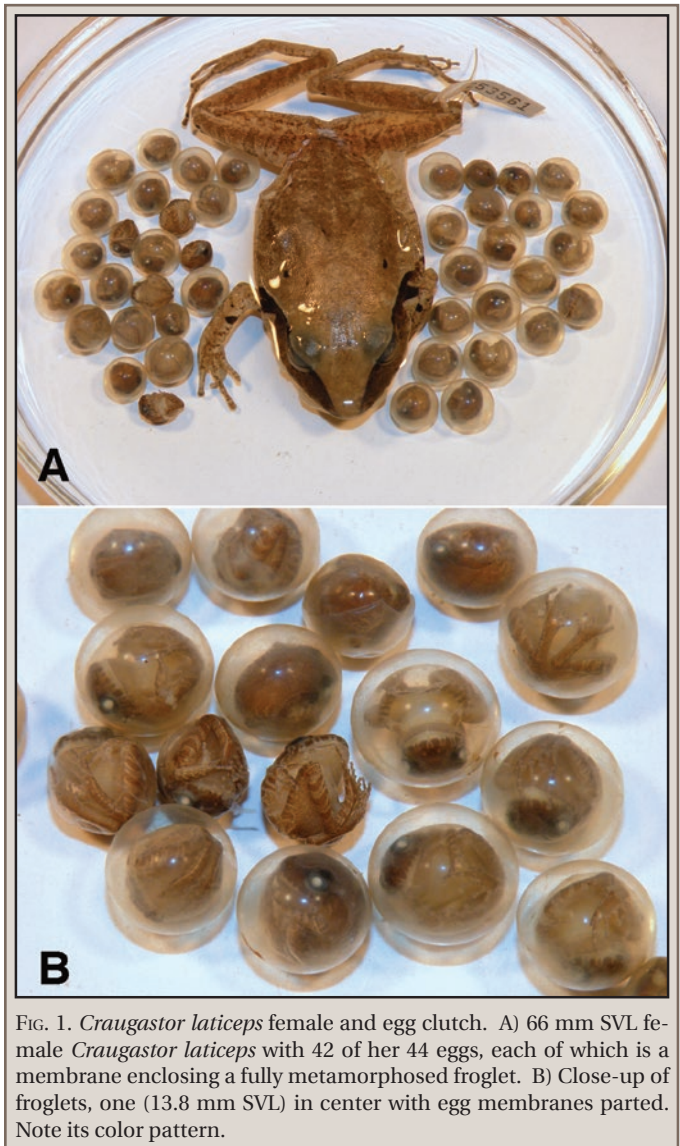


FIG. 1. *Craugastor laticeps* female and egg clutch. A) 66 mm SVL female *Craugastor laticeps* with 42 of her 44 eggs, each of which is a membrane enclosing a fully metamorphosed froglet. B) Close-up of froglets, one (13.8 mm SVL) in center with egg membranes parted. Note its color pattern.

the stress associated with collection precipitated the oviposition of the membrane-bound froglets, such that normally they would hatch in the oviducts just prior to birth, or whether oviposition precedes hatching of the froglets. How she was able to oviposit the large intramembranous froglets without bursting the egg membranes is of biomechanical interest. We have no information on the length of the gestation/developmental period, the endocrine maintenance of the “pregnancy,” nor any aspects of seasonality of reproduction. We lack information on egg sizes and numbers in standard clutches for the species; the presence of some yolk remaining in the gut of the advanced froglets supports the idea that the eggs are relatively large, and that the froglets are dependent on that yolk for their development through metamorphosis.

There are other reports of apparent ovoviviparity in related taxa. The now-extinct *Eleutherodactylus jasperi* (Eleutherodactylidae) was definitely ovoviviparous, based on several females that had 1–5 embryos that developed through metamorphosis in her oviducts (Wake 1978. *J. Herpetol.* 12:121–133). Furthermore, Lynn (1940. *Bull. Inst. Jamaica Sci. Ser.* 1:1–60) reported that he collected adult *E. orcutti* (Eleutherodactylidae) in Jamaica, placed them in a bottle, and upon return from the night’s collecting, found six newly hatched young in the bottle. Lynn suspected ovoviviparity, but his dissections of a number of females gave no support to that idea, and he referred to the finding as “mysterious.”

Our observations similarly leave the reproductive biology of *Craugastor laticeps* mysterious. We urge that extensive field research be initiated for this species (considered vulnerable in the IUCN Red List; 2013. <http://www.iucnredlist.org>). We also strongly recommend that, because specimens are now routinely tissueed, collectors should examine gonads and their ducts to sex adults and record any information relevant to the potential reproductive attributes of the animals that they collect—surprises await!

We thank Daniel Portik for photographing the female and her clutch.

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**CRAUGASTOR RANIFORMIS (Robber Frog). PARENTAL BEHAVIOR.** The genus *Craugastor* contains ca. 113 species distributed in the Americas from the southwestern USA to northwestern South America (AmphibiaWeb 2013. <http://amphibiaweb.org/>). The representatives of this genus have a terrestrial mode of reproduction with direct development, depositing their eggs in fallen leaves or under rocks or tree trunks, where there is moisture for egg development. Parental care has been reported in *Craugastor angelicus*, *C. aurilegulus*, *C. crassidigitus*, *C. decoratus*, *C. fitzingeri*, *C. latrans*, *C. noblei*, *C. psephosypharus*, *C. talamancae* (Jameson 1950. *Copeia* 1950[1]:44–46; Bogert 1969. *Amer. Mus. Novitates* 2367:1–9; Hayes 1985. *J. Herpetol.* 19[1]:168–169; Savage et al. 1988. *Bull. S. California Acad. Sci.* 87:50–56; Campbell et al. 1994. *Herpetologica* 50[4]:412–419; Mendoza-Quijano et al. 2002. *Herpetol. Rev.* 33[2]:125; Whitfield and Pierce 2003. *Herpetol. Rev.* 34[4]:357–358; Ryan 2005. *Herpetol. Rev.* 36[4]:234–236; Whitfield et al. 2008. *Herpetol. Rev.* 39[1]:76). *Craugastor raniformis* occurs from southeast-central Panama to the San Juan

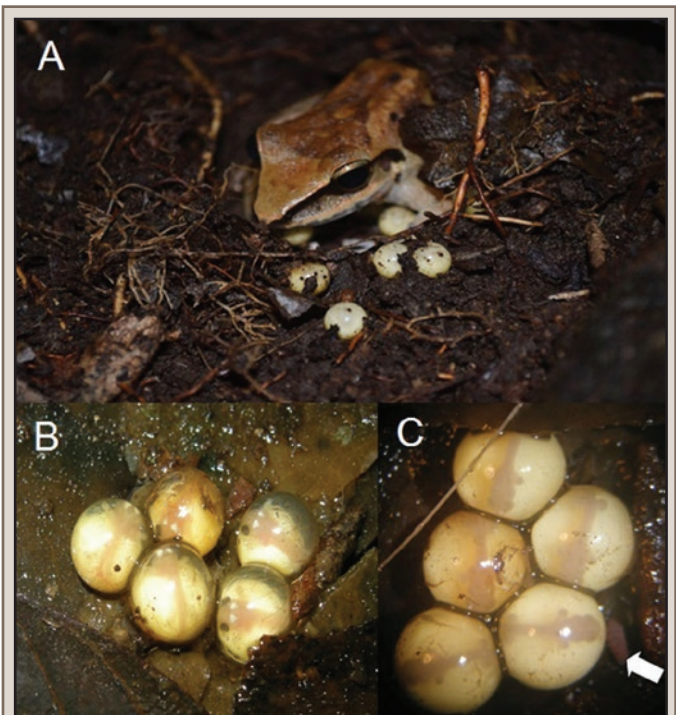


FIG. 1. Parental care in *Craugastor raniformis*. A) Female assisting a nest; eggs in stage 3 of development. B) Egg in stage 5 of development with presence of four limbs; C) Eggs with parasites, the white arrow indicates a parasitic organism.

de Micay River in Cauca, western Colombia, in the forested lowlands on the west side of the Andes Mountain Chain, and possibly as isolated populations in the Cauca and Magdalena River inter-Andean valleys (Lynch and Myers 1983. *Bull. Amer. Mus. Nat. Hist.* 175[5]:481–572). Here we report observations on the parental care of *C. raniformis*, as well as data on nesting sites and nest sizes within a premontane wet forest-warm transition, according to Holdridge classification (Instituto Geográfico Agustín Codazzi 1977. 13[11]:238).

In September 2011, a *C. raniformis* nest cavity measuring 58.8 x 66.7 mm was found in the “corregimiento” of Pianguüita-Bazan, Buenaventura, Valle del Cauca, Colombia (3.845250°N, 77.200001°W, 50 m elev.). The nest was next to a rotting log, in a ca. 60-mm deep hole in the forest floor amid fallen leaves. On 16 Sept at 2100 h, the first observation was made; the nest was found unattended, protected by the trunk and the leaves. Prior to this, an adult female *C. raniformis* (68.7 mm SVL) was seen perched on top of the trunk near the nest, possibly feeding.

The second observation was made on 17 Sept 2011 at 1905 h. An adult female *C. raniformis* was observed tucked into the cavity, on top of an egg clutch, protecting 95% of them with her body and forelimbs (Fig. 1). In addition, when the nest site was disturbed a little, the female performed “push” movements with the front legs in an attempt to not allow us to approach the eggs. Five eggs removed from the nest were completely spherical, with an abundant cream-white colored yolk and a translucent longitudinal band corresponding to the embryo. Five additional eggs were collected for observation of embryonic development. The eggs were in stage 3 (Townsend and Stewart 1985. *Copeia* 1985[2]:423–436). Five days following collection, the eggs began to develop microorganisms which became pathogenic. On the seventh day, when the embryos had reached stage 5 (four limb development; Townsend and Stewart 1985, *op. cit.*) (Fig. 1B), all

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PHOTO BY FERNANDO CASTRO-H

eggs showed a complete invasion of fungi and other organisms' larvae (Fig. 1C), preventing their viability.

Based on this observation, it is likely that attending *C. rani-formis* females influence hatching success by protecting the eggs from attack by fungi and other predators. Females have been observed to leave the nest to perform other activities, although they do not venture far from it.

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**EUPARKERELLA TRIDACTYLA** (*Sapinho-de-folhiço-de-três-dedos*). **DEFENSIVE BEHAVIOR.** *Euparkerella* is an Atlantic Forest endemic genus composed of four slow-moving leaf litter species (Ferreira et al. 2010. Herpetol. Notes 3:57–60). *Euparkerella tridactyla* is distributed throughout south and central regions of Espírito Santo state, southeastern Brazil (Frost 2013. Amphibian Species of the World: an Online Reference. Ver. 5.6. Electronic database accessible at <http://research.amnh.org/herpetology/amphibia/index.html>. American Museum of Natural History, New York; accessed 10 Aug 2013). This is an enigmatic species with few reports on its life history. Here we report for the first time defensive behaviors of *E. tridactyla*.

During fieldwork in 2009, 2012, and 2013, we hand-captured nine individuals of *E. tridactyla* within and around the

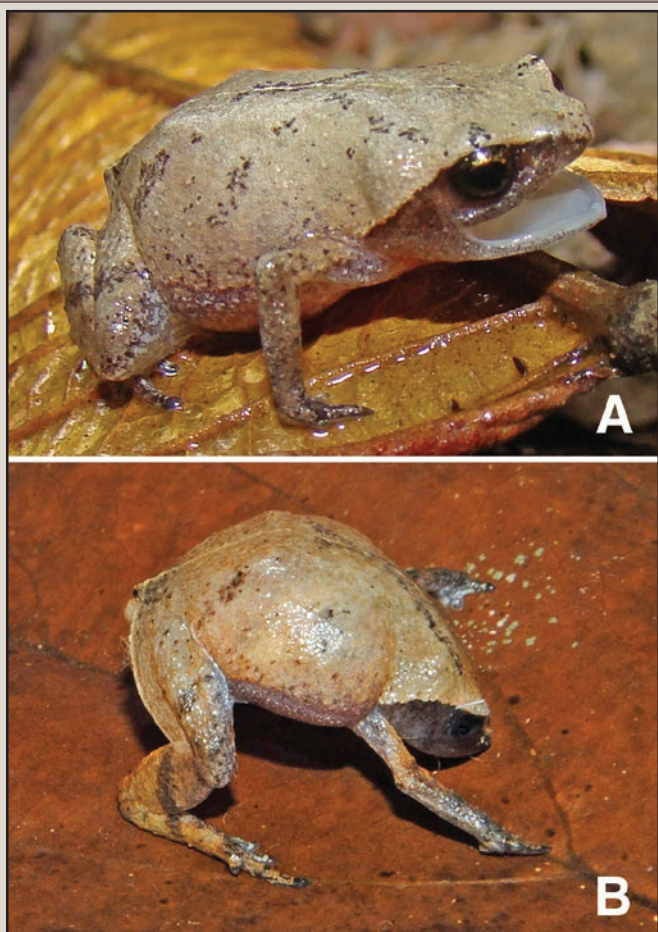


FIG. 1. Defensive behaviors of *Euparkerella tridactyla*: A) mouth-gaping, and B) body-raising display.

type locality, Reserva Biológica Augusto Ruschi (19.90694°S, 40.55553°W, datum: UTM; elev. 724–890 m), Santa Teresa municipality. Seven of these individuals were collected (MBML 7565; 7584–7589). In the field, one individual displayed mouth-gaping behavior (Fig. 1A; MBML 7565). In the laboratory during daytime, another eight individuals displayed immobility, fleeing, and active escape in sequence after being disturbed by forceps. Also in the laboratory, one of these individuals displayed a partial body-raising behavior (Fig. 1B; MBML 7586). The only other report of defensive posture for this genus is for *E. cochranæ* displaying stiff-legged behavior (Toledo et al. 2011. Ethol. Ecol. Evol. 23:1–25). Mouth-gaping is presumably a threat display, while elevating the body presumably makes the frog appear larger to a predator.

We thank João F. R. Tonini, Paulo de Jesus, Francys Lacchine, Gustavo Milanezi, and Juliano Saich for help during fieldwork. This observation is part of the Bromeligenous Project that was supported by The Herpetologists' League, Ecology Center at Utah State University, and Rufford Small Grant for Conservation.

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**HYLARANA GUENTHERI** (*Günther's Frog*). **DIET.** *Hylarana guentheri* is widely distributed from central Vietnam throughout southern China, including Hainan and Taiwan. The species is common in lowland and mountainous areas (Fei et al. 2009. Fauna Sinica. Amphibia. Vol. 3. Science Press. 559–1847 pp.). The diet includes insects, earthworms, snails, and small frogs (Fei et al. 2010. Colored Atlas of Chinese Amphibians. Sichuan Publishing Group. 519 pp.). Here we report the first case of predation on a bat by this species.

On 11 Sept 2009, we encountered an adult *H. guentheri* on the ground near a pool eating a bat (Mt. Tianmenshan, Shangqing Town, Yingtan City, Jiangxi province, China). We could not identify the bat as only a part of the wing could be seen (Fig. 1). We took a few photos, and the frog jumped into the pool before we could make any further observations.

To our knowledge, there have been very few cases of predation on bats by frogs in the wild, including *Rana esculenta* (Országhová et al. 2003 Biologia 58:291–293) and *Rana ridibunda* (Kuzmin 1999. The Amphibians of the Former Soviet Union. Pensoft Publishers, Sofia. 538 pp.). It is possible that the bat was injured and picked up by the frog, as it may be unusual that the bat was flying near the ground. This report suggests that *H. guentheri* is an opportunistic predator that preys on non-specific food items depending on the availability.

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**INCILIUS NEBULIFER** (*Gulf Coast Toad*). **NECROPHILIA.** *Incilius nebulifer* (Bufonidae) occurs along the Gulf Coast of the

United States and Mexico (Mulcahy and Mendelson 2000. *Mol. Biol. Evol.* 17:173–189). At 2255 h on 18 May 2010, in Hidalgo Co., Texas, USA (26.19620°N, 98.12411°W; datum WGS 84), an adult male *Incilius nebulifer* was found amplexed with a deceased female of the same species. The temperature was 25.5°C and approximately 7.2 cm of rainfall occurred that day. The pair was found on a dirt road. The amplexus was photographed and a copy of the image was deposited in the University of Texas–Pan American vertebrate museum (voucher #05109).

Extremely dry habitats impose unique and intense pressures on amphibians. To our knowledge this is the first time this behavior has been observed for this species. This is a noteworthy observation because it may provide insight into the reproductive strategy of these toads in semiarid habitats. There may be an advantage to amplexing dead females if the eggs are still viable and can be extracted and fertilized by the male. This behavior has been described in other anurans and termed “functional necrophile strategy” by Izzo et al. (2012. *J. Nat. Hist.* 46:47–48).

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**LEPTODACTYLUS FRAGILIS (Mexican White-lipped Frog). ENDOPARASITES.** *Leptodactylus fragilis* ranges from southern Texas to central Colombia and northern Venezuela (Dodd 2013. *Frogs of the United States and Canada*, Vol. 1, Johns Hopkins University Press, Baltimore, Maryland. 460 pp.). The purpose of this note is to add to the list of known helminth endoparasites of *L. fragilis*. A sample of eight *L. fragilis* (mean SVL = 32.4 mm ± 3.5 SD, range = 27–39 mm) was examined for helminths. Frogs were collected in Guanacaste Province, Costa Rica during 1963–64 and 1973–74 (LACM 157201, 157211, 157212, 157226, 157230, 157234, 57240, 157250).

Two nematode species were found in the large intestines. They were identified as *Schrankiana formosula* (N = 68; prevalence, number infected frogs/number examined frogs at 100x = 25%, mean intensity, mean number infected individuals = 34.0 ± 14.1 SD, range = 24–44) and *Cosmocerca podicipinus* (N = 3; prevalence = 38%, mean infection intensity = 1.0). Voucher specimens were deposited in the United States National Parasite Collection (USNPC) as: *Cosmocerca podicipinus* (USNPC 107220) and *Schrankiana formosula* (USNPC 107221). *Schrankiana formosula* is known from *Leptodactylus fuscus* from Brazil and *L. elenae* from Paraguay (Goldberg et al. 2007. *Comp. Parasitol.* 74:327–342). *Leptodactylus fragilis* is the third anuran species known to harbor *S. formosula* and represents a new host record for *Schrankiana formosula*; furthermore, Costa Rica is a new locality record for this nematode. *Cosmocerca podicipinus* is widespread in Meso and South American anurans (Goldberg et al., *op. cit.*) and was previously found in *L. fragilis* in Guanacaste Province, Costa Rica (Burse and Brooks 2010. *Comp. Parasitol.* 77:221–231).

We thank G. Pauly (LACM) for permission to examine *L. fragilis*.

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**LIMNONECTES GRUNNIENS. SALINE WATER TOLERANCE.**

Individuals of *Limnonectes grunniens* were observed and collected (Museum of Vertebrate Zoology; ALS 297–305, 339) along the banks of saltwater channels in the Aru Islands, Maluku, Indonesia. The Aru Islands are a network of 95 islands in eastern Indonesia, most of which are separated by narrow brackish channels. Located on the Sahul Shelf, the Aru Islands share much of their fauna with New Guinea and formed a land bridge with New Guinea and Australia during glacial maxima. Ten *Limnonectes grunniens* were collected at night on 30 September 2011 along a saltwater channel adjacent to Desa Kongan, Kecamatan Aru Tengah, Kabupaten Kepulauan Aru (6.50277°S, 134.39137°E). All individuals were found along the banks of these saltwater channels, though two specimens collected were found on a small rock (2 m x 5 m) surrounded by water inside the channel. These rocks were located at least 3 m from other land and any access to them would require these frogs voluntarily entering saline water even at low tide. In addition, *L. grunniens* frequently jumped into the saline water as an escape response, often attempting to hide motionless under dead leaves or vegetation to avoid detection. Using a refractometer, we measured the salinity of the water in the channel to be 27 parts per thousand, just below the salinity of seawater which is ca. 31–37 parts per thousand. We conclude that this population of *L. grunniens* is capable of tolerating saline water at least for brief periods and represents another example of salt-water tolerance in dicoglossid frogs as also noted for *Feljervarya cancrivora*.

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**OSTEOPILUS SEPTENTRIONALIS (Cuban Treefrog). POST-INVASION SPREAD.** *Osteopilus septentrionalis*, a native hylid of Cuba, was first recorded in Florida, USA, in 1931 in Key West, Monroe Co., where it may or may not have been native (Meshaka 2001. *The Cuban Treefrog in Florida: Life History of a Successful Colonizing Species*. Univ. Florida Press, Gainesville. 191 pp.). The Cuban Treefrog is highly vagile, able to thrive in urban settings and disturbed habitats, and has spread throughout peninsular Florida with a few isolated occurrences in the panhandle (Meshaka 2001, *op. cit.*; Meshaka 2010. *A Runaway Train in the Making: The Exotic Amphibians, Reptiles, Turtles, and Crocodylians of Florida*. Monograph 1. *Herpetol. Cons. Biol.* 6:1–101). Cuban Treefrogs have successfully invaded hardwood hammocks and other natural habitats, but further spread is limited by low relative humidity during the dry season in subtropical Florida and cold climate farther north (Meshaka 2001, *op. cit.*).

Cuban Treefrogs were first observed on the Archbold Biological Station (ABS; Highlands Co., Florida; 27.181°N, 81.350°W; elev. 42 m) more than 20 years ago, based on specimens deposited in the ABS Vertebrate Collection. The earliest ABS specimens were collected in 1987 (from a site 15 km N of ABS) and 1993 (found on the main research building at ABS). However, the first published record for Highlands Co. was in the late 1970s (Stevenson 1976. *Vertebrates of Florida*. Univ. Florida Press, Gainesville. 607 pp.). In July 2009, we saw and heard adult Cuban Treefrogs near a granite-lined drainage ditch that bisects the main grounds of ABS, and individuals were often seen on the exterior of the research building at night.

To determine the extent to which Cuban Treefrogs have invaded adjacent scrub habitats, we installed an array of 50 3.9-cm-diameter PVC pipes extending east and west from the main ditch, with the pipe grid covering an area of ca. 0.1 km<sup>2</sup>. Pipes were checked on average every seven days from October 2009 through November 2010. Captured Cuban Treefrogs were euthanized and preserved, and native hylids were relocated well outside the grid to prevent recapture. We also measured snout-urostyle length (SUL) of most individuals to the nearest mm. In total, we captured nine Cuban Treefrogs (two at the ditch, four at 50 m, one at 100 m, and two at 150 m east of the ditch) and 76 native hylids, including 60 *Hyla squirella*, 14 *H. femoralis*, and two *H. cinerea* as far as 200 m away from the ditch. Mean SUL  $\pm$  SD was 37.3  $\pm$  6.7 mm for *O. septentrionalis* (range 28–45; N = 7), 28.7  $\pm$  5.3 mm for *H. femoralis* (19–37; N = 13), 23.8  $\pm$  4.3 mm for *H. squirella* (18–36; N = 47), and 41.0 mm for *H. cinerea* (N = 1).

Although 32% of the captures of native hylids occurred after 28 January 2010, no Cuban Treefrogs were captured after this date. January 2010 was a particularly cold month at ABS with record-setting minimum temperatures. Daily minimum temperatures at ABS were at or below 0° C for six consecutive days, followed by a low temperature of 2.8°C, and then five more days below 0°C; there were three days in January 2010 when the temperature dropped to -7°C. It is plausible that this extended period of extreme cold reduced the population of Cuban Treefrogs at ABS. Furthermore, Cuban Treefrogs have not colonized undisturbed oak scrub and scrubby flatwoods surrounding the developed part of ABS, despite the presence of many seasonally inundated wetlands. In addition to low humidity during the dry season, the frequent application of prescribed fire at ABS may impose a constraint on this species, either directly or indirectly via effects on vegetation structure and availability of suitable refuges. Refuge availability has previously been shown to be a factor limiting abundance of this species (Meshaka 2001, *op. cit.*).

We thank Steve Johnson (Univ. Florida) and his 2009 Conservation of Amphibians and Reptiles class for assistance installing the pipe sampling grid; Chris Jennings, John Vanek, Nick Swain, and Josh Daskin for assistance with data collection; and Walter Meshaka for providing valuable suggestions on the manuscript.

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**RHINELLA GRANULOSA (Granulated Toad). PREDATION.** Anurans are preyed upon by several kinds of invertebrates, such as water bugs (Giaretta and Menin 2004. J. Nat. Hist. 38:1711–1722), scorpions (Villanueva-Rivera et al. 2000. Herpetol. Rev. 31:100), spiders (Menin et al. 2005. Phyllomedusa 4:39–47), and all vertebrate groups (Pombal Jr. 2007. Rev. Bras. Zool. 24: 841–843; Toledo et al. 2005 Herpetol. Rev. 36:395–400). The present communication reports predation of *Rhinella granulosa* (Bufonidae) by a banana-spider of the Amazonian genus *Phoneutria* (species unidentified; Ctenidae). At 2118 h on 10 July 2013, the spider was observed preying on an adult male of *R. granulosa* (62.3 mm SVL). Our observation occurred at a residence in an urban area in the municipality of Santana, State of Amapá, North Brazil (0.022778°S, 51.164722°W; datum WGS84). The observation lasted at least eight minutes and during this time the spider had already captured the anuran with the aid of its pedipalps, and its chelicerae were inserted in the prey's lateral body.

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**RHINELLA SCHNEIDERI (Cururu Toad). DIET.** *Rhinella schneideri* is a large bufonid found in open and urban areas, and is widely distributed in South America, inhabiting some regions of Brazil, Paraguay, Bolivia, Argentina, and Uruguay (Pramuk 2006. Zool. J. Linn. Soc. 146:407–452). This species feeds mainly on arthropods (Batista et al. 2011. Herpetol. Notes 4:17–21; Duré et al. 2009. Phyllomedusa 8:27–39; Lajmanovich 1994. Rev. Hydrobiol. Trop. 27:107–112; Moreira and Barreto 1996. Rev. Bras. Zool. 123:313–320), however, like many anurans, it is considered to be a generalist and opportunistic predator.

On 08 February 2013, we collected a female *R. schneideri* (SVL = 905.5 mm; CFBH 35704) from a ranch on the Tietê River, located within the municipality of Barbosa, São Paulo state, southeast Brazil (21.25048°S, 49.92132°W; datum WGS84; elev. 371 m). Stomach contents included ten individuals of newly metamorphosed *Dermatonotus muelleri* (Mueller's Narrow-mouthed Frogs; mean SVL = 16.1 mm). It is known that adults of *R. schneideri*, as well as some congeneric species (Camilotti and Barreto-Lima 2011. Bioscience J. 27:993–994) feed on small vertebrates, such as birds (Vaz-Silva 2003, *op. cit.*) and legless lizards (Oda and Landgraf 2012. Bol. Assoc. Herpetol. Esp. 23:57–59). However, to our knowledge, this is the first record of an adult *R. schneideri* preying upon an anuran. At the time our observation was made, there was a massive emergence of *D. muelleri* in the area, which corroborates the opportunistic feeding behavior of *R. schneideri*. All specimens are housed at Coleção de Anfíbios “Célio F. B. Hadad” at UNESP, Rio Claro, Brazil.

We thank Celso Gavira for field and handling assistance. Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) provided financial support. Collecting permit was issued by IBAMA (process number 22028-1).

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#### GYMNOPHIONA — CAECILIANS

**DERMOPHIS GLANDULOSUS. PREDATION BY MICRURUS ALLENI.** Little is known regarding predation on caecilians, due mainly to their fossorial nature and the difficulty to find them. It has been suggested that various semifossorial and fossorial snakes appear to be major predators of these amphibians (Savage 2002. The Amphibians and Reptiles of Costa Rica: A Herpetofauna between Two Continents, between Two Seas. Univ. Chicago Press, Chicago, Illinois. 934 pp.). Roze (1996. Coral Snakes of the Americas: Biology, Identification, and Venoms. Krieger Publ. Co., Malabar, Florida. 340 pp.) found that the coral snake *Micrurus nigrocinctus* eats caecilians, however he did not identify prey species. Solórzano (2004. Serpientes de Costa Rica: Distribución, taxonomía e historia natural. INBio, Heredia, Costa Rica. 792 pp.) suggested that other species of *Micrurus* also include caecilians in their diet.

On 18 April 2012, a juvenile male *Micrurus alleni* (UCR 21534) was found near Rio Sonador in Volcán of Buenos Aires, Puntarenas, Costa Rica (9.29797°N, 83.47062°W, WGS84; 1120 m elev.).



This region is classified as premontane rainforest (Bolaños et al. 2005. Mapa Ecológico de Costa Rica. Centro Científico Tropical, San José, Costa Rica). A few hours after collection the snake (420 mm TL) regurgitated a caecilian *Dermophis glandulosus* (UCR 21533; 240 mm TL). This specimen showed mechanical damage in the head and nuchal region, suggesting that it was ingested head first.

This is the first record of a predator for *D. glandulosus*, and also the first report of the species in the diet of *M. alleni*, supporting the hypothesis that coral snakes feed on caecilians. Solórzano (2005. Rev. Biol. Trop. 53:227–228) indicated that the diet of *M. alleni* is composed primarily of Marbled Swamps Eels (*Symbranchus marmoratus*); however, this eel is found in Costa Rica from sea level to 650 m elev. (Bussing 1998. Rev. Biol. Trop. 46:1–468), while *M. alleni* is relatively common from sea level to 1500 m elev. (Solórzano 2004, *op. cit.*), suggesting a dietary shift at higher elevations.

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### TESTUDINES — TURTLES

**CHRYSEMYS PICTA PICTA** (Eastern Painted Turtle). **PREDATION.** On 22 August 2012 at 1030 h we observed a second-year Bald Eagle (*Haliaeetus leucocephalus*) kill and consume an adult *Chrysemys picta picta* along the bank of a farm impoundment at Chesapeake Farms, Kent Co., Maryland, USA (39.1962°N, 76.21707°W). The *C. p. picta* was basking ca. 1.5 m up the gradual, muddy bank of the 6.5-acre impoundment when the eagle landed beside the turtle, used both feet to turn the turtle on edge, and grasped the turtle in its left talon. The bird then flew to a height of ca. 15 m and dropped the turtle on the bank, at which point the turtle attempted to right itself. This pattern was repeated several times until the turtle remained motionless upon landing. The *H. leucocephalus* then picked up the *C. p. picta* and flew to a perch ca. 250 m from the capture sight and ca. 10 m above the ground, where it was seen consuming the apparently dead *C. p. picta*.

Ernst and Lovich (2009. Turtles of the United States and Canada. Johns Hopkins University Press, Baltimore, Maryland. 840 pp.) lists *H. leucocephalus* among the many predators of *C. p. picta*, but careful scrutiny of references therein (e.g., Vogt 1981. Natural History of Amphibians and Reptiles of Wisconsin. Milwaukee Public Museum, Milwaukee, Wisconsin. 205 pp.; Ross 1989. Wisconsin Endangered Species Report 59:1–33) and other studies of the diet of *H. leucocephalus* (e.g., Smith 1936. Auk 53:301–305; Imler and Kalmbach 1955. U.S. Fish Wildl. Serv. Circ. 30; Clark 1982. J. Field. Ornithol. 53:49–51) reveals that such assertions are based on observations of *C. p. picta* shells below or in active *H. leucocephalus* nests. It is thus unclear if the turtles noted in these studies were depredated or collected as carrion, as *H. leucocephalus* is a frequent and voracious scavenger (e.g., Buehler 2000. In: The Birds of North America, No. 506: 40; Wilmer et al. 2003. Ecol. Lett. 6:996–1003). Further, if these *C. p. picta* were indeed depredated, the studies fail to document the means by which the turtles were killed by *H. leucocephalus* or if the turtles were consumed by non-nestling *H. leucocephalus*. Thus this observation apparently represents the first reported direct observation of predation of *C. p. picta* by *H. leucocephalus* and provides evidence for the inclusion of *C. p. picta* in the diet of non-nestling *H. leucocephalus*.

We thank Travis LaDuc and Erin Counihan for helpful comments on this note.

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**LEPIDOCHELYS OLIVACEA** (Olive Ridley Sea Turtle). **LEUCISTIC HATCHLING.** Along the Odisha coast of eastern India, “*arribadas*” (simultaneous mass nestings) of Olive Ridley Sea Turtles occur at three beaches *viz.*, Gahirmatha, Devi, and Rushikulya. Gahirmatha Beach, within Bhitarkanika National Park, was once regarded as the largest reported *arribada* nesting ground for Olive Ridelys in the world (Bustard 1976. Tigerpaper 3:25). The other two sites, Devi and Rushikulya, are outside the protected area, but are regularly monitored by the Odisha Forest Department during the nesting period.

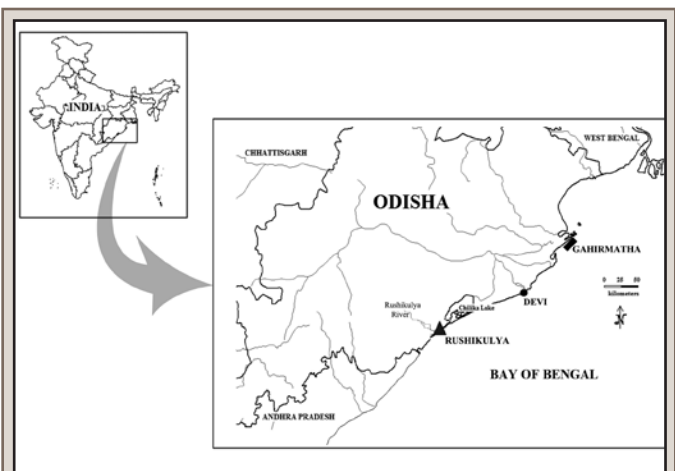


FIG. 1. Map showing the three *arribada* sites in Odisha coast. Solid fill triangle = site of observation at Rushikulya Beach. The coastline between these sites is used by *Lepidochelys olivacea* for sporadic nesting.



FIG. 2. *Lepidochelys olivacea* hatchlings observed at Rushikulya. A) Leucistic hatchling; arrow marks showing normal eye color and black sutures between plates of the carapace. B) Typical black hatchlings. C) Cluster of normal hatchlings. D) Arrow indicates the narrow white line surrounding the carapace of normal hatchlings.

Rushikulya Beach (19.3945°N, 85.0896°E; WGS 84) is the southernmost nesting site along the Odisha coast (Pandav et al. 1994. A Status Survey of Olive Ridley Sea Turtle [*Lepidochelys olivacea*] and its Nesting Habitats along the Orissa Coast, India. Wildlife Institute of India, Dehradun. 48 pp.). The site falls in the Ganjam district and is north of the Rushikulya River mouth from Purunabandha to Kantiagada village (Fig. 1). In 2012, an *arribada* occurred during the first week of March at Rushikulya Beach and the associated hatching event started after approximately 50 days (mid-April).

On 22 April 2012, while observing the hatching event we came across a rare leucistic hatchling of *L. olivacea*, along with the normal gray/black form (Fig. 2A). The white hatchling looked similar to the black form in size, shape, and structures (Fig. 2B). It was not a true albino because its eyes were of normal black color (typically red in albinos). It had a grayish tinge on the head and edge of the flippers. The sutures between the plates of the carapace and upper part of the beak were blackish. Normal hatchlings are dark gray, but appear black when wet (Fig. 2C), and a narrow white line surrounds the carapace, as well as the trailing edge of the fore and hind flippers (Fig. 2D). The leucistic hatchling was not collected as the species is protected. A literature survey suggests that the leucistic form of *L. olivacea* has not been reported earlier from the Indian coast. Media photographic records are available for leucistic sea turtles from Florida, and some studies have been performed on malformations in hatchlings of *L. olivacea* outside India (Ibarra and Gasca 2009. Vet. Méx. 40:371–380). A thorough monitoring of nesting sites in India during peak season may reveal additional aberrancies or deformities which might provide new insights on the biology and physiology of this species.

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**TERRAPENE CAROLINA** (Eastern Box Turtle). **DIET.** *Terrapene carolina* is known to consume carrion and small snakes,



FIG. 1. Eastern Box Turtle (*Terrapene carolina*) scavenging road-killed Cottonmouth (*Agkistrodon piscivorus*), Jackson Co., Mississippi, USA.

including snakes in the genus *Agkistrodon* (Jensen 1999. Herpetol. Rev. 30[2]:95; Ernst and Lovich 2009. Turtles of the United States and Canada. Johns Hopkins Univ. Press, Baltimore, Maryland. 840 pp.). On 5 July 2013, at approximately 1745 h, BD observed a road-killed *A. piscivorus* in Jackson Co., Mississippi, USA (30.528056°N, 88.548889°W, datum WGS84/NAD83). Upon returning 5 minutes later he discovered an adult *T. carolina* feeding on the snake carcass (Fig. 1). Photos were taken and the turtle was left undisturbed. Later that same evening, the turtle could not be located but the snake had been pulled to the margin of the road, possibly by the turtle. Similar behavior was noted by Jensen (*op. cit.*). This is the first diet record of a *T. carolina* consuming *A. piscivorus*. This observation also highlights an additional vulnerability of *T. carolina* to road mortality while scavenging carcasses.

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## CROCODYLIA — CROCODYLIANS

**ALLIGATOR MISSISSIPPIENSIS** (American Alligator). **MAXIMUM CLUTCH SIZE.** *Alligator mississippiensis* is an oviparous crocodylian species that is characteristic of the Gulf Coast and lower Atlantic Coastal Plains of the USA (Conant and Collins 1998. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. 3<sup>rd</sup> ed. Houghton Mifflin Co., Boston, Massachusetts. 616 pp.). The nesting ecology and clutch characteristics of this species have been well documented (Hall 1991. J. Herpetol. 25:133–141; Joanen and McNease 1989. Am. Zool. 29:987–998). The maximum clutch size previously reported for *A. mississippiensis* is 75 eggs (Platt et al. 2004. Florida Field Nat. 32:102–106), collected in 1925 from a nest at Lake Miccosukee, Jefferson Co., Florida, USA.

On 27 June 2012 two of us (LWJ and JJ) collected a clutch from a single nest containing 91 eggs. Further examination of the eggs for banding patterns (i.e., to determine viability) revealed that of the 91 eggs, 82 were fertile and 9 were infertile. The clutch was subsequently taken and hatched in captivity under optimum conditions. The clutch produced 60 hatchling alligators (66% success) on 30 August 2012. The clutch was collected on Eagle Lake in southeastern Colorado Co., Texas, USA (29.55870°N, 96.35287°W, WGS84; 46.6 m elev.)

Detailed examination of the eggs revealed essentially identical size and shape. In oviparous reptiles, data suggest that variability in egg width is restricted by the diameter of the pelvic aperture (Congdon and Gibbons 1985. Herpetologica 41:194–205; Thorbjarnarson 1994. Copeia 1994:907–919; Werner 1989. Israeli J. Zool. 35:199–213). Consequently, because of the egg homogeneity coupled with the uniform hatching date, we hypothesize this clutch was most likely produced by a single gravid female.

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**ALLIGATOR MISSISSIPPIENSIS** (American Alligator). **NESTS USED BY OTHER REPTILES IN COASTAL LOUISIANA.** Alligator nests have been documented to serve as commensal nesting

sites for other reptiles in the southeastern USA (see review and references in Enge et al. 2000. *J. Herpetol.* 34:497–503). Several species of turtle have been identified to nest in alligator nests in these studies, including *Pseudemys nelsoni* (Florida Redbelly), *Apalone ferox* (Florida Softshell), *Kinosternon subrubrum* (Florida Mud Turtle), *K. baurii* (Striped Mud Turtle), and *Sternotherus odoratus* (Common Musk Turtle) (Deitz and Jackson 1979. *J. Herpetol.* 13:510–512; Enge et al., *op. cit.*; Kushlan and Kushlan 1980. *Copeia* 1980:930–932). Eggs of *Anolis carolinensis* (Green Anole) have also been found in alligator nests (Deitz and Jackson, *op. cit.*; Kushlan and Kushlan, *op. cit.*), although far less commonly than turtle eggs. Snake eggs are also rarely found in alligator nests, but Deitz and Jackson (*op. cit.*) described *Farancia abacura* (Mud Snake) eggs in one alligator nest in Florida, as well as several specimens of *Seminatrix pygaea* (Swamp Snake) and *Nerodia cyclopion* (Green Water Snake).

In Louisiana, four clutches of *F. abacura reinwardtii* (Western Mud Snake) eggs and one female were found in two alligator nest mounds; one nest had been depredated and the other appeared to be a false nest (Hall and Meier 1993. *Copeia* 1993:219–222). Additionally, *S. odoratus* eggs were located within two alligator nests in southwestern Louisiana, with two additional nests containing *F. abacura* specimens and eggs (Carbonneau 1987. Unpubl. M.S. thesis. Louisiana State Univ. 54 pp.). We herein report on findings of new reptiles using alligator nests for egg deposition sites in coastal Louisiana, which to our knowledge have not been previously documented.

Alligator eggs were collected from numerous nests on Rockefeller Wildlife Refuge in Cameron and Vermilion parishes for various research projects between 25 June and 2 July 2013. Two clutches of snake eggs were incidentally found within alligator nests. The snake eggs (clutch 1, N = 12; clutch 2, N = 4) were in the nest mound, but not within the egg cavities in which the alligator eggs were deposited. The snake eggs were collected and incubated in a field incubator in the same manner as alligator eggs, as previously described (Joanen and McNease 1977. *Proc. World Mariculture Soc.* 8:483–489). On 23 July we noted the presence of shed snake skins adhering to the wire mesh container in which the eggs had been placed; regrettably the ventilation holes were large enough to allow escape of the hatched snakes. Examination of the eggshells suggested 8 of 12 eggs from the larger clutch had hatched. The shed skins were collected, and viewed under a dissecting microscope. The presence of one preocular scale and two postocular scales from one shed skin was indicative the hatched snakes were likely *Lampropeltis getula holbrooki* (Speckled Kingsnakes).

One egg of the second clutch of four eggs was then dissected, as we were concerned they were non-viable. A near-term Speckled Kingsnake was noted and the remainder of the clutch was then moved to a more secure container for continued incubation. On the morning of 26 July we found a live Speckled Kingsnake had hatched; it measured 21.0 mm TL, 18.5 SVL, and had a mass of 4.07 g. That afternoon a second snake was beginning to emerge. We attempted to assist it in liberating itself from the egg by gently cutting the eggshell further. The snake did not readily emerge so we replaced the egg mass in the incubator. The following morning that egg had hatched, the snake measured 22.5 mm TL, 20.0 mm SVL, and 4.42 g. Both snakes were released to the wild near the field incubator on the day of hatching. The remaining egg appeared desiccated and non-viable.

On 29 July 2013, we visited six additional alligator nests to collect vegetation and soil samples for an associated research

project. Two nests contained presumed skink eggs, but we had not previously attempted to incubate these, although we commonly encounter them in alligator nests. Each clutch contained approximately five eggs; some may have been overlooked due to their small size. One egg in one clutch appeared collapsed and non-viable when collected and incubated in our field incubator. On 5 August two hatchling Ground Skinks (*Scincella lateralis*) were found in the incubator; they each had a mass of 0.14 g. These were released near the field incubator that afternoon. On 8 August six more *S. lateralis* were found hatched. Four had masses of 0.17 g, and one had a mass of 0.11 g and another of 0.15 g. We suspect the two smaller skinks may have hatched with those measured on 5 August but were undetected, having been burrowed in the nesting vegetation at the time.

We incidentally collected twenty clutches of alligator eggs from nests on White Lake Conservation Area in Vermilion Parish, Louisiana on 23 June 2009. One nest contained ten *Pseudemys concinna* (River Cooter) eggs. These were incubated at our field laboratory and seven turtles hatched on 2 August. We occasionally find turtle eggs in coastal marsh nests on Rockefeller Refuge, but far less frequently than in Florida lakes as per Enge et al.'s (2000) multi-year, multi-site study (26.6% of 1586 active alligator nests had *P. nelsoni* eggs).

Kushlan and Kushlan (*op. cit.*) noted that commensal nesting in vertebrates is rare, thus our finding of three previously unreported reptile species using alligator nests is of interest. We regularly see *L. getula holbrooki* locally, and *S. lateralis* was the most commonly encountered reptile in a herpetofaunal study conducted in a nearby chenier habitat (W. Selman, unpubl. data). The River Cooter, however, occurs less commonly in southwestern Louisiana marsh habitats (Dundee and Rossman 1989. *The Amphibians and Reptiles of Louisiana*. Louisiana State Univ. Press, Baton Rouge, Louisiana. 300 pp.). The advantages and disadvantages of turtles nesting in alligator nests were discussed in detail by Enge et al. (*op. cit.*, and references therein). Hall and Meier (*op. cit.*) also discussed strategic advantages of commensal nesting in alligator nests for nesting turtles and snakes (and their eggs). Similar benefits and adverse effects may play a role in other reptiles using alligator nests, such as the taxa described herein: *L. getula holbrooki*, *S. lateralis*, and *P. concinna*.

We thank Jeff Boundy and Thomas Rainwater for helpful discussion about these findings.

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#### SQUAMATA — LIZARDS

**ANOLIS EQUESTRIS** (Cuban Knight Anole). **NOCTURNAL ACTIVITY.** *Anolis equestris* is native to Cuba and has been introduced to Florida, USA (Kraus 2009. *Alien Reptiles and Amphibians: A Scientific Compendium and Analysis*. Springer, Dordrecht, Netherlands. 563 pp.; Krysko et al. 2003. *Florida Sci.* 66:74–79). This species consumes a wide variety of animals and plants including vertebrates, invertebrates, and fruit (Camposano et al. 2008. *Iguana* 15:212–219, Giery et al., unpubl.). Documented activity times for populations in southern Florida indicate that *A. equestris* activity falls between mid-morning and late afternoon, ceasing at sunset (Meshaka et al. 2004. *The Exotic Amphibians*

and Reptiles of Florida. Krieger Publ. Co., Malabar, Florida. 166 pp.). Here, we report on nocturnal activity of *A. equestris* in South Florida.

On 18 April 2013 between 2203–2215 h, a single adult *Anolis equestris* was observed at Fairchild Tropical Botanical Gardens, Miami, Florida, USA (25.677°N, 80.276°W, WGS84; <1 m elev.). This individual was observed consuming Lepidoptera attracted to an artificial light source positioned above a doorway. Nocturnal lizards (*Hemidactylus mabouia*) were also present around the light source and could represent another potential prey source for nocturnally foraging *A. equestris*. This is the first documentation of *A. equestris* using artificial light sources to allow for nocturnal activity.

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**ANOLIS EQUESTRIS (Cuban Knight Anole) and ANOLIS DISTICHUS (Hispaniolian Bark Anole). EXOTIC INTRAGUILD PREDATION.** *Anolis equestris* is native to Cuba and *A. distichus* is native to Hispaniola; both have been introduced to Florida, USA (Kraus 2009. Alien Reptiles and Amphibians: A Scientific Compendium and Analysis. Springer, [Dordrecht, Netherlands], 563 pp.; Krysko et al. 2003. Florida Sci. 66:74–79). *Anolis equestris* consumes a wide variety of animals and plants including vertebrates, invertebrates and fruit (Camposano et al. 2008. Iguana 15:212–219, Giery et al. 2013. Functional Ecol. 2013:1–6). Documented activity times for populations in southern Florida indicate that *A. equestris* activity falls between mid-morning and late afternoon, ceasing at sunset (Meshaka et al. 2004. The Exotic Amphibians and Reptiles of Florida. Krieger Publ. Co., Malabar, Florida. 166 pp.). Here, we report on an intraguild predation event of *A. equestris* in South Florida (Miami) on an *A. distichus*.

On 28 August 2013 at 1504 h, a single adult female *Anolis equestris* was observed at Florida International University, Modesto A. Maidique Campus, Miami, Florida (25.757°N, 80.376°W, WGS84; ~2 m elev.). This individual was observed consuming a juvenile *A. distichus* on a tree at ~2 m height. Ingestion took <1 minute. Prior to the predation event, the *A. equestris* was a uniform dark brown base color, with faded yellow barring. Upon predation of the smaller anole, the *A. equestris* rapidly returned to a more typical pattern—green base color with a yellow bar above the shoulder of the forelimb. During the predation event an adult male *A. distichus* was observed performing dewlap extension displays at the *A. equestris* from a distance of ~55 cm. Following consumption, the *A. equestris* proceeded to try and catch an adult female *A. distichus* between 1507–1508 h but failed. This is the first recorded observation of *Anolis equestris* predating *Anolis distichus* in Florida.

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**ANOLIS SAGREI (Brown Anole). SEXUAL CANNIBALISM.** Sexual cannibalism occurs when a reproductive adult kills and consumes a potential mate. This form of sexual conflict is common among invertebrates, especially arachnids (Birkhead et al. 1988. Behaviour 106:112–118; Dick 1995. J. Zool. 236:697–706; Kaston 1970. Trans. San Diego Soc. Nat. Hist. 16:33–82; Polis 1980. Annu.

Rev. Ecol. Syst. 12:225–251), and typically involves the consumption of males by females. In contrast to its frequent occurrence among invertebrates, cannibalism of any form among adult vertebrates is typically reported only in isolated instances in captivity or under stressful conditions (Amstrup et al. 2006. Polar Biol. 29:997–1002; Gander 1934. Copeia 187; Martinez-Freiria et al. 2006. Herpetol. Bull. 96:26–28). Here, we describe four separate occurrences of sexual cannibalism involving the consumption of adult female *Anolis sagrei* by conspecific males, two of which occurred under natural conditions in a wild population.

Brown Anoles exhibit pronounced sexual size dimorphism. Males from our study populations on the islands of Eleuthera and Great Exuma in The Bahamas exceed females by 22–32% in mean adult snout–vent length (SVL) and 106–153% in mean adult body mass (Cox and Calsbeek 2010. Evolution 64:798–809). Both sexes typically consume a variety of small invertebrates, but only rarely consume vertebrate prey (Norval et al. 2007. Russ. J. Herpetol. 17:131–138). Although males of *A. sagrei* and other *Anolis* species are known to cannibalize conspecific juveniles (Cochran 1989. Herpetol. Rev. 20:70; Gerber 1999. Anolis Newsl. V:28–39; Gerber and Echternacht 2000. Oecologia 124:599–607; Nicholson et al. 2000. Herpetol. Rev. 31:173), we report cannibalism among adult *Anolis* lizards in the wild.

During a mark-recapture study in September 2007 on Eleuthera, The Bahamas (24.83°N, 76.32°W), we captured and temporarily confined ca. 20 *A. sagrei* adults of both sexes together in a 6-gal plastic bucket (containing a large pile of sea grape leaves, *Coccoloba uvifera*, to provide individuals with shelter and spatial structure) for transport to a nearby field station. Upon removal of the animals for measurement ca. 2–4 h after capture, two individual adult males were found with the hind limbs and tails of females protruding from their mouths. Both females had lacerations and bite marks on their heads and necks and were dead or nearly dead when removed from the males. We did not document the sizes of the individual males and females in this incident, which we interpreted as an unfortunate and unnatural response to high density and stressful conditions.

We later observed two separate instances of sexual cannibalism under natural conditions during mark-recapture studies of a second population on Regatta Point, near Georgetown, Great Exuma, The Bahamas (23.5°N, 75.75°W). On 7 September 2010, we captured an adult male that was lethargic and visibly



FIG. 1. Conspecific female removed from the mouth of male *Anolis sagrei*.

encumbered. Upon capture, the male immediately regurgitated a conspecific female that he had swallowed headfirst. The female was dead but nearly intact, with only the anterior tip of her head exhibiting signs of digestion. The female weighed 1.0 g (measured to the nearest 0.1 g with a Pesola spring scale) and the SVL and mass of the male after regurgitation were 63 mm and 6.2 g respectively. Although we did not dissect the female comestible to assess her reproductive condition, she exceeded the minimum size of maturity that we have previously established for this population (Cox and Calsbeek 2010. *Evolution* 64:1321–1330). In a separate instance on 28 May 2013, we captured an adult male with the hind limb of a conspecific female protruding from his mouth. The female was extracted and found to be partially digested, with digestion most pronounced at the anterior end (Fig. 1). The partially digested female weighed 1.0 g, and the SVL and mass of the male after regurgitation were 63 mm and 4.9 g respectively. Dissection of the female revealed mature ovaries with enlarged, vitellogenic follicles, indicating sexual maturity.

Although we do not know how frequently adult males of *Anolis sagrei* prey upon conspecific adult females, our independent observations under natural conditions suggest that sexual cannibalism in this species is not limited to isolated instances or unnatural conditions. In arthropods, sexual cannibalism of males by females has been interpreted as adaptive for males in cases where males have a low chance of finding another mate, and when being consumed during copulation leads to greater paternity (Andrade 1996. *Science* 201:70–72). This behavior may also be explained by adaptive mate choice in females if the decision of whether or not to cannibalize the male prior to mating is influenced by indicators of his genetic quality (Pearsons and Utey 2005. *Anim. Behav.* 69:89–94). By contrast, a non-adaptive explanation for sexual cannibalism includes “aggressive spillover,” where aggression during the juvenile stage leads to rapid growth, rapid growth leads to greater fecundity in the adult female, and the genetic correlation between aggression in the two life stages is the ultimate driver of sexual cannibalism (Arnqvist and Henriksson 1997. *Evol. Ecol.* 11:255–273). Adaptive explanations for sexual cannibalism of males are possible because after sperm transfer, a female can gain further fitness benefits from consuming the male. By contrast, a sexually mature female is a necessity for reproduction and presumably always represents a reproductive opportunity for a male. Thus, the sexual cannibalism of females by males in *A. sagrei* appears to be maladaptive. The framework of the “aggressive spillover” hypothesis or even that of male mate choice could hold potential explanations for this behavior (Sentenská and Pekár 2013. *Behav. Ecol. Sociobiol.* 67:1131–1139).

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**ANOLIS UNIFORMIS (Lesser Scaly Anole). SELECTED BODY TEMPERATURE.** Body temperature ( $T_b$ ) data collected in the field form the basis of most of the thermal biology reports in the herpetological literature (Avery 1982. *In* Gans and Pough [eds.], *Biology of the Reptilia*, Vol. 12, Physiology C, pp. 93–166. Academic Press, New York). In contrast, selected body temperatures ( $T_{sel}$ ) in laboratory conditions are rarely reported even though they are essential to understanding behavior, natural history, and effects of global warming on ectotherms (Sinervo et al. 2010. *Science* 328:894–899).  $T_{sel}$  represents the range of core temperature

within which an ectothermic animal seeks to maintain itself by behavioral means (IUPS Thermal Commission 2003. *J. Therm. Biol.* 28:75–106). Hence, here we present data on *Anolis uniformis* body temperatures in both field and laboratory conditions.

*Anolis uniformis* is a small, widely distributed lizard that is found in tropical wet forest in northern Middle America. The thermal ecology of this species has not been adequately addressed (Birt et al. 2001. *J. Herpetol.* 35:161–166). Thus, during June 2013, we conducted field work in wet tropical rain forest habitat located in Macuspana, Tabasco, Mexico (17.6239°N, 92.4449°W; 195 m elev.). The data presented here are based on 17 adults (> 36 mm SVL; 9 females and 8 males; Campbell et al. 1989. *Biotropica* 21:237–243) of *A. uniformis* captured by noose and hand. Snout–vent length (SVL) was measured to the nearest 0.05 mm, and sex was determined for all individuals.  $T_b$  was recorded using a digital thermometer (Fluke model 51-II) with the sensor introduced one centimeter into the cloaca. We also recorded substrate temperature ( $T_s$ ) at the exact point of observation and air temperature ( $T_a$ ) 1 cm above the substrate where the lizard was captured.

In the laboratory, the lizards were maintained at 25°C in plastic containers. Laboratory experiments were conducted one day after capture using a thermal gradient. The thermal gradient consisted of a polycarbonate box 150 cm long x 100 cm wide x 70 cm high. The box was located in a room with controlled temperature of 20°C and two 150 W lamps were placed at different highs over the box to offer thermal gradient (20–50°C). The  $T_{sel}$  of individuals in the thermal gradient was taken manually each hour between 0930 and 1400 hs using the digital thermometer. Following laboratory experiments, all lizards were released at the site of capture.

Mean SVL was 38.2 mm (SD = 1.77, range = 36–41 mm). Mean  $T_b$  was 28.4°C (SD = 2.71°C, range = 24.5–32.7°C). Mean  $T_s$  was 26.1°C (SD = 1.15°C, range = 23.4–27.6°C) and mean  $T_a$  was 26.2°C (SD = 1.22°C, range = 23.4–27.9°C). A positive and significant correlation was found between  $T_b$  and the microhabitat temperature (Spearman Rank Correlation:  $r = 0.70$ ,  $P < 0.0001$ ,  $N = 17$ , based on  $T_s$ ;  $r = 0.80$ ,  $P < 0.0001$ ,  $N = 17$ , based on  $T_a$ ). There was no statistically significant difference between sexes ( $U = 34$ ,  $P = 0.885$ ). Mean  $T_{sel}$  was 30.1°C (SD = 1.90°C, range = 22–34.4°C). Interquartile of 25% and 75% was 28.9 and 30.9°C, respectively.  $T_b$  shows that *A. uniformis* analyzed in this study was thermopassive, a mechanism where individuals do not need to invest time and energy actively selecting microhabitats for thermoregulation in tropical habitats (Huey and Slatkin 1976. *Q. Rev. Biol.* 51:363–384).  $T_{sel}$  suggests that *A. uniformis* can be considered a stenothermic species due to the narrow range of temperatures. Previous thermal ecology studies of anoles have also demonstrated these trends (Birt et al. 2001, *op. cit.*; Hertz 1974. *J. Herpetol.* 8:323–327; Hertz et al. 1993. *Am. Nat.* 142:796–818).

We thank Holcim Station, Fausto Méndez-de la Cruz, and Lourdes Trejo-Pérez for the economic resources and the facilities. Many students from Universidad Juárez Autónoma de Tabasco provided valuable assistance in the field.

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**ASPIDOSCELIS EXSANGUIS (Chihuahuan Spotted Whiptail).** **FEEDING BEHAVIOR.** *Aspidoscelis exanguis* is a parthenogenetic species of whiptail lizard that primarily ranges within the Chihuahuan Desert ecoregion of the southwestern United States and northern Mexico (Babb 2009. *In* Jones and Lovich [eds.]. *Lizards of the American Southwest: A Photographic Field Guide*, pp. 338–341. Rio Nuevo Publ., Tucson, Arizona). The species is an active diurnal forager that feeds mostly on arthropods, with termites, grasshoppers, beetles, and arachnids being important prey items (Degenhardt et al. 1996. *Amphibians and Reptiles of New Mexico*. Univ. New Mexico Press, Albuquerque. 431 pp.; Scudday and Dixon 1973. *Southwest. Nat.* 18:279–289; Smith 1989. *Southwest. Nat.* 34:418–429). Most published information on food preference is based on removed stomach contents identified to higher taxonomic categories, so little is known about specific food items taken and on the feeding behavior of the lizard in the wild. Herein, we report on the ambushing, subjugation, and consumption of a tarantula by an adult *A. exanguis* in a Black Gramma (*Bouteloua eriopoda*) dominated Chihuahuan Desert grassland landscape.

On 17 June 2009, at 0920 h, on Fort Bliss, McGregor Range in Otero Co., New Mexico, USA (32.418611°N, 105.852778°W, WGS 84; 1606 m elev.), an *A. exanguis* was observed ambushing and consuming an adult tarantula (*Aphonopelma* sp.) (Fig. 1). The lizard was observed subjugating the tarantula by grasping the tubercle dorsal portion of the thorax, utilizing vigorous head and body twisting, reminiscent of larger, predatory lizard behavior when overcoming large prey. The time frame it took for subduing the prey lasted *ca.* two minutes until the spider showed no signs of movement and was then consumed. Scudday and Dixon (*op. cit.*), mention that *A. exanguis* exhibit a higher foraging activity and more aggression towards prey (i.e., act of slamming prey on the ground) than other sympatrically occurring *Aspidoscelis* species, from which this observation appears to reflect those behaviors. To our knowledge, this is the first documented sighting of *A. exanguis* subjugating and consuming large prey of comparable size (*Aphonopelma* sp.).

We thank Steven Dilks for his assistance in the field.

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FIG.1. Adult *Aspidoscelis exanguis* consuming a tarantula (*Aphonopelma* sp.) in Otero County, New Mexico, USA.

**ASPIDOSCELIS EXSANGUIS (Chihuahuan Spotted Whiptail), ASPIDOSCELIS NEOMEXICANA (New Mexico Whiptail), ASPIDOSCELIS UNIPARENS (Desert Grassland Whiptail).** **BIFURCATED TAILS.** We report occurrences of bifurcated tails in three parthenogenetic whiptail species (Jones and Lovich 2009. *Lizards of the American Southwest: A Photographic Field Guide*. Rio Nuevo Publ. Tucson, Arizona. 567 pp.) captured during a long-term study (Bateman et al. 2008. *Restor. Ecol.* 16:180–190). Bifurcated tails have also been reported from museum specimens in *A. velox*, another parthenogenetic whiptail (Cordes and Walker 2013. *Herpetol. Rev.* 44:319–320).

We captured and released lizards from late May to mid-September from 2000 to 2006 from riparian forest habitat along the middle Rio Grande in central New Mexico from Albuquerque (35.008380°N, 106.681805°W) to Bosque del Apache National Wildlife Refuge (33.805122°N, 106.859980°W). We measured lizard snout-vent length (SVL), vent-tail length (VTL), and mass. When we encountered lizards with regenerated tails, we recorded the length from the vent to the start of tail regeneration (original tail length, OTL). For some lizards with bifurcated tails, we measured the length of the regenerated portion of the “second” tail (bifid tail length, BTL). The bifurcation typically began at the regenerated or damaged tail segment, as observed by Cordes and Walker (2013, *op. cit.*). In other cases, the bifurcation stemmed from within a portion of a regenerated tail as observed by Gogliath et al. (2012. *Herpetol. Rev.* 43:129) in *Ameiva ameiva*.

We captured four individual *A. exanguis* with bifurcated tails (20 July 2001, SVL = 73 mm, VTL = 92 mm, OTL = 27 mm, mass = 9.5 g; 27 July 2001, SVL = 82 mm, VTL = 141 mm, OTL = 56 mm, mass = 12.0 g; 11 July 2005, SVL = 60 mm, VTL = 116 mm, OTL = 61 mm; and 1 Aug 2005, SVL = 70 mm, VTL = 135 mm, OTL = 99 mm, BTL = 7 mm, mass = 5.5 g). We captured four individual *A. neomexicana* with bifurcated tails (10 June 2002, SVL = 71 mm, VTL = 87 mm, OTL = 15 mm, BTL = 60, mass = 10.5 g; 18 July 2002, SVL = 81 mm, VTL = 170 mm, OTL = 150 mm, BTL = 20, mass = 17.0 g; 27 June 2006, SVL = 77 mm, VTL = 99 mm, OTL = 19 mm, mass = 8.5 g; and 17 Aug 2006, SVL = 82 mm, VTL = 152 mm, OTL = 125 mm, BTL = 27, mass = 12.5 g). We captured three individual *A. uniparens* with bifurcated tails (7 July 2001, SVL = 69 mm, VTL = 117 mm, OTL = 86 mm, mass = 6.5 g; 13 July 2001, SVL = 65 mm, VTL = 121 mm, OTL = 87 mm, mass = 7.5 g; 11 June 2002, SVL = 67 mm, VTL = 123 mm, OTL = 85 mm, mass = 9.0 g). These records are among the first reports of bifurcated tails in *A. exanguis*, *A. neomexicana*, and *A. uniparens*.

The Middle Rio Grande Conservancy District, Bosque del Apache National Wildlife Refuge, and Albuquerque Open Space permitted access to study sites. The University of New Mexico Animal Care and Use Committee approved field techniques (protocol #20415). The long-term herpetofaunal study was funded by the USDA Forest Service – RMRS Middle Rio Grande Ecosystem Management Unit, Joint Fire Sciences Program, National Fire Plan, US FWS Bosque Improvement Initiative, and USFS S&PF NM Collaborative Forest Restoration Program.

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**ASPIDOSCELIS GULARIS GULARIS (Texas Spotted Whiptail).** **ACQUIRED COLOR PATTERN.** We have studied *Aspidoscelis gularis gularis* since 1985 near El Ranchito at a site on the Rio Grande near US Hwy 281 (26.028333°N, 97.645278°W, WGS84; ~16 m elev.), Cameron Co., Texas, USA (Walker 1987. Texas J. Sci. 39:313–334). On 4 August 2008, one of us (JEC) collected an adult male of this taxon (SVL 93 mm, tail length 281 mm, and body mass 22.9 g) with a remarkable dorsal color pattern. The specimen (Fig. 1A–C) was originally cataloged as University of Arkansas Department of Zoology 8474 and recently re-catalogued as Arkansas State University Museum of Zoology (ASUMZ) 32691. It is obvious that the essentially symmetrical rearrangement of alternating pale stripes and dark fields on the anterior part of the dorsum resulted from a major superficial injury that healed to produce the pattern featured in Fig. 1A, C. Surviving such an injury, resulting from a likely predator encounter, was remarkable in itself; however, the uniqueness of the acquired dorsal pattern deserves commemoration in the literature.

Adult males of *A. g. gularis* at El Ranchito have a ventral pattern consisting of an unspotted pink-red chin and throat, blue-purple chest, and the latter color in a checkerboard pattern on the abdomen (Fig. 1B; Walker et al. 1989. J. Herpetol. 23:119–130). The dorsal pattern includes six pale colored primary stripes that are fixed in position (ventral to dorsal; pairs of laterals, dorsolaterals, and paravertebrals) and one or two darker variable secondary stripes between the paravertebrals (the vertebral[s]). In some of the intervening dark areas between the stripes (the fields) are pale rounded spots (e.g., in the

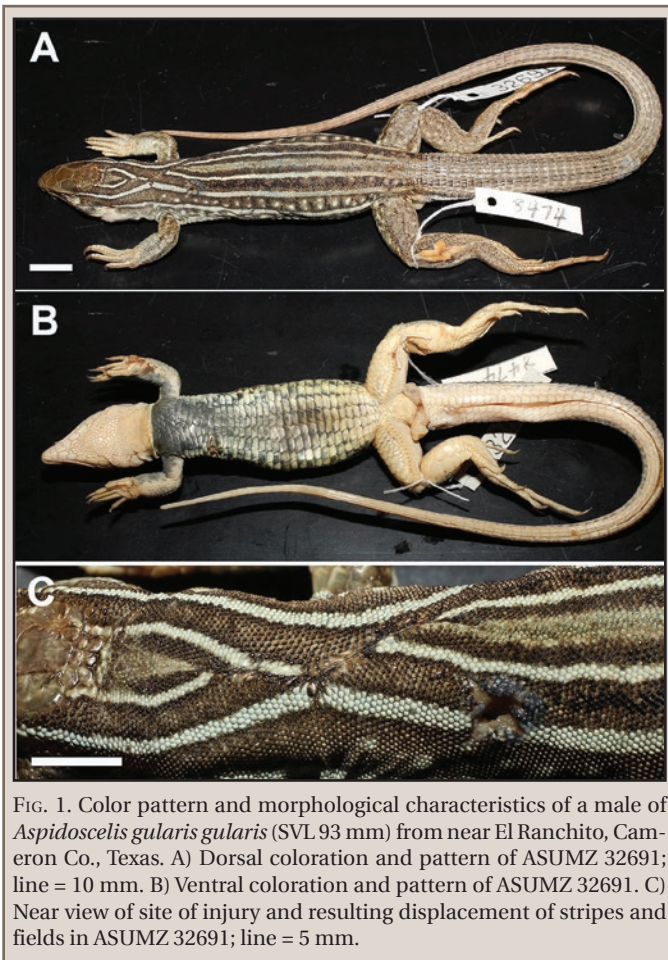


FIG. 1. Color pattern and morphological characteristics of a male of *Aspidoscelis gularis gularis* (SVL 93 mm) from near El Ranchito, Cameron Co., Texas. A) Dorsal coloration and pattern of ASUMZ 32691; line = 10 mm. B) Ventral coloration and pattern of ASUMZ 32691. C) Near view of site of injury and resulting displacement of stripes and fields in ASUMZ 32691; line = 5 mm.

upper lateral fields superior to lateral stripes). The dorsal pattern described is apparent in ASUMZ 32691, starting a few mm posterior to the forelimbs (Fig. 1A). In the post-cephalic region there is only a small pointed remnant of a vertebral stripe and the paravertebral stripe remnants are displaced medially to being only narrowly separated as the right stripe fragment extends posterior to the left (Fig. 1A). There is a scarred area just anterior to the forelimbs where no parts of the paravertebral and vertebral stripes remain, and beyond which the dorsolateral striped are noticeably displaced medially. In the latter region, the anterior ends of the interrupted paravertebral stripes are displaced medially to an open point (Fig. 1A). A near view of scars and displaced stripes and fields in the lizard, acquired by unknown means, is captured by Fig. 1C.

Specimens were collected under authority of Texas Parks and Wildlife Department permit SPR-1090-298 issued to JEC.

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**ASPIDOSCELIS LAREDOENSIS A (Laredo Striped Whiptail) × ASPIDOSCELIS GULARIS (Texas Spotted Whiptail).** **DIFFERENTIAL RATE OF HYBRIDIZATION.** *Aspidoscelis laredoensis* is a hybrid-derived parthenogenetic species (Bickham et al. 1976. Herpetologica 32:395–399; Dessauer and Cole 1989. In Dawley and Bogert [eds.], Evolution and Ecology of Unisexual Vertebrates, pp. 49–71. Bull. 466. New York State Museum, Albany, New York; McKinney et al. 1973. Herpetologica 29:361–366; Parker et al. 1989. In Dawley and Bogert [eds.], Evolution and Ecology of Unisexual Vertebrates, pp. 72–86. Bull. 466. New York State Museum, Albany, New York; Wright et al. 1983. Herpetologica 39:410–416) that reproduces asexually by development of unreduced diploid eggs. Sexual reproduction by an individual of this species occurs only when its eggs are fertilized by sperm from a male of a gonochoristic species such as *A. gularis* (Trauth et al. 2013a. Herpetol. Rev. 44:138–140; Trauth et al. 2013b. Herpetol. Rev. 44:314–316; Trauth et al. 2013c. Herpetol. Rev. 44:316–318; Walker et al. 1989a. J. Herpetol. 23:119–130; Walker et al. 1989b. Copeia 1989:1059–1064; Walker et al. 1991. Herpetologica 47:152–164; Walker et al. 2008. Herpetol. Rev. 39:340) resulting in sterile triploid hybrid males and mostly sterile triploid females. However, it is possible that a rare hybrid female from these species could be fertile and become the founder of a new allotriploid parthenogenetic species as has occurred repeatedly through hybridization in the genus *Aspidoscelis* (see Dessauer and Cole, *op. cit.*; Reeder et al. 2002. Amer. Mus. Novitat. 3365:1–61).

There are two morphologically distinct clonal complexes of *A. laredoensis* (Walker 1987. Texas J. Sci. 39:313–334; Walker et al. 1989a, *op. cit.*; Walker et al. 1991, *op. cit.*), each of which originated from a different hybrid of *A. laredoensis* × *A. gularis* based on their histoincompatibility to skin transplants (Abuhteba et al. 2000. Can. J. Zool. 78:895–904; Abuhteba et al. 2001. Copeia 2001:262–266). We used phenotypic attributes to support identification of a hybrid of *A. laredoensis* × *A. gularis* in order to establish that the rate of hybridization between these species is correlated with clonal complex. Complex B only rarely hybridizes (Walker et al. 1991, *op. cit.*). However, complex A is known to hybridize much more frequently (Walker et al. 1989a, *op. cit.*;

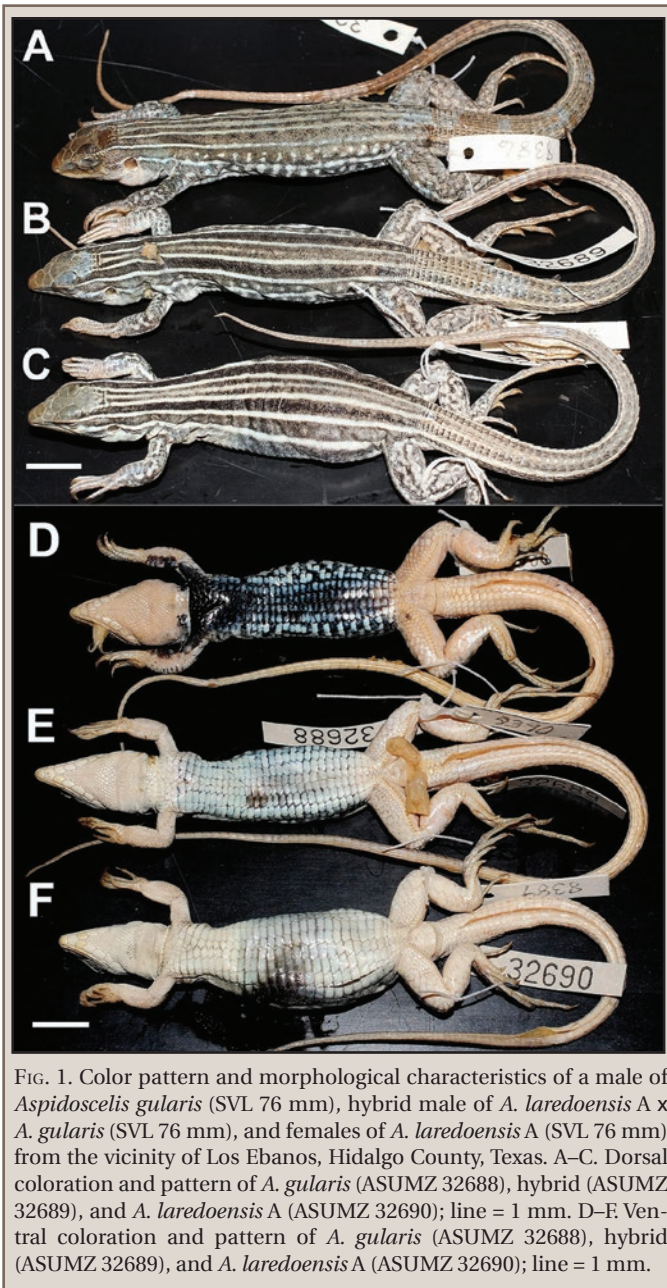


FIG. 1. Color pattern and morphological characteristics of a male of *Aspidoscelis gularis* (SVL 76 mm), hybrid male of *A. laredoensis* A x *A. gularis* (SVL 76 mm), and females of *A. laredoensis* A (SVL 76 mm) from the vicinity of Los Ebanos, Hidalgo County, Texas. A–C. Dorsal coloration and pattern of *A. gularis* (ASUMZ 32688), hybrid (ASUMZ 32689), and *A. laredoensis* A (ASUMZ 32690); line = 1 mm. D–F. Ventral coloration and pattern of *A. gularis* (ASUMZ 32688), hybrid (ASUMZ 32689), and *A. laredoensis* A (ASUMZ 32690); line = 1 mm.

this study) based on records for 20+ years (1986–2008) in an area near the Rio Grande (26.233889°N, 98.560833°W, WGS84; ~ 40 m elev.) in the vicinity of Los Ebanos, Hidalgo Co., Texas, USA. The male of *A. gularis*, male hybrid, and female of *A. laredoensis* A featured in Fig. 1A–F, originally cataloged as University of Arkansas Department of Zoology 8386, 8390, and 8389, respectively, and re-catalogued as Arkansas State University Museum of Zoology (ASUMZ) 32688, 32689, and 32690, respectively, were collected by one of us (JEC) on 22 June 2008 in the aforementioned area. We have also collected hybrids of *A. laredoensis* A x *A. gularis* from other sites in Dimmit, La Salle, Webb, Star, and Hidalgo counties, Texas, and Tamaulipas State, Mexico (Walker et al. 1989a, *op. cit.*). The distinctive Los Ebanos area, within a prominent oxbow of the Rio Grande, supports a thriving guild of whiptail lizards comprising large numbers of *A. gularis* (gonochoristic) and both clonal complexes A and B of *A. laredoensis* (diploid parthenogens). Here, these congeners are locally



FIG. 2. Enlarged postantebrachial scales of the hybrid (ASUMZ 32689); line = 1 mm.

dispersed such that opportunities for hybridization of *A. gularis* with each of *A. laredoensis* A and B are essentially present whenever lizards are active.

Prior to preservation, hybrid ASUMZ 32689 had a SVL of 76 mm, tail length of 263 mm, and body mass of 10.6 gm. This male could not be identified to *A. gularis* because of divergent features of both dorsal and ventral color patterns, as well as scutellation (see Conant and Collins 1998. *A Field Guide to Reptiles and Amphibians of Eastern and Central North America*, 3<sup>rd</sup> ed. Houghton Mifflin Co., New York, New York. 640 pp.). It lacked the low contrast darkly hued dorsal stripes/spots and fields, and lacked the intense purple-blue ventral suffusion of the mesopterygium, fore limbs, and thoracic/abdominal regions typical of *A. gularis* (Fig. 1A, D). Although the specimen resembles *A. laredoensis* A (Fig. 1C, F) more closely than *A. gularis* (Fig. 1A, D) or *A. laredoensis* B, characters indicating its hybrid origin are these aspects of color pattern: two pairs of pale straight-margined primary stripes (dorsolaterals, and paravertebrals), one pair of pale unevenly margined primary stripes resulting from contact with pale rounded spots and vertical bars, large distinct spots in brown to brown-black fields above (upper laterals) and below (lower laterals) lateral stripes nearest to ventral scales, a single indistinct and discontinuous vertebral stripe past midbody, thoracic and abdominal scales narrowly edged with purple-blue, and pink-red ventral surface of the head (Fig. 1B, E). In comparison, the typically patterned female of *A. laredoensis* depicted in Fig. 1C, F lacks large spots in the upper and lower lateral dark fields, does not have unevenly margined lateral stripes, and has a cream-white venter absent a pink-red throat and purple-blue edged thoracic and abdominal scales.



Also indicative of a hybrid origin for ASUMZ 32689 (comparison with *A. laredoensis* in paren) are the greatly enlarged mesoptychial scales bordering the gular fold (rather than enlarged); enlarged postantibrachial scales on posterior aspect of forelimbs (Fig. 2, rather than moderately enlarged), and 80 granular scales around midbody (compared with  $91.8 \pm 0.76$  based on Walker et al. 1989b, *op. cit.*).

The specimen collected in 2008 described herein establishes that production of viable, if infertile, hybrids of *A. laredoensis* A x *A. gularis* has been ongoing in the Los Ebanos vicinity for 20+ years. The first of these was collected by combinations of the authors at Los Ebanos a few hundred meters from the Rio Grande in 1986 (Walker et al. 1989a, *op. cit.*) followed by collection of other hybrids over the years up to 2008. Remarkably, there are apparently strong pre-mating/post-mating isolating mechanisms to hybridization between *A. laredoensis* B x *A. gularis*, as only three hybrids representing this combination (Walker et al. 1991, *op. cit.*) have been collected in Texas and Mexico during ~75 expeditions since 1984. Internal examination of reproductive organs in the present hybrid by one of us (SET) revealed the following: the testes were enlarged and appeared to be functional; the epididymis was expanded and appeared to have sperm present.

Specimens were collected under authority of Texas Parks and Wildlife Department permit SPR1090-298 and USDI/IRGVNWR special use permit 21552-09-13-MS. Special thanks are given to Mitch Sternberg of the USFWS at Santa Ana NWR for providing the special use permit.

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**ASPIDOSCELIS LAREDOENSIS A (Laredo Striped Whiptail) x ASPIDOSCELIS GULARIS (Texas Spotted Whiptail). STOMACH CONTENTS.** Diploid parthenogenetic *Aspidoscelis laredoensis* clonal complexes A and B, and gonochoristic parental species *A. gularis*, are syntopic at many sites in Texas and Mexico, mostly in the vicinity of the Rio Grande (Walker 1987. Texas J. Sci. 39:313–334). During the past 20+ years (1986–2008), it has not been unusual to find one or more hybrids of *A. laredoensis* A x *A. gularis* among collections from sites such as the one near the Rio Grande (26.233889°N, 98.560833°W, WGS84, ~40 m elev.) in the vicinity of Los Ebanos, Hidalgo Co., Texas (Walker et al. 1989. J. Herpetol. 23:119–130). Recently, SET examined stomach contents of hybrid male Arkansas State University Museum of Zoology (ASUMZ) 32689 (Trauth et al. 2013. Herpetol. Rev. 44: *in press*) collected by JEC on 22 June 2008 at the aforementioned site. We use this individual of 76 mm SVL as the basis for the first reported observations on the diet of a hybrid whiptail. Upon opening the body cavity of ASUMZ 32689, the stomach was seen to be distended to maximum capacity. The contents consisted almost entirely of termites (order Isoptera). By counting intact termites and detached heads it was found that the hybrid had consumed 181 of these insects. Although it would require several minutes for a lizard to consume such a large number of prey items while relatively stationary at an exposed termite colony

(and thus be susceptible to predation), such a bonanza discovery would yield far more calories per unit of time than the more difficult tactic of harvesting grasshoppers which are typically in evidence at Los Ebanos. Paulissen 2001. (J. Herpetol. 35:282–292) and Paulissen et al. 1992 (J. Herpetol. 26:153–158) reported that termites comprised the numerical majority of prey consumed by both of the parental species of the hybrid, *A. laredoensis* A and *A. gularis*, at several sites of syntopy in Texas.

The specimen was collected under authority of Texas Parks and Wildlife Department permit SPR-1090-298 and USDI/IRGVNWR special use permit 21552-09-13-MS. Special thanks are given to Mitch Sternberg of the USFWS at Santa Ana NWR for providing the special use permit.

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**ASPIDOSCELIS NEOMEXICANA (New Mexico Whiptail) x ASPIDOSCELIS INORNATA LLANURAS (Plains Striped Whiptail). PHENOTYPE.** *Aspidoscelis neomexicana*, a hybrid-derived parthenogenetic species (Cole et al. 1988. Amer. Mus. Novitat. 2905:1–38; Parker and Selander 1984. Herpetologica 40:245–252), reproduces asexually by development of unreduced diploid eggs. Sexual reproduction in the species occasionally occurs when its eggs are fertilized by sperm from a male of *A. inornata* (Axtell 1966. Herpetologica 22:241–253; Cuellar and McKinney 1976. J. Exp. Zool. 196:341–350; Taylor and Medica 1966. Univ. Colorado, Ser. Biol. 22:1–9; Taylor and Walker 1996. Copeia 1996:945–954; Wright and Lowe 1967. Amer. Mus. Novitat. 2286:1–36) resulting in sterile triploid hybrid males or females.

Herein, we describe phenotypic attributes of the first hybrid of *A. neomexicana* x *A. inornata llanuras* reported as involving this subspecies and the first one reported from the western-most part of the distribution of these species in New Mexico (see map in Cole et al., *op. cit.*). This female (originally catalogued as University of Arkansas Department of Zoology 6081 and re-catalogued as Arkansas State University Museum of Zoology 32423) was collected by JEC on 13 July 1998 in Hidalgo Co.: 21.321.6 km NW jct of US Hwy 90 and New Mexico Hwy 70, on 70 in the vicinity of the site at 32.515000°N, 108.876667°W (datum WGS84). Also obtained here during six visits between 1998 and 2001 were 17 (19.3%) *A. inornata llanuras* (gonochoristic), 22 (25.0%) *A. neomexicana* (diploid parthenogen), and 48 (54.5%) *A. uniparens* (triploid parthenogen). Prior to preservation, the hybrid had a SVL of 62 mm, tail length of 217 mm, and body mass of 6.3 gm. It could not be identified to *A. inornata llanuras* because of the presence of spots (i.e., rounded pale areas) in the dark fields between the stripes; this taxon is characterized by the lack of spots throughout ontogeny (Sullivan et al. 2013. Copeia 2013[3]:366–377; Wright and Lowe 1993. J. Arizona-Nevada Acad. Sci. 27:129–157). Although the specimen resembles *A. neomexicana* more closely than *A. inornata llanuras*, obvious phenotypic consequences of the hybrid genome are these intermediate aspects of color pattern (Fig. 1A–B): paired lateral and dorsolateral stripes relatively straight-margined, paired paravertebral stripes slightly unevenly margined,

single vertebral stripe with several interruptions and unevenly margined, strongly contrasting pale stripes and dark fields, incipient rather than distinct spots; and off-white to very pale blue rather than gray-blue venter. Data for four morphological characters are also consistent with the hypothesis for a hybrid origin for ASUMZ 32423 (comparison with *A. neomexicana* in paren): low number of granules around midbody (compared to 75–83,  $N = 22$ ); moderately enlarged mesoptychial scales (Fig. 1C, rather than small); slightly enlarged postantibrachial scales (Fig. 1D, rather than granular), and incomplete circumorbital scales (Fig. 1E, rather than complete).

That production of viable, if not fertile, hybrids of *A. neomexicana*  $\times$  *A. inornata llanuras* is a rare event in the guild sampled at the Hidalgo Co. site is indicated by ASUMZ 32423 (0.01% being among 88 specimens collected (i.e., < 33% of observed whiptail lizards) in six visits from 1998 to 2001. The hybrid is an “immature” female with both oviducts highly regressed, exhibiting minimal enlargement posteriorly. Both gonads appear as minimally-expanded, linear strips of translucent tissue, exhibiting no evidence of developing follicles. Abdominal fat bodies are modestly enlarged. Based on these observations, we infer that the hybrid was sterile.

Specimens in Hidalgo Co. were collected under authority of permit number 1850 issued to JEC by the New Mexico Department of Game and Fish.

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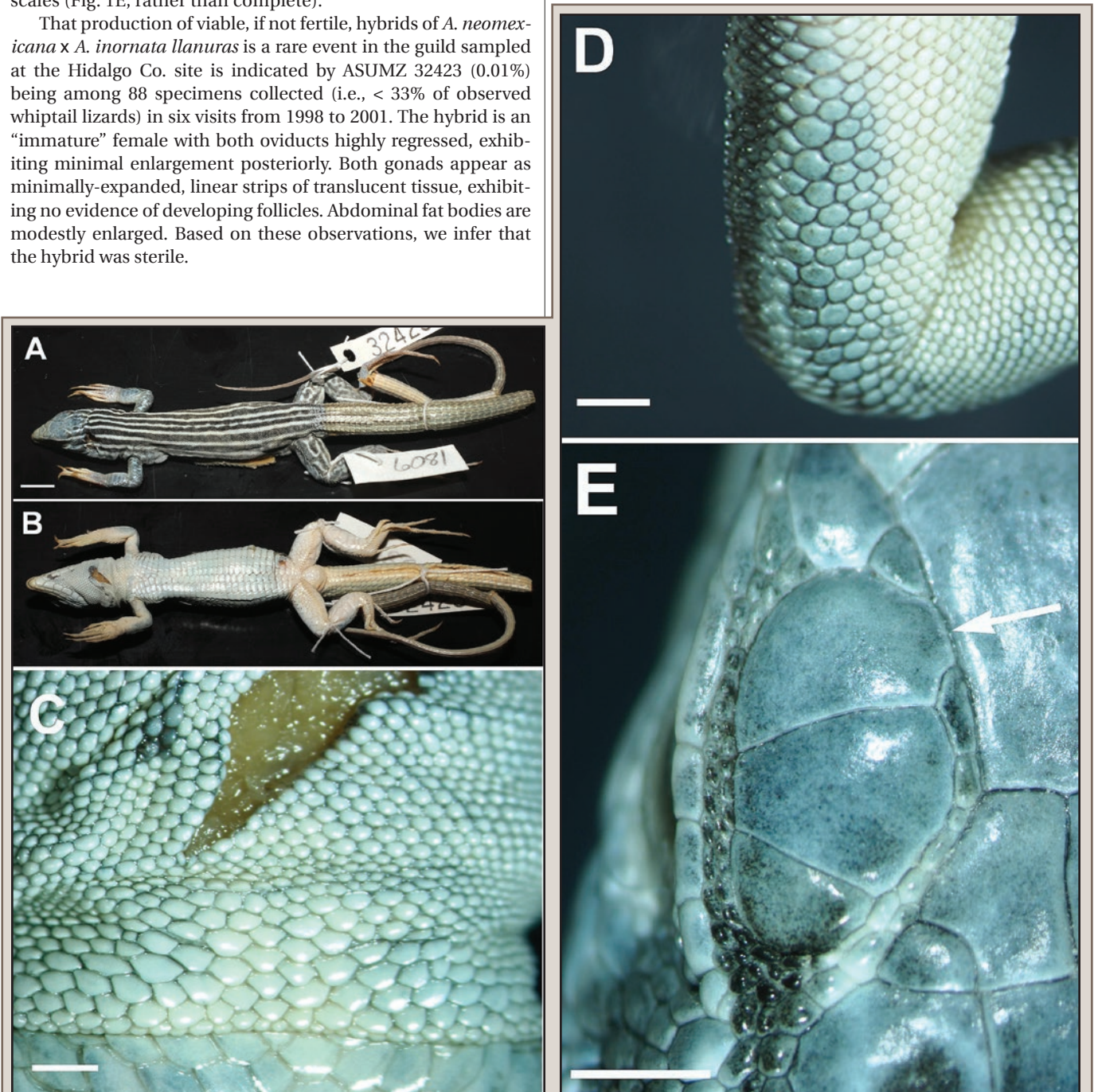


FIG. 1. Color pattern and morphological characteristics of a putative hybrid female specimen of *Aspidoscelis neomexicana*  $\times$  *A. inornata llanuras*. A) Dorsal coloration and pattern of ASUMZ 32423; line = 10 mm for A and B. B) Ventral coloration of ASUMZ 32423. C) Moderately enlarged mesoptychial scales of ASUMZ 32433; line = 1 mm. D) Slightly enlarged postantibrachial scales of ASUMZ 32423; line = 1 mm. E) Incomplete circumorbital scale series (see arrow) in ASUMZ 32423; line = 1 mm.

**ASPIDOSCELIS SEXLINEATA (Six-lined Racerunner). ARTIFICIAL HABITAT.** *Aspidoscelis sexlineata* is a “species in greatest conservation need” in Minnesota. It typically lives in sand prairies or bluff prairies, although Oldfield and Moriarty (1994. *Amphibians and Reptiles Native to Minnesota*. University of Minnesota Press, Minneapolis, Minnesota. 237 pp.) noted that it can inhabit the rock and cinder fill of railroad tracks and dike roads. We examined racerunner use of artificial habitat associated with the Prairie Island dike near Winona, Winona Co., Minnesota, USA. Completed in 1967, the dike is topped by a two-lane black-top road approximately 7–8 m above normal river level (less during periods of flooding). Sampling was conducted in a 4.7-km stretch extending northwest from Mississippi River Lock-and-Dam 5A toward Minnesota City. The river (northeastern) side of the dike was rip-rapped with boulders and chunks of concrete, whereas the southwestern side, which bordered bottomland marsh and forest, consisted of prairie-like habitat with patches of open sandy substrate. A remnant sand prairie that formerly existed near the southeastern end of the study stretch, where racerunners were observed as recently as the early 2000s, presumably served as the source of racerunners that inhabited the dike, but the site is now occupied by artificial wetlands.

Paired transect surveys, one on each side of the road, were conducted in 2010 on 15 July (5 pairs), 16 July (10), 21 August (10), 22 August (10), and 1 September (10). The 50-m transects were parallel to the road and randomly positioned with respect to distance from the southeastern end of the study stretch (0–4.7 km) and distance from the roadside (0–13 m). Data were collected by two observers using an event recorder to tally the number of racerunners observed within 1 m of each side of the transect. Substrate and shaded air temperature was measured at the start of each transect.

Racerunners were observed over a distance of 3 km on the southwestern side of the road ( $N = 17$ ) and 1 km on the northeastern side ( $N = 2$ ). Racerunners occurred from 2 m to 13 m from the edge of the road; mean distance on the southwestern side (7.23 m) and the northeastern side (5.50 m) were not significantly different ( $t = 0.674$ ,  $df = 13$ ,  $p = 0.512$ ). The number of racerunners per transect was significantly greater on the southwestern side of the dike (paired  $t$ -test,  $t = 3.028$ ,  $df = 44$ ,  $p = 0.004$ ). This may have been related to the greater substrate temperature on the southwestern side (paired  $t$ -test,  $t = 3.305$ ,  $df = 44$ ,  $p = 0.002$ ), but racerunners may have been less detectable among the boulders on the northeastern side.

The substrate temperature for transects when racerunners were observed ranged from 26°C to 46°C, with a mean (32.8°C) slightly less than substrate temperatures selected in oak savannah (34.7°C) and open grassland (39.2°C) in Wisconsin (Kapfer and Pauers 2006. *Herpetol. Rev.* 37:420–423). Shaded air temperature ranged from 22°C to 34°C. Oldfield and Moriarty (*op. cit.*) reported that racerunners have been observed active in Minnesota at air temperatures as low as 22°C, and Fitch (1958. *Univ. Kansas Publ. Mus. Nat. Hist.* 11:11–62) reported an optimal air temperature in Kansas of 34°C.

Expanding the estimated densities of racerunners observed on the 50 m × 2 m transects on the southwestern (0.00378/m<sup>2</sup>) and northeastern (0.00044/m<sup>2</sup>) sides of the dike to the total area of potential habitat on each side yielded total estimates of 229 and 26 racerunners, respectively. These are likely underestimates because of imperfect detectability (Smolensky and Fitzgerald 2010. *J. Herpetol.* 44:372–381). Nevertheless, they fall within the range of densities reported by Bellis (1964. *Herpetologica*

20:9–16) in South Carolina (0.0245/m<sup>2</sup>) and Warner (2000. *Trans. Illinois St. Acad. Sci.* 93:239–248) in northwestern Illinois.

The southwestern-facing slope of the Prairie Island dike provides extensive artificial habitat similar to the bluff prairies typically inhabited by racerunners in southeastern Minnesota. This sort of artificial habitat may become increasingly important as bluff prairies decline in area due to encroachment by invasive woody plants. Kraszewski (2004. *A Survey of Native Flowering Plant Species on Goat Prairies in Winona, Minnesota*. Unpubl. B.A. thesis, Saint Mary's University of Minnesota, Winona. 29 pp.) used aerial photographs to estimate the areas of 10 bluff prairie remnants in the Winona area, some of which are inhabited by racerunners. Prairie area varied from 0.25 ha to 3.14 ha (mean = 1.49 ha). When Gerty (2013. *Species Richness in Relation to Both Remnant Size and Leafy Spurge [*Euphorbia esula*] Invasion*. Unpubl. B.A. thesis, Saint Mary's University of Minnesota, Winona. 19 pp.) remeasured the same areas on the ground, she found them broken into 20 remnants of 0.03–0.56 ha. In comparison, each side of the Prairie Island dike provides 6.07 ha of potential habitat, although racerunners do not necessarily occur along the entire road and available habitat is reduced during years with periods of high water.

This research was funded in part by a grant from *Beta Beta Beta*. We thank Madison Sienko for field assistance.

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**ASPIDOSCELIS SEXLINEATA VIRIDIS (Prairie Racerunner). BURROW SITE FIDELITY.** The burrows and burrowing activity of Prairie Racerunner, *Aspidoscelis sexlineata viridis*, have been well documented (Fitch 1958. *Univ. Kansas Publ., Mus. Nat. Hist.* 11:11–62; Hardy 1962. *Univ. Kansas Sci. Bull.* 43:3–73; Leuck 1982. *Copeia* 1982:416–424; Trauth et al. 2004. *The Amphibians and Reptiles of Arkansas*. Univ. of Arkansas Press, Fayetteville, 421 pp.). Burrow types, excavation sites, space use, and lizard activity were described by Hardy (*op. cit.*) and Leuck (*op. cit.*) from their observations of the lizards in outdoor enclosures, whereas Fitch (*op. cit.*) and Trauth et al. (*op. cit.*) described or illustrated burrows as reported from field studies on this species. In the present study, we report on an unusual incident of burrow site fidelity in *A. s. viridis*.

On 18 June 2013, one of us (SET) observed burrowing activity of a large (78 mm SVL) male Prairie Racerunner on a gradual-sloping, west-facing, red clay, highway embankment from ca. 1800–1840 h. The site is located on the Salem Plateau in the Ozarks Mountains (Randolph County, Arkansas 36.28215°N, 91.253°W). About 2 m<sup>2</sup> of ground surface had been disrupted earlier in the day with a potato rake by SET while searching for lizard egg clutches. The excavated site had previously contained numerous surface burrows prior to unearthing and had been photographed on 7 May 2010 (Fig. 1). What made this particular observation significant was that the lizard moved toward this disrupted excavation site from the surrounding grassy habitat and stopped abruptly at a point directly in front of the observer (within 1 m) before it began digging in the loosened soil. The lizard moved back and forth across the torn ground presumably searching for former burrow shelters. The lizard soon departed the area, but it then returned and repeated the searching and digging behavior in and around the dirt pile. A repetition of this searching/digging behavior in the dirt pile continued several times during a time span of ca. 35 min. Eventually, SET attempted to catch the lizard as it had partially



FIG. 1. Finger points to the open mouth of a Prairie Racerunner burrow photographed on 7 May 2010 (see text for site description). Arrow points to fresh soil tailing (an indication of the presence of a lizard) from a recently excavated burrow shelter.

dug a burrow shelter, but the lizard evaded the attempted capture and darted into the adjacent grassy habitat. Soon, the lizard returned and walked directly beside the observer's feet and began digging again into the dirt pile. Finally, the lizard dug into the same loose soil where it had previously evaded capture and soon disappeared far enough within its burrow so as to allow for its capture.

The digging behavior of this racerunner was similar to observations reported by Hardy (*op. cit.*), although not in the context of burrow fidelity. She termed the shelter created as being an "inactivity-tunnel," a nighttime refuge or one for periods of prolonged inactivity. The particular lizard reported here would dig with alternating front legs and by pushing into the soil inward with its snout; then, it would turn around and push the tailings out of the hole with its front legs and chest. This behavior was repeated several times until the lizard's body was well hidden inside the burrow. The loose soil tailings created by this type of burrowing behavior are shown in Fig. 1.

We have collectively studied *A. s. viridis* in many parts of the range in Arkansas and other states, and have often observed fleeing lizards work their way to what appeared to be a targeted burrow. We suggest that burrow fidelity, in addition to conservation of energy by continued use of a burrow, can also serve as a targeted escape route for a lizard.

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**ASPIDOSCELIS SEXLINEATA VIRIDIS (Prairie Racerunner). SKELETAL REMAINS.** Between 1973 and 1980, Trauth (1983. *Amer. Midl. Nat.* 109:289–299) studied nesting habitat of *Aspidoscelis sexlineata* (as *Cnemidophorus sexlineatus*) across 10 states, during which 195 clutches of eggs and large numbers of lizards were excavated. The excavations took place mostly from within well-drained red clay exposures facing S to W along secondary highways and rural dirt roads. Most of this work was conducted in the Interior Highlands Region of Arkansas while studying *A. s. viridis* (Prairie Racerunner) where it was noted that, with

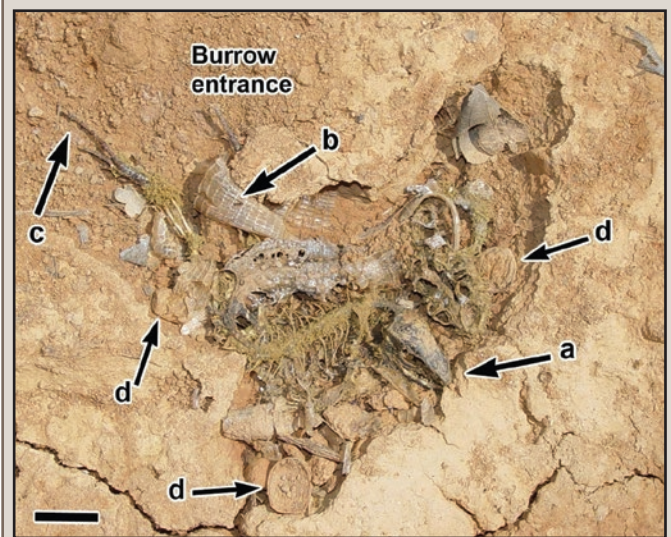


FIG. 1. Skeletal remains of a Prairie Racerunner photographed on 20 September 2003 (see text for site description). Characteristics of this species include a combination of the following structures (designated by labeled arrows): (a) a wedge-shaped head, (b) rectangular belly scutes, and (c) an elongated fourth toe. Eggshells (d) from a previous egg clutch of *A. s. viridis* are also evident. Line = 10 mm.

the hundreds of hours of excavation work, remains of expired lizards were never found. Thus, on 20 September 2003 SET was surprised by the discovery of clearly identifiable skeletal remains which we agree are those of a large Prairie Racerunner (Fig. 1) in a burrow shelter uncovered from beneath a flat rock (ca. 25 cm in diameter) on a gradual-sloping, south-facing, red clay embankment at 1435 h. The site is located within the Arkansas Army National Guard controlled Fort Chaffee Maneuver Training Center in the Arkansas River Valley, Sebastian Co., Arkansas, USA (35.20034°N, 94.15700°W; elev. 241 m). The lizard was occupying a nesting chamber that contained eggshells from a previous egg clutch (Fig. 1). Bacterial action on the lizard's undetached skin and/or the remaining flesh along the spine and hind legs cast a greenish tint to the exposed dorsum. Moreover, and based upon the presence of this greenish coloration, there appeared to be the corpse of another vertebrate beside the lizard, although its identity was not determined at the time of the discovery.

We have collectively studied *A. sexlineata* in many parts of the range in Arkansas and other states, and only SET has observed another instance of a dead racerunner in a burrow shelter. That instance occurred on 29 July 1982 in Pasco Co., Florida, in which the partially decomposed body of an Eastern Six-lined Racerunner, *A. s. sexlineata*, was infested with what appeared to be fire ants. These examples of deceased racerunners located in burrow retreats provide preliminary support for our hypothesis that many of them die by means other than predation. Nevertheless, it seems likely that skeletal remains of racerunners are ephemeral given their rare discovery during the large number of excavations performed by SET.

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FIG. 1. Adult *Leptophis ahaetulla* preying upon an adult *Bogertia lutzae* in Pernambuco, Brazil.

**BOGERTIA LUTZAE. PREDATION BY LEPTOPHIS AHAETULLA.** *Bogertia lutzae* is a small bromelicolous lizard (Avila et al. 2010. J. Helminthol. 84:199–201) endemic to the northeast region of Brazil and is found in different ecosystems, mainly inhabiting sandbanks, Atlantic forest, and Caatinga (Rodrigues 1987. Arq. Zool. 1:105–230). *Leptophis ahaetulla* is a snake with a wide geographical distribution, occurring from southern Mexico to northern Uruguay (Albuquerque et al. 2007. J. Nat. Hist. 41:1237–1243; Carvalho et al. 2007. Biol. Geral Exper. 7:41–59). It is a primarily diurnal and semi-arboreal snake and is reported to occur over a wide range of habitats. The diet of *L. ahaetulla* consists predominantly of hylid frogs; however, there are also records of *Anolis* sp., *Thecadactylus rapicauda*, *Mastigodryas boddaerti*, and young birds in their diet (Albuquerque et al. 2007, *op. cit.*).

On 8 April 2013 at 1230 h we observed an adult *L. ahaetulla* preying upon an adult *B. lutzae*. This event occurred at Tapacurá Ecological Station, Pernambuco, Brazil (8.036°S, 35.199°W; datum WGS 84). The event was recorded at a forest edge. This is the first record of predation reported for *B. lutzae* by *L. ahaetulla*. The image of predation is available in the collection of images of Herpetology and Paleontology Laboratory of the Federal Rural University of Pernambuco - UFRPE, Recife, Pernambuco, Brazil.

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**CALLOPISTES MACULATUS (Chilean Iguana). SAUROPHAGY ON LIOLAEMUS.** The highly endemic reptile diversity of Chile is characterized by lower numbers of lizard species, of predominantly small body sizes (SVL <180 mm), compared to adjacent countries. Among these species, *Callopiastes maculatus*, the largest known lizard (and only teiid) occurring in the country (SVL average:  $150.5 \pm 10.9$  mm, range [adult size estimated from the largest 2/3 of a 38-specimen sample]: 135–173 mm), and the *Liolaemus* evolutionary radiation, one of the richest amniote genera on Earth and the richest vertebrate genus in Chile (Pincheira-Donoso et al. 2008. Zootaxa 1800:1–85), stand out as some of the most prominent elements of the indigenous herpetofauna. All



FIG. 1. Saurophagy of *Callopiastes maculatus* on *Liolaemus nitidus* in central Chile.

geographic areas where *C. maculatus* has been recorded are also inhabited by one or more species of *Liolaemus*. In these common areas, both groups of lizards are found in the same microhabitats, and overlap temporally (they are all diurnal). Surprisingly, however, ecological interactions among *Callopiastes* and *Liolaemus* have only rarely been documented in the literature (e.g., see Jaksic 1998. Ecología de los Vertebrados Terrestres de Chile. Pont. Univ. Católica Press, Santiago. 262 pp.). Here, we report a predation event between *C. maculatus* and *L. nitidus*, one of the largest known *Liolaemus* species (SVL average: 92.5 mm, range: 85.4–107.5 mm; Pincheira-Donoso et al. 2008. BMC Evol. Biol. 8:68).

The feeding ecology of *Callopiastes maculatus* is primarily insectivorous and secondarily carnivorous (including both heterospecific and conspecific small lizards, as well as birds and mammals), while other reports also describe consumption of plant material (Fuentes 1976. Ecology 57:3–17; Mellado 1982. Donana Acta Verteb. 9:372–373; Vidal and Ortiz 2003. Herpetol. Rev. 34:364–365). Within the lizard component of *C. maculatus* diet, only small *Liolaemus* species (*L. lemniscatus*, SVL average = 48.8 mm; *L. tenuis*, SVL average = 56.9 mm) have been observed as prey.

Near the city of Ovalle (30.39861°S, 71.22889°W), Coquimbo Region of Chile, we observed an adult male *Callopiastes maculatus* actively preying on an adult *Liolaemus nitidus* (Fig. 1). The observation took place on 10 January 2009, at 1310 h, and the recorded air temperature was 27°C. The feeding behavior of the *C. maculatus* consisted of multiple attacks to the body of the *L. nitidus*, which at the time of our initial observation was lying dead ~50 cm from a shrub (*Fabiana imbricata*). The *C. maculatus* was using this shrub as an intermittent shelter (possibly as a result of our presence) while periodically returning to the prey item to continue its attacks. Every attack to the lifeless *L. nitidus* lasted only a few seconds, and given the adult size of the prey, the predatory lizard showed signs of difficulty in handling it. Within 72 sec. of observation, the *C. maculatus* eventually moved the body of *L. nitidus* out of sight into the vegetation. Although it remains unknown whether the predator managed to eat the captured prey item, our report shows that *C. maculatus* will target other lizard species with only slightly smaller body sizes. In addition, from the ecological perspective of the prey, our observation reveals that the largest species of the genus *Liolaemus* are not only preyed upon by considerably larger vertebrates, such as

mammalian carnivores, birds of prey, or snakes, but also by other lizards. A recent study (Pincheira-Donoso 2012. *Anim. Biol.* 62:277–287) showed that saurophagy within *Liolaemus* mostly involves adults feeding on heterospecific and conspecific (i.e., cannibalism) newborns and juveniles. Collectively, our report challenges the generality for predators of *Liolaemus* lizards. This note provides a record of the largest known prey consumed by *C. maculatus*, while expanding the diversity of reptiles this large species feeds on.

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**CNEMIDOPHORUS OCELLIFER (Spix's Whiptail). PREDATION.** Predation events are difficult to record in the natural environment (Shepard 2007. *Herpetologica* 63:193–202). Such reports are relevant because they present ecological interactions within ecosystem dynamics, thus providing key information concerning diet and natural life history of the species (Morin 1983. *Ecol. Monogr.* 53:119–138).

In natural environments, lizards serve as potential prey for arthropods (Bocchiglieri and Mendonça 2009. *Herpetol. Rev.* 40:438–438) and vertebrates such as other lizards (Faria and Araujo 2004. *Braz. J. Biol.* 64:775–786), snakes (Silva and Araújo 2008. *Ecologia dos Lagartos Brasileiros*. Technical Books, Rio de Janeiro. 271 pp.), and birds (Gogliath et al. 2010. *Herpetol. Bull.* 114:36–38). In this note, we describe a predation event of a terrestrial lizard, *Cnemidophorus ocellifer*, by a Great Egret (*Ardea alba*) on a sand dune beach complex in northeastern Brazil.

On 19 September 2012 at 1530 h during fieldwork at Mosqueiro's Beach, Aracaju, Brazil (11.0885°S, 37.1166°W) we observed a predation attack by a Great Egret on a *C. ocellifer*. The egret was observed walking slowly along the dunes, and suddenly changed its stance, beginning to walk faster with the neck stretched toward and facing upright. It then stopped close



FIG. 1. Great Egret predation upon *Cnemidophorus ocellifer* at Mosqueiro's Beach, Aracaju, Brazil.

to some herbaceous vegetation and remained still with the neck held in an S-shape, the typical posture of this species during stalking behavior. A few seconds later the egret attacked and captured the lizard with its bill (Fig. 1).

We thank Bolista FAPITEC for funding and support of our research.

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**COPESGLOSSUM AFF. NIGROPUNCTATUM (Amazonian Skink). PREDATION.** The Amazonian Pygmy-Owl (*Glaucidium hardyi*) typically feeds on arthropods and is considered insectivorous, although it may less commonly predate on small vertebrates such as birds, mammals, amphibians and reptiles (Sick 1997. *Ornitologia Brasileira*. Editora Nova Fronteira, Rio de Janeiro. 912 pp.). At 1000 h on 1 November 2012, while I was birdwatching on “ZF-2 Tower,” at “Reserva Cuieiras,” property of Instituto Nacional de Pesquisas da Amazônia, 80 km from Manaus, Amazonas, Brazil, I saw a *G. hardyi* perched near the tower. I approached quietly and took some photos. After a few minutes, the owl flew to a 30 m-high platform on the tower where it remained for a few seconds, as if in pursuit of prey. Upon returning to its perch, the owl was holding a *Copesglossum aff. nigropunctata* in its talons. The skink tried to escape, but the owl bit the dorsal region of the neck, killing it, and flew away with the prey. This is the first record of predation on a *C. aff. nigropunctata* by an Amazonian Pygmy-owl, and a rare record of vertebrate predation by this species.

I am grateful to Teresa C. S. de Avila-Pires of Emilio Goeldi Paraense Museum for her help with the identification of the lizard, Fernanda Dragan for English revision, CNPq for the PhD scholarship (#145304/2009-4), and Atend Ltda for research funding.

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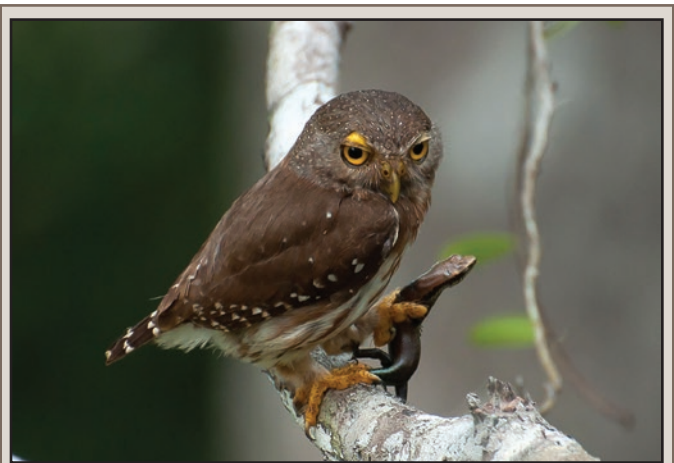


FIG. 1. An Amazonian Pygmy-Owl (*Glaucidium hardyi*) holding an Amazonian Skink (*Copesglossum aff. nigropunctata*).

TABLE 1. Observations of aggregations of Japanese Geckos (*Gekko japonicus*) in Fukuoka, Japan conducted from November 2011 to April 2012. Geocoordinates based on datum WGS84. A = # of *G. japonicus* observed in aggregation.

Site 1		Coordinates: 33.597266°N, 130.3748°E Natural Ground Elevation: 21 m									
Date	10 Dec	25 Dec	29 Dec	18 Jan	30 Jan	18 Feb	6 Mar	27 Mar	9 Apr	16 Apr	27 Apr
Time	1430 h	1030 h	1030 h	1130 h	1230 h	1330 h	1400 h	1230 h	1230 h	1300 h	1545 h
°C	7.5°	4.5°	7°	9°	8.5°	1°	12°	15°	21.5°	22°	19°
A group 1	4	5	4	7	6	6	6	3	7	2	4
A group 2	5	6	7	7	5	6	6	5	6	3	0
Site 2		Coordinates: 33.589433°N, 130.458316°E Natural Ground Elevation: 14 m									
Date	28 Nov	15 Dec	24 Dec	4 Jan	12 Dec	4 Mar	8 Apr	15 Apr	22 Apr		
Time	1830 h	1900 h	1800 h	1500 h	1830 h	1730 h	1500 h	1700 h	1600 h		
°C	17°	9°	6°	3°	6.5°	9°	22°	20°	22°		
A group 3	4	7	7	8	6	7	4	1	1		
A group 4*	5	10	11	8	6	5	4	2	1		

\*View partially obscured by a small can placed in hole. # of animals present may be higher.

**GEKKO JAPONICUS (Japanese Gecko). COLD WEATHER AGGREGATIONS.** There is little in the literature discussing brumating aggregations of *Gekko japonicus* (Hisai 1997. Misc. Rep. Inst. Nat. Stud. 28:1–5 [In Japanese]; Hisai 1998. Misc. Rep. Inst. Nat. Stud. 29:1–3 [In Japanese]) and, to the best of my knowledge, nothing in English. Hisai (1997, 1998, *op. cit.*) continuously observed two brumating aggregations of *G. japonicus* behind sign boards on a building and also noted that this species has been reported to utilize woodpiles, potted plants, retaining walls, loose bark, and crevices of utility poles and buildings. Here I report on observations of four large aggregations of *G. japonicus* in weep holes (Fig. 1) in retaining walls at two sites in the city of Fukuoka, Japan. The aggregations were initially found during a survey of utilization of retaining walls by *G. japonicus*. As time permitted, observations were repeated from November 2011 through April 2012 (Table 1). These aggregations occurred in holes that were 1–1.5 m from the ground. Holes were viewed with a 3-LED flashlight and observation times were limited to 1 minute or less in an attempt to minimize disturbance to the animals. The geckos remained responsive on all but the coldest days (air temp < 3°C).



FIG. 1. Aggregation of six *Gekko japonicus* occupying a weep hole at a park in Fukuoka, Japan (33.597266°N, 130.3748°E) observed at 1400 h, 6 March 2012.

The aggregations were primarily comprised of adults, though juveniles were often present. Consistent with Hisai's observations, the geckos moved to and from holes throughout their brumation period. The aggregations fluctuated in size, peaking in December or January and grew smaller from January to April. The largest aggregation, consisting of at least 11 individuals, was observed on 24 December 2011 among group 4 at Site 2. At each site, the aggregations were in neighboring holes, though many other holes were available. All holes housing the aggregations had also been sites of oviposition as evidenced by the presence of unhatched gecko eggs and eggshells.

Among all groups, the geckos typically clustered near the back of the holes. However, in the latter half of April, after the brumation period had clearly ended, geckos were always observed near the mouths of the holes, retreating to the back upon being approached. During that time, the aggregations largely dispersed, though four geckos were observed occupying one hole at Site 1 during the final observation on 27 April.

Aggregating in lizards mitigates the effects of abiotic environmental factors, such as temperature fluctuations and evaporative water loss; it has been postulated that aggregative behavior evolved among multiple gecko species to take advantage of this (Lancaster et al. 2006. *Anim. Behav.* 72:199–207; Shah et al. 2003. *Behaviour* 140:1039–1052). The overall patterns observed in these *G. japonicus* aggregations, which peaked in late December and January, suggests that aggregative behavior during brumation in this species could be an adaptation to exploit the thermal inertia of a group as a means of protection against drops in temperature.

I thank Xi Hong for providing English translations of the Japanese literature cited.

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**GEKKO MONARCHUS (Spotted House Gecko). REPRODUCTION.** *Gekko monarchus* ranges from the Philippines and southern Thailand through Peninsular Malaysia and Singapore, eastward through the Indo-Australian Archipelago (Grismer 2011. *Lizards of Peninsular Malaysia, Singapore and their Adjacent Archipelagos*. Chimaira, Frankfurt am Main. 728 pp.). There is anecdotal information on its reproduction in Grismer (*op. cit.*) and

numerous accounts of clutches consisting of two eggs and communal nesting in various field guides on reptiles from Southeast Asia, for example, see Das (2006. A Photographic Guide to Snakes and Other Reptiles of Borneo. Ralph Curtis Books, Sanibel Island, Florida. 144 pp.). In this note we present information on reproduction of *G. monarchus* from West Malaysia from a histological examination of museum specimens. Minimum sizes for reproduction are given for both sexes.

A sample of 129 *G. monarchus* from West Malaysia collected 2002, 2003, 2004 to 2006, 2008, and 2011 and deposited in the herpetology collection of La Sierra University, Riverside, California, USA was examined. The sample consisted of 51 adult males (mean SVL = 78.1 mm  $\pm$  6.5 SD, range = 58–90 mm), 30 adult females (mean SVL = 66.0 mm  $\pm$  4.5 SD, range = 56–75 mm), 35 juveniles (mean SVL = 43.6 mm  $\pm$  6.1 SD, range = 31–54 mm) and 10 neonates (mean SVL = 28.4 mm  $\pm$  1.3 SD, range = 27–30 mm). All juveniles contained very small gonads indicating reproductive activity had not commenced. Neonates were within the size range for *G. monarchus* in Malkmus et al. (2002. Amphibians and Reptiles of Mount Kinabalu [North Borneo] Koeltz Scientific Books, Königstein. 424 pp.). *Gekko monarchus* were collected in West (Peninsular) Malaysia (by state): Johor (N = 64), Melaka (N = 3), Pahang (N = 60), Perak (N = 1), Penang (N = 2), Selangor (N = 3), Terengganu (N = 1).

A cut was made in the lower abdominal cavity and the left testis or ovary was removed, embedded in paraffin, cut into 5  $\mu$ m sections and stained with Harris hematoxylin followed by eosin counterstain. Enlarged follicles (> 4 mm) or oviductal eggs were counted. Histology slides were deposited in LSUHC.

Two stages were present in the testicular cycle: 1) recrudescence, characterized by a proliferation of germ cells in the seminiferous tubules, primary or secondary spermatocytes predominate; 2) spermiogenesis, seminiferous tubules lined by clusters of sperm or metamorphosing spermatids. Spermiogenesis was the predominant phase in the months data was available from: March (N = 9, 100%), June (N = 2, 100%), July (N = 16, 100%), August (N = 8, 63%), September (N = 16, 94%). The smallest reproductively active male (spermiogenesis) measured 58 mm SVL (LSUHC 5257) and was collected in March. The significance of males exhibiting recrudescence in August (N = 3) and September (N = 1) is not known. One of the August males (LSUHC 5766) measured 58 mm SVL and likely had not joined the breeding population.

Four stages were present in the monthly distribution of stages in the ovarian cycle of *G. monarchus* (Table 1); 1) quiescent, no yolk deposition; 2) yolk deposition, basophilic yolk granules in the ooplasm; 3) enlarged follicles > 4 mm; 4) oviductal eggs. The smallest reproductively active female (yolk deposition) measured 56 mm SVL (LSUHC 5710) and was from August.

TABLE 1. Monthly stages in the ovarian cycle of 30 *Gekko monarchus* from West Malaysia.

Month	N	Quiescent	Yolk depositon	Enlarged follicles > 4 mm	Oviductal eggs
March	5	3	1	0	1
June	1	0	0	0	1
July	8	5	1	0	2
August	4	3	1	0	0
September	12	5	3	1	3

Mean clutch size for 8 females was  $1.9 \pm 0.35$ , range = 1–2. *Gekko monarchus* females were reproductively active in all months sampled. No female with oviductal eggs or corpora lutea and concurrent yolk deposition, indicating production of multiple clutches was found. Nevertheless this is likely possible in view of the extended breeding period and likely reflects our small adult female sample size (N = 30).

The presence of reproductively active males and females in all months examined and the observations of gravid females from March through November by Grismer (*op. cit.*) indicates *G. monarchus* exhibits a prolonged reproductive cycle. This was found to occur in other geckos from Southeast Asia including the congener *G. smithi* (Goldberg 2009. Texas J. Sci. 61:225–228, *Dixonius siamensis* (Goldberg 2008. Texas J. Sci. 60:233–238), and *Cyrtodactylus baluensis* (Goldberg 2012. Hamadryad 36:42–44).

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**HEMIDACTYLUS MABOUIA (Tropical House Gecko). CANNIBALISM.** Intraspecific predation (cannibalism) is a widespread ecological behavior that has been reported in numerous lizards (Blanco et al. 2012. Cuad. Herpetol. 26:91–93; Pincheira-Donoso 2012. Anim. Biol. 62: 277–287; Sales et al. 2011. Herpetol. Notes 4:265–267). *Hemidactylus mabouia* is a prolific colonizer, widely distributed, and frequently associated with urban areas, but also found in natural environments from the Amazonia to the Caatinga (Ávila-Pires 1995. Zool. Verh. Leiden. 299:1–706; Zamprogno and Teixeira 1998. Brazil. J. Biol. 58: 143–150). The diet reported for *H. mabouia* consists mainly of spiders, insect larvae, and termites (Rocha and Anjos 2007. Brazil. J. Biol. 67: 485–491). In this note we report a case of intraspecific predation by *H. mabouia*.



FIG. 1. Gravid female *Hemidactylus mabouia* preying upon a juvenile conspecific.



During the rainy season on 21 May 2013 at ca. 2110 h, we observed an adult female *H. mabouia* (57.5 mm in SVL) with two eggs in its abdomen (viewable through the skin) and a conspecific juvenile gecko (36.5 mm in SVL) inside its mouth (Fig. 1). The adult had a firm bite hold on the lateral region of the juvenile's torso. Our observation occurred in a residence in the urban area (0.002694°S, 51.091306°W, datum WGS84; 31 m elev.), municipality of Macapá, State of Amapá, northern Brazil. The observations here lasted 20–35 minutes. Seven minutes subsequent to ingestion, the adult female gecko regurgitated the juvenile. The regurgitation may have been caused by the body size of the juvenile, which represented more than half of SVL female adult. A previous case of cannibalism in this species was reported from southeastern Brazil (Pombal and Pombal, Jr. 2010. *Herpetol. Rev.* 41: 223–224). Cannibalism in *H. mabouia* might represent opportunistic feeding based on an increase in the juvenile population or as a strategy to minimize the ecological costs during periods of low arthropod availability.

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**HEMIDACTYLUS MABOUIA (African House Gecko). PREDATION BY CALLITHRIX PENICILLATA.** *Hemidactylus mabouia* is an exotic lizard that broadly distributed in Brazil from forests to urban areas (Sousa and Freire 2010. *Biotemas* 23:231–234) but native to Africa. This is a nocturnal species, sheltering in crevices and under tree bark during the day. Marmosets (*Callithrix* spp.) are endemic Brazilian primates that consume different kinds of food, from plant reproductive parts to animals, such as insects, toads, and lizards (e.g., *Anolis*, *Mabuya*) (Martins and Setz 2000. *Int. J. Primatol.* 21:476–476; Passamani and Rylands 2000. *Primates* 41:27–38; Rylands et al. 2009. *In* Ford et al. [eds.], *The Smallest Anthropoids: the Marmoset/Callimico Radiation*, pp. 25–61. Springer, New York). In this short note, we describe an autotomy event in *H. mabouia* followed by its predation by *C. penicillata* (É. Geoffroy, 1812).

On 18 June 2013, while monitoring a group of *Callithrix penicillata* (eight individuals), we observed the capture and predation of an individual *Hemidactylus mabouia* by two marmosets (a juvenile and an adult). This event occurred in a Cerrado remnant, located in the urban area of Campo Grande, state of Mato Grosso do Sul, Brazil (20.301418°S, 54.365219°W). At 0929 h (ambient temperature = 28°C), a juvenile marmoset (< 6 months) was foraging on a trunk (ca. 60 cm circumference) at ca. 1.5 m above ground. It tracked and captured a *H. mabouia*. Instantaneously, the lizard released the tail while in the hands of the primate, launched itself to the ground, and remained motionless. The juvenile marmoset started to eat the tail, whereas the adult marmoset (> 2 years) searched the ground intensively. After 1 min (0930 h), the adult marmoset came down to the ground, leaped onto the lizard, captured it and brought it to its mouth. Later, the same individual marmoset climbed a tree at 2 m above ground and started to eat the lizard (Fig. 1). The juvenile marmoset made successive requests for food to the adult, which shared a small part of the lizard. From the tracking to the end of the ingestion approximately 6 min elapsed.

Tail autotomy in lizards is a mechanism that may reduce mortality by predation, since tail movements (postautotomy) may distract or confound the predator (Congdon et al. 1974. *Science*



FIG. 1. An adult *Callithrix penicillata* preying on *Hemidactylus mabouia* in Campo Grande, Mato Grosso do Sul, Brazil.

184:1379–1380). However, it is possible that this antipredator mechanism is more efficient against solitary predators than against individuals that forage in groups, such as marmosets.

We thank Juliana Terra and Sabine Borges for the identification of the lizard and Coordination for the Improvement of Higher Education Personnel (CAPES) for granting the scholarship for the first two authors.

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**HOLASPIS GUENTHERI (Günther's Gliding Lizard). PREDATION.** On 13 January 2010, at 1117 h, one of us (SI) observed and photographed an adult Senegal Kingfisher (Coraciiformes: Alcedinidae: *Halcyon senegalensis*) holding an adult *Holaspis guentheri* in its beak. The bird was perched on the landing strip barrier of the Joachim Mahothes Magouindi Airport (2.79°S, 10.06°E), Gamba, Ogooué-Maritime Province, southwestern Gabon. Neither the bird nor the lizard was collected, but their respective color patterns readily distinguish them from related taxa recorded in the region (Angehr et al. 2006. *In* Alonso et al. Gamba, Gabon: Biodiversité d'une forêt équatoriale africaine, pp. 327–351. *Bull. Biol. Soc. Washington* 12; Pauwels and Vande



FIG. 1. A Senegal Kingfisher (*Halcyon senegalensis*) with an adult Günther's Gliding Lizard (*Holaspis guentheri*).

weghe 2008. Reptiles du Gabon. Smithsonian Institution, Washington. 272 pp.). It is the first time that this specific predator-prey relationship is reported.

We thank ornithologists Patrice Christy and Jean Pierre Vande weghe (Libreville) for the confirmation of the identification of the kingfisher and discussions on its ecology.

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**LIOLAEMUS MONTICOLA (Mountain Lava Lizard). PREDATION ON LIOLAEMUS LEMNISCATUS.** *Liolaemus* is a diverse genus of small to medium-sized, omnivorous lizards, distributed in the southern hemisphere of the Neotropical realm. *Liolaemus monticola* is endemic to Chile and is distributed in Andean scrub from Coquimbo to Maule regions, from 500–3000 m elev. (Pincheira-Donoso and Nuñez 2005. Publ. Ocas. Mus. Nac. Hist. Nat. Chile 59:1–486). This species is an active forager on insects with more than 50% of its reported diet as ants (Fuentes and Ipinza 1979. J. Herpetol. 13:123–124; Vidal and Labra 2008. Herpetología de Chile. Science Verlag, Santiago. 593 pp.). Here I report an observation of saurophagy.

On 21 January 2011, at 1100 h, on a sunny day with an ambient temperature of 22°C, an adult *L. monticola* (mean SVL 157



FIG. 1. *Liolaemus monticola* eating a juvenile *L. lemniscatus*.

mm and tail length at 94 mm) was observed attacking and then ingesting a juvenile *Liolaemus lemniscatus* (SVL = 45 mm) at Fundo Las Lomas, Colina County, Metropolitan region, Central Chile (33.065546°S, 70.670172°W, WGS84; elev. 810 m). The adult was resting in the soil and then chased the *L. lemniscatus* when it approached, taking ca. five minutes to capture and ingest the small lizard, and then sought refuge under some rocks. The habitat was an open and rocky scrubland dominated by *Baccharis linearis* and *Proustia cuneifolia*, with an additional assemblage of annual forbs. The area is not currently pristine with the original vegetation showing anthropogenic disturbance as a result of wood and charcoal extraction, and livestock use. To my knowledge, this is the first record of saurophagy for *L. monticola* as well as for the entire genus of *Liolaemus* (cf. Vidal and Labra, *op. cit.*).

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**LIOLAEMUS WIEGMANNII. PREDATION.** Lizards are typical prey items for birds, however direct observations of predation are relatively rare in the field. The sand lizard *Liolaemus wiegmanni* (SVL = 42–64 mm), is largely restricted to sandy soils of a vast region of Argentina and Uruguay (Ceï 1993. Reptiles del Noroeste, Nordeste y Este de la Argentina. Museo Regionale di Scienze Naturali. Torino, Italy. 949 pp.). This species occurs along coastal sand dunes of the Buenos Aires Province in semi-fixed dunes, usually far away from open spaces and beach (Block et al. 2012. J. Herpetol. 46:608–613). This note reports a single observation of predation on *Liolaemus wiegmanni* by a Burrowing Owl (*Athene cunicularia*). The Burrowing Owl is commonly found in grassy plains of Argentina, being the most abundant owl in agroecosystems (Bellocq and Kravetz 1994. Ecol. Austral. 4:29–34). Reptiles, like the sand lizard, are generally less common prey item in the owl's diet (0.3%, Sanchez et al. 2008. Ornitol. Neotrop. 19:71–80).

During a lizard survey through coastal sand dunes in Arenera Galati (37.38658°S, 57.05781°W; datum Campo Inchauspe), Buenos Aires Province, on 31 October 2008 at 1030 h, we observed the carcass of an adult female of *L. wiegmanni* (SVL = 52 mm; total length = 64 mm) lying a few centimeters away from an *A. cunicularia* burrow. The burrow was located on a dune and the owls were present at the moment of the observation. The lizard's body was completely intact suggesting that the lizard had been recently caught. The specimen of *L. wiegmanni* (UNMDP 1778) was deposited in the Herpetological Collection of the Universidad Nacional de Mar del Plata, Buenos Aires, Argentina.

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**MEROLES CUNEIROSTRIS (Wedge-snouted Sand Lizard). CANNIBALISM.** Cannibalism has been observed in a diverse number of reptile species; numerous studies have shown that it is not only common, but that it may play an integral role in shaping the ecology of a species and community dynamics (Fox 1975. Annu. Rev. Ecol. Syst. 6:87–106; Jenssen et al. 1989. Anim. Behav. 38:1054–1061; Keren-Rotem et al. 2006. Behav. Ecol. Sociobiol. 59:723–731). Studies suggest that cannibalism is common in generalist predators that might prey on conspecifics opportunistically. This pattern has been observed in diverse

taxa, and most reported cases involve larger individuals feeding on younger, smaller conspecifics (e.g., Polis and Myers 1985. *J. Herpetol.* 19:99–107; Pincheira-Donoso 2012. *Anim. Biol.* 62:277–287; Siqueira and Rocha 2008. *S. Am. J. Herpetol.* 3:82–87). Among lacertid lizards, cannibalism has been mainly documented among island species characterized by high population densities and limited food resources (Amat et al. 2008. *Amphibia-Reptilia* 29:329–336; Pafilis et al. 2009. *Naturwissenschaften* 96:1107–1113; Perez-Mellado and Corti 1993. *Bonn. Zool. Beitr.* 44:193–220; Žagar et al. 2012. *Acta Herpetol.* 7:29–39). This behavior, however, has been poorly documented among continental species.

On 27 December 2011 near the Gobabeb Training and Research Centre, Erongo, Namibia (23.561986°S, 15.041616°E, datum WGS84; 408 m elev.) we observed a juvenile *Meroles cuneirostris* being eaten by a conspecific adult female (SVL = 44 mm; tail length = 72 mm; 2.6 g). At ca. 1100 h, while attempting to capture the juvenile, an adult female dashed from underneath a small bush and began to chase the juvenile. The chase lasted less than 30 sec. before the female captured the juvenile, biting down on its head and then violently shook her own head. The juvenile then briefly escaped but was recaptured in the same manner. The female relocated to a spot underneath the bush where initially observed and continued to grip the head and neck of the juvenile as it struggled to escape, tightening her grip every few moments. After several minutes the juvenile became lifeless, and the female began to swallow the juvenile whole, headfirst. The entire consumption of the juvenile was completed in ca. 3 min., during which time the female appeared to have no trouble swallowing. Afterward the female remained under the bush for nearly 5 min. and then sprinted ca. 30 m away across the open sand.

There have been no prior examples of cannibalism in any *Meroles* species to date. The diet of *M. cuneirostris* is primarily insectivorous, and relative food availability is thought to remain constantly low throughout the year in this temperate desert climate (Goldberg and Robinson 1979. *Herpetologica* 35:169–175). At the time of this observation, median juvenile SVL for this population was 33 mm (range = 27–42 mm; N = 53).

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**MESALINA OLIVIERI (Olivier's Sand Lizard). CESTODE ENDOPARASITES.** *Mesalina olivieri* is known from Algeria, Western Sahara, Tunisia, Libya, Egypt, Israel, Jordan, Iraq, and Saudi Arabia (Bar and Haimovitch 2011. *A Field Guide to Reptiles and Amphibians of Israel*. Herzliya, Israel. 245 pp.). We know of no endoparasite records for this species. The purpose of this note is to establish the initial helminth list for *M. olivieri*.

One female *M. olivieri* (SVL = 48 mm) collected April 1956 in the Central Negev Region, Israel and deposited in the herpetology collection of the Tel Aviv Museum of Natural History (TAUM), Tel Aviv, Israel as TAUM 2201, was examined for endoparasites. A lateral slit was made on the left side and the coelomic cavity was examined for endoparasites using a dissecting microscope. Found were 30 oblong whitish, bodies measuring ca. 1 mm in length. They were regressively stained in hematoxylin, cleared in xylol, mounted in balsam, studied under a compound microscope and identified as tetrathyridia larvae of the

cestode, *Mesocestoides* sp. Voucher helminths were deposited in the United States National Parasite Collection, USNPC, Beltsville, Maryland as USNPC 107017. The life cycle of *Mesocestoides* sp. is unknown but is thought to utilize three hosts, a vertebrate definitive host, a vertebrate second intermediate host and an arthropod first intermediate host (Rausch 1994. *In* Khalil et al. [eds.], *Keys to the Cestode Parasites of Vertebrates*, pp. 309–314. CAM International, Oxon, U.K.). Tetrathyridia are commonly found in the body cavities of amphibians, reptiles, and rodents (Padgett and Boyce 2004. *J. Parasitol.* 90:108–113). *Mesocestoides* sp. was previously reported in the congener *M. guttulata* from Israel (Goldberg and Bursey 2012. *Herpetol. Rev.* 43:136). *Mesocestoides* sp. in *Mesalina olivieri* is a new host record.

We thank Shai Meiri (TAUM) for permission to examine *M. olivieri*, Ezra Maza for facilitating the loan, and the National Collections of Natural History at Tel Aviv University for providing *M. olivieri* for this study.

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**MESALINA OLIVIERI (Olivier's Sand Lizard). REPRODUCTION.** *Mesalina olivieri* is known from Algeria, Western Sahara, Tunisia, Libya, Egypt, Israel, Jordan, Iraq, and Saudi Arabia (Bar and Haimovitch 2011. *A Field Guide to Reptiles and Amphibians of Israel*. Pazbar LTD, Herzliya, Israel. 245 pp.). Schleich et al. (1995. *Amphibians and Reptiles of North Africa*. Koeltz Scientific Publishers, Koenigstein. 627 pp.) reported *M. olivieri* from Oran, Algeria commenced mating in October after emergence from aestivation, females with fully developed eggs occurred from mid-October to the end of May, and at least two clutches of 2–4 eggs were produced. In Jordan, clutches of 4–8 eggs were produced (Disi et al. 2001. *Amphibians and Reptiles of the Hashemite Kingdom of Jordan*. Edition Chimaira, Frankfurt am Main. 408 pp.). In this note I present information on the reproductive cycle of *M. olivieri* from Israel.

A sample of 39 *M. olivieri* collected 1941 to 1965 in Israel consisting of 16 adult males (mean SVL = 44.6 mm ± 2.9 SD, range = 40–50 mm), 17 adult females (mean SVL = 44.6 mm ± 3.3 SD, range = 40–51 mm), 2 juvenile males (mean SVL = 37.0 mm ± 2.8 SD, range = 35–39 mm) and 4 juvenile females mean SVL = 38 mm ± 1.7 SD, range = 35–39 mm) was examined from the National Collections of Natural History at Tel Aviv University (TAUM), Tel Aviv, Israel by Region Name: Arava Valley TAUM 1832, 2602, 4113; Central Negev TAUM 1121, 1480, 1481, 1483, 1486, 1490, 1731, 1741, 2201, 2475, 2500, 2501, 3438, 4367, 5964, 5982; Northern Negev TAUM 1116, 1131, 1445, 1479, 1484, 1485, 1492, 1496,

TABLE 1. Monthly stages in the ovarian cycle of 17 *Mesalina olivieri* females from Israel; one April female (\*) with oviductal eggs was also undergoing yolk deposition.

Month	N	Quiescent	Early yolk depositon	Follicles > 4 mm	Oviductal eggs
January	1	0	0	1	0
March	6	1	2	1	2
April	9	2	3	1	3*
November	1	1	0	0	0

1967, 3682, 3951, 3991, 3996; Southern Coastal Plain TAUM 1493, 1495, 2064, 2456, 2953, 2954, 5965.

The left testis was removed from males and the left ovary was removed from females for histological examination. Gonads were embedded in paraffin and histological sections were cut at 5  $\mu\text{m}$  and stained with hematoxylin followed by eosin counterstain. Enlarged ovarian follicles ( $> 4$  mm) and oviductal eggs were counted. No histology was performed on them. Histology slides were deposited at TAUM.

Two stages were observed in the testicular cycle: Spermiogenesis, (seminiferous tubules are lined by sperm or clusters of metamorphosing spermatids); Recrudescence (proliferation of germ cells prior to spermiogenesis), was observed in two juvenile males from September, measuring 35 mm and 39 mm SVL, respectively). Males exhibiting spermiogenesis by month were January (N = 1), March (N = 4), April (N = 8), May (N = 1), November (N = 1). The smallest reproductively active male measured 40 mm SVL (TAUM 1121) and was collected in April. The presence of the November male undergoing spermiogenesis suggests *M. olivieri* exhibits a testicular cycle similar to the congener *Mesalina guttulata* from Israel (Goldberg 2012. Zool. Mid. East 56:27–30) which also initiates sperm formation in autumn.

Four stages were noted in the ovarian cycle of *M. olivieri* (Table 1): Quiescent (no yolk deposition; Early yolk deposition (yolk granules in the ooplasm); Enlarged ovarian follicles  $> 4$  mm; Oviductal eggs. The smallest reproductively active *M. olivieri* females measured 40 mm SVL (TAUM 1731) 3 follicles  $> 4$  mm, early yolk deposition (TAUM 2501) both collected in March. Four smaller females with quiescent ovaries, 35 (September), 38 (December), 38 (January), 39 mm (January) SVL, respectively, were considered juveniles. Mean clutch size (N = 8) was  $3.4 \pm 0.74$ , range = 2–4. One female from April with oviductal eggs was undergoing concurrent yolk deposition for a subsequent clutch indicating *M. olivieri* can produce multiple clutches in the same reproductive season in Israel.

I thank Shai Meiri (TAUM) for permission to examine *M. olivieri*, Ezra Maza for facilitating the loan and the National Collections of Natural History at Tel Aviv University for providing *M. olivieri* for this study.

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**NOROPS PENTAPRION (Lichen Anole). DIRECTED AERIAL DESCENT.** Lizards with gliding or directed aerial descent behaviors are well known from the Old World Tropics (e.g., *Draco*, *Ptychozoon*), and snakes and frogs exhibiting these behaviors are found both in the Old and New World Tropics (Dudley et al. 2007. Annu. Rev. Ecol. Evol. Syst. 38:179–201). However, lizards showing directed aerial descent have not been reported from the New World Tropics. Here we report on directed aerial descent capability and behavior in *Norops pentaprion*, a canopy lizard from eastern Costa Rica, southern Nicaragua, and western Panama (Köhler 2010. Zootaxa 2354:1–18).

The initial discovery of this behavior in *N. pentaprion* was serendipitous in July 2001 when an individual was captured on a walk-up meteorological tower at canopy level (~ 25 m) at La Selva Biological Station in the Atlantic lowlands of Costa Rica. After identification, the animal was returned to the original location on the tower, but upon release to a horizontal tower brace, it executed a controlled aerial descent to a tree in the distance below. Individuals of *N. pentaprion* have been occasionally observed on



FIG. 1. Frames from video of a *Norops pentaprion* individual executing an aerial rotation during directed aerial descent. Arrows track the lizard's descent.

our meteorological towers subsequent to our first observation of directed aerial descent. The lizards are typically at canopy level but are sometimes found well above the canopy on the highest levels of the towers (up to 42 m). While the typical response of *N. pentaprion* to the presence of personnel on the tower is to race

down the tower or hide on the opposite side of vertical supports, the animals will occasionally jump from the tower to escape when approached. Since 2001 we have observed directed aerial descent by *N. pentaprion* from canopy towers on several occasions. In at least two instances the lizard landed at lower levels on the tower, but in other occurrences they covered substantial distance to adjacent trees including aerial rotations of near 180°. During more than one observation, animals appeared to glide with near-horizontal trajectories towards termination of the descent.

Similar to some snakes, frogs, lizards, and ants showing directed aerial descent, *N. pentaprion* does not have strongly specialized features associated with gliding behavior such as skin flaps, skin extensions, or webbed feet. *Norops pentaprion* has a relatively flattened head and wide body. During aerial descent this lizard proceeds headfirst, with limbs partially extended and the body strongly flattened, a position that may take advantage of regions of relatively loose skin along the sides of the body (Guyer and Donnelly 2005. *Amphibians and Reptiles of La Selva, Costa Rica, and the Caribbean Slope*, Univ. California Press, Berkeley, California. 299 pp.).

At La Selva Biological Station this species is uncommon in the understory and is usually found on trees limbs. *Norops pentaprion* is a member of a closely-related group of anoline lizards subjected to a recent analysis of morphology and morphometrics (Köhler, *op. cit.*); these related taxa share similar body size characteristics with *N. pentaprion* and are frequently arboreal. Future observations of some of these species may result in the discovery of similar directed-aerial descent behavior.

Canopy pioneer Donald Perry reported lizards with a rose dewlap parachuting between trees in the canopy in Costa Rican forests (Perry 1986. *Life Above the Jungle Floor*, Simon and Schuster, Inc. New York, New York. 170 pp.), but the species was not identified. In their description of *Norops pentaprion*, Guyer and Donnelly (*op. cit.*) indicated that parachuting behavior likely occurs in this species on the basis of our initial observations and those of Perry. Our repeated observations verify directed aerial descent in this species and confirm that the lizard observed by Perry was *N. pentaprion*, the only lizard in the region with magenta dewlap coloration.

These observations were made possible by frequent canopy access provided with support from NSF grants BE 0421178 and DEB-0842235.

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**OPLURUS CUVIERI CUVIERI** (*Madagascar Spiny-tailed Iguana*). **PREY**. Several studies have shown that *Oplurus cuvieri cuvieri* (Opluridae) primarily feeds on invertebrates with a high proportion of ants, but also consumes plant matter such as leaves, twigs, flower buds and seeds (Bloxam et al. 1996. *Prim. Rep.* 46:189–201; Brillet 1982. *Rev. Ecol. Terre Vie* 36:79–148; Mori and Randriamahazo 2002. *Afr. J. Ecol.* 40:61–64; Randriamahazo and Mori 2012. *Current Herpetol.* 31:8–13). Brillet (*op. cit.*) also reported that *O. c. cuvieri* feeds on small mammals, but it is unclear



FIG. 1 *Oplurus cuvieri cuvieri* captured by a fledgling Madagascar Bulbul.

whether this was an observation under natural conditions or in captivity. In addition, *O. c. cuvieri* has been suggested as a potential predator on nestlings of birds based on the observation that adult Rufous Vangas (*Schetba rufa*) intensely attacked an individual iguana that came close to a nest (Eguchi 2005. In *Social Organization of the Rufous Vanga*, pp. 83–104. Kyoto Univ. Press, Kyoto). Here, I report on a case of predation on a bird by *O. c. cuvieri*.

During a field study in Ampijoroa forest in Ankarafantsika National Park, Madagascar, I observed a predation event of an adult *O. c. cuvieri* on a fledgling of the Madagascar Bulbul (*Hypsipetes madagascariensis*). At ca. 1130 h on 28 November 2011, a fledgling *H. madagascariensis* fell to the ground from a nest in a tree approximately 4 m high. Several avian species such as, the Sickie-billed Vanga (*Falco leucurus*) and the Broad-billed Roller (*Eurystomus glaucurus*) repeatedly flew down and pecked at the fledgling, attempting to capture it, but the parent birds of the fledgling mobbed the other birds and protected the fledgling from their attacks. At 1215 h, a male *O. c. cuvieri* rushed to the fledgling from ca. 10 m away while several birds were still attempting to attack the fledgling, but the lizard failed to capture the fledgling due of the parents' mobbing. This iguana and several birds continued their predation attempts on the fledgling, and the parents of the fledgling had gradually let up mobbing over the course of almost 3 hours of protecting their offspring. Then at 1415 h, the iguana successfully bit and captured the fledgling in its forth attack (Fig. 1), 2 h following its first attempted attack. The parents did not mob the iguana after it captured the fledgling. The iguana tore the body and began consumption, banging the bird on the ground and then against the trunk of the tree while climbing many times. This is the first reported evidence for the predation of vertebrates by *O. c. cuvieri* in the wild.

This study was financially supported by JSPS Grant-in-Aid for Scientific Research (B: nos. 21405007 and 24405008) and JSPS Grant-in-Aid for Young Scientists (B: no. 25870369). I thank Akira Mori for his valuable comments and staff of Madagascar National Park for their assistance in the field study.

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**PETRACOLA VENTRIMACULATUS** (*Spotted Lightbulb Lizard*). **CANNIBALISM**. *Petracola ventrimaculatus* is a gymnophthalmid

lizard endemic to the northern Peruvian Andes (Kizirian et al. 2008. Zootaxa. 1700:53–62). The natural history of this species is poorly known and there is no published information regarding its diet. However, species of the related genus *Proctoporus* are known to feed on arthropods—mostly beetles, ants, and spiders (Doan 2008. J. Herpetol. 42:16–21).

While clearing and staining three specimens of *P. ventrimaculatus* for a taxonomic review, a hatchling (SVL = 22.93 mm) of *P. ventrimaculatus* was found in the stomach of an adult male conspecific (SVL = 65.2 mm), collected on 18 September 2006 at Puente Hierba Buena (6.981131°S, 78.379764°W), Province of Celendín, Cajamarca Region, Perú. The stomach contents of the other two specimens included one mite, coleopterans (three adults and two larvae), and one amblypygid. This is the first record of cannibalism in the Gymnophthalmidae, as well as the first prey items reported for the diet of *P. ventrimaculatus*.

The male specimen of *Petracola ventrimaculatus* is deposited in the herpetological collection of the Museo de la Universidad San Marcos, Lima, Perú (MUSM 26233). We thank C. Torres for allowing access to the collection of the MUSM.

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**PHYMATURUS EXTRILIDUS. PREDATION.** On 28 November 2011 at 1710 h, we observed a female Red-backed Hawk (*Buteo polyosoma*) presenting an adult *Phymaturus extrilidus* to a nest of two approximately 1.5-week-old chicks above a canyon known as Aguada de Pinchagua at the Multiple Use Nature Reserve Don Carmelo, Ullum Department, San Juan Province, Argentina (30.977504°S, 69.083017°W, 3122 m elev.). The hawk had removed the head of the lizard prior to arriving at the nest to feed it to the chicks (Fig. 1). Although Red-backed Hawks are known to eat lizards (Jiménez 1995. Hornero 14:1–9), this is the first record of one eating this species and the first record of a confirmed predator for *P. extrilidus* (Lobo et al. 2012. Copeia 2012:12–22). R. E. Espinoza confirmed the identity of the lizard.

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FIG. 1. Female *Buteo polyosoma* feeding an adult *Phymaturus extrilidus* to two nestlings.

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**PHYMATURUS SPECTABILIS. PREDATION.** *Phymaturus spectabilis* is a medium-sized liolaemid lizard endemic to northwestern Patagonia, found in rocky outcrops near Ingeniero Jacobacci, Departamento 25 de Mayo, southwestern Río Negro Province, Argentina. Predation data are absent for this species, but it has been reported to share its habitat with potential reptile predators such as the colubrid snakes *Philodryas patagoniensis* and *P. trilineata*, and the viperid *Rhinocerophis ammodotyoides* (Scolaro et al. 2008. Zootaxa 1786:48–70). Here I report an observation of predation of *P. spectabilis* by a Lesser Grison (*Galictis cuja*).

On 7 December 2011 during a field trip to Paraje Yuquiche, Río Negro Province, northwestern Patagonia, Argentina (41.434050°S, 69.751983°W, datum WGS84; elev. 942 m), I observed a Lesser Grison moving below a shrub (*Stillingia patagonica*) at the bottom of a rocky outcrop, where I had earlier observed three individuals of *Liolaemus elongatus* basking. When I approached to get a closer view I realized that the grison was holding a dead *Phymaturus spectabilis* in its mouth. As soon as it saw me, the grison released the dead lizard from its mouth and retreated. The dead lizard was identified as a juvenile female (69.1 mm SVL). The head of the lizard had been completely crushed, indicating that the grison had captured the lizard by this part of its body. It has been reported previously that Lesser Grisons in Patagonia prey secondarily on reptiles (Diuk-Wasser and Cassini 1998. Stud. Neotrop. Fauna Environ. 33:3–6), however, this is the first case of predation on *Phymaturus* lizards.

Erika Kubisch verified the identifications and the *P. spectabilis* (PH229) was deposited in the Herpetological Collection of the Centro Regional Universitario Bariloche (CRUB), San Carlos de Bariloche, Río Negro.

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**PHYSIGNATHUS LESUEURII (Australian Water Dragon). MUTILATION BY RAVENS.** During spring and summer 2005 I observed two instances of Australian Ravens (*Corvus coronoides*) removing parts of the tail from adult Australian Water Dragons (*Physignathus lesueurii*) at the Australian National Botanic Gardens, Canberra, Australia (35.27894°S, 149.11048°E). In the first instance, a raven approached and landed on a pavement cement path approximately 2 m from an adult male dragon (size of the lizard was nearly 1 m in total length). The dragon showed little response other than obvious visual contact. The raven then clasped the dragon's tail (about 10–15 cm from the tip) with its bill and dragged the dragon by the tail in different directions. This occurred for nearly one minute, the dragon running in place as it was being pulled. The raven then ran in circles around the dragon, still holding the tail, with the lizard spinning in one spot and still running in place. After another 30 seconds of this behavior part of the tail snapped off, and the raven flew away with it. A second similar event involved an adult female dragon and possibly the same raven about two weeks later. The raven was first observed already clasping the tail of the dragon, again about 10–15 cm from the tip, on the same path as the first event. This time the raven shook the tail vigorously, breaking off the tip within 20 sec

of first being observed. The raven flew off with the tail piece. I could not confirm whether the raven(s) consumed the tails.

Tail breakage induced or caused by ravens appeared to be deliberate, rather than a failed attempt at predation. It seems likely that the ravens consumed the tails (or the muscle component). Corvids are known for their problem solving abilities (e.g., Weir et al. 2002. *Science* 297:981), and ravens may be responsible for previous observations of incomplete tails in Australian Water Dragon populations. Thompson (1993. *Wildl. Res.* 20:613–619) speculated that the 41–47% rate of tail breakage/regeneration in adult water dragons in another population was due to predators, rather than intraspecific fighting. My observations partially support this idea, but also suggest deliberate “mutilation” by ravens. Further observations of the proportion of tail loss in a population, along with confirmation of ravens consuming the tails (or parts of them), are needed to determine both the cognitive underpinning of tail removal by ravens and its importance to Australian Water Dragon populations.

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**PLESTIODON FASCIATUS (Five-lined Skink). ARTIFICIAL HABITAT USE.** In central Ontario, Canada, from 1 May to 31 August 2012, systematic surveys were conducted to examine the impacts of roads on reptiles. Surveys were conducted along 13 km of Highway 69/400 in Parry Sound District and 6 km of Highway 529 in Magnetawan First Nation. Of the 28 *Plestiodon fasciatus* found on or within 3 m of a road, 3 (11%) were dead, while the remaining 25 (89%) were alive and interacting with the road. Interactions were categorized as either crossing the road (3 individuals; 12%) or hiding under cover alongside the roadside (22 individuals; 88%; Fig. 1). Only 2 individuals (9%) were found under natural cover objects (rock, grass thicket), while 20 individuals (91%) were found under anthropogenic debris (garbage, tires, sections of retread and cardboard). During haphazard surveys of non-road sites, 7 individuals were observed, 2 (29%) of which were under natural cover and 3 (43%) were under artificial cover (habitat was not recorded for 2 skinks).

Interestingly, only 6% of all of the skinks found on Magnetawan First Nation (both road and non-road sites; Fig. 1) were found under natural cover, suggesting that artificial cover may be preferred habitat within this population. If this is the case, the high level of refuse found along the roadside may attract skinks to areas that subject them to an increased likelihood of road mortality. Road mortality is a known threat to *P. fasciatus* populations in Ontario (COSEWIC 2007. COSEWIC assessment and update status report on the Five-lined Skink, *Eumeces fasciatus*, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 50 pp.), and elsewhere across the species' range (Illinois; COSEWIC 2007, *op. cit.*, and Florida; Aresco 2003. *J. Wildl. Manage.* 69:549–560).

It has been previously documented that *P. fasciatus* only occasionally uses artificial cover objects in some populations (e.g., Hecnar 1994. *Can. J. Zool.* 72:1510–1516). In central Ontario, *P. fasciatus* is thought to select habitat based on specific microhabitat characteristics; specifically, rocks averaging 55 cm in length that provide thermal conditions that vary by no more than 1.99°C (Quirt et al. 2006. *J. Herpetol.* 40:335–342) and that provide an optimum cover temperature range of 28°C to 36°C (Fitch 1954. *Univ. Kansas Publ. Mus. Nat. Hist.* 8:1–156). The specificity of this species' habitat preference is so strong that degradation

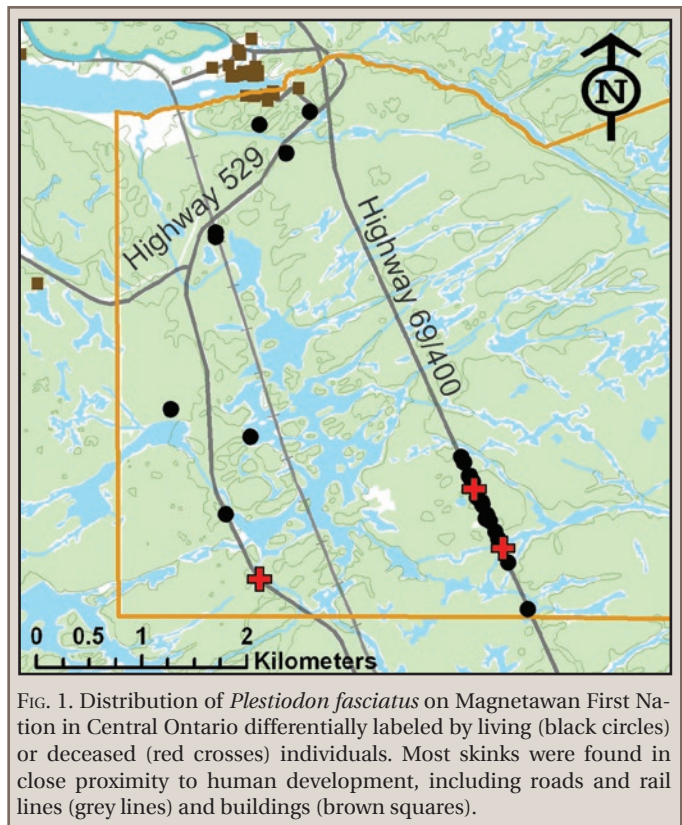


FIG. 1. Distribution of *Plestiodon fasciatus* on Magnetawan First Nation in Central Ontario differentially labeled by living (black circles) or deceased (red crosses) individuals. Most skinks were found in close proximity to human development, including roads and rail lines (grey lines) and buildings (brown squares).

or alteration of microhabitat has been linked to population declines (COSEWIC 2007, *op. cit.*). In our observations, temperature underneath artificial cover averaged 23.5°C (N = 16), which is 4.5°C cooler than the previously reported selected minimum optimum cover temperature (28°C) for this species. So, why would *P. fasciatus* be selecting these artificial cover objects? One possible explanation may be that factors other than temperature, such as an increase in potential prey, are contributing to the increased skink abundance around roadways.

During the course of our road surveys, insects were collected to examine insect road mortality, with an estimated total of 12,900 dead insects collected after colliding with vehicles (Baxter-Gilbert et al., unpubl. data). Insects are known to be a major food source for *P. fasciatus* (COSEWIC 2007, *op. cit.*), and a fecal sample from one of the live Five-lined Skinks on Magnetawan First Nation was comprised mostly of beetle elytra. It might be that the abundance of *P. fasciatus* around roadways is correlated with the increased availability of immobilized prey items. Our observations demonstrate a need to study the relationship between lizard ecology and roadways to determine if anthropogenically-created resources, such as roadside refuse and road-killed insects, are attracting these reptiles to a known population threat.

We thank Jenn Baxter-Gilbert, Sean Boyle, Damien Buttineau, Ron Maleau, and Chris Neufeld for their field assistance. Financial support for this research was provided by Magnetawan First Nation, Laurentian University, the Ontario Ministry of Natural Resources, and the Ontario Ministry of Transportation. All research was conducted under an approved Laurentian University Animal Care Committee protocol, and authorized by Magnetawan First Nation's Chief and Band Council and the Ontario Ministry of Natural Resources.

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**PLESTIODON GILBERTI (Gilbert's Skink). PREDATION.** *Plestiodon gilberti* typically occur in open grassy areas where burrows or rocks provide quick cover. They also occupy woodlands, streams, and other wetland areas (Behler and King 1979. The National Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, New York, New York. 744 pp.; Stebbins and McGinnis 2012. Field Guide to Amphibians and Reptiles of California. Univ. California Press, Berkeley. 538 pp.). Their association with wetland areas increases their risk of predation by wading birds, including Great Egrets (*Ardea alba*), which are opportunistic predators that take a variety of prey, such as crustaceans, insects, frogs, tadpoles, lizards, snakes, and small mammals. Great Egrets have been observed in the Florida Keys searching for *Anolis* lizards (McCrimmon et al. 2011. *In A. Poole* [ed.], The Birds of North America Online. Cornell Lab of Ornithology, Ithaca, New York; doi: 10.2173/bna.570).

On 19 April 2013, while hiking along a trail approximately 675 m E of the San Joaquin River in Fresno Co., California, USA (36.8765°N, 119.7796°W; 90 m elev.), we observed a Great Egret in an upland area struggling with something in its beak. Upon initial observation the item appeared to be a snake but after further examination of photographs taken of the egret, the prey was identified as an adult *P. gilberti*. The skink was whipping its tail back and forth, forcing the bird to attempt a better grip. The bird tossed the lizard into the air and recaptured it with its beak, swallowing the skink whole in less than 30 sec. Although likely a common occurrence based on the similar habitat associations of these two species, this observation, to our knowledge, is the first to be reported.

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FIG. 1. Great Egret (*Ardea alba*) predating a Gilbert's Skink (*Plestiodon gilberti*) in Fresno Co., California

**PSEUDOTRAPELUS SINAITUS (Sinai Agama). ENDOPARASITES.** *Pseudotraperelus sinaitus* is widely distributed in the Middle East where it inhabits rocky desert habitats (Bar and Haimovitch 2011. A Field Guide to Reptiles and Amphibians of Israel. Pazbar Ltd, Herzliya, Israel. 245 pp.). To our knowledge there are no reports of endoparasites from this species. The purpose of this note is to establish the initial parasite list for *P. sinaitus*.

The body cavity of one female (SVL = 83 mm) *P. sinaitus* collected 23 April 1952 in Israel, Northern Negev Region and deposited in the Tel Aviv University Museum (TAUM), Israel as TAUM 688 was examined for endoparasites. A mid-ventral incision was made and the coelomic contents were examined under a dissecting microscope. Two nematodes were found. The stomach wall was punctured in preservation and some contents had spilled into the body cavity. Thus it is likely the infection site for the nematodes was the stomach. The nematodes were cleared on a glass slide in a drop of lactophenol, cover slipped, examined under a compound microscope, and identified as two immature ascarid nematodes. Voucher nematodes were deposited in the United States National Parasite Collection (USNPC), Beltsville, Maryland as USNPC 106981.

Ascaridoids commonly utilize vertebrates as intermediate hosts; development to the adult nematode occurs when the intermediate host (in this case a lizard) containing infective larvae is eaten by the definitive host (Anderson 2000. Nematode Parasites of Vertebrates, Their Development and Transmission, CABI Publishing, Oxon, UK. 650 pp.). *Pseudotraperelus sinaitus* represents a new host record for larval ascarid nematodes.

We thank Shai Meiri (TAUM) for permission to examine *P. sinaitus*, Erez Maza for facilitating the loan, and the National Collections of Natural History at Tel Aviv University for providing the *P. sinaitus* for this study.

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**PSEUDOTRAPELUS SINAITUS (Sinai Agama). REPRODUCTION.** *Pseudotraperelus sinaitus* is widely distributed in the Middle East and is known from Libya, Egypt, Israel, Jordan, Syria, Saudi Arabia, Arabian Peninsula, U.A.E., Oman, Sudan, Ethiopia, and Eritrea where it inhabits rocky desert habitats (Bar and Haimovitch 2011. A Field Guide to Reptiles and Amphibians of Israel. Pazbar Ltd, Herzliya, Israel. 245 pp.). There is anecdotal information on its reproduction found in Bar and Haimovitch (*op. cit.*; Disi et al. 2001. Amphibians and Reptiles of the Hashemite Kingdom of Jordan, An Atlas and Field Guide. Edition Chimaira, Frankfurt am Main, Germany. 408 pp.; Schleich et al. 1996. Amphibians and Reptiles of North Africa. Koeltz Scientific Publications, Koenigstein, Germany. 630 pp.), indicating a spring-summer breeding season with clutches of 5–9 eggs produced. In this note I provide additional information on *P. sinaitus* reproduction from a histological examination of gonads from museum specimens.

A sample of 24 *P. sinaitus* deposited in the Zoological Museum of the Department of Zoology, Tel Aviv University (TAUM), Tel Aviv, Israel, was examined. The sample consisted of 13 males (mean SVL = 78.2 mm  $\pm$  4.3 SD, range = 71–83 mm), 10 females (mean SVL = 75.3 mm  $\pm$  5.1 SD, range = 68–73 mm), and one juvenile female (SVL = 54 mm) collected 1941–1958 in Israel (32.01587°N, 34.78740°E). Vouchers utilized in this study include:



TABLE 1. Monthly stages in the ovarian cycle of 10 *Pseudotrapelus sinaitus* females from Israel.

Month	N	Quiescent	Yolk deposition	Enlarged follicles > 4 mm	Oviductal eggs
April	6	2	1	2	1
May	2	0	0	1	0
Sept	1	1	0	0	0
Nov	1	1	0	0	0

TAUM 688, 696–698, 701, 705, 709–711, 713–716, 855, 1123, 1279, 1317, 1460, 1839, 2146, 2595, 2985, 3048, 3119.

An incision was made in the lower abdominal cavity and the left testis or ovary was removed, embedded in paraffin, cut at 5  $\mu$ m sections, and stained with Harris hematoxylin followed by eosin counterstain. Enlarged follicles > 4 mm or oviductal eggs were counted. Histology slides are deposited in TAUM.

Two stages were observed in the testicular cycle: 1) recrudescence. A proliferation of germ cells occurs for the next period of sperm formation; primary and/or secondary spermatocytes predominate; 2) spermiogenesis. Lumina of the seminiferous tubules are lined by sperm or rows of metamorphosing spermatids. Monthly distribution of stages were: March (N = 3, spermiogenesis); April (N = 7, 1 recrudescence, 6 spermiogenesis); May (N = 1, spermiogenesis); October (N = 1, recrudescence); November (N = 1, recrudescence). The smallest reproductively active male (spermiogenesis) measured 72 mm SVL (TAUM 2146) and was collected in March.

Four stages were observed in the monthly ovarian cycle (Table 1): 1) quiescent, no yolk deposition; 2) early yolk deposition, basophilic yolk granules in the ooplasm; 3) enlarged ovarian follicles > 4 mm; 4) oviductal eggs. Mean clutch size for five females was  $4.4 \pm 1.3$  SD, range = 3–6. The three smallest reproductively active females each measured 73 mm SVL; (1) TAUM 2595, early yolk deposition, collected in April; (2 and 3) TAUM 696, 2985, 3 follicles > 4 mm, collected in April. Schleich (*op. cit.*) also reported 73 mm SVL as the minimum size for reproductive maturity of *P. sinaitus* females. I arbitrarily considered one slightly smaller reproductively inactive female from April (TAUM 701, SVL = 70 mm) as being an adult. One reproductively inactive smaller female (TAUM 1123, SVL = 54 mm) was clearly a juvenile.

My histological findings confirm *P. sinaitus* exhibits a reproductive cycle typical of numerous temperate zone lizards. Breeding occurs in spring; renewal of germinal epithelium (recrudescence) in males for the forthcoming spring spermiogenesis occurs in autumn. No reproductive activity was exhibited in autumn females. Three is a new minimum clutch size for *P. sinaitus*.

I thank Shai Meiri (TAUM) for permission to examine *P. sinaitus*, Erez Maza for facilitating the loan, and the National Collections of Natural History at Tel Aviv University for providing samples of *P. sinaitus* for this study.

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**SCELOPORUS ANAHUACUS (Anahuacan Graphic Lizard). SELECTED BODY TEMPERATURE.** Field body temperatures of reptiles have been widely reported (Avery 1982, *In* Gans and Pough [eds.], *Biology of the Reptilia*, Vol. 12, Physiology C, pp. 93–166. Academic Press, New York), but reports on preferred or

selected body temperature is actually quite rare in the literature (Sinervo et al. 2010. *Science* 328:894–899) because measurement in a laboratory thermal gradient under standard conditions is required (Huey 1982. *In* Gans and Pough [eds.], *Biology of the Reptilia*, Vol. 12, Physiology C, pp. 25–91. Academic Press, New York). *Sceloporus anahuacus* is a viviparous lizard of the *grammicus* group, which inhabits high elevation pine forest. This species is endemic to central Mexico in Sierra Nevada, Distrito Federal, and Estado de México (Ramírez-Bautista et al. 2009. *Herpetofauna del Valle de México, Diversidad y Conservación*. CONABIO-UAH. 210 pp.). There have been several reports detailing thermal ecology in *grammicus* group members (Güizado-Rodríguez et al. 2011. *Southwest. Nat.* 56:120–124; Lemos-Espinal et al. 1995. *Can. J. Zool.* 73:2184–2191; Woolrich-Piña et al. 2006. *Acta Zool. Mex.* 22:137–150), and specific to *S. anahuacus* within field conditions (Ávila-Bocanegra et al. 2012. *Herpetol. Bull.* 121:27–29), but the selected body temperature has not been documented. Here, we provide preliminary selected temperatures of wild-caught individuals of this species under laboratory conditions.

During May 2007, one of us (UOGV) conducted field work in the Ejido Magdalena Petlatlaco, Delegación Magdalena Contreras, Sierra del Ajusco, Distrito Federal, México (19.2210°N, 99.2856°W; 3500–3930 m elev.), located in a forested area dominated by pine trees (*Pinus* sp.). The data presented here are based on 10 adults (> 46 mm SVL; 6 females and 4 males) of *S. anahuacus* captured by hand. In the laboratory, the lizards were separated by gender and maintained at 25°C in plastic containers with soil, trunks, and grass, and hydrated with a sprinkler every day. Laboratory experiments were conducted two days after capture using a thermal gradient, which consisted of a wood box (150 cm long x 150 cm wide x 70 cm high) divided into ten tracks of 15 cm each to prevent interaction between lizards. The box was located in a room with a controlled temperature of 20°C and three 150 W lamps were placed at different heights over the box to offer the thermal gradient (20–50°C). Body temperature data were collected manually using a digital thermometer (Fluke model 51-II) with the sensor introduced one centimeter into the cloaca during each hour between 1330 and 1930 hs.

Mean selected body temperature was 32.64°C (SD = 2.73°C, range = 26.0–36.5°C). Interquartile of 25% and 75% was 32.1 and 34.2°C, respectively. These results suggest *S. anahuacus* maintains its thermal requirements similar to others species of the *grammicus* group (Güizado-Rodríguez et al 2011, *op. cit.*; Lara-Resendiz and Díaz de la Vega-Pérez, in press, *Herpetol. Rev.*; Lemos-Espinal et al. 1995, *op. cit.*; Woolrich-Piña et al. 2006, *op. cit.*). Specifically, the mean selected body temperature is higher than that reported by Ávila-Bocanegra et al. (2012, *op. cit.*) for this species under field conditions. Finally, we propose for future research to assess the thermal biology of the *S. grammicus* group based in tolerance ranges, selected body temperatures in laboratory, body temperatures taken in the field coupled with environmental temperatures, in order to address the patterns of thermoregulation and to determine if the thermal biology in this group of lizards is limited by the environment or if it is evolutionarily conservative.

Financial support for this trip was provided by grants Universidad Nacional Autónoma de México, SDEI-PTID-02 (Manejo de Ecosistemas y Desarrollo Humano).

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**SCELOPORUS GRANDAEVUS (Cerralvo Island Sator). REPRODUCTION.** *Sceloporus grandaeveus* is known only from Isla Cerralvo in the Gulf of California where it is most commonly found in rocky arroyos (Grismer 2002. *Amphibians and Reptiles of Baja California, Including its Pacific Islands and the Islands in the Sea of Cortés*, University California Press, Berkeley. 399 pp.). Grismer (*op. cit.*) observed gravid females from June through October. The purpose of this note is to present additional information on *S. grandaeveus* reproduction from a histological examination of museum specimens.

A sample of 11 *S. grandaeveus* was examined consisting of 9 males (mean SVL = 72.1 mm  $\pm$  3.8 SD, range = 67–78 mm) and 2 females (mean SVL = 58.5 mm  $\pm$  0.71 SD, range = 58–59 mm), collected August 1969 at Isla Cerralvo, (24.25000°N, 109.91666°W) Baja California Sur, Mexico and deposited in the herpetology collection, University of Arizona (UAZ), Tucson, Arizona as UAZ 31487, 31493, 31494, 31539, 31500, 31622, 31742, 31743, 31745–31747.

A cut was made in the lower abdominal cavity and the left testis or ovary was removed, embedded in paraffin, cut at 5 $\mu$ m and stained with Harris hematoxylin followed by eosin counterstain. Enlarged ovarian follicles > 5 mm or oviductal eggs were counted. No histology was performed on them. Histology slides were deposited at UAZ.

Eight of the nine males exhibited spermiogenesis (lumina of the seminiferous tubules were lined by sperm or rows of metamorphosing spermatids), one male had regressed seminiferous tubules which contained spermatogonia and Sertoli cells, however the epididymis contained moderate amounts of sperm. The smallest reproductively active male (spermiogenesis in progress) measured 67 mm SVL (UAZ 31494).

Both females contained clutches of 6 and 7 eggs, respectively (N = 2, mean = 6.5  $\pm$  0.71 SD, range = 6–7 eggs). The smallest reproductively active female (7 oviductal eggs) measured 58 mm SVL (UAZ 31539).

I thank George L. Bradley (UAZ) for permission to examine *S. grandaeveus*.

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**SCELOPORUS SCALARIS (Light-bellied Bunchgrass Lizard).**

**CLUTCH SIZE.** *Sceloporus scalaris* is an oviparous species with the breeding season occurring during the summer (Vázquez-Díaz and Quintero-Díaz. 2005. *Anfibios y Reptiles de Aguascalientes*. CONABIO y CIEMA. 2<sup>nd</sup> ed. México, D.F. 318 pp.). Some information has been published on the reproduction of *S. scalaris*, including a clutch of 4–8 eggs reported from México Valley (Ramírez-Bautista et al. 2009. *Herpetofauna del Valle de México: Diversidad y Conservación*. UAEH, CONABIO, Pachuca. 213 pp.). Additionally, one specimen from a population in extreme western Nuevo León deposited 5 eggs on 11 August (Lemos-Espinal and Dixon 2013. *Amphibians and Reptiles of San Luis Potosí*. Eagle Mountain Publishing, LC, Eagle Mountain, Utah. 300 pp.). Populations from Aguascalientes have been reported to lay clutches of 9–13 eggs, where it was observed that the females retain the eggs until they are almost fully developed embryos (Vázquez-Díaz and Quintero-Díaz 2005, *op. cit.*). Herein we present the largest clutch size yet reported for *S. scalaris*.



FIG. 1. Clutch of 15 eggs of *Sceloporus scalaris* found at Mesa Montoro, Aguascalientes, Mexico.

On 14 August 2013 at 1700 h, we found a female *S. scalaris* with a clutch of 15 eggs (Fig. 1) beneath a rock in oak savanna at Mesa Montoro, Aguascalientes, México (22.019912°N, 102.562113°W, datum WGS84; elev. 2366 m). Although the female fled after being disturbed, *S. scalaris* is the only species of oviparous lizard in the area.

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**SCELOPORUS SCALARIS (Light-bellied Bunchgrass Lizard).**

**MATING BEHAVIOR.** Little is known about the reproductive behavior of *Sceloporus scalaris*. In the literature there is only information about the mating or courtship of this widely distributed species from La Michilia, Durango, México (Gutiérrez and Ortega 1986. *Bull. Maryland Herpetol. Soc.* 22:23–25). We provide here an observation of mating behavior of *Sceloporus scalaris* in a population from Aguascalientes, México.

During a field survey on 29 May 2013 at 1040 h, at Mesa Las Preñadas, El Llano, Aguascalientes, México (21.93409°N,



FIG. 1. Male and female *Sceloporus scalaris* displaying mating behavior at Mesa Las Preñadas, Aguascalientes, México.

101.88137°W, datum WGS84; 2432 m elev.), we observed a pair of *S. scalaris* engaged in mating behavior. The male was biting the tail of the female, while she bit the neck of the male, forming a ring with their bodies and exposing their bellies. Both males and females exhibit a white belly in this *Sceloporus* species and in this belly-up position the pair displayed a striking contrast to the surrounding low-growing, green vegetation, presumably making them more vulnerable to predation (Fig. 1). As we approached, the lizards remained in this position for about five minutes, then the male released the female and both tried to escape. The specimens were deposited in the Herpetological Collection, Universidad Autónoma de Aguascalientes (UAA-CV-R 0258–0259). According to our observations, reproductive activity in this population begins in May with the mating events, and gravid females and neonates observed in mid-June.

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**SCELOPORUS SPINOSUS (Eastern Spiny Lizard). AVIAN PREDATION.** The natural history of *Sceloporus spinosus* is well known, with some reports documenting predators (Leyte-Manrique 2007. Bol. Soc. Herpetol. Mex. 15:23–24; Solano-Zavaleta et al. 2008. Herpetol. Rev. 39:469). This species is a widespread endemic found over much of central México. It ranges between 1500 and 2300 m elev. (Mendoza-Quijano et al. 2007. In IUCN 2013. IUCN Red List of Threatened Species, ver. 2013.1 <www.iucnredlist.org>). Herein we provide the first observation of predation on *S. spinosus* by a Solitary Eagle (*Harpyhaliaetus solitarius*), a near threatened bird species (BirdLife International 2012. In IUCN 2013. IUCN Red List of Threatened Species, ver. 2013.1 <www.iucnredlist.org>).

On 16 December 2012 at 1552 h, during a survey in Juan Grande Mountain, Aguascalientes, México (21.942281°N, 101.910708°W, datum WGS84; 2276 m elev.), we observed an adult *H. solitarius* preying an adult male *S. spinosus* approx. 100 mm SVL (Fig. 1). Our observation occurred in habitat dominated by

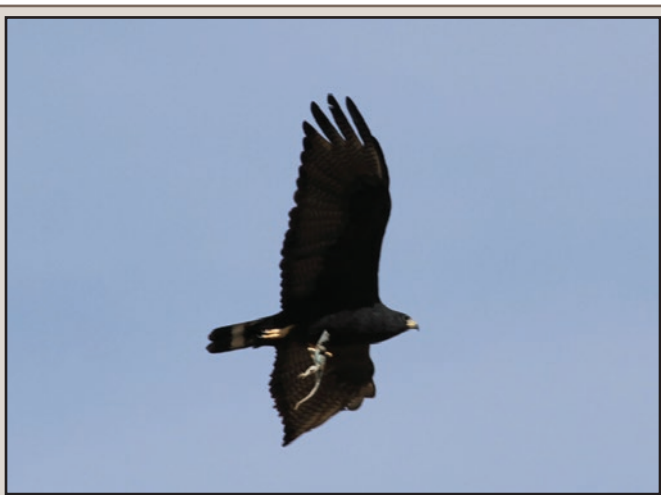


FIG. 1. Solitary Eagle female (*Harpyhaliaetus solitarius*) preying an adult male *Sceloporus spinosus*.

*Dodonea viscosa*, *Prosopis laevigata*, and *Quercus potosina*. During our observation the *S. spinosus* was perched on a rock, then a Solitary Eagle suddenly came down from behind and grabbed the lizard in its talons and flew away. This observation is the first photographic evidence of the predation of *Harpyhaliaetus solitarius* on an adult *S. spinosus*.

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**SPHENOMORPHUS MACULATUS (Spotted Forest Skink). REPRODUCTION.** *Sphenomorphus maculatus* is known from Myanmar, Thailand, Laos, Cambodia, Vietnam, eastern India, Andaman Islands and southern China inhabiting evergreen forests and more open areas up to 800 m (Das 2010. A Field Guide to the Reptiles of South-East Asia, Myanmar, Thailand, Laos, Cambodia, Vietnam, Peninsular Malaysia, Singapore, Sumatra, Borneo, Java, Bali. New Holland Publishers Ltd. London. 376 pp.). Das (*op. cit.*) reported it as an oviparous species, producing clutches of 4–5 eggs. The purpose of this note is to report information on the reproductive cycle of *S. maculatus* from Thailand.

A sample of 44 *S. maculatus* consisting of 21 adult males (mean SVL = 55.5 mm ± 4.7 SD, range = 48–66 mm), 21 adult females (mean SVL = 57.1 mm ± 5.1 SD, range = 50–56 mm) and 2 juvenile females (mean SVL = 47.5 mm ± 0.71 SD, range = 47–48) collected in 1969 and deposited in the herpetology collection of the Field Museum of Natural History (FMNH), Chicago, Illinois USA was examined from the following localities: Thailand, Nakhon Ratchasima Province, Amphoe Pak Thong Chai (14.7197°N, 102.0214°E) FMNH 182403, 182405, 182407–182410, 182420, 182423–182425, 182427, 182429, 182430, 182432, 182433, 182435–182438, 182440, 182443–182446, 182448, 182450–182453, 182455, 182457, 182458, 182460, 182465, 182466, 182469, 182472, 182474, 182482, 182484, 182486, 182499; Thailand, Nakhon Nayok Province, Sarika falls (14.3213°N, 101.2511°E) FMNH 182414; Thailand, Sara Buri Province, Muak Lek (14.6638°N 101.2027°E) FMNH 182507.

A cut was made in the lower abdominal cavity and the left testis or ovary was removed, embedded in paraffin, cut at 5µm and stained with Harris hematoxylin followed by eosin counterstain. Enlarged ovarian follicles > 5 mm or oviductal eggs were counted. No histology was performed on them. Histology slides were deposited in FMNH.

TABLE 1. Monthly changes in the ovarian cycle of 21 adult *Sphenomorphus maculatus* females from Thailand.

Month	N	Quiescent	Yolk depositon	Enlarged follicles > 5 mm	Oviductal eggs
February	2	2	0	0	0
March	7	7	0	0	0
April	4	2	0	2	0
May	7	1	3	1	2
June	1	0	0	0	1

All males examined from February (N = 2), March (N = 7), April (N = 9), June (N = 1), July (N = 1) were undergoing spermiogenesis (seminiferous tubules are lined by sperm or groups of metamorphosing spermatids). It thus appears the *S. maculatus* males examined exhibited an extended period of sperm production. The only male examined from August contained a regressed testis in which the seminiferous tubules contained spermatogonia and Sertoli cells. Before the significance of this single male with a regressed testis can be ascertained, examination of additional specimens are needed. The smallest reproductively active males both measured 48 mm SVL (FMNH 182450, 182407) and were collected in February and April, respectively.

Monthly stages in the ovarian cycle are in Table 1. Four stages were observed: 1) quiescent, no yolk deposition; 2) early yolk deposition, vitellogenic granules in ooplasm; 3) enlarged follicles > 5 mm; 4) oviductal eggs. Mean clutch size (N = 6) =  $3.7 \pm 1.6$  SD, range = 2–6. Clutches of two and six eggs represent new minimum and maximum clutch sizes for *S. maculatus*. The smallest reproductively active female 51 mm SVL (FMNH 182474) contained two enlarged ovarian follicles (> 5 mm) and was collected in May. Whether the nine *S. maculatus* females from February–March with quiescent ovaries indicates a period of female reproductive inactivity will require further study.

I thank Alan Resetar (FMNH) for permission to examine *S. maculatus*.

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**STROPHURUS CILIARIS (Northern Spiny-tailed Gecko). COMMUNAL NESTING.** Communal nesting is widespread in reptiles, and is more common than currently appreciated because the eggs and nests of many species are either unknown or rarely recorded in nature (Doody et al. 2009. *Quart. Rev. Biol.* 84:229–252). One group with secretive nests are the diplodactylid geckos. Unlike the hard-shelled eggs of gekkonid geckos, which are often deposited in relatively conspicuous sites (e.g., under bark, logs, or rocks, on cave walls, in houses), the pliable-shelled eggs of diplodactylid geckos are generally deposited underground where higher humidity or soil moisture is required to promote successful development (Bustard 1968. *Copeia* 1968:162–164). Details of the eggs and nests of most of the ~125 diplodactylid species are thus, unknown. Accordingly, communal nesting is rarely reported in these species (Doody et al., *op. cit.*). Herein we report on eight communal nests of *Strophurus ciliaris* that were found while excavating the nesting warrens (groups of burrows) of the Yellow-Spotted Monitor (*Varanus panoptes*) in tropical northern Australia.

During May and June 2013 we studied the nesting biology of *V. panoptes* (data reported elsewhere) at El Questro Wilderness Park in the east Kimberley Region of Western Australia (15.895033°S, 128.132456°E). The area consists of savannah woodland situated in the wet-dry tropics, with distinct wet (Nov–March) and dry (April–Oct) seasons. The nesting warrens, each comprising 6–21 burrows within a ca. 10 m<sup>2</sup> area, were in sandy soils of sandhill habitat along creeks and rivers. Warrens were excavated by hand (with the aid of shovels and picks) to a depth of up to 3.6 m (Doody et al. 2014. *J. Herpetol.* 48: *in press*). During the excavation process we found 15 *S. ciliaris* eggs and 48 eggshells comprising 11 nests in small, back-filled chambers constructed in the floor of burrows of four *V. panoptes* nesting warrens at two locations. One warren contained no *V. panoptes* eggs in that year

(but contained eggshells from previous years). Nest depths were < 1 m; depths of three of the nests averaged 45 cm (range = 30–60 cm). We incubated four of these eggs to hatching under ambient temperatures in a makeshift field laboratory; all were confirmed to be *S. ciliaris*. Hatching dates were 10, 16, 22, and 28 June. We assumed that the remaining eggs and eggshells were also *S. ciliaris* based on their similar size and shape, and the absence of other pliable-shelled gecko species in the study area.

There are three interesting implications of our findings. First, like other geckos, *S. ciliaris* lays two eggs. Thus, eight (73%) of the clutches represented communal nests. Second and relatedly, it is interesting (and possibly a novel finding) that *S. ciliaris* mothers added their eggs to other clutches that were completely buried. In at least six of the communal nests the eggs were together within the same back-filled chamber excavated by the first mother. Communal back-filled reptile nests generally involve clusters of nests, rather than egg complements of multiple mothers in one chamber (Doody et al., *op. cit.*). If the alternative is true, that multiple mothers excavated or entered a single nest to lay at the same time, this also represents an interesting and novel finding (although it is considered less likely). Third, our data suggest that *S. ciliaris* is a common burrow associate of *V. panoptes*, at least during nesting. The distributions of the two species overlap in the Kimberley region of Western Australia, the Top End of the Northern Territory, and the gulf country and central desert regions of Queensland (Wilson and Swan. 2008. *A Complete Guide to Reptiles of Australia*, New Holland, Sydney. 512 pp.). The severe population-level declines incurred by *V. panoptes* due to poisoning by invasive Cane Toads, *Bufo marinus* (Doody et al. 2009. *Anim. Conserv.* 12:46–53), could thus eventually reduce nesting sites for *S. ciliaris* and other burrow associates (we also found the eggs of *V. gouldii*, and adults of 14 species of reptiles and amphibians in the warrens). The functional role of *V. panoptes* burrows in the savannah woodland ecosystem thus needs more scientific attention, particularly in areas ahead of the Cane Toad front in the west Kimberley region.

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**TRAPELUS SAVIGNII (Egyptian Sand Agama). REPRODUCTION.** *Trapelus savignii* is known from Egypt and Israel where

it is diurnal and found in sandy habitats (Baha El Din 2006. A Guide to the Reptiles and Amphibians of Egypt. The American University in Cairo Press, Cairo. 359 pp.; Bar and Haimovitch 2011. A Field Guide to Reptiles and Amphibians of Israel. Pazbar LTD 1989, Herzliya, Israel. 245 pp.). There is anecdotal information on its reproduction in Bar and Haimovitch (*op. cit.*). The purpose of this note is to add information on the reproductive biology of *T. savignii* utilizing information from a histological analysis of gonadal material.

A sample of 35 *T. savignii* collected in Israel from 1946 to 2012 and deposited in the herpetology collection of the Natural History Collections of Tel Aviv University (TAUM) was examined, consisting of 9 adult males (mean snout-vent length, SVL = 76.6 mm  $\pm$  7.1 SD, range = 68–85 mm) 10 adult females (mean SVL = 87.9 mm  $\pm$  5.6 SD, range = 81–98 mm), 7 subadult males (mean SVL = 52.9 mm  $\pm$  4.3 SD, range = 48–59 mm), 7 subadult females (mean SVL = 55.0 mm  $\pm$  6.2 SD, range = 45–63 mm) and 2 subadults of indeterminate sex (mean SVL = 44.5 mm  $\pm$  2.1 SD, range = 43–46 mm).

A cut was made in the lower abdomen and the left testis or ovary was removed, embedded in paraffin, cut into 5  $\mu$ m sections and stained with Harris' hematoxylin followed by eosin counterstain. Enlarged follicles > 5 mm or oviductal eggs were quantified. Histology slides were deposited in TAUM. *Trapelus savignii* from Israel examined (by region) from TAUM were: Northern Negev Region: TAUM 635–637, 639, 640, 643–645, 1213, 1227, 1917, 2545, 2632, 2633, 5162, 5534, 5535, 5995, 5999, 6005, 6416, 6420, 6421–6426, 6428, 6398, 6399, 6439, 8475, 16128, Southern Coastal Region: TAUM 1233.

Three stages were noted in the testicular cycle (Table 1): 1) regressed, seminiferous tubules reduced in size, containing spermatogonia and interspersed Sertoli cells; 2) recrudescing, proliferation of germ cells for the next period of spermiogenesis (sperm formation); 3) spermiogenesis, seminiferous tubules lined by sperm or clusters of metamorphosing spermatids. The presence of spermiogenic males in March and April indicate *T. savignii* is a spring breeder. The smallest mature males (spermiogenesis in progress) all measured 68 mm SVL and were collected

TABLE 1. Monthly stages in the testicular cycle of 9 adult male *Trapelus savignii* from Israel.

Month	N	Regressed	Recrudescing	Spermiogenesis
March	5	0	0	5
April	2	0	0	2
August	1	1	0	0
September	1	1	0	0

TABLE 2. Monthly stages in the ovarian cycle of 10 adult female *Trapelus savignii* from Israel.

Month	N	Quiescent	Yolk depositon	Enlarged follicles > 5 mm	Oviductal eggs
April	1	0	1	0	0
May	1	0	1	0	0
June	2	1	0	0	1
August	2	0	0	1	1
September	4	4	0	0	0

in March TAUM 5999, 6399, 6439. Testes of smaller males (48–59 mm) were either regressed or in recrudescence and were classified as juveniles.

Four stages were noted in the ovarian cycle (Table 2): 1) quiescent (no yolk deposition); 2) yolk deposition (basophilic granules in ooplasm); 3) enlarged pre-ovulatory follicles > 5 mm; 4) oviductal eggs. The period of female reproductive activity encompassed April through August (Table 2). Mean clutch size (N = 3) was 6.3  $\pm$  3.8 SD, range = 2–9. The smallest reproductively active female (TAUM 5535), measured 81 mm SVL, exhibited early yolk deposition and was collected in April. There was no indication (oviductal eggs and concurrent yolk deposition in the same female) to suggest *T. savignii* produces multiple clutches in the same reproductive season. However, the apparent absence of females in the process of preparing a second clutch may be a reflection of small sample size (N = 10). Six smaller females (range 45–63 mm) exhibited quiescent ovaries and were considered as juveniles. One *T. savignii* (TAUM 6421) of indeterminate sex (SVL = 46 mm) was also considered a juvenile.

My finding of one female with oviductal eggs and one with enlarged pre-ovulatory follicles from August (Table 2) confirms the statement in Bar and Haimovitch (*op. cit.*) that *T. savignii* oviposits in August. The presence of reproductive activity in March and April (Tables 1, 2) indicates *T. savignii* commences reproduction early in the spring in Israel. The clutch values reported herein, to my knowledge, represent the first reported for *T. savignii*. In addition, it appears males mature at smaller body sizes than females.

I thank Shai Meiri (TAUM) for permission to examine *T. savignii*, Erez Maza for facilitating the loan and the National Collections of Natural History at Tel Aviv University for providing specimens of *T. savignii* for this study.

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**UROSAURUS BICARINATUS (Tropical Tree Lizard). BIFURCATION.** *Urosaurus bicarinatus* is a small phrynosomatid endemic to Mexico, found from southern Sonora to Chiapas, primarily along the Pacific versant and interior valleys (Feldman et al. 2011. Mol. Phyl. Evol. 61:714–725; Köhler 2008. Reptiles of Central America, 2<sup>nd</sup> ed., Herpeton Verlag Elke Köhler, Offenbach. 400 pp.; Wiens 1993. Herpetologica 49:399–420; Wilson and Johnson 2010. In Wilson et al [eds.], Conservation of Mesoamerican Amphibians and Reptiles, pp. 31–235. Eagle Mountain Publ., LC, Eagle Mountain, Utah), from near sea level to 2500 m elevation (Wilson and Johnson 2010, *op. cit.*). Herein, we report an incidence of tail bifurcation in a *U. bicarinatus* from the coastal lowlands of Oaxaca, Mexico.

On 23 June 2013, at 0940 h, an adult female *U. bicarinatus* was observed resting on a tree trunk on a slope with tropical deciduous forest, ca. 3 km N of La Soledad, Municipality of Tututepec, Oaxaca (18.157883°N, 96.091658°W, WGS 84; elev. 25 m). When the lizard was caught, we noticed that it had a bifurcated tail (Fig. 1). Bifurcation of the tail was represented by the end section of the original tail and the new regenerated tail. This bifurcation was located 41 mm posterior to the cloaca. Length of the original segment after the bifurcation was 15 mm (left side) and the regenerated section was 30 mm (right side). The new regenerated tail section was likely the result of an incomplete autotomy of the original tail (Goin and Goin 1971. Introduction to Herpetology, 2<sup>nd</sup> ed. W. H. Freeman and Co., San Francisco,



FIG. 1. Female Tropical Tree Lizard (*Urosaurus bicarinatus*) with tail bifurcation found near La Soledad, Oaxaca, México.

California, 353 pp.; Clark 1973. HISS News-J. 1:158). Bifurcated or multiple tail regeneration cases have been published for many species of lizards, including members in the family Phrynosomatidae (see Cordes and Walker 2013. Herpetol. Rev. 44:319; Gogliath et al. 2012. Herpetol. Rev. 43:129; Kumbar and Ghadage 2011. Herpetol. Rev. 42:94; Mata-Silva et al. 2010. Herpetol. Rev. 41:352–353; Mitchell et al. 2012. Herpetol. Rev. 43:650; Tamar et al. 2013. Herptol. Rev. 44:135–136, and citations therein). To the best of our knowledge this is the first report of tail bifurcation in *U. bicarinatus*.

We thank E. V. Rosas-López, Y. U. Rosas-Cortéz, J. Rosas-Cruz, E. Mata-Silva, and A. Mata-Silva for their help and great company in the field.

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**VARANUS GLEBOPALMA (Black-palmed Monitor). NOCTURNAL ACTIVITY AND FORAGING.** Monitor lizards are thought to be diurnal, based on a body of ecological research and on eye structure. Studies of the eye structure of *Varanus exanthematicus* and *V. griseus* have suggested that prey capture in these species is reliant on visual cues, based on the presence of cone cells in the eyes (Bhattacharjee 1992. Exp. Eye Res. 55:243; Röhl and Horn 2000. Mertensiella 2:291–306). The morphological similarity of monitor lizards led Röhl and Horn (*op. cit.*) to conclude that all *Varanus* species possess the same or similar eye structure and therefore all are diurnal.

However, a number of observations suggest that some monitor lizards occasionally undertake crepuscular and/or nocturnal activity. Of the 53 known species of monitor lizards, field observations of crepuscular or nocturnal activity have been recorded in nine species (*V. spenceri*, *V. panoptes*, *V. tristis*, *V. glebopalma*, *V. rosenbergi*, *V. melinus*, *V. glauerti*, *V. salvator*, and *V. dumerilli*), and six species in captivity (*V. acanthurus*, *V. giganteus*, *V. indicus*, *V. keithhorni*, *V. mertensi*, and *V. varius*) (Bohme and Ziegler 1997. Herpetofauna 19:26–34; Cota et al. 2008. Biawak 2:152–158; Fyfe

1980. Herpetofauna 12:15; Irwin et al. 1996. Herpetofauna 26:50; Irwin et al. 1996. Herpetol. Rev. 27:192–194; Jones 1998. Herpetofauna, 28:50; Rokylle 1989. Herpetofauna 7:4–8; Trembath 2000. Herpetofauna 30:52; Uyeda et al. 2013. Biawak 7:25–30; Valentic 1995. Herpetofauna 25:49–50; Yong et al. 2008. Nature in Singapore 1:21–22).

In particular, there are several reports of crepuscular activity in *V. glebopalma*. Christian (1977. Victoria Herpetol. Soc. Newsl. 6:11–13) suggested that *V. glebopalma* does most of its foraging during the first couple of hours after sunset. Wilson and Knowles (1988. Australia's Reptiles: A Photographic Reference to the Terrestrial Reptiles of Australia. Cornstalk, Pymble. 447 pp.) stated that “although active by day, it is commonly crepuscular and can often be disturbed foraging just after sundown.” Two individuals were spotlighted active at night between 1900 and 2100 h by Shea et al (1988. West. Austral. Herpetofauna 18:16), and Valentic (1994. South Austral. Herpetol. Group Newsl. 87:11) observed an individual active in twilight period (1830–1900 h) catching and swallowing prey. It was thus surprising that the only quantitative study on *V. glebopalma* resulted in a lack of nocturnal behavior. In a radio-telemetry study of the spatial ecology of *V. glebopalma*, Sweet (1999. Mertensiella 2:317–366) failed to record any crepuscular or nocturnal activity other than specimens that had been disturbed after dark, despite considerable effort to support previous accounts. Sweet concluded that previous observations of nocturnal/crepuscular activity were a result of the animal being disturbed by the observer. It is only through the continual documentation of observations that we can fully understand the apparent disparity between these findings. This note presents two further observations of nocturnal activity from *V. glebopalma* in tropical northwestern Australia.

At 2300 h on 6 May 2012, an adult male *V. glebopalma* (SVL 253 mm, TL 751 mm) was observed moving across a large flat rock approximately 0.5 m in height and through a clump of spinifex grass. The animal continued to move for another 8 m across another flat section of rock where it was captured. At the time of the observation, there was a full moon and little to no cloud cover. Although the surrounding area was being burned by a small, slow moving fire, the nearest fire front was 300 m from the animal's location. However, it is possible that the animal detected the fire through olfaction from its roost. In a second observation, while spotlighting at approximately 1950 h 28 June 2012, a frog's alarm call drew the attention of observers to a rocky area on the side of a sandstone gorge. Upon closer inspection a *V. glebopalma* was observed for 15 minutes feeding on a frog (unidentified *Litoria* sp.). When observers moved closer to confirm the species of frog, the animal became wary and swallowed the frog prior to retreating into a hole among fallen rocks and boulders. A short search failed to relocate the animal. The temperature at the time of observation was 19.5°C. Sunset that night occurred at 1722 h, and there was a half moon.

Our observations provide further evidence that *V. glebopalma* may forage nocturnally. The lack of crepuscular and nocturnal behavior in Sweet's (*op. cit.*) study may reflect population and/or seasonal variation. Alternatively, observations of nocturnal activity in the species may reflect lizards that were flushed from their roost sites by potential predators (S. Sweet, pers. comm.). However, the growing number of observations suggests that nocturnal behavior occurs in some populations. Interestingly, Sweet (*op. cit.*) noted that *V. glebopalma* adopts a sit and wait, or ambush, foraging strategy that may be unique to monitor lizards. This strategy may allow *V. glebopalma* to forage during low light

conditions. Investigations into the eye structure of *V. glebopalma* should be undertaken to test for any differences between this and other species of monitor lizards.

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### SQUAMATA — SNAKES

**CHILOMENISCUS STRAMINEUS (Variable Sandsnake). ENDO-PARASITES.** *Chilomeniscus stramineus* occurs in two disjunct populations. The eastern population ranges from southwestern Arizona, south through western Sonora, Mexico to northern Sinaloa, Mexico; the western population is restricted to Baja California (Grismer 2002. Amphibians and Reptiles of Baja California Including its Pacific Islands and the Islands in the Sea of Cortés. Univ. Calif. Press, Berkeley. 399 pp.). To our knowledge there are no helminths reported from *C. stramineus*. The purpose of this note is to establish the initial helminth list for *C. stramineus* as part of an ongoing survey of the helminths of reptiles from Baja California.

The coelomic cavity of one male *C. stramineus* (SVL = 203 mm) collected at 24 km S Loreto (26.0167°N, 111.3500°W, datum: WGS84), Baja California Sur, Mexico in January 1974 and deposited in the herpetology collection of the Natural History Museum of Los Angeles County (LACM), Los Angeles, California, USA as LACM 138142 was examined. Two oval shaped whitish endoparasites ca. 2 mm in length, found in the body cavity, were studied under a dissecting microscope. Based on body shape, pseudoanulation, and hook root morphology, the parasites were identified as an oligacanthorhynchid acanthocephalan cystacanth. It was deposited in the United States National Parasite Collection, Beltsville, Maryland, USA as USNPC 106939. Acanthocephalans require an arthropod intermediate host in which the cystacanth develops (Kennedy 2006. Ecology of the Acanthocephala. Cambridge Univ. Press, Cambridge, UK. 249 pp.). *Chilomeniscus stramineus* likely become infected with cystacanths when feeding on infected insects (Grismer, *op. cit.*). Because development beyond the cystacanth does not occur, snakes likely serve as paratenic (= transport) hosts. *Chilomeniscus stramineus* represents a new host record for oligacanthorhynchid acanthocephalan cystacanths.

We thank Greg Pauly (LACM) for permission to examine *C. stramineus*.

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**CROTALUS ADAMANTEUS (Eastern Diamondback Rattlesnake). ANTI-PREDATOR BEHAVIOR.** Snakes exhibit a variety of defensive behaviors when confronted with potential predators. Among rattlesnakes, the most common defensive behaviors include fleeing, coiling, head hiding, body bridging, body flattening, hissing, tongue-flicking, discharging scent gland secretions, vibrating the tail (rattle), and striking (Klauber 1972. Rattlesnakes: Their Habits, Life Histories, and Influence on Mankind. Univ. California Press, Berkeley. 1533 pp.; Weldon and Burghardt 1979. J. Chem. Ecol. 5:141–151). Although primarily terrestrial, rattlesnakes are adept swimmers and will enter water readily in order to pursue food, mates and refuge, and to escape harassment or danger (Klauber, *op. cit.*). While defensive/anti-predator behaviors of most rattlesnakes have been well-described (Klauber, *op. cit.*), few if any reports exist regarding anti-predator behavior of rattlesnakes while in water. Here we describe anti-predator behavior exhibited by *C. adamanteus* while swimming.

On 28 December 2003 at approximately 1200 h, we observed an adult (Total Length [TL] ca. 150 cm) *C. adamanteus* swimming across a small lake (25.40005°N, 80.65630°W, datum: WGS84) on Long Pine Key in Everglades National Park, Florida, USA. The snake was swimming along the shoreline approximately 30 m from land with its head elevated and majority of its body, though not the tip of its tail, visible above the water's surface. As the snake continued swimming, it passed an adult (TL ca. 210 cm) *Alligator mississippiensis* (American Alligator) in shallow water along the shoreline. The alligator turned and rapidly began to pursue the snake from directly behind. When the alligator was within approximately 2.5 m of the snake, the snake suddenly stopped swimming and raised the tip of its tail out of the water. The alligator, at this point approximately 1 m from the snake, abruptly stopped swimming and ceased moving towards the snake. Due to a strong breeze and moderate wave action, we were unable to discern if the snake vibrated its tail (and rattle). After approximately 15 sec, the rattlesnake lowered its tail and resumed swimming towards the shoreline. The alligator allowed the snake to open up a distance of approximately 5 m between them before slowly resuming pursuit. However, within approximately 1 min the snake reached the shore and crawled into the adjacent pine forest.

It is unclear what component of the rattlesnake's behavior deterred the alligator from attacking. Rattlesnakes, like many snakes when threatened, discharge scent gland secretions from the cloaca and multiple reports contend that alligators can distinguish between venomous and non-venomous snakes, presumably by chemical cues (McIlhenny 1935. The Alligator's Life History. Ten Speed Press, Berkeley, California. 117 pp.; Neill 1971. Last of the Ruling Reptiles. Columbia Univ. Press, New York. 486 pp.). However, controlled laboratory studies with captive alligators and snakes failed to corroborate this suggestion (Weldon and McNease 1991. Herpetologica 47:403–406). Whether the raised tail of the rattlesnake resulted in a chemical (scent gland secretion), auditory (vibrating rattle), or visual (tail color) cue remains unknown, but the behavior clearly appeared to be a deliberate and effective warning display.

In addition to the observed defensive behavior by the rattlesnake, to our knowledge this is also the first report of attempted predation by *A. mississippiensis* on *C. adamanteus* in the wild. Given that these two species are often sympatric, encounters between these animals are likely not uncommon.

We thank Allan Woodward and Paul Moler for sharing their knowledge of rattlesnake and alligator interactions in Florida.

The findings and conclusions in this note are those of the authors and do not necessarily represent the views of the U.S. Fish and Wildlife Service.

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***CROTALUS ATROX* × *CROTALUS HORRIDUS* (Western Diamond-backed Rattlesnake × Timber Rattlesnake). NATURAL HYBRID.** Hybridization in rattlesnakes has been unequivocally demonstrated in captivity as a result of intentional or unintentional breeding (Klauber 1972. *Rattlesnakes: Their Habits, Life Histories, and Influence on Mankind*. Univ. California Press, Berkeley. x + 1533 pp.; Rubio 1998. *Rattlesnake: Portrait of a Predator*. Smithsonian Press, Washington. 240 pp.). In nature, however, documentation of putative hybrid rattlesnakes is scant and ascertained primarily by way of morphological characters (e.g., Campbell et al. 1989. *Herpetologica* 45:344–349); molecular methods (allozymes, mtDNA, msats) are rarely used (e.g., Murphy and Crabtree 1988. *Herpetologica* 44:119–123; Gerard et al. 2011. *BMC Evol. Biol.* 11:291; see Campbell and Lamar 2004. *Venomous Reptiles of the Western Hemisphere*. Cornell Univ. Press, Ithaca, New York. 870 pp.). Here, using the mtDNA genes ATPase 8 and ATPase 6 as markers and assessing scalation and color pattern, we report on a subject that we suspect to be a natural hybrid of *Crotalus atrox* × *Crotalus horridus*.

On 2 May 2007 a large (~ 1 m total length) rattlesnake was found coiled on a trail 4.8 km N of the town of Blue, 64 km NE of Austin, Lee Co., Texas, USA. The area is categorized as Post Oak Savannah but the immediate landscape that surrounds this property is disturbed and largely agricultural. Using the methods described in Douglas et al. (2006. *Mol. Ecol.* 15:3353–3374), we obtained DNA from a sample of shed skin. A comparative analysis of the sequence information (ATPase 8 and 6) obtained from the hybrid to a pre-existing phylogeny of rattlesnakes and other North American pitvipers (M. E. Douglas et al., unpubl. data) revealed that the haplotype was that of *C. horridus*. Thus, owing to matrilineal inheritance of mtDNA, we assigned the hybrid's mother to be *C. horridus*. The overall appearance of the subject appears intermediate to that of the putative parents (Fig. 1A). The paired parietal marking, post-ocular stripe, and mottled venter pattern (not visible) are *C. horridus*-like, whereas the broad dorsal blotches and black and white rings on the tail are *C. atrox*-like.

To our knowledge, this is the second record of natural hybridization between *C. atrox* and *C. horridus*. Meik et al. (2008. *Southwest. Nat.* 53:196–200), using morphological characters (e.g., scales, color pattern), provided robust evidence for hybridization between *C. atrox* and *C. horridus* in a subadult (SVL = 667) female subject collected 50 km W of Denton, in Wise Co., Texas (University of Texas at Arlington [UTA] R-52942; Fig. 1B). This specimen bears a striking resemblance to the hybrid reported here (Fig. 1A). Our analysis of scalation and color pattern of the present hybrid essentially mirrors the results of Meik et al. (*op. cit.*). However, in our analysis of interocularials we followed the definition provided by Klauber (*op. cit.*), which includes counting a subocular and a supralabial. Our count for interocularials was 5-5 (both sides of the head). Using this definition, the hybrid



FIG. 1. A) The adult male hybrid (*Crotalus atrox* × *C. horridus*) from Lee Co., Texas. B) The subadult female hybrid (*C. atrox* × *C. horridus*) described by Meik et al. (*op. cit.*) from Wise Co., Texas.

described in Meik et al. (2008, *op. cit.*) is 5-5 rather than 3 (i.e., 3-3) as reported (J. Meik, pers. comm.).

We thank Hugh Brown for alerting us to the snake we report here. Margie Crisp helped with care and assisted in obtaining photographs of the hybrid. Louis Porras helped to measure scales. Jesse Meik and Carl Franklin discussed hybridization in rattlesnakes, and they allowed us to use their image of the hybrid rattlesnake (*C. atrox* × *C. horridus*) discussed in their 2008 publication. Ryan Sawby kindly prepared the digital image for publication.

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***DROMICODRYAS BERNIERI* (Bernier's Striped Snake). DIET.** Few studies have investigated the ecology of Madagascar's more common diurnal colubrid snake species (Glaw and Vences 2007. *A Field Guide to the Amphibians and Reptiles of Madagascar*. 3<sup>rd</sup> ed. Vences & Glaw, Köln. 496 pp.; Kaloloha et al. 2011. *Herpetol. Notes* 4:397–402). *Dromicodryas bernieri* has only been documented preying upon saurian prey and is assumed to be strictly saurophagous (Cadle 2003. *In* Goodman and Benstead [eds.],





FIG. 1. *Dromicodryas bernieri* consuming an adult *Boophis doulioti* in Mariarano, northwest Madagascar.

The Natural History of Madagascar, pp. 997–1004. Univ. Chicago Press, Chicago and London); Gehring 2006. Zeitschrift des Kölner Zoo - Heft 49:127–141). Here we report on the predation of an amphibian by a *D. bernieri*.

On 2 August 2011, at 1130 h, at the edge of the main thoroughfare in Mariarano Village, North West Madagascar (15.44878°S, 46.69146°E, datum: WGS84) we encountered a *D. bernieri* with an adult frog, *Boophis doulioti*, that it had seized and partially ingested, head first (Fig. 1). For approximately 3 min we observed the snake attempting to consume the frog; however, our presence seemed to distract the snake and it moved further into the undergrowth with its amphibian prey in its mouth. Considering that *B. doulioti* is locally abundant in this area, even during the long dry season, it is reasonable to assume that this predation event is not unique and that this amphibian forms a regular part of the diet of *D. bernieri* at this location.

We thank the Transitional Government of Madagascar, the Ministère de l'Environnement et des Forêts for allowing us to undertake this work (permit 54710/MEF/SG/DGE/DREBOE), Operation Wallacea for funding, Development and Biodiversity Conservation Action for Madagascar (DBCAM) for logistics and our local guides and team at Mariarano Village.

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**DRYMARCHON MELANURUS** (Central American Indigo Snake). **DIET.** *Drymarchon melanurus* is known to feed on a wide variety of prey, including small mammals, frogs, fish, hatchling turtles, birds, and snakes (Irwin et al. 2003. J. Kansas Herpetol. 7:13–18; Stevenson et al. 2010. Southwest. Nat. 9:1–18). On 5 October 2011, at about 1430 h, AVN found an adult *D. melanurus* near the CIE (Centro Interpretativo Ecológico) inside the Biosphere Reserve of “El Cielo” (23.88555°N, 99.16861°W, datum WGS84; elev. 360 m), municipality of Gómez Farías, state of Tamaulipas, México. The snake was in the process of feeding on an adult *Spilotes pullatus* (Fig. 1). After an hour, the *D. melanurus* had ingested half of the prey and subsequently it crawled under a rock with the prey in its mouth. When checked 2 h later, the prey was found, regurgitated and abandoned by the predator. To our knowledge this represents the first record of *D. melanurus* preying on *S. pullatus*.

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FIG. 1. *Drymarchon melanurus* attempting to prey on a *Spilotes pullatus* in Tamaulipas, México.

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**CHILABOTHRUS (=EPICRATES) CHRYSOGASTER CHRYSOGASTER** (Turks Island Boa). **CLIMBING BEHAVIOR.** *Chilabothrus (=Epicrates) chrysogaster chrysogaster* is considered to be a rare example of an active terrestrial foraging boid (Reynolds and Gerber 2012. J. Herpetol. 46:578–586). Out of over 350 observations of active boas on Big Ambergris Cay, Turks and Caicos



FIG. 1. *Chilabothrus chrysogaster chrysogaster* demonstrating rarely documented climbing behavior.

Islands, British West Indies, only two individuals were found active off of the ground (Reynolds and Gerber, *op. cit.*). It is thought that juveniles of this species, like others of the genus, might be largely arboreal, though this has not been conclusively demonstrated (Reynolds and Gerber, *op. cit.*). While Big Ambergris Cay is mostly scrub and coppice, some arboreal habitat does exist, though boas have never been found higher than 2 m off the ground (Reynolds and Gerber, *op. cit.*). However, on larger islands in the Turks and Caicos such as North and Middle Caicos, remnant tropical dry forest and pine barrens exist, which provide a great deal of arboreal habitat.

On 12 October 2012, BNM observed a previously unobserved climbing behavior in this species on Pine Cay, Turks and Caicos Islands (Fig. 1). The individual (SVL ca. 1000 mm; likely female) was climbing a telephone pole located along a road in secondary tropical dry forest habitat with a canopy height of ~7 m. The individual was using a stereotyped version of concertina locomotion often associated with other snake species, such as rat snakes (genus *Pantherophis*) and boa constrictors (*Boa constrictor*). The motion consists of lateral undulation against a scaffold (Jayne and Herrmann 2011. *J. Exp. Biol.* 214:2189–2201). This represents a rare observation of climbing in this species, and suggests that individuals employ a similar strategy to other frequent climbers such as rat snakes and boa constrictors.

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**HEMACHATUS HAEMACHATUS (Rinkhals). DIET / CANNIBALISM.** Although African elapids are well known to be ophiophagous (FitzSimons 1962. *Snakes of Southern Africa*. Purnell and Sons Ltd., Johannesburg. 423 pp.) and may consume congeners (Shine et al. 2007. *J. Zool.* 272:183–193), only one species is known to be cannibalistic (*Naja nivea*; FitzSimons, *op. cit.*). On 10 December 2012 on the farm Ryswick (27.9009°S, 029.2107°E, datum WGS84; elev. 1790 m) in the district of Harrismith of the Free State province, South Africa, I collected an adult male *Hemachatus haemachatus* that had been shot by the landowner. Upon dissection, the snake (SVL = 877 mm; tail length = 200 mm; mass = 661 g) was found to have consumed a smaller female conspecific (SVL = 509 mm, tail length = 118 mm, mass = 105.95 g). The adult male had also recently consumed three toads (*Amietophrynus* sp.; mass = 130.08 g), while a single partially digested toad was found in the digestive tract of the female (*Amietophrynus* sp.; mass = 11.04 g). I thank Graham Alexander for assisting with snake dissection and manuscript preparation.

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**HETERODON PLATIRHINOS (Eastern Hog-nosed Snake). DIET.** *Heterodon platirhinos* primarily feeds upon amphibians, but it has been reported to eat reptiles, mammals, birds, fishes, and invertebrates (Ernst and Ernst 2003. *Snakes of the United States and Canada*. Smithsonian Books, Washington, D.C. 668 pp.). The only reports of avian consumption were an unidentified bird (Surface 1906. *Bull. Pennsylvania State Dept. Agric. Div. Zool.* 4:113–208.) and a nestling sparrow (Conant 1938.

*Am. Midl. Nat.* 20:1–200.). Here, we report predation upon an adult Northern Mockingbird (*Mimus polyglottos*) by a female *H. platirhinos* (SVL = 658 mm) from 5.3 km S of Howey-in-the-Hills, Lake Co., Florida, USA. When captured in June 2004, the snake's body was distended by a large prey item. In captivity, the snake died two days after regurgitating the partially digested bird. Both the snake and bird are deposited in the Florida Museum of Natural History (UF 169545).

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**HETERODON PLATIRHINOS (Eastern Hog-nosed Snake). REPRODUCTION.** There is a lack of consensus regarding the oviposition frequency of *Heterodon platirhinos*. *Heterodon* spp. have been described as laying eggs every other year or less frequently (Greene 1997. *Snakes: The Evolution of Mystery in Nature*. Univ. California Press, Berkeley. 365 pp.). In South Carolina, the small proportion of mature female *H. platirhinos* bearing oviducal eggs suggests that annual oviposition is uncommon (Smith 1976. *Ecology* 57:252–264), whereas body mass data in Kansas has been interpreted to suggest that mature females oviposit annually (Platt 1969. *Univ. Kansas Publ., Mus. Nat. Hist.* 18[4]:253–420). Moreover, observations of captive *H. platirhinos* producing two clutches in the same breeding season (Wenzel 1990. *Bull. Chicago Herpetol. Soc.* 25:86) suggest that this trait is plastic and may be influenced by resource availability.

We radiotracked 17 adult *H. platirhinos* (10 females, 7 males) between April 2009 and November 2011 at Cape Cod National Seashore, Barnstable Co., Massachusetts, USA. The study area was located at the northern terminus of the Cape Cod peninsula in an approximately 1800 ha early-successional sand dune landscape. Snakes were relocated approximately once every three days from May–August and less frequently during the early spring and fall. When not observed directly, oviposition was inferred by measuring body mass. Females oviposited from mid-June to mid-July (Table 1). Of the seven females successfully radiotracked during the nesting season, six deposited eggs. Four of these were successfully radiotracked in consecutive years and all

TABLE 1. Summary of *Heterodon platirhinos* oviposition events from Cape Cod National Seashore, Massachusetts, USA, 2009–2011. Asterisk (\*) indicates that snake was observed actively depositing eggs.

Snake ID	SVL	Year	Pre-oviposition body mass (g)	RCM (%)	Oviposition date	Hatch date
D	685	2009	370	47.8	08–12 Jul	-
H	610	2009	308	34.4	11–15 Jul	-
F	580	2009	-	-	11 Jul*	-
D	685	2010	415	42.9	22 Jun*	14–16 Aug
H	610	2010	382	37.7	22–24 Jun	-
K	780	2010	541	44.7	22–24 Jun	-
L	585	2010	245	41.6	07 Jul*	01 Sep
N	520	2010	198	52.0	22–27 Jun	-
K	780	2011	-	-	22–23 Jun*	-
N	520	2011	-	-	29–30 Jun*	-
Mean (SE)	-	-	-	43.0 (2.2)	-	-

four deposited eggs in both years. Moreover, we observed well-developed eggs in the oviducts of an eighth radiotracked female that was predated on 01 July 2009. Thus, during this three-year period there were 12 cases where it was possible to determine if the females we were tracking produced a clutch of eggs and/or oviposited. In 11 of 12 instances (~92%) they did so, indicating that at our study site, a high proportion of mature female *H. platirhinos* oviposit annually. Although it may seem surprising to document annual reproduction near the northern extent of this species' range, moderate coastal temperatures, which appear to extend the activity season relative to other *H. platirhinos* sites at similar latitudes, combined with a locally abundant prey base (*Anaxyrus fowleri* and *Scaphiopus holbrookii*) may explain the high oviposition frequency at our study site. The mean relative clutch mass (RCM) for *H. platirhinos* in our study (mean = 0.430, SE = 0.022, N = 7 events) is similar to that reported by Seigel and Fitch (1984 *Oecologia* 61:293–301; mean RCM = 0.439).

Work was carried out under scientific collecting permit #017.10SCRA issued by the Massachusetts Division of Fisheries and Wildlife and scientific research and collecting permits #CACO-2011-SCI-0005 and #CACO-2011-SCI-0018 issued by the National Park Service. Work was approved by the Institutional Animal Care and Use Committee of Montclair State University (Ref #2009-01).

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**LACHESIS MUTA (Surucucu, Atlantic Forest Bushmaster). PARASITISM.** Snakes are parasitized by a wide variety of helminths, mainly nematodes (Silva et al. 2001. *Rev. Brasil. Parasitol. Veterinaria* 10:91–93). *Lachesis muta* is a tropical rainforest species and the largest viperid of the Americas. Herein we report the nematodes found in a *L. muta* from an Atlantic Forest population in northeastern Brazil.

At 1840 h on 5 August 2012 at the Natural Heritage Reserve (RPPN) Pedra D'Antas, State of Pernambuco (8.69339°S, 35.85824°W, datum SAD 69; elev. 584 m) we found a dead female *L. muta* (total length = 104 cm; Fig. 1A). The snake was underweight with visible vertebral columns. During a necropsy we found one male (30.35 mm) and three female (too damaged to measure) *Hastospiculum onchocercum* in the coelomatic cavity



FIG. 1. A) Dead female *Lachesis muta* from Atlantic Forest in the Pernambuco state, northeastern Brazil; B) the coelomatic cavity of the snake.

(Fig. 1B). The snake is housed in the Herpetological Collection of the Universidade Regional do Cariri (URCA-H 4184). Nematodes are housed in the Parasitological Collection of the Universidade Regional do Cariri (URCA-P 362). Although *Hastospiculum* has been found in the coelomatic cavity of snakes and lizards throughout Central and South America, this is the first record of *H. onchocercum* parasitizing *L. muta*.

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**LAMPROPELTIS SPLENDIDA (Desert Kingsnake). DIET.** *Lampropeltis splendida* consumes other snakes, including those within the genus *Thamnophis* (Werler and Dixon. 2000. *Texas Snakes: Identification, Distribution, and Natural History*. Univ. Texas Press, Austin. 437 pp.; Ernst and Ernst. 2003. *Snakes of the United States and Canada*. Smithsonian Institution Press, Washington D. C., 668 pp.; Lemos-Espinal and Smith 2007. *Anfibios y Reptiles del Estado de Chihuahua, México*. UNAM, Tlalneptla, México. 613 pp.). *Thamnophis marcianus* is also consumed by snakes within the genus *Lampropeltis* (Ernst and Ernst 2003, *op. cit.*); however, species-specific observations are lacking. We herein present the first confirmed record of *L. splendida* feeding on *T. marcianus*.

On 15 September 2012 at 1419 h a female *L. splendida* (SVL = 660 mm; tail length = 102 mm; 111 g) was found crossing a dirt road in the Municipality of Chihuahua, Chihuahua, Mexico (28.675959°N, 105.964771°W, datum WGS84; elev. 1368 m). Following capture, the snake regurgitated a female *T. marcianus* (SVL = 485 mm, tail length = 124 mm, 86 g) that had been swallowed head-first. The *L. splendida* was released but the *T. marcianus* was deposited in the Herpetological Collection, Universidad Autónoma de Aguascalientes (UAA-CV-0353).

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**LEPTODEIRA ANNULATA (Banded Cat-eyed Snake). DIET.** *Leptodeira annulata* is a nocturnal semi-arboreal colubrid snake that inhabits forested areas in the cerrado, pantanal, caatinga, and rain forest regions of Brazil (Freitas 2003. *Serpentes Brasileiras*. Malha de Sapo Publicações, Lauro de Freitas-BA. 160 pp). It is usually found near water bodies and feeds primarily on amphibians, with occasional records of small lizards and other snakes in its diet (Cantor and Pizzatto 2008. *Herpetol. Rev.* 39:462–463). Here we report the first record of a *L. annulata* preying on *Crossodactylus bokermanni*, a frog species endemic

to the Serra do Espinhaço, Minas Gerais, Brazil (Leite et al. 2008. *Megadiversidade* 4:162).

On 11 February 2012, a *L. annulata* was collected and deposited in Coleção Herpetológica da Universidade Federal de Minas Gerais (UFMG 1022; female; SVL = 290 mm) that had consumed a *C. bokermanni* (UFMG 11303; SVL = 32 mm) in the Municipality of Itacambira, Minas Gerais, Brazil (17.014133°S, 43.3056166°W, WGS 84; elev. 1020 m). *Leptodeira annulata* is known to prey on bufonid, hylid, and leptodactylid frogs (Cantor and Pizzatto, *op. cit.*); however, this is the first predation record on a hylodid species. The observation is also interesting because *L. annulata* is considered nocturnal, while *C. bokermanni* is diurnal (Wachlewski 2007. *J. Nat. Hist.* 42:1422). This suggests that *L. annulata* may capture *C. bokermanni* while the frogs are in nocturnal refugia.

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**LIASIS OLIVACEUS BARRONI (Pilbara Olive Python). DIET.** Although the diet of most Australian pythons is relatively well documented, the diet of *Liasis olivaceus barroni* remains poorly known. *Liasis olivaceus* is a highly opportunistic predator that is generally associated with aquatic habitats. Shine and Slip (1990. *Herpetologica* 46:283–290) characterized the diet of *L. olivaceus* as approximately 26% reptilian, 26% avian, and 48% mammalian prey, but their study did not include individuals of the Pilbara subspecies. The diet of *L. o. barroni* is not well understood apart from few records and observations that include “waterbird species” including “ducks,” “pigeons” including *Geophaps plumifera* (Spinifex Pigeon), *Petrogale rothschildi* (Rothschild’s Rock-wallaby), small Euros (*Macropus robustus*), captive birds such as *Melopsittacus undulates* (Budgerigar) and finch species (Barker and Barker 1994. *Pythons of the World*. Vol. 1. Australia. Advanced Vivarium Systems, Lakeside, California 171 pp.; Pearson 2006. *Landscape* 19:32–39; Pearson 2007. *In* Swan [ed.], *Keeping and Breeding Australian Pythons*, pp. 174–181. Mike Swan Herp Books, Australia).

During August 2010, a road-killed *L. o. barroni* (total length = 2.8 m; ca. 7 kg) was found next to a large permanent water body near Tom Price, Western Australia. Dissection revealed two previously unknown prey items: a sub-adult *Egretta novaehollandiae* (White-faced Heron; ca. 50 cm in height) and an adult *Chenonetta jubata* (Australian Wood Duck). *Liasis o. barroni* has been identified as an opportunistic ambush predator, often observed at water’s edge in ambush position awaiting prey items. The association between the species and aquatic habitats within the Pilbara region suggest avian fauna, particularly water birds, are a frequent prey items in addition to mammals attracted to water resources.

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**MASTIGODRYAS MELANOLOMUS (Salmon-bellied Racer). DEFENSIVE BEHAVIOR.** Defensive behavior of snakes is variable and includes biting, death-feigning, tail detachment, and various postures, including distorting head shape to a form similar to that observed among venomous species (Solórzano 2004. *Snakes of Costa Rica*. Instituto Nacional de Biodiversidad,



FIG. 1. *Mastigodryas melanolomus* entangled with *Buteo magnirostris* in San Vito de Coto Brus, Puntarenas Province, Costa Rica.

Heredia, Costa Rica. 792 pp.). Here we describe a novel defensive behavior in *Mastigodryas melanolomus* not previously observed in snakes.

On 28 May 2012, at 0700 h in a coffee plantation in southern Costa Rica (Coto Brus County, 8.7805°N, 82.9602°W, datum WGS84; elev. 1200 m), we observed a subadult *M. melanolomus* entangled with a *Buteo magnirostris* (Roadside Hawk) on the ground (Fig. 1). We did not observe the start of the engagement, but we assume that the hawk attacked the snake (Stiles and Skutch 2007. *Guía de Aves de Costa Rica*. Instituto Nacional de Biodiversidad, Heredia, Costa Rica. 572 pp.). The hawk attempted to fly but failed, hopping about 50 cm from its original position. The snake was coiled around the wings and legs of the hawk, constraining its movement and precluding flight. The hawk attempted to fly three times but each attempt failed. After the third attempt, the hawk and snake remained still on the ground for several minutes. The hawk was breathing heavily and seemed without energy. We did not observe the conclusion of the interaction.

Based on previous observations, when *M. melanolomus* is handled by humans it typically coils around one’s hands but does not bite; we suspect that this strategy might also be employed for defense against predators when fleeing is not possible. By preventing flight and keeping its head out of range of a hawk’s beak and talons, *M. melanolomus* may remove a raptor’s primary killing mechanisms and exhaust it in a protracted struggle.

We thank Alejandro Solórzano and J. Leighton Reid for their assistance on the manuscript.

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**MICRURUS DIASTEMA (Variable Coralsnake). DEFENSIVE BEHAVIOR.** An adult *Micrurus diastema* (FLMNH 144690) was collected from a campsite (15.49°N, 88.28°W, datum WGS84; elev. 1325 m) approximately 4 km W of La Fortuna, Dept. Santa Bárbara, Honduras, during the early morning of 2 July 2005. While photographing the live snake, we observed it perform a tail-flattening defensive behavior, a form of self-mimicry called the protean effect (Gehlbach 1972. *Forma et Functio* 5:311–320;



FIG. 1. *Micrurus diastema* performing the first stages of tail-flattening defensive behavior by elongating its posterior to draw attention.

Roze 1996. Coral Snakes of the Americas: Biology, Identification, and Venoms. Krieger Publishing, Malabar, Florida. xii + 328 pp.). The snake flattened its yellow-banded tail and extended the posterior portion of its body, moving the tail in a manner similar to typical anterior/head movement (erecting the tail while flattening it to appear like a head), while simultaneously tucking its actual yellow-banded head under its body (Fig. 1). This type of defensive behavior has been seen from numerous genera within the Elapidae, including *Micrurus surinamensis* (Roze, *op. cit.*) but this is the first documented case from *M. diastema*. The behavior serves several purposes, including predator distraction (Roze, *op. cit.*).

We thank Roberto Downing M. for arranging the logistics of our work, and helping to obtain collection and export permits. Conrado Gonzáles, Martha Moreno, Ibrahim Padilla, and Carla Cárcamo of the Departamento de Areas Protegidas y Vida Silvestre (DAPVS) of the Administración Forestal del Estado Corporación Hondureña de Desarrollo Forestal (AFE-COHDEFOR), Honduras, generously provided permission to collect and export scientific specimens. Fieldwork was supported by Operation Wallacea and the Reptile and Amphibian Conservation Corps (RACC).

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**MICRURUS NIGROCINCTUS (Central American Coralsnake).**

**DIET.** *Micrurus nigrocinctus* is a relatively common semi-fossorial snake that ranges from southern Mexico to northern Colombia; its diet is known to include caecilians, lizards, and snakes (Ray et al. 2012. *Herpetol. Rev.* 43:148). On 30 November 2012 at 0245 h an adult male *M. nigrocinctus* (SVL = 44.7 cm, total length = 52.0 cm; La MICA Biological Station/Team Snake Panama #2012-210) was found on the entrance road to El Copé, Coclé Province, Republic of Panama, between the communities of Las Tibias and El Copé (08.62343°N, 080.57100°W; datum WGS84). The *M. nigrocinctus* was attempting to feed on a dead female *Erythrolamprus bizona* (SVL = 33.7, total length = 39.0 cm; La MICA Biological Station/Team Snake Panama #2012-211), which was flattened and stuck to the road. When approached and

poked with a stick the *M. nigrocinctus* continued to try to ingest the *E. bizona* for approximately 1 min, after which the *E. bizona* was released. This is the first record of *M. nigrocinctus* attempting to feed on a snake within the genus *Erythrolamprus* and of *M. nigrocinctus* attempting to feed on carrion. I thank La MICA Biological Station for logistical support, ANAM for permit (SE/A-22-12) and P. Santana for field assistance.

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**MICRURUS TENER (Texas Coralsnake). ABERRANT PATTERN.**

Here we describe unusual dorsal blotches, or a “target” pattern, appearing on *Micrurus tener*, a species that normally bears a pattern of tri-colored rings. Aberrant pattern variations are occasionally reported in snakes; Bechtel (1995. *Reptile and Amphibian Variants: Colors, Patterns, and Scales*. Krieger Publ. Co., Malabar, Florida. 224 pp.) reviewed many examples. Strecker (1935. *Baylor Univ. Bull.* 38:1–69) reported exceptional color patterns in *M. tener* and Gloyd (1938. *Herpetologica* 1:121–124) reported a bite involving a melanistic specimen. On 6 October 2012 one of us (TW) found an aberrantly colored *M. tener* crossing Chandler Road (30.757137°N, 95.660561°W, datum WGS84; elev. 94 m) in Crabbs Prairie, Walker Co., Texas, USA. The snake (Fig. 1; adult female; 47.6 g), which exhibited scutellation patterns consistent with *M. tener*, was donated to Houston Zoo and accessioned into the live collection (HZI 27381).

The typical black, red, and yellow colors characteristic of the species are present, however, the pattern is far from typical. The head and neck are predominantly yellow, with the black restricted to a mask like pattern around the eyes and connecting through the rostral and adjacent scales. The black nuchal band is reduced to a dorsal blotch, barely in contact with the parietals, the center of which has faint flecks of red and yellow. The ground color of the body is red, with many scales being posteriorly tipped with black, but less so on the lateral scale rows. There are 17 black body “bands” appearing as blotches. Each blotch has the appearance of a target, the first (outer) ring being yellow and

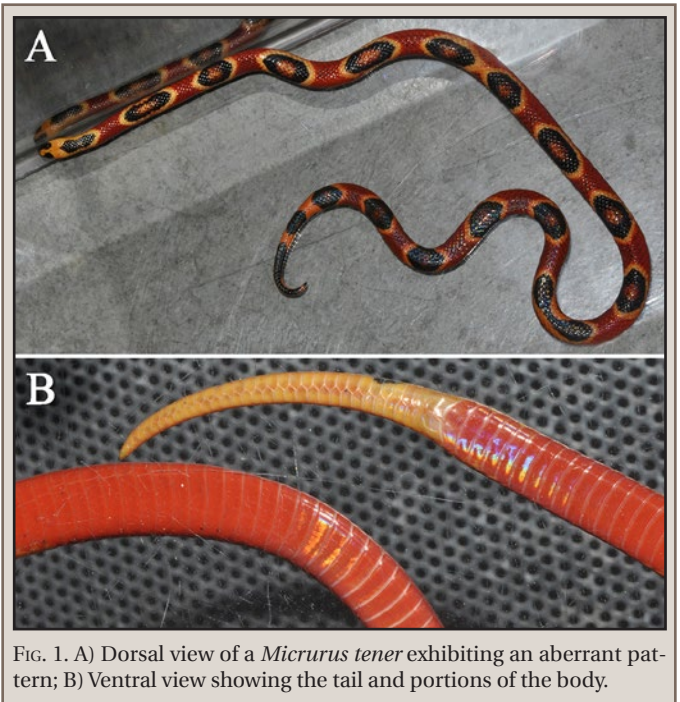


FIG. 1. A) Dorsal view of a *Micrurus tener* exhibiting an aberrant pattern; B) Ventral view showing the tail and portions of the body.

the second black, with sharply defined edges. The inner rings are red with a yellow center but, with indistinct edges bleed into one another. The venter is nearly uniform red with minute black specks, occurring on a few scales, and some yellow from the dorsal blotches entering onto the extreme lateral edges of some ventrals. The subcaudals are predominantly orange, with a "wash" of red appearing at the medium seams of the divided subcaudals. We thank Houston Zoo, Inc. for consent to report on this unusual specimen.

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**NERODIA FLORIDANA (Florida Green Watersnake). DIET.** *Nerodia floridana*, North America's largest watersnake, occupies most of Florida, small parts of southern Alabama and Georgia, and a portion of southern South Carolina. Fish and adult frogs have been reported to comprise the bulk of its diet; however, it has also been known to consume salamanders, tadpoles, small turtles, and invertebrates (Ashton and Ashton 1981. Handbook of Reptiles and Amphibians of Florida. Part 1. The Snakes. Windward Publ., Miami, Florida. 176 pp.). Here we report several new diet records for *N. floridana*.

In the course of long-term monitoring of aquatic snake populations on the U.S Department of Energy's Savannah River Site (SRS), Aiken and Barnwell counties, South Carolina, USA, we documented the following diet items from individual *N. floridana* captured in plastic minnow traps: 6 June 2006 (33.286533°N, 81.488019°W, datum WGS84), *Erimyzon sucetta* (Lake Chub-sucker); 1 July 2006 (33.255185°N, 81.585210°W), *Lepomis gulosus* (Warmouth) and *Lithobates sphenoccephalus* (Southern Leopard Frog); 29 March 2007 (33.161047°N, 81.692606°W), two larval *Ambystoma opacum* (Marbled Salamander); 25 June 2008 (33.161047°N, 81.692606°W), two *Acantharchus pomotis* (Mud Sunfish; total length = 48 and 75 mm). On 2 July 2010, a *N. floridana* (SVL = 534 mm) was collected dead in hoop trap set for turtles at Pond 2 on the SRS (33.255185°N, 81.585210°W). Dissection revealed two crayfish (species not determined). No additional prey were found, indicating this was not a case of secondary ingestion. Crayfish are considered a rare diet item for *Nerodia* spp. and have not been documented in *N. floridana* (Gibbons and Dorcas 2004. North American Watersnakes: a Natural History. Univ. Oklahoma Press, Norman. 438 pp.). Finally, at 2025 h on 18 December 2012, an adult *N. floridana* (SVL = ~ 70 cm) was

seen consuming a large *Ameiurus* sp. (bullhead catfish; Fig. 1) at the edge of a wetland in Grassy Waters Preserve (26.816926°N, 80.174894°W), Palm Beach Co., Florida, USA.

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**NERODIA SIPEDON (Northern Watersnake). DIET.** Although Gibbons and Dorcas (2004. North American Watersnakes: a Natural History. Univ. Oklahoma Press, Norman. 438 pp.) listed eight species of ictalurid catfish that have been reported in the diet of *Nerodia sipedon*, their list did not include *Pyloodictis olivaris* (Flathead Catfish). On 4 September 2012, we encountered an adult *N. sipedon* (total length = 95 cm) in the process of swallowing a juvenile *P. olivaris* (total length = 26 cm). They were found in shallow water along the shoreline of Pollander Lake, an Upper Mississippi River backwater, immediately upstream from the spillway that extends from Lock and Dam 5A to the Minnesota shoreline, Winona Co., Minnesota, USA (44.080°N, 91.684°W; datum WGS 84). The snake had swallowed most of the head of the catfish, which was still alive when they were observed. Previously, *P. olivaris* has been found in the diet of three other *Nerodia* species (Gibbons and Dorcas, *op. cit.*; Tyson et al. 2008. Herpetol. Rev. 39:472).

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**PELAMIS PLATURA (Yellow-bellied Seasnake). REPRODUCTION / MATING BEHAVIOR.** The elapid seasnake *Pelamis platura* has the widest distribution range of any snake, including most of tropical and subtropical Pacific and Indian oceans from Central America to Madagascar. Its reproductive cycle is considered to be continuous throughout the year (Ineich 1988. L'Année Biologique, 4ème sér. 27:93–117) but two birthing peaks have been reported in Costa Rica, one in December and January and another in July and August (Solorzano 2004. Serpientes de Costa Rica. Editorial INBio, Santo Domingo Heredia, Costa Rica. 791 pp.). Solorzano and Sasa (2011. Herpetol. Rev. 42:443–444)



FIG. 1. *Nerodia floridana* consuming an *Ameiurus* sp. (bullhead catfish) at Grassy Waters Preserve, Palm Beach Co., Florida, USA.

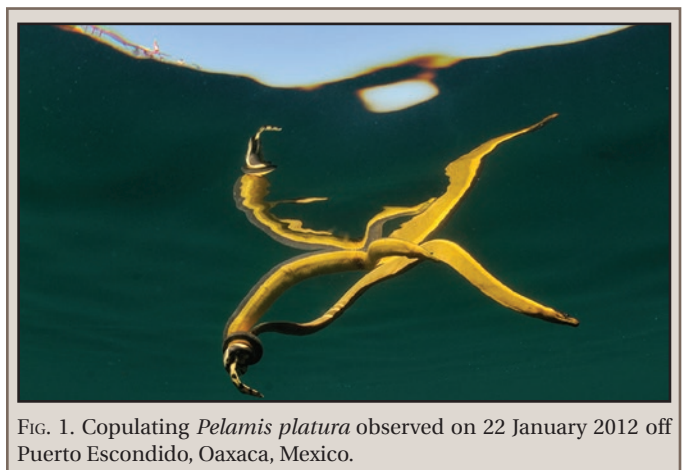


FIG. 1. Copulating *Pelamis platura* observed on 22 January 2012 off Puerto Escondido, Oaxaca, Mexico.

PHOTO BY M. DUNE/DORIS/FESSM/FR

reported the first observation of mating behavior for the species. They observed copulating specimens floating at the sea surface in Costa Rica in August 2009. We here report a second copulation observation (Fig. 1) made in natural conditions off Puerto Escondido (Oaxaca, Mexico) ca. 4 km from the coast (15.60°N, 97.13°W, datum WGS84; 22 January 2012). Copulation occurred just below the water's surface, as in the first observation reported above, and lasted over 15 min; the diver (MD) left before its end. Both snakes moved repeatedly from vertical to horizontal position with their tails intertwined and most often maintained a vertical position. Water temperature was ca. 23°C. This is the second observation of mating behavior in the species and is consistent with a continuous or bimodal mating season in Central America.

We wish to thank the DORIS website (<http://doris.ffessm.fr/>) that enables information exchange among scientists, biologists, divers, and underwater photographers.

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**PHILODRYAS TRILINEATA (Argentina Mousehole Snake).**

**DIET.** *Philodryas trilineata* is a large (maximum length = 200 cm) species endemic to the Monte biogeographic region in western Argentina (Giraud and Scrocchi 2002. *Smithson. Herpetol. Inform. Serv.* 132:1–53). The diet of *P. trilineata* is known to include birds, mammals, lizards, and other snakes; some individuals are known to hunt domestic fowl or rabbits (Cei 1993. *Reptiles del Noroeste, Nordeste y Este de la Argentina. Herpetofauna de las Selvas Subtropicales, Puna y Pampas. Mus. Reg. Sci. Nat. Torino.* 945 pp.; Laspiur et al. 2012. *Herpetol. Rev.* 43:151–152). Rodents are frequently reported as prey, but consistent data about diet of this species are lacking. Here we report the first vouchered case of predation by *P. trilineata* on *Microcavia australis*.

On 12 February 2011, at 1015 h, we collected an adult *P. trilineata* (total length = 1635 mm) near Puerto Madryn city, Chubut, Argentina (42.7894°S, 65.0049°W, datum WGS84; elev. 11 m). During transport to the laboratory, the snake regurgitated a partially digested juvenile *M. australis* (Fig. 1). Based on comparison with *Microcavia* specimens from Chubut (N = 33), we estimate a



FIG. 1. *Philodryas trilineata* and partially digested adult *Microcavia australis* from Chubut Province, Argentina.

total length of 130 mm for the prey. The snake and its prey were deposited in the Herpetological Collection LJAMM of Centro Nacional Patagónico (LJAMM-CNP 8236). We thank D. Udrizar Sauthier for *Microcavia* identification and revision of comparative material.

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**PITUOPHIS CATENIFER AFFINIS (Sonoran Gophersnake).**

**PREDATION.** On 9 October 2012, 1400 h, one of us (ECB) found a juvenile *Pituophis catenifer affinis* (SVL ca. 500 mm) entangled with a *Scolopendra heros* (Giant Centipede; total length ca. 178 mm; photo voucher UAZ 57469-PSV) on a path near the western base of Cathedral Rock near Sedona, Yavapai Co., Arizona, USA (34.886467°N, 111.801529°W, datum WGS84; elev. 1524 m). When found, the centipede was wrapped around the posterior two thirds of the snake. The anterior one third of the snake was free, outstretched in an attempt to escape. The animals were disentangled and it became apparent that the centipede was indeed preying upon the snake. The latter exhibited a sizable mid-dorsal wound where the centipede had gnawed through the snake's back. When freed the gophersnake moved slowly away while the centipede rapidly departed.



FIG. 1. *Scolopendra heros* preying on a young-of-year *Pituophis catenifer*.

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**PITUOPHIS CATENIFER (Gophersnake).** **DIET.** *Pituophis catenifer* is primarily a predator of rodents, but also takes birds, bird eggs, and lizards (Rodríguez-Robles 2002. *Biol. J. Linn. Soc.* 77:165–183). Here we describe the first confirmed predation by *P. catenifer* on *Dipodomys ingens* (Giant Kangaroo Rat), a federally and state listed (endangered) species. *Pituophis catenifer* have been observed within colonies of *D. ingens*, and use their burrow systems as shelter (Williams and Kilburn 1991. *Mammalian Species* 377:1–7). On 12 December 2012 a *D. ingens* burrow system in the Carrizo Plain, San Luis Obispo Co., California, USA (35.3081°N, 119.8787°W; elev. 655 m) was being excavated for

preservation purposes. A female *P. catenifer* (SVL = 989 mm; tail length = 144) sheltering within the burrow was inadvertently fatally injured during the excavation process. Upon examining the snake a prey bolus was found and extracted. The prey was determined to be an adult male *D. ingens* based on hind foot length (48.8 mm). Predation on *D. ingens* by *P. catenifer* has long been suspected and our observation provides conclusive evidence. This predation event is also notable both due to the relative size of the prey item (88 adult male Giant Kangaroo Rats at this site averaged 123 g; s.d.  $\pm$  12.9) and the time of the year. Although winter days in the Carrizo Plain can afford clear skies and moderate daytime temperatures, offering opportunities for heliothermic temperature regulation, nighttime temperatures frequently fall below 0°C, and prolonged periods of precipitation and cloud cover can occur. The anterior portion of this *D. ingens*, including the head, had been digested, suggesting that the snake had been able to maintain body temperatures sufficient to permit digestion despite the season. We thank M. Huising, M. Hemenez, and B. Windecker for their assistance. SunPower Corporation and NRG Energy provided additional support.

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**PLIOCERCUS ELAPOIDES (Variegated False Coralsnake). REPRODUCTION / CLUTCH SIZE.** Little information has been published on the reproduction of *Pliocercus elapoides*. However, a clutch of 4–8 eggs (August deposition) is known from northern Guatemala (Köhler 2003. Reptiles of Central America. Herpeton, Verlag Elke Köhler, Offenbach. Germany. 367 pp.; Lee 2000. A Field Guide to the Amphibians and Reptiles of the Maya World, The Lowlands of Mexico, Northern Guatemala, and Belize. Cornell Univ. Press. Ithaca, New York. 402 pp.). The natural history of this uncommon species in Mexico is poorly known.

On 22 April 2010 at 1827 h, we found a female *P. elapoides* (UAA-CV 0355, SVL = 350 mm; tail length = 220 mm) in a montane cloud forest in the Sierra Madre Oriental at Alaquines, San Luis Potosí, México (22.122500°N, 99.504890°W, datum WGS84; elev. 1405 m). On 1 May 2010 at 0100 h (after nine days in captivity) she deposited seven eggs in a depression in the substrate below leaf litter. The eggs averaged 15 mm in length (SE = 0.8164).

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**SPILOTES PULLATUS (Tiger Ratsnake). DIET.** *Spilotes pullatus* is a diurnal generalist that typically feeds on small rodents, birds, and bird eggs (Hartmann et al. 2009. Pap. Avul. Zool. 49:343–360; Mendonça et al. 2011. Herpetol. Notes 4:425–427). On 11 December 2012, at 2145 h, on the property of Chico Mendes Institute for Biodiversity Conservation, ICMBIO (7.38383°S, 39.3544°W; datum WGS 84) in the Araripe National Forest, State of Ceará,

Brazil, we observed an attempted predation by *S. pullatus* on the eggs of *Turdus rufiventris* (Rufous-bellied Thrush). Predation was not successful due to “mobbing” behavior of the adult *T. rufiventris* (Yamamoto and Ades 2002. Rev. Etol. 4:75–94), followed by intense vocalization away from their nest. This is the first record of *S. pullatus* attempting predation on *T. rufiventris*.

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**STORERIA DEKAYI (Dekay's Brownsnake). SEASONAL ACTIVITY.** The annual activity period of *Storeria dekayi* varies with latitude (Ernst and Ernst. 2003. Snakes of the United States and Canada. Smithsonian Univ. Press, Washington, D.C. 668 pp.). Few data are available for northern populations, but Vogt (1981. Natural History of Amphibians and Reptiles of Wisconsin. Milwaukee Public Museum, Milwaukee. 205 pp.) stated that they emerge in late April and are most often seen in May and October as they cross roads while moving to and from hibernacula. Here I present data on activity of *S. dekayi* from a population on the western side of Pheasant Branch Marsh, Dane Co., Wisconsin, USA (43.110°N, 89.493°W; datum WGS 84; Cochran 1988. Bull. Chicago Herpetol. Soc. 23:69–71).

On most days from mid-1981 to mid-1984, I drove Pheasant Branch Road along the slope of a ground moraine adjacent to marsh and observed *S. dekayi* on the road only during spring and fall (Fig. 1). The only three living individuals were recorded on 2 May, 11 May, and 5 October, consistent with the dates for the 25 dead snakes. Mean first sighting date for 1982–1984 was 26 April

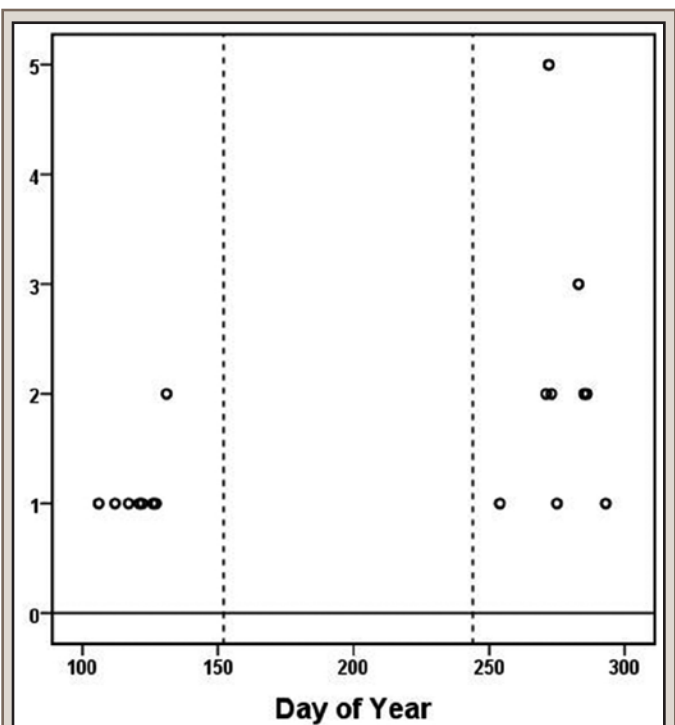


FIG. 1. Dot plot showing dates on which *Storeria dekayi* were observed on Pheasant Branch Road, Dane Co., Wisconsin (N = 25 dead and 3 living snakes). The dashed vertical lines indicate 1 June and 1 September.



(SE = 5.8 d) and mean last date for 1981–1983 was 7 October (SE = 6.6 d). During the same periods, *Thamnophis sirtalis* tended to be found both earlier (mean first date: 18 April; SE = 3.2 d) and later (mean last date: 29 October, SE = 3.3 d), but the difference was significant only for the end of the season (paired-*t* tests: spring – *t* = 1.589, d.f. = 2, *p* = 0.253; fall – *t* = 6.803, d.f. = 2, *p* = 0.021). These observations present a more detailed documentation of general descriptions of activity periods presented in regional field guides (e.g., Vogt, *op. cit.*). Voucher specimens were placed in the University of Wisconsin-Madison Zoology Museum (UWZM 22556, 22594) and the Milwaukee Public Museum (MPM 30266, 33146).

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**THAMNOPHIS SIRTALIS SIRTALIS (Eastern Gartersnake).**

**HABITAT USE.** Terrestrial snakes typically congregate during colder months in dry, underground refugia; however, some snake species will partially or completely submerge themselves in flooded sites to hibernate (Carpenter 1953. *Ecology* 34:74–80; Costanzo 1985. *Physiol. Zool.* 58:682–692). *Thamnophis sirtalis* normally hibernate in terrestrial habitats such as rock piles, debris filled wells, old stumps, rodent burrows, crevices in shale, ant mounds, crayfish and prairie dog burrows (Ernst and Ernst 2003. *Snakes of the United States and Canada*. Smithsonian Books, Washington, DC. 680 pp.). Published accounts of crayfish burrow use by *Thamnophis* spp. indicate either daily refugia use (Dalrymple and Reichenback 1984. *Biol. Cons.* 30:195–200) or were identified by burrow excavation (Carpenter, *op. cit.*). Few observations have identified either the frequency/seasonality of use or the species of crayfish creating burrows.

During an investigation of *T. s. sirtalis* ecology in Lake Forest, Illinois, USA (42.260°N, 87.883°W; datum WGS84) we observed snakes entering and exiting burrows of an invasive crayfish species, *Cambarus diogenes* (Devil crayfish). On 11 March 2011 three juvenile snakes were observed emerging from a *C. diogenes* burrow and were PIT tagged. The PIT tagged snakes were found again on 6 June and 10 October 2011 at the same site with individuals either partially emerged or basking outside of the burrow. Additional anecdotal evidence of use was presence of silty, clay-like soil on freshly emerged individuals, and high density of individuals surrounding burrows. Our observations are the first confirmation that *T. s. sirtalis* use burrows of *C. diogenes* and indicate that they use these structures throughout the year as refugia.

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**VIPERA ASPIS HUGYI (Southern Italian Asp). MELANISM.**

Melanism, excess of dark pigmentation in the skin, is common in some snakes (Lorioux et al. 2008. *Amphibia-Reptilia* 29:1–5), resulting from the over-production or dispersion of melanin by melanophores (Sherbrooke et al. 1989. *Amer. Mus. Novit.* 2943:1–14). In cold environments, dark phenotypes (with low reflectance on the skin) may have a thermoregulatory advantage over lighter phenotypes (Clusella-Trullas et al. 2008. *Funct. Ecol.* 22:232–238) but are less cryptic and therefore may be more vulnerable to predation (Clusella-Trullas et al. 2007. *J. Therm. Biol.* 32:235–245).

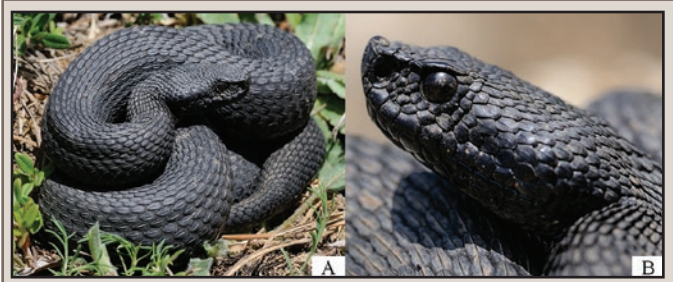


FIG. 1. Melanistic adult female *Vipera aspis hugyi*: whole body (A); close up on the head (B).

PHOTOS BY M. R. DI NICOLA

*Vipera aspis hugyi* is endemic to southern Italy and usually treated as subspecies of *Vipera aspis*, although in some studies it has been raised to species rank (Zuffi 2002. *Amphibia-Reptilia* 23:191–213). Color polymorphism is not accentuated in this subspecies and the pattern usually consists of a broad wavy line, often fragmented in round or oval patches, with a dark outer edge that is often black, and a lighter central area.

On 2 May 2012, around 1020 h, a melanistic adult female *V. aspis hugyi* was encountered basking at the edge of a pine forest at 1300 m elev. in the Sila mountainous plateau, Calabria, Italy. The body was almost completely black except for some small pale dots on the labial scales and a few reddish ventral scales in the terminal part of the tail; the eyes were also very dark, with barely visible reddish pigmentation (Fig. 1). A normally-pigmented adult female *V. aspis hugyi* was found in the same area two days earlier.

Although melanism has been reported for other subspecies of *V. aspis* (Monney et al. 1996. *Rev. Suisse Zool.* 103:81–100; Naulleau 1973. *Bull. Soc. Zool. France* 98:595–596) it doesn't seem to have been scientifically recorded for *V. aspis hugyi*, although a photograph of a melanistic specimen was published in Brodmann (1987. *Peter Brodmann, Die giftschlanger Europas und die gattung Vipera in Africa und Asien*, Kummerly+Frey 148 pp.). Thus, this record constitutes only the second published account of melanism in *V. aspis hugyi*. It is unclear whether melanism is rare in *V. aspis hugyi* or if the paucity of records is simply due to insufficient sampling. We thank Johan De Smedt for his advice and Arthur Anker and Marco Colombo for their comments to the manuscript.

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**XENOCHROPHIS MACULATUS (Spotted Keelback). DIET.**

*Xenochrophis maculatus* is a terrestrial and semiaquatic diurnal snake with a distribution restricted to southeastern Asia (Das 2010. *A Field Guide to the Reptiles of South-east Asia*. New Holland Publishers Ltd., London, U.K. 376 pp.). Along the Lower Pierce Trail in the Central Catchment Nature Reserve, Singapore, at 2217 h on 05 January 2013, we found an adult female *X. maculatus* (SVL = 64.6 cm, tail length = 14.4 cm, 105 g) with an obvious food bolus near its mid-body. The snake was perched 56 cm off the ground on vegetation approximately 3 m from a reservoir edge. The snake died in transport to the laboratory and dissection revealed the prey item as an adult *Limnonectes malesianus* (27.89 g, ~ 36% of the snake's pre-ingestion mass; Fig. 1). Both the *X. maculatus* and *L. malesianus* were deposited in the Raffles Museum of Biodiversity Research (ZRC 2.7000 and ZRC 1.12501, respectively). *Xenochrophis maculatus* is known to prey upon



FIG. 1. *Xenochrophis maculatus* with ingested *Limnonectes malesianus* in Central Catchment Nature Reserve, Singapore.

frogs and fish (David and Vogel 1996. *The Snakes of Sumatra: An Annotated Checklist and Key with Natural History Notes*. Edition Chimaira, Frankfurt, Germany. 260 pp.); however, we were unable to find any references documenting specific prey or prey size. We thank the National Parks Board of Singapore for issuing us work permit NP/RP11-03-1 and Kelvin K. P. Lim at the Raffles Museum of Biodiversity Research for accessioning specimens.

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**XENOPHOLIS SCALARIS (Wucherer's Ground Snake). DEFENSIVE BEHAVIOR.** *Xenopholis scalaris* is a dipsadid snake found in leaf litter in humid tropical forests of Bolivia, Brazil, Peru, Ecuador, Colombia, Suriname, and French Guiana (Lehr and Doan 2013. *In* IUCN Red List of Threatened Species, version 2013.1. <www.iucnredlist.org>. Downloaded 5 March 2013). Defensive behavior of this species is relatively unknown. We observed defensive behavior of *X. scalaris* on three occasions in southern Bahia, Brazil. The observations occurred on 1) 17 September 2012 at 2230 h in an area of Atlantic forest at Michelin Ecological Reserve (13.816667°S, 39.133333°W; datum SAD69),



FIG. 1. *Xenopholis scalaris* from southern Bahia, Brazil, exhibiting flattening and head hiding defensive behavior.

Igrapiúna municipality; 2) 3 May 2009 at 1600 h on a trail between a secondary forest and cocoa plantation at RPPN Serra Bonita (15.42387°S; 39.54736°W), Camacan municipality; and 3) 24 February 1992 at the Centro de Pesquisas do Cacau, CEPEC/CEPLAC (14.767492°S; 39.228062°W), Ilhéus municipality. In all observations, the snakes flattened their bodies, hid their heads, and remained motionless for several minutes (Fig. 1). The third observation was of two neonates. Although body flattening behavior has been described for this species (Martins 1996. *In* K. Del Claro [ed.], *Anais do XIV Encontro Annual de Etologia*, pp. 185–199. Sociedade Brasileira de Etologia, Universidade Federal de Uberlândia, Brazil) this is the first time the head-hiding behavior (Greene 1988. *In* Gans and Huey [eds.], *Biology of the Reptilia*, pp.1–152. Alan R. Liss, New York) has been noted.

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