NATURAL HISTORY NOTES

CAUDATA — SALAMANDERS

AMBYSTOMA ANNULATUM (Ringed Salamander) and *AMBYS-TOMA MACULATUM* (Spotted Salamander). **CLIMBING BE-HAVIOR.** Climbing behavior is well documented in plethodontid salamanders and likely serves a variety of functions. While some members of the genus *Aneides* are truly arboreal (Spickler et al. 2006. Herpetol. Conserv. Biol. 1:16–26), climbing behavior by terrestrial species has been associated with olfactory orientation and homing (Madison and Shoop 1970. Science 168:1484–1487), periodic foraging (Jaeger 1978. Copeia 1978:686–691), and predator avoidance (Roberts and Liebgold 2008. Behav. Ecol. 19:621–626). For ambystomatid salamanders, however, observations of climbing behavior have not been previously reported. This may be because most observations of ambystomatid salamanders are of aquatic larvae or adults arriving at or leaving breeding ponds. Observations of juveniles emerging from their natal wetland and moving into novel terrestrial habitats are much less common. During this vulnerable time, juvenile ambystomatid salamanders must orient and navigate, while attempting to select microhabitat for best avoiding desiccation or predation (Rothermel and Semlitsch 2006. Can. J. Zool. 84:797–807).

In May through August of 2009 and 2010, while conducting enclosure experiments and fluorescent powder-tracking at Daniel Boone Conservation Area, in Warren Co., Missouri, USA, we observed juvenile *Ambystoma annulatum* and *A. maculatum* climbing on vegetation and the walls of plastic silt fence enclosures. We observed juvenile salamanders (N = 20) climbing small saplings, grass clumps, and stumps, as well as the trunks of large trees (Table 1). Ringed Salamanders may climb more readily than Spotted Salamanders (7.1% of powder-tracked Ringed Salamanders climbing, compared to 3.2% climbing in Spotted Salamanders; Pittman, unpubl. data). We observed Ringed Salamanders climbing to a maximum height of 152 cm (mean: 66.5 ± 9.59 SE) and Spotted Salamanders climbing to a maximum height of 100 cm (mean: 61.7 ± 8.72 SE). In addition to these observations, juveniles readily climbed over downed logs (ca. 20 cm in diameter) and where observed crawling out of pitfall traps (45 cm deep plastic plant pots) during wet conditions.

The observed climbing behavior in juvenile ambystomatids likely has two principle functions. Individuals climbing over downed logs may be attempting to maintain their current movement trajectory by traversing over obstacles in their path. Climbing over an obstacle may require less energy than moving around it. In contrast, individuals climbing up herbaceous vegetation or tree trucks were not climbing over obstructions in their path, but appear to have selected those structures specifically for the purpose of elevating themselves off the ground. Given high desiccation risk, it seems likely that juvenile ambystomatid salamanders moving through novel terrestrial habitats would possess behavioral mechanisms for efficiently locating suitable microhabitats. The orientation hypothesis for climbing behavior in *Plethodon jordani*, offered by Madison and Shoop (1970. Science 168:1484–1487), might also apply to juvenile ambystomatid salamanders. On the occasions where we directly observed individuals on vegetation, their posture (nose up, forelegs and neck extended) suggested that they were attempting to increase their sensory perceptual range. It is possible that by elevating themselves, juveniles may access less-obstructed air currents, thereby broadening their range of olfactory perception and possibly increasing detection of visual cues as well.

Climbing in ambystomatids is probably a much more common behavior than the scant documentation would suggest. We recommend that climbing behavior be considered when designing experiments. Depending on the nature of the experiment, it may be necessary to add lips angled inward to enclosures, drift fences, and pitfall traps to obstruct ambystomatid climbing. Because our observations were of juveniles, we cannot confirm if climbing behavior is as prevalent in adults.

TABLE 1. Observations of juvenile ambystomatid salamander climbing behavior.

Date	Structure	Height	Observation
Ambystoma annulatum			
5/11/2009	Grass clump	50 cm	Visual observation
5/14/2009	On leaf of sapling	30 cm	Visual observation
5/26/2009	White Oak stump	60 cm	Fluorescent powder trail
5/29/2009	On Sassafras sapling leaf	75 cm	Visual observation
6/10/2009	Plastic silt fence	100 cm	Visual observation
6/11/2009	Dead White Oak trunk	50 cm	Found under bark
6/14/2009	Downed woody debris	70 cm	Visual observation
6/14/2009	Branch of young tree	152 cm	Fluorescent powder trail
6/18/2009	On leaf of sapling	30 cm	Visual observation
6/18/2009	Grass clump	40 cm	Fluorescent powder trail
6/1/2010	Plastic silt fence	100 cm	Visual observation
7/10/2010	Sapling	25 cm	Fluorescent powder trail
7/26/2010	Persimmon tree trunk	49 cm	Fluorescent powder trail
7/27/2010	White Oak trunk	100 cm	Fluorescent powder trail
Ambystoma maculatum			
6/14/2009	Grass clump	100 cm	Visual observation
6/20/2009	Grass clump	50 cm	Fluorescent powder trail
6/20/2009	Grass clump	40 cm	Fluorescent powder trail
6/28/2009	Tree stump	60 cm	Fluorescent powder trail
7/7/2009	Tree stump	50 cm	Fluorescent powder trail
7/7/2009	Grass clump	70 cm	Visual observation

MICHAEL S. OSBOURN (e-mail: msodkc@mail.missouri.edu), SHANNON E. PITTMAN, DANA L. DRAKE, and RAYMOND D. SEMLITSCH, University of Missouri, Division of Biological Sciences, 105 Tucker Hall, Columbia, Missouri 65211-7400, USA.

AMBYSTOMA OPACUM (Marbled Salamander). **UNUSUAL LARVAL DEATH.** *Ambystoma opacum* breed in autumn, and females typically deposit eggs in dry wetland basins or margins, and embryos develop to hatching stage (Scott 2005. *In* Lannoo [ed.], Amphibian Declines: The Conservation Status of United States Species, pp. 627–632. Univ. California Press, Berkeley). When the wetlands fill, embryos hatch immediately from eggs and begin development as free-swimming larvae. This occurs prior to the presence of other amphibian eggs or larvae in these wetlands. Here I report the unusual death of a free-swimming larval Marbled Salamander.

On 7 Feb 2012 while surveying ridge-top wetlands in the Daniel Boone National Forest, Morgan County, Kentucky, USA, I observed a larval *A. opacum* that had died and was located within the egg mass of a Wood Frog, *Lithobates sylvaticus* (Fig. 1). The egg mass was on the edge of a small cluster of eight egg masses. The larva was either attempting to eat the embryos, was inactive near the eggs as the jellies swelled, or was attempting to move through egg mass and was trapped. Larval *A. opacum* primarily eat macrozooplankton and other invertebrates (Scott 2005, *op. cit.*), so this was apparently not a predatory attempt. To my knowledge, this is the first report of a larval salamander being entrapped in an amphibian egg mass.

STEPHEN C. RICHTER, Department of Biological Sciences, Eastern Kentucky University, Richmond, Kentucky 40475, USA; e-mail: stephen.richter@eku.edu.

FIG. 1. Larval Marbled Salamander, *Ambystoma opacum*, found dead within the egg mass of a Wood Frog, Lithobates sylvaticus.

FIG. 1. Female *Desmognathus folkertsi* found with her early-stage nest underneath a small rock in a headwater stream.

DESMOGNATHUS FOLKERTSI (Dwarf Black-Bellied Salamander). **NEST.** On 22 July 2010, I uncovered two nests of *Desmognathus folkertsi* in Habersham Co., Georgia, USA. Eggs were early in development and attached to the underside of small, flat rocks in a first-order stream. Both nests were guarded by female *D. folkertsi*. The nest that was photographed contained 29 eggs. Upon returning on 28 Aug 2010, I flipped the same rocks and found the hatched larvae underneath, and the females had moved out. This is the first record of nesting behavior of *D. folkertsi*.

TODD PIERSON, Odum School of Ecology, University of Georgia, Athens, Georgia 30609, USA; e-mail: twpierso@uga.edu.

EURYCEA CIRRIGERA (Southern Two-Lined Salamander). **OVIPOSITION SITE.** For most oviparous species, female oviposition site selection can impact reproductive fitness by dictating offspring survival and phenotype, juvenile performance, as well as potential survival of the ovipositing female. Thus, oviposition-site choice is a life-history trait of critical importance (Bernardo 1996. Amer. Zool. 36:83–105; Refsnider and Janzen 2010. Ann. Rev. Ecol. Evol. Syst. 41:39–57; Resetarits 1996. Amer. Zool. 36:205–215).

We document oviposition by a female *E. cirrigera* inside a leaf litterbag sampling device, in Decatur Co., Georgia, USA (30.791667°N, 84.625°W). In February 2004, we retrieved a leaf litterbag containing a female *E. cirrigera* (3.7 cm SVL) tending a clutch of eggs on the underside of a curled leaf (Fig. 1). We estimated 30 eggs in the clutch, including ca. 6 eggs that fell into the stream upon retrieval. Leaf litterbags are a passive sampling device that mimic natural leaf packs in streams, serving as both refugia from predators and sources of prey substrate (Fraser 1976. Ecology 57:459–471; Waldron et al. 2003. Applied Herpetol. 1:23–36).

This oviposition observation was made during a study examining the effectiveness of leaf litterbags versus dipnetting (Talley and Crisman 2007. Env. Monitor. Assess. 132:505–519). We constructed leaf litterbags by gathering the corners of 30 x 30 cm squares of heavy gauge plastic mesh to form pockets we filled with litter debris from stream edges. We placed 12 litterbags in each survey stream at locations where debris naturally accumulated (e.g., channel bends, pools, and incised banks). Following a 30-day incubation period, where salamanders can freely move in and out of the litterbag, we remove litterbags from the stream to inspect the interiors.

Fig. 1. Female *Eurycea cirrigera* tending egg clutch.

PHOTO BY G. JONGSMA

Fig. 1. Leucistic *Plethodon cinereus* found in Fredericton, New Brunswick, Canada in 2010.

Eurycea cirrigera typically breed December through March in the southern US, so that eggs are typically present January through April. The female deposits ca. 15–100 eggs per clutch, remaining with them until they hatch (1–2 months). Females typically attach eggs singly beneath submerged rocks or logs in slow-moving water, or to submerged vegetation when sufficient rocks are unavailable (Brimley 1896. Amer. Nat. 30:500–501; Jensen et al. 2008. Amphibians and Reptiles of Georgia. Univ. Georgia Press, Athens and London. 575 pp.; Mitchell and Gibbons. 2010. Salamanders of the Southeast. Univ. Georgia Press, Athens and London. 324 pp.).

The current observation supports the documented timing of oviposition in the southern populations of *E. cirrigera* mentioned above, and suggests the efficacy of salamanders to occupy leaf litterbags because they mimic the natural microhabitat. We may have found additional salamanders with egg clutches if we had checked the contents more frequently during breeding months or if we had placed them in microhabitats better suited for attracting adults (i.e., at stream edges where rocks are more available and litterbags are not fully submerged).

BROOKE L. TALLEY, Department of Zoology, Southern Illinois University – Carbondale, Carbondale, Illinois 62901, USA (e-mail: bltalley@siu.edu); **THOMAS L. CRISMAN,** Department of Integrative Biology, University of South Florida, 4202 E. Fowler Avenue, Tampa, Florida 33620, USA.

PLETHODON CINEREUS (Eastern Red-backed Salamander). MORPHOLOGY. *Plethodon cinereus* is one of the most common salamanders in the Maritime Provinces of eastern Canada (Cook 1984. Introduction to Canadian Amphibians and Reptiles. National Museum of Natural Sciences, Ottawa; Conant and Collins 1998. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Houghton-Mifflin Co., Boston, Massachusetts. 616 pp.). There are three commonly recognized color morphs: a deep red-striped back with black sides referred to as red-backed, a black pigmented back and sides, referred to as lead-backed, and the rarest of the three morphs, red with varying degrees of black mottling referred to as erythristic. Far less common across its range is the leucistic morph, which lacks pigmentation but has the regular black eyes and hence not considered albino. Across its range, three leucistic individuals have been reported from Maryland (Mitchell and Mazur 1998. Northeast. Nat. 5[4]:367–369), one each from West Virginia (Pauley 1974. The Restart 42:104), New York, and Massachusetts (Mendyk et al. 2010. Herpetol. Rev. 41[2]:189–190), two from Nova Scotia, one from Quebec (Moore and Gilhen 2011. Can. Field Nat.125:58–60) and one from Ontario (Rye 1991. Can. Field Nat. 10:573–574). The individual from New Brunswick, Canada was discovered 10 May 2009 at the UNB Woodlot in Fredericton (45.927841°N, 66.65769°W; WGS 84) under a rock next to a gravel road. This is the first confirmed record for New Brunswick. The individual was not collected; however John Gilhen (Nova Scotia Museum) verified that the individual was leucistic based on photographs.

GREGOR F. M. JONGSMA, 366 George Street, Apt. 1B, Fredericton, New Brunswick, Canada; e-mail: Gregor.Jongsma@gmail.com.

SALAMANDRA SALAMANDRA GALLAICA and SALAMANDRA SALAMANDRA EUROPAEA (Fire Salamander). AGONISTIC BEHAVIOR. Rival combat between male salamanders has been described in a central European population of *Salamandra salamandra* (Kästle 1986. *In* Z. Roçek [ed.], Studies in Herpetology, pp. 525–528. Societas Eurpaea Herpetologica, Prague), as well as in other salamander species including *S. algira tingitana* (Bogaerts and Donaire-Barroso 2005. Zeitschrift für Feldherpetologie 12:137–141), *S. lanzai* (Andreone 1992. Bull. Brit. Herpetol. Soc. 39:31–33), *S. atra* (Häfeli 1971. Rev. Suisse Zool. 78:235–293), *Plethodon cinereus* (Jaeger 1984. Copeia 1984:309–314; Gabor and Jaeger 1995. Anim. Behav. 49:71–79), and *Ensatina eschscholtzii* (Wiltenmuth and Nishikawa 1998. Anim. Behav. 55:1595–1606). Herein we report this behavior in two Iberian subspecies of *Salamandra salamandra*.

On 11 Oct 2011, GV-A observed and filmed this behavior in *S. s. gallaica* (http://youtube.com/watch?v=qJPmSTwTBCM; Bueu, NW Spain, 42.286°N, 8.758°W). XB filmed the same behavior in *S. s. europaea* on 27 Oct 2011 (http://youtu.be/ULD_v1-2Q_k; Les Preses, NE Spain; 42.135°N, 2.460°E). Our observations agree with the combat sequence reported in *S. salamandra* (Kästle 1986, *op. cit.*) and lasted more than 10 minutes. Our field observations provide evidence of male combat in other lineages of *S. salamandra* and extend this behavior across its wide range. Male combat in natural populations of *Salamandra* is difficult to observe (Kästle 1986, *op. cit.*; Bogaerts and Donaire-Barroso 2005,

op. cit.) and our experience agrees with field observations in other lineages since this behavior has been observed only twice in *S. s. gallaica* (first observation on 24 Oct 1998 in Parque Natural das Fragas do Eume, NW Spain, 43.418°N, 8.103°W) after numerous field surveys during the last 20 years. In *S. s. europaea* it has been observed four times in Les Preses (twice on 23 Dec 2007 and twice on 27 Oct 2011) and twice in La Vall d'en Bas (on 3 Nov 2011 in Espai d'Interès Natural Puigsacalm-Bellmunt; 42.162°N, 2.412°E). However, due to the scarcity of male-male agonistic behavioral observations in *S. salamandra*, whether these observations correspond to mistaken matings or rival male combat to defend their territory remains unclear.

GUILLERMO VELO-ANTÓN, CIBIO - Centro de Investigação em Biodiversidade e Recursos Genéticos da Universidade do Porto, Instituto de Ciências Agrárias de Vairão, R. Padre Armando Quintas, 4485-661 Vairão, Portugal (e-mail: guillermo.velo@mail.icav.up.pt); **PEDRO GALÁN**, Departamento de Bioloxía Animal, Bioloxía Vexetal e Ecoloxía. Facultade de Ciencias. Universidade da Coruña. Campus da Zapateira, s/n. 15071-A Coruña, Spain (e-mail: pgalan@udc.es); **XAVIER BÉJAR,** Delegació de la Garrotxa de la Institució Catalana d'Història Natural, Fontanella 3, 17800 Olot, Spain (e-mail: xevi.bejar@gmail.com).

ANURA — FROGS

ANAXYRUS FOWLERI (Fowler's Toad). HABITAT. *Anaxyrus fowleri* is endangered in Canada where it reaches its northern range limit (COSEWIC 2010). Fowler's Toads at Long Point Ontario breed almost exclusively within a large complex of wetlands on the leeward side of Lake Erie shoreline beach dunes (Green 1989. Can. Field Nat. 103:486–496). After the breeding season has ended males and females return to the beaches and sand dunes for the remainder of the active season. During the post breeding period these toads spend their evenings foraging along the beach and shoreline. Daylight hours are spent buried in the sand, typically within the eroding face of dunes (Boenke, unpubl. M.Sc. Thesis). The daytime habits of toads during the breeding season have not been previously reported.

During the breeding season on 29 May 2010, we attached a radio-transmitter (BD-2N manufactured by Holohil) to a calling male in the back-dune wetlands of Long Point (UTM 17N, 552007N, 4714034E) at 2355 h. The following day at 0900 h we tracked this radio-transmitter to a vegetation mound (UTM 17N, 552029N, 4714051E) near the attachment location within the same wetland. Unfortunately we were unable to visually confirm the presence of the toad and assumed the transmitter had been shed. On 9 June 2010, at 2344 h, well after the breeding season had ended, the same toad was found on the beach (UTM 17N, 551723N, 4713877E) wearing the same radio transmitter as confirmed by its serial number.

We interpret this as the first documented evidence of Fowler's Toads making use of daily refuge sites in wetlands or vegetation mounds. Previous to this it was unclear if during the breeding season toads returned to the sandy beaches between each night of calling or took refuge within the wetlands. Different toads may employ different refuge seeking strategies and further research into this behavior is needed.

MORGAN BOENKE (e-mail: morgan.boenke@mail.mcgill.ca) and **DAVID M. GREEN,** Redpath Museum, McGill University, 859 Sherbrooke Street West, Montréal, PQ, H3A 2K6, Canada.

CORYTHOMANTIS GREENINGI (Greening's Frog). REPRODUCTION. Some anuran species are known by their short
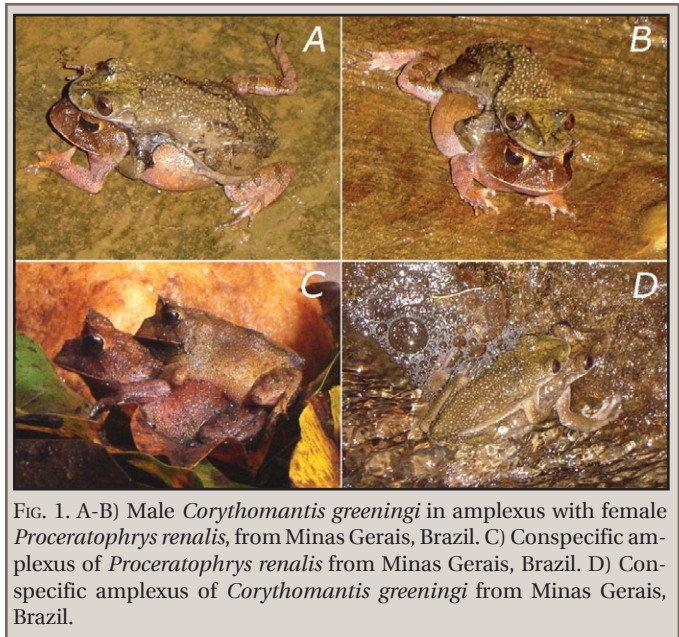

Fig. 1. A-B) Male *Corythomantis greeningi* in amplexus with female *Proceratophrys renalis*, from Minas Gerais, Brazil. C) Conspecific amplexus of *Proceratophrys renalis* from Minas Gerais, Brazil. D) Conspecific amplexus of *Corythomantis greeningi* from Minas Gerais, Brazil.

breeding activity, which occurs during a few weeks or days when it is possible to observe large reproductive choruses of individuals (Kopp et al. 2010. Iheringia 100:192–200; Wells 1977. Anim. Behav. 25:666–693). During spatial and temporal overlap in species reproductive activities, interspecific mating interactions are known to occur (Grogan and Grogan Jr. 2011. Herpetol. Rev. 42:89–90; Streicher et al 2010. Herpetol. Rev. 41:208). Herein we report an interspecific amplexus between individuals from two different species and families: Hylidae and Cycloramphidae. On 11 Nov 2006 at ca. 2000 h during the rainy season we found 12 anuran species in reproductive activity at a stream with small ponds in a transition area between Atlantic and Cerrado domains, near the city of Grão Mogol, Jequitinhonha River Basin, state of Minas Gerais, southeastern Brazil (16.5716°S, 42.7734°W, 599 m elev.). These species were: *Proceratophrys renalis, Odontophrynus carvalhoi, O. cultripes, Corythomantis greeningi, Dendropsophus minutus, Hypsiboas crepitans, Phyllomedusa burmeisteri, P.* gr. *hypochondrialis, Scinax* gr. *catharinae, Leptodactylus mystacinus, L. troglodytes,* and *Physalaemus cuvieri.* We observed amplexus between an adult male *Corythomantis greeningi* and a female *Proceratophrys renalis* (Fig. 1A, B) on rocks at the stream margin. The pair remained in amplexus and did not move while being observed for ca. 10 min. In the same chorus we observed conspecific amplexus of adult *P. renalis* (Fig. 1C) and *C. greeningi* (Fig. 1D). Although interspecific amplexus in anurans has been reported by numerous authors, amplexus between different families of anurans is only rarely observed.

RONALD R. CARVALHO JR., Sapiens Soluções Ambientais Ltda, 30220-260, Belo Horizonte, Minas Gerais, Brazil (e-mail: ronald.sapiens@gmail.com); **LUCIANA B. NASCIMENTO**, Programa de Pós Graduação em Zoologia de Vertebrados and Museu de Ciências Naturais, Pontifícia Universidade Católica de Minas Gerais, Minas Gerais, Brazil (e-mail: luna@pucminas.br).

DUTTAPHRYNUS MELANOSTICTUS (Asian Common Toad). PARASITISM. *Duttaphrynus melanostictus* is a common toad throughout South Asia. Although there have been reports of parasitism of *D. melanostictus* by endoparasites such as nematodes

(Walton 1933. J. Parasitol. 20:1–32) and parasitoids such as dipteran larvae (Roy and Dasgupta 1977. Proc. Indian Acad. Sci. 86B:207–209), reports of this species being parasitized by leeches could not be found. On 30 May 2011 at 2048 h we observed a leech attached to the lower back near the urostyle of an adult female *D. melanostictus* in Tai Po Kau Nature Reserve, New Territories, Hong Kong, China (22.43°N, 114.19389°E). The leech was identified as *Tritetrabdella taiwana*, and was deposited in the Zoological Collection of Kyoto University (KUZ Z196). Its COI sequence was deposited in GenBank (AB685259).

Tritetrabdella taiwana is only recorded in East and South East Asia (Lai et al. 2011. ZooKeys 139:1–22). This species inhabits moist forests in mountains of low to middle-elevation and attaches to substrates like leaf litter, grasses, and bushes on the ground (Lai et al. 2011, *op. cit.*). A detailed description of this species is limited to a few publications from Taiwan (Lai and Chan 2010. Leech Fauna of Taiwan. National Taiwan University Press, Taiwan. 118 pp.; Lai et al. 2011, *op. cit.*). Amphibians are believed to be the primary host of this terrestrial blood-sucking leech as this species has usually been recorded to parasitize anurans in Taiwan (Lai et al. 2011, *op. cit.*). *Duttaphrynus melanostictus* is a newly reported host for this leech species.

YAN-LING YUEN, School of Biological Sciences, Kadoorie Biological Sciences Building, University of Hong Kong, Hong Kong, China (e-mail: elaineyuen2003@yahoo.com.hk); **TAKAFUMI NAKANO**, Department of Zoology, Graduate School of Science, Kyoto University, Kyoto 606-8502, Japan (e-mail: nakano@zoo.zool.kyoto-u.ac.jp).

ECNOMIOHYLA MIOTYMPANUM (Small Eared Treefrog). PREDATION. Numerous aquatic insects have been reported as anuran predators (Duellman 2001. The Hylid Frogs of Middle America, 2nd ed. SSAR Contributions to Herpetology, No. 18. Lawrence, Kansas. 1159 pp.; Duellman and Trueb 1994. Biology of Amphibians. Johns Hopkins Univ. Press, Baltimore, Maryland. 670 pp.). *Ecnomiohyla miotympanum* is endemic to Mexico, and inhabits pine-oak and cloud forest in the Sierra Madre Oriental from the states of Nuevo León and Chiapas to Veracruz (Duellman 2001, *op. cit.*). On 16 March 2008 during fieldwork at Rancho Badillo (20.73°N, 98.81°E; WGS84; elev 1930 m), Municipality of Eloxochitlan, Hidalgo State, at 2030 h, we observed an adult *E. miotympanum* (CIB 3040, Centro de Investigaciones Biológicas, Universidad Autónoma del Estado de Hidalgo) being preyed upon on by a giant water bug of the family Belostomatidae (33.5 mm length; 1.4 g). The frog (44.0 mm SVL; 5.2 g;) was caught in the middle of the water body (Fig. 1). This is the first report of predation on *E. miotympanum* by an aquatic insect in the state of Hidalgo, México. We thank Diversidad Biológica del Estado de Hidalgo and FOMIX-CONACYT- HIDALGO 43761, 95828, and S52552-Q for funding our fieldwork.

URIEL HERNÁNDEZ SALINAS (uhernndez3@gmail.com), **AURELIO RAMÍREZ BAUTISTA** (aurelior@uaeh.edu.mx), **LUIS M. BADILLO SALDAÑA** (luismbadillosal@hotmail.com), and **DANIEL LARA TUFIÑO** (hidra127@hotmail.com) Centro de Investigaciones Biológicas (CIB), Universidad Autónoma del Estado de Hidalgo, A.P. 1-69 Plaza Juárez, C.P. 42001, Pachuca, Hidalgo, México.

EUPHLYCTIS CYANOPHLYCTIS (Indian Skipper Frog). PREDATION. Many vertebrates, invertebrates, and carnivorous plants prey on amphibians, which are generally small to moderate in size and have soft skin (Duellman and Trueb 1994. Biology of Amphibians. John Hopkins University Press, Baltimore, Maryland. 670 pp.). During the breeding season, adults, tadpoles, and metamorphosing young are concentrated and are easily acquired meals for predators (Duellman and Trueb 1994, *op. cit.*). Many authors suggest that the breeding strategies of anurans expose them to potential predation (Pough et al. 1992. *In* M. E. Feder and W. W. Burggren [eds.], Environmental Physiology of the Amphibians, pp. 395–436. University of Chicago Press, Chicago, Illinois; Toledo 2003. Phyllomedusa 2:105–108). Water bugs, (*Lethocerus* spp.) are known predators of larval and adult frogs (De-Andrade et al. 2010. Herpetol. Notes 3:53–54; Toledo 2003, *op. cit.*). Reported herein is the first record of predation of *Euphlyctis cyanophlyctis* by *Lethocerus indicus*.

Euphlyctis cyanophlyctis is widely distributed in Sri Lanka and occurs up to 1710 m elev. (Manamendra-Arachchi and Pethiyagoda 2005, 2006. Sri Lankawe Ubhayajeeven "Amphibian Fauna of Sri Lanka." Wildlife Heritage Trust of Sri Lanka). *Lethocerus indicus* and *E. cyanophlyctis* are common inhabitants of seasonal ponds in the Mihintale Sanctuary where *E. cyanophlyctis* are known to breed (Dissanayake et al. 2011. Diversity, Abundance, and Distribution of Amphibians in the Mihintale Sanctuary, Sri Lanka. 16th International Forestry and Environment Symposium 2011. 43).

On 12 Oct 2011 at 2245 h, we observed an adult *L. indicus* (71 mm total length) feeding on an adult male *E. cyanophlyctis* (32 mm SVL) on the margins of a seasonal pond located at Mihintale Sanctuary (8.34968°N, 80.50449°E; 117.6 m elev.), in the region of Anuradhapura, Sri Lanka. The *E. cyanophlyctis* was already dead, with the *L. indicus* biting its right side just below the head region (Fig. 1). The frog was strongly held by the forelimbs of the *L. indicus.* This observation lasted 20 minutes and occurred at

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Fig. 1. *Ecnomiohyla miotympanum* being predated by Giant Water Bug (Belostomatidae) in the locality of Municipality of Eloxochitlan, Hidalgo State, México.

Fɪɢ. 1. Predation of *Euphlyctis cyanophlyctis* by *Lethocerus indicus* observed at Mihintale Sanctuary, Sri Lanka.

the beginning of the rainy period immediately after a drought season of about five months.

The effect that predation has on amphibian populations in Sri Lanka is not well studied. Therefore, further studies should be conducted in this area. We thank L. J. Mendis Wickramasinghe for valuable comments, and K. G. D. de. A Abeysinghe and C. Hassapakis who enriched this work.

DUMINDA S. B. DISSANAYAKE (e-mail: duminda.rusl@gmail.com), **S. M. WELLAPULI-ARACHCHI**, and **C. S. V. PATHIRANA**, Department of Biological Sciences, Faculty of Applied Sciences, Rajarata University of Sri Lanka, Mihintale, Sri Lanka.

HYPEROLIUS DISCODACTYLUS (Disc-fingered Reed Frog). PARACHUTING. Several species of frogs are capable of a controlled aerial descent (for definition see Dudley et al. 2007. Ann. Rev. Ecol. Evol. Syst. 38:179–201) which includes gliding flights and parachuting. Traditionally, a gliding flight has been characterized by a descent angle of less than 45° to the horizontal whereas in parachuting, the descent angle is more than 45° (Oliver 1951. Am. Nat. 85:171–176). The most famous of these species are probably the Southeast Asian flying frogs of the genus *Rhacophorus*, but controlled aerial descent is also known from several other Asian members of the Rhacophoridae, a number of New World hylids, a single member of the Eleutherodactylidae (*Eleutherodactylus coqui*), and a single member of the Hyperoliidae (*Hyperolius castaneus*) (Dudley et al. 2007, *op. cit.*; Mendelson et al. 2008. J. Herpetol. 42:750–759; Stewart 1985. J. Herpetol. 19:391–401). During field work in Rwanda in October 2010, I tested the aerial performance of *Hyperolius discodactylus*, a species endemic to the montane forests of the Albertine Rift in Central Africa. I collected four individuals in Nyungwe National Park in southern Rwanda in October 2010 and transported them to a laboratory in the city of Butare. To test their ability to perform parachuting flights, I positioned them at a height of ca. 2 m above the floor and made them jump to the ground by touching their back. Subsequent to the initial leap, the frogs flexed their limbs, spread the fingers and toes and held hands and feet in the frontal plane of the body, which was oriented parallel to the ground (Fig. 1). They remained in this stable posture until they landed on the ground. This posture is known from other species of frogs during controlled aerial descent and has been shown to be best suited for maneuvering in the air (Emerson and Koehl 1990. Evolution 44:1931–1946). Two of the frogs were released in

Fɪɢ. 1. Parachuting adult male *Hyperolius discodactylus* from Rwanda.

the air upside down in a second test. In the air, the frogs turned their bodies by rapid movements of the limbs and quickly assumed the parachuting posture described above. Because the frogs always landed within a horizontal distance of 2 m from the starting point, I choose the term parachuting for the kind of the aerial descent reported here.

Currently, 129 species of *Hyperolius* are considered valid (Frost 2011. Amphibian Species of the World: an Online Reference. Version 5.5 [31 January, 2011]. Electronic database accessible at http://research.amnh.org/vz/herpetology/amphibia/. American Museum of Natural History, New York). Many of these species live in the canopy layer and show morphological characteristics—such as extensive webbing between fingers and toes—that suggest an ability to perform controlled aerial descents. Therefore, controlled aerial descent might be more widespread within *Hyperolius* than currently known.

J. MAXIMILIAN DEHLING, Institut für Integrierte Naturwissenschaften, Abteilung Biologie, Universität Koblenz-Landau, Universitätsstraße 1, 56070 Koblenz, Germany; e-mail: megophrys@gmail.com.

ISTHMOHYLA PSEUDOPUMA (Meadow Treefrog). PREDATION. Likely predators of *Isthmohyla pseudopuma* include mammals, birds, snakes, aquatic insects, and even conspecifics (tadpole cannibalism) (Duellman and Trueb 1994. Biology of Amphibians. John Hopkins University Press, Baltimore, Maryland. 670 pp.; Pounds 2000. *In* N. M. Nadkarni and N. T. Wheelwright [eds.], Monteverde: Ecology and Conservation of a Tropical Cloud Forest, pp. 149–177. Oxford Univ. Press, New York; Savage 2002. The Amphibians and Reptiles of Costa Rica: A Herpetofauna Between Two Continents, Between Two

FIG. 1. Corpse of an *Isthmohyla pseudopuma* (Meadow Treefrog) that was observed in the cheliped of an *Epibolocera sinuatifrons* (Freshwater Crab) as it fed on the dead frog. Note the limited amount of decomposition, suggesting predation and not scavenging.

Seas. Univ. Chicago Press, Chicago, Illinois. 934 pp.). Crustacean predation of anurans has been documented during the pre-hatching, tadpole, and adult stages of life (Gutsche and Elepfandt 2007. Herpetol. Rev. 38:198–199; Hayes 1983. Biotropica 15:74–76; Heather and John 2000. Crustaceana 73:1023–1025); however, this is the first predation account in which a freshwater crab (*Epibolocera sinuatifrons*) was found preying on an adult *I. pseudopuma*.

Isthmohyla pseudopuma use lentic water such as small ponds, puddles, and water filled depressions for egg deposition (Savage 2002, *op. cit.*). It was in such a puddle in the Monteverde Cloud Forest Biological Reserve, Puntarenas, Costa Rica (Sendero Camino trail; 6.679519°N, 81.223459°E; ca. 1600 m elev.) that we observed presumed predation of *I. pseudopuma.* On 1 June 2011 at 0900 h we encountered an *E. sinuatifrons* (39.5 mm carapace width) clutching the upper torso of an adult *I. pseudopuma* (33.3 mm SUL) in its left cheliped. From this observation we assume predation and consumption of the anuran. The puddle had been visited previously and found to contain two *E. sinuatifrons* and four clutches of *I. pseudopuma* eggs. Based on the absence of the *I. pseudopuma* corpse the previous night, the lack of decomposition (Fig. 1), and the observation of chorusing males and amplectic pairs the previous evening, we suggest the crab predated the frog during the breeding chorus. The puddle was minimally covered by about 40% canopy and was approximately 1 m x 0.3 m x 0.1 m deep. This observation documents yet another predation risk for *I. pseudopuma.*

JOY M. WARRINGTON (e-mail: jwarrington@nnu.edu) and JOHN O. COSSEL JR., Department of Biology, Northwest Nazarene University, 623 South University Boulevard, Nampa, Idaho 83686, USA.

LEPTOBRACHIUM PULLUM (Vietnam Spadefoot Toad). SITUS INVERSUS. On 24 May 2009 a *Leptobrachium pullum* tadpole was collected from the Nui Ong Nature Reserve in Binh Thuan Province in Southern Vietnam (11.0657°N, 107.7360°E). Upon later examination of the preserved specimen (AMS R 173274; Gosner Stage 29 [Gosner 1960. Herpetologica 16:183–190], total length = 79.5 mm), it was observed to have a reversal in the position of external morphological characters including a dextral spiracle and sinistral vent tube. All other *Leptobrachium*

tadpoles examined from this site and others throughout Vietnam and Cambodia (N = 46) had a sinistral spiracle, common to most tadpoles, and dextral vent tube, characteristic of the family Megophryidae (McDiarmid and Altig 1999. Tadpoles: The Biology of Anuran Larvae. Univ. Chicago Press, Chicago, Illinois. 444 pp.). Further examination also found that the internal gut coil was reversed and ran in a clockwise direction and that the kidney and associated fat bodies were larger on the left side. Most tadpoles have right-left asymmetry in the size of the kidneys and associated fat bodies, being larger toward the dextral side of the body (Malashichev and Wassersug 2004. BioEssays 26:512–522). This reversal of major asymmetric viscera is a relatively rare congenital disorder known as situs inversus.

LAKSHMI SUNDERASAN, School of Biological Sciences, The University of Sydney, NSW 2006, Australia (e-mail: lsun7424@uni.sydney.edu.au); JODI J. L. ROWLEY, Australian Museum, 6 College St, Sydney, NSW 2010, Australia (e-mail: jodi.rowley@austmus.gov.au).

LEPTODACTYLUS LATRANS (Caçote Frog). PREDATION. *Leptodactylus latrans* is a euryphagous anuran that feeds on small frogs, arthropods, fish, mollusks, and annelids (Meneyro et al. 2004. Iheringia, Sér. Zool., Porto Alegre 94[1]:57–61; Sanabria et al. 2005. Rev. Peruana Biol. 12[3]:472–477; Solé et al. 2009. Herpetol. Notes 2:9–15; Teixeira and Vrcibradic 2003. Cuad. Herpetol. 17[1-2]:111–118). On 24 Nov 2011, at 2230 h, in the "Sítio Pinheiros" (7.364°S 39.342°W, WGS84; 693 m elev.), district of Caldas, Barbalha City, Ceará, Brazil, we captured a *Leptodactylus latrans* (79.5 mm SVL) attempting to consume a *Hypsiboas raniceps* (66 mm SVL) (Fig. 1). Although there are records of small frogs in the diet of *L. latrans*, this event is significant because of the size of prey in relation to the predator and because this is the first report of *H. raniceps* in the diet of *L. latrans*. Additionally, these two species are generally found in different ecological niches (Silva and Santos 2011. Herpetologia no Estado de Pernambuco. 1:211–217. IBAMA, Brasília). The specimens were deposited in the Herpetological and Paleoherpetological collection of Federal Rural University of Pernambuco - UFRPE, Recife, Brazil (CHPUFRPE 981 *Leptodactylus latrans*; CHPUFRPE 982 *Hypsiboas raniceps*). This field work was authorized by ICMBio, Permit No. 27143-1.

LEONARDO DA SILVA CHAVES (e-mail: l_schaves@yahoo.com.br), ELIANA SOFIA FAJARDO VEGA (e-mail: sofi.fajardo@gmail.com), CARINA CARNEIRO DE MELO MOURA (e-mail: carinacarneiro@yahoo.com.br), SÉRGIO LUIZ DA SILVA MUNIZ (e-mail: sergiomuniz86@gmail.com),

FIG. 1. Predation of *Hypsiboas raniceps* by *Leptodactylus latrans* in Barbalha, Ceará, Brazil.

and **GERALDO JORGE BARBOSA DE MOURA** (e-mail: geraldojbm@
yahoo.com.br), Universidade Federal Rural de Pernambuco, Paleoherpe-
tological and Herpetological Laboratory, UFRPE, Rua Dom Manoel de Me-
deiros, Dois Irmãos - CEP: 52171-900, Recife, PE, Brazil.

LEPTODACTYLUS MYSTACEUS (Basin White-lipped Frog).
PREDATION. Anurans are known to be preyed upon by a vari-
ety of vertebrates and invertebrates (Toledo et al. 2007. J. Zool.
271:270–277). Herein we here report predation by the amblypy-
gid *Heterophrynus* sp. of an adult *Leptodactylus mystaceus*. This
species is a medium-sized anuran (males 43–50 mm, females
47–60 mm) (Lima et al. 2006. Guia de Sapos da Reserva Ducke
– Amazônia Central / Guide to the Frogs of Reserva Adolpho Du-
cke – Central Amazonia. Áttema Design Editorial, Manaus, Bra-
zil. 168 pp.) known from Colombia, Venezuela, French Guiana,
Guyana, Suriname, northeastern and central Brazil, Ecuador,
Peru, and Bolivia (Frost 2011. Amphibian Species of the World:
an Online Reference. Version 5.5 [31 January 2011]. Electronic
database accessible at http://research.amnh.org/vz/herpetolo-
gy/amphibia/. American Museum of Natural History, New York).
It inhabits primary and secondary tropical rainforests, forest
edge, and savannah enclaves in forest, flooded, and open envi-
ronments. It lives on the ground around temporary ponds and
other water bodies. It is somewhat adaptable to human modi-
fication of its habitat (Heyer and Rodrigues 2010. *In* IUCN 2011.
IUCN Red List of Threatened Species. Version 2011.2).

On 23 Nov 2011 at 2030 h, we found an adult *L. mystaceus*
being preyed upon by an adult *Heterophrynus* sp. at the edge of
a temporary stream on the forest floor in the proximity of Cave
Planaltina, Brasil Novo – Pará, Brazil (3.3761°S, 52.5761°W). The
size relationship observed in this predation event is consistent
with Toledo et al. (2010. Herpetol. Rev. 41[3]:340–341), where
solitary, venomous invertebrate predators generally eat prey that
are a little shorter or equal to their own size.

EMIL JOSÉ HERNÁNDEZ-RUZ (e-mail: emilhjh@yahoo.com), **EL-
CIOMAR ARAUJO DE OLIVEIRA** (e-mail: ramoiclebio@yahoo.com.br),
CLAUDIA LIZ BAIA TELES, MARCOS DIONES FERREIRA SANTANA,
and **KLEITON RABELO DE ARAÚJO**, Laboratório de Zoologia, Faculdade
de Ciências Biológicas, Universidade Federal do Pará, Campus de Altamira,
Rua Coronel José Porfírio, 2515 - CEP 68.372-040 - Altamira – PA, Brazil.

LIMNONECTES PALAVANENSIS (Smooth Guardian Frog). **AB-
ERRANT COLORATION.** *Limnonectes palavanensis* is a primary
forest leaf litter dwelling anuran (Inger and Stuebing 2005. A
Field Guide to the Frogs of Borneo, 2nd ed. Natural History Pub-
lications [Borneo] Sdn. Bhd. Kota Kinabalu. 201 pp.; Malkmus
et al. 2002. Amphibians and Reptiles of Mount Kinabalu [North
Borneo]. A.R.G. Gantner Verlag K.G. Ruggell. 424 pp.) that can
be found from near sea level to 1502 m elev. (Kueh et al. 2011.
Herpetol. Rev. 42:261) in Palawan of the Philippines, and Borneo
(Sabah and Sarawak of Malaysia, Brunei Darussalam, and Kali-
mantan of Indonesia) (Das 2007. A Pocket Guide: Amphibians
and Reptiles of Brunei. Natural History Publications [Borneo]
Sdn. Bhd. Kota Kinabalu. 200 pp.; Inger 2007. Systematics and
Zoogeography of Philippine Amphibia. Natural History Publica-
tions [Borneo] Sdn. Bhd. Kota Kinabalu. 370 pp.). *Limnonectes
palavanensis* is a small (to 40 mm SVL) anuran, which is recog-
nizable by a characteristic reverse V-shaped ridge in the middle
of its smooth and reddish to chocolate brown back with two
thin, unbroken dorsolateral groin folds, several posterior dorso-
lateral dark spots, limbs with dark brown crossbars, as well as
unmarked orange yellow chest, abdomen, and undersides of legs

(Inger 2005. The Systematics and Zoogeography of the Amphibia
of Borneo. Natural History Publications [Borneo] Sdn. Bhd. Kota
Kinabalu. 402 pp.; Malkmus et al. 2002, *op. cit.*). Herein we report
an aberrant color morph of *L. palavanensis*.

Two aberrantly colored adult *L. palavanensis* were collected
on 27 June 2008 (36 mm SVL; 5.5 g) and 2 Dec 2008 (32 mm SVL;
2.9 g), between 1900 and 2200 h, from among dead leaves be-
tween a forested hill slope (Geludu Hill) and a gravel village road
(Kinasaraban-Bundu Tuhan Road) (5.9989°N, 116.5377°E; 1280
m and 1319 m elev.), Bundu Tuhan, Ranau District, West Coast
Division, Sabah, Bornean Malaysia. The frogs had a dark green-
ish brown back with a white vertebral stripe, limbs with dark
greenish crossbars, and a fine white line on the upper surface of
each shin, besides the typical posterior dorsolateral dark spots
and ventral coloration of *L. palavanensis* (Fig. 1). The anurans
were void of the reverse V-shaped ridge on the back. The two
frogs were found together with typically colored individuals at
a high frequency of 0.29 for the occurrence of the aberrant color
morph in that population, and hence, excludes the causal fac-
tor of rare variation or random mutation. Further studies on the
factors and advantages of such a color morph in *L. palavanensis*
by revealing the form and microgeographical range of all color
morphs would be informative. Blackburn and Droissart (2008.
Herpetol. Rev. 39:208–209) suggested that color polymorphism
in anurans contributes towards crypsis, mimicry, and even apo-
sematism. The two specimens (27 June 2008: HEP00541, and 2
Dec 2008: HEP00759) were deposited in BORNEENSIS, the Bor-
nean reference collection of the Institute for Tropical Biology
and Conservation, Universiti Malaysia Sabah.

KUEH BOON-HEE (e-mail: kbhkelvin@hotmail.com), **ELANGKUMA-
RAN S/O SAGTIA SIWAN** (e-mail: ela_jeevan@yahoo.com), **NORASMIL IS-
MAIL** (e-mail: norasmilismail@yahoo.com.my), **JUELBER ALBERT** (e-mail:

Fig. 1. An aberrant color morph of *Limnonectes palavanensis* (left)
compared to a typically colored morph (right), Bundu Tuhan, ranau,
Sabah, Malaysia.

juelberalbert@gmail.com), **CINDY LAU EN SHING** (e-mail: cindyenxi@ho-tmail.com), and **VYNER BAYANG ANAK NGINDANG** (e-mail: peace87fe@yahoo.com), Institute for Tropical Biology and Conservation, Universi Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah, Malaysia.

LITHOBATES BERLANDIERI (Rio Grande Leopard Frog), ***DRYMOBIUS MARGARITIFERUS*** (Speckled Racer), and ***PANTHERA ONCA*** (Jaguar). **SCREAM-CALLING.** Scream-calling in non-social vertebrates (outside of reproductive behavior) is a behavior exhibited by prey that can 1) startle a predator into releasing the prey (startle response), and/or 2) attract a secondary predator (P2) causing the primary predator (P1) to release the prey. Scream-calling has been reviewed in neotropical frogs (Hödl and Gollman 1986. Amphibia-Reptilia 7:11–21) and the P2 condition has been tested in leopard frogs (*Lithobates pipiens*) being predated by gartersnakes (*Thamnophis sirtalis*) under the premise that snakes cannot hear the higher frequency pitch of a distress call and thus will not release a prey based on the call (Schuett and Gillingham 1990. Bull. Chicago Herpetol. Soc. 25:137–142).

Schuett and Gillingham (1990, *op. cit.*) listed three conditions that must be met to validate the presence of scream-calling: 1) a scream call attracts P2; 2) P1 releases the prey upon arrival of P2; and 3) prey escapes predation. Critical to the second condition is that P1 releases the prey prior to physical contact with P2 and exhibits defensive behavior towards P2, presumably distracting possible further predation to the calling prey. Schuett and Gillingham (1990, *op. cit.*) noted that a secondary, minimal startle response could be induced from vibrations created by the scream of the captured prey item. They suggested further testing was warranted in neotropical and temperate regions and with predators of both the prey and P1.

Compared to sympatric large felids, the diet of wild Jaguars (*Panthera onca*) is diverse, with amphibians and reptiles comprising a noticeable portion throughout its range (Brown and López González 2001. Borderland Jaguars: Tigres de la Frontera. Univ. Utah Press, Logan. 170 pp.). In this regard, chelonians appear to be favored (Emmons 1989. J. Herpetol. 23:311–314) followed by iguanas, crocodilians, and large boids. Brown and González (2001, *op. cit.*) mention a Jaguar taken in southern Arizona whose stomach contained numerous frogs of undetermined identity.

On 24 March 2001, a distress call was heard in the Jaguar exhibit at the Belize City Zoo, Belize. The source was determined to be a *Lithobates berlandieri* that had been captured by the hind leg by a *Drymobius magaritiferus* near a pool of water. At this point a video recorder was used to film the frog and snake. The Jaguar became aware of the scream-calls and made its way to within about 1.2 m of the outstretched frog and snake. A crowd of people then gathered and the Jaguar retreated. At this point the recording stopped. After a short while, the frog then struggled free from the snake before escaping the lunge of another *D. margaritiferus* and retreating into the pool with other frogs. A video recording of this event is available at: http://www.youtube.com/watch?v=y38UN6TUl-4.

Although it appears the snake did not release the frog in response to the arrival of the Jaguar, the event involves the appearance of a potential predator of the prey and the P1 after hearing the scream-call of the prey as described by Schuett and Gillingham (1990, *op. cit.*).

JOE FURMAN, 2511 Roy Circle, Houston, Texas 77007, USA (e-mail: wart.hog@comcast.net); **ROBERT A. VILLA**, 811 N. 10th Ave., Tucson, Arizona 85705, USA (e-mail: cascabel1985@gmail.com).

LITORIA MOOREI (Motorbike Frog). **TEMPERATURE.** Many anurans have some form of resistance to evaporative water loss through the skin (see Tracy et al. 2010. Comp. Biochem. Physiol. A 150:102–108). Very high resistances occur in many burrowing species that form cocoons (Withers 1998. Aust. J. Zool. 46:405–418) but resistances are also relatively high in arboreal frogs (*Litoria* species) in northern Australia from seasonally arid, hot environments (Tracy et al. 2010, *op. cit.*). *Litoria* species from cooler areas generally have lower resistance but there are exceptions: e.g., *Litoria adelaidensis* from south-western Australia has a resistance approximately ten times that of the co-occuring and co-distributed *Litoria moorei* (Tyler and Doughty 2009. Field Guide to Frogs of Western Australia. Western Australian Museum, Perth; Withers 1998, *op. cit.*).

On 28 Dec 2011 we noticed a *Litoria moorei* in a curled piece of bark suspended in a passion fruit vine growing over two dead shrubs about 2.2 m above the ground in a suburban garden in Perth, Western Australia (31.93259°S, 115.81463°E). The frog was in the classic water conserving posture and stayed in that position from when it was first observed at 0830 h until it was last seen at 1911 h. We measured air temperature in the shaded section of the folded bark, ≈ 0.5 cm above the frog. Temperatures ranged from 34.1° to 40.7°C, averaging 37.7°C over 7 measurements made roughly hourly from 1130 to 1900 h. From about 1300 to 1900 h the left side of the head and body were in direct sun with about 1/3 of the upper body surface exposed for most of that time. At the Swanbourne climate station (31.96°S, 115.76°E, ca. 6 km SW of the observation site), shade temperatures peaked at 39.1°C and in the observation period (0830 to 1930 h) averaged 34.4°C (23.3° to 39.1°C), relative humidities averaged 21% (10–34%) and wind speeds 4.5 m.s^{-1} (1.9–6.7; data from http://www.bom.gov.au/products/IDW60901/IDW60901.94614.shtml sites accessed 29 Dec 2011). These represent extreme conditions for Australian frogs (Tracy et al. 2010, *op. cit.*) and are close to or above Critical Thermal Maxima for many frog species from eastern Australia (Brattstrom 1970. Comp. Biochem. Physiol. 35:69–103).

The cutaneous resistance to water loss in *L. moorei* is the second lowest reported in Australian tree frogs (0.5 s.cm^{-1}; Tracy et al. 2010, *op. cit.*) and based on predicted patterns of water loss for frogs at air temperatures of 30°C, this species (a comparable sized frog captured that night weighed 28.69 g) would be at 70% of fully hydrated body mass in about 1 hour (Tracy et al. 2010, *op. cit.*). Main and Bentley (1964. Ecology 45:379–382), reported that weight losses of 31–45% were lethal for *Litoria moorei* (as *Hyla moorei*). If water was evaporating freely from the skin, this frog should have suffered extreme water loss leading to lethal levels of dehydration. That it did not, might indicate a facultative capacity to alter skin resistance not detected in the conditions used by Withers (1998, *op. cit.*). It is impossible to reliably estimate body temperature but if this was close to air temperatures then this frog must also have been close to its anticipated critical thermal maximum (mid 30s to low 40s °C for species from warm to hot locations (Tracy et al. 2008, *op. cit.*; 36.2°C for a closely related species, *Litoria aurea*, from eastern Australia, acclimated at 30°C, Brattstrom 1970, *op. cit.*).

Murray et al. (2011. J. Appl. Ecol. 48:163–173) reported chytrid fungus infections in *Litoria moorei* at several locations across south-western Australia and predicted a broad occurrence of

chytrid in south-western Australia. But, there is no evidence of chytrid induced, population decline in *L. moorei* or any other frogs species in this area (Hero et al. 2006. Pacific Cons. Biol. 12:315–320). This may be because frogs often voluntarily expose themselves to high temperatures: coincidentally, or, deliberately, eliminating chytrid fungus infections (Puschendorf et al. 2011. Cons. Biol. 25:956–964; Woodhams et al. 2003. Dis. Aquat. Org. 55:65–67).

Chance observations of frog behavior might give us useful insights into field capacities for frogs not determined by laboratory trials and should also caution us against rash conclusions about impacts of climate change on temperate faunas—frogs might be tougher than we think!

BEVERLEY P. ROBERTS and **J. DALE ROBERTS** (e-mail: dale.roberts@uwa.edu.au), School of Animal Biology M092, University of Western Australia, 35 Stirling Highway, Crawley, WA, 6009, Australia.

PELOBATES CULTRIPES (Western Spadefoot Toad). **DEPREDATION.** One factor in the decline of amphibian populations is the presence of invasive alien species. In addition to invasive alien species, there are examples of native species that have experienced significant population growth and negatively impacted amphibians. The Wild Boar (*Sus scrofa*), native to Europe, as well as domestic varieties descended from it, forming feral populations in various parts of the world, and is considered one of the "100 world's worst invasive species" (Lowe et al. 2004. 100 of the World's Worst Invasive Alien Species. A Selection from the Global Invasive Species Database. The Invasive Species Specialist Group. Species Survival Commission. IUCN. 12 pp. www.issg.org/booklet.pdf). In Spain, as in many other European countries, Wild Boar populations have increased rapidly in recent decades (Rosell et al. 2001. Galemys 13:1–25), leading to an increase in damage to meadows by the rooting activities of the animals. The negative impact on the natural environment is well known (Massei and Genov 2004. Galemys 16:135–145) and their detrimental effect on native herpetofauna has been documented (Jolley et al. 2010. J. Mammal. 91:510–524).

Traces of the rooting activities of the wild boar have become evident in recent years in the Natural Park of Corrubedo (Ribeira, A Coruña, Spain), making this activity a clear threat to amphibian populations, as observed throughout Galicia. Furthermore, in this natural area lives one of the few surviving Galician populations of *Pelobates cultripes*, considered the most endangered amphibian of Galicia (Galán et al. 2010. Bol. Asoc. Herpetol. Esp. 21:90–99), and listed as vulnerable by regional legislation (Xunta de Galicia 2007. Diario Oficial de Galicia 89:7409–7423).

On 23 Feb 2011, the remains of four adult *P. cultripes* were found around the periphery of one of the ponds where this species breeds (Vilar Pond, Natural Park of Corrubedo; 42.5567°N, 9.0228°W). These remains were found in a heavily rooted area showing numerous wild boar tracks, which covered nearly the entire periphery of the pond and nearby areas. The remains consisted of the heads of four adult *P. cultripes*, two of which had adherent pieces of skin (Fig. 1). Along with the heads were remains of the viscera. This date coincides with the breeding period of the species in the area, suggesting these individuals were likely breeding adults.

In the same pond in 2008 several adult *P. cultripes* were found depredated, but with signs of having been eaten by the American Mink (*Neovison vison*), from the marks left on the bodies (Galán and Ferreiro 2010. Bol. Asoc. Herpetol. Esp. 21:30–34). In the present case, however, the many tracks of Wild Boar found near the remains, together with the almost total consumption of the toads, suggest that the predator was the Wild Boar. During March 2008, a group of five Wild Boars were seen on the shore of the pond, rooting in the ground.

Vilar Pond is one of the few areas in the Natural Park of Corrubedo where *P. cultripes* still breeds, but this area has shown a sharp decline of this species in recent years (Galán 2006. Guía dos Anfibios e Réptiles. Parque Natural do complexo dunar de Corrubedo e lagoas de Carregal e Vixán. Xunta de Galicia. Dir. Xeral Conservación Natureza, A Coruña. 91 pp.), as has the whole of Galicia. In recent years an attempt has been made to quantify the number of *P. cultripes* in this area by counting larvae in the months of their maximum presence in aquatic environments (February to April). Samples were taken using a hand net, both at Vilar Pond in the southern part of the Park, where the adult toads were found depredated, and at five ponds in a sandy area located in Olveira in the northern part of the Park. In Olveira there was a notable presence of Wild Boar footprints, wallows, and rooting activities. The sampling results were expressed as the number of larvae captured by hand net passes (number of larvae/number of passes of hand net). During 2006 to 2011, the hand net was passed 100–150 times at each pond, making a similar sampling effort between years and different areas. At Vilar Pond, the number of larvae per pass of the hand net was: 2006: 1.71; 2007: 2.28; 2008: 0.12; 2009: 0.04; 2010: 0.07; 2011: 0.03. In the ponds of Olveira, the number of larvae per pass was: 2006: 0.65; 2007: 0.19; 2008: 0.18; 2009: 0.04; 2010: 0.04; 2011: 0.03.

According to these data, after a relatively high number of larvae during 2006 and 2007, especially in the Vilar Pond, the number decreased markedly, remaining low or very low during 2008–2011. Although quantification of the presence of Wild Boar during these years was not possible, the presence of tracks, trails, and rooting was much lower during 2006 and 2007 than in the following years. The number of observations of Wild Boar in the Park also increased during that time.

During these years, in the Natural Park of Corrubedo there were no other environmental changes that might account for the observed decline in the number of *P. cultripes* larvae, with the exception of the presence of the invasive alien species *Neovison vison.*

The European Wild Boar eats several amphibian species, such as anurans (Kuzmin 1999. The Amphibians of the Former

FIG. 1. Adults of *Pelobates cultripes* devoured by Wild Boar (*Sus scrofa*) in the Natural Park of Corrubedo (Galicia, Spain). These remains were found among an intensely impacted rooting area at the periphery of an amphibian breeding pond.

Soviet Union. Pensoft Publishers, Sofia, Bulgaria. 538 pp.) or Fire Salamanders (Carretero and Rosell 1999. Herpetol. Rev. 30:161). Consumption of European spadefoot toads by boars has been reported in *P. fuscus* (Nöllert 1984. Die Knoblauchkröte. *Pelobates fuscus*. A. Ziemsen Verlag, Wittenberg Luthersadt, Germany. 103 pp.), and *P. cultripes*, even in the Iberian Peninsula (Recuero 2010. *Pelobates cultripes*. Enciclopedia Virtual de los Vertebrados Españoles. Museo Nacional de Ciencias Naturales, Madrid. www.vertebradosibericos.org). However, the most comprehensive study on the effect of *Sus scrofa* (the feral domestic form) on North American *Scaphiopus* and *Spea* is that of Jolley et al. (2010, *op. cit.*). They examined the stomach contents of 68 Wild Boars from the southern United States, and highlighted the vulnerability of *Scaphiopus holbrookii* to depredation by the wild pig because of their terrestrial habits and massive displacements during migrations to breeding ponds (behavior similar to *P. cultripes*). For example, a single wild pig had eaten 49 *S. holbrookii*. This spadefoot was the most prominent of all species of amphibians consumed by pigs (21.4% of amphibians and reptiles and 4.4% of total prey consumed).

Studies similar to those of Jolley et al. (2010, *op. cit.*) have not been carried out in Galicia or Spain, but in view of the observations made at Corrubedo Natural Park the predation exerted by the wild boar may be a serious factor threatening this endangered amphibian.

PEDRO GALÁN, Departamento de Bioloxía Animal, Bioloxía Vexetal e Ecoloxía, Facultade de Ciencias, Universidade da Coruña, Campus da Zapateira, s/n, 15071-A Coruña, Spain; e-mail: pgalan@udc.es.

PHYSALAEMUS ALBONOTATUS (Menwig Frog). **PREDATION.**
Anurans are commonly predated by several species of vertebrates and invertebrates (Toledo et al. 2007. J. Zool. 271:170–177). Among the invertebrates, water bugs (Hemiptera: Belostomatidae) and spiders (Araneae) are the main predators of frogs in and out of water, with an important role in population control (Toledo 2005. Herpetol. Rev. 36[4]:395–400). *Physalaemus albonotatus* occurs in the states of Mato Grosso and Mato Grosso do Sul in Brazil, and regions of Chaco in Paraguay, Bolivia, and Argentina, adapting well to human disturbances (Aquino et al. 2004. IUCN Red List of Threatened Species. Ver. 2011.2. http://www.iucnredlist.org/). The only published predation of this species was by birds (Rodrigues and Arruda 2006. Herpetol. Rev. 37[2]:212).

On 17 March 2011 at 1709 h in a Cerrado area in central-western Brazil, we recorded an adult *P. albonotatus* being preyed upon by a spider of the family Lycosidae (Fig. 1). The event was observed at the margins of a swamp surrounded by exotic grass (*Urochloa* sp.), in the county of Vincentina, state of Mato Grosso do Sul (22.4841°S, 54.3946°W). Although this event is the first record of spider predation on *P. albonotatus*, spiders are considered an important predator of small frogs, with several records in the Neotropical region (Menin et al. 2005. Phyllomedusa 4[1]:39–47).

JOSÉ LUIZ MASSAO M. SUGAI (e-mail: jlmassao@gmail.com), **MAURÍCIO NEVES GODOI** (e-mail: mauricioecologia@hotmail.com), **FERNANDO IBANEZ MARTINS** (e-mail: fimquelonio@gmail.com), and **HUGO BORGHEZAN MOZERLE** (e-mail: hugobio_ha@hotmail.com), Pós Graduação em Ecologia e Conservação, Universidade Federal de Mato Grosso do Sul, Cidade Universitária, Caixa Postal 549, CEP 79070-900, Campo Grande, MS, Brazil.

PHYSALAEMUS CUVIERI (Cuvier's Foam Froglet). **ALBINISM.**
Physalaemus cuvieri is a small, nocturnal frog that occurs in Brazil and other portions of South America (Haddad et al 2008. Atlantic Forest Amphibians. Neotropica Press, São Paulo. 243 pp.; Frost 2011. Amphibian Species of the World: an Online Reference. Version 5.5 (31 January 2011). Electronic database accessible at http://research.amnh.org/vz/herpetology/amphibia/. American Museum of Natural History, New York). Herein we report an albino adult male *P. cuvieri* (23.8 mm SVL; Fig. 1) collected during the rainy season on 19 Nov 2010 in a little stream associated with a swamp in a transitional area with Atlantic Forest fragment, near the city of Morro do Pilar, near Serra do Cipó National Park, state of Minas Gerais, Brazil (19.1417°S, 43.3935°W, 724 m elev.). This specimen was observed in a nocturnal chorus on wet ground and was associated with conspecifics and 10 additional anuran species: *Dendropsophus branneri, D. elegans, D. minutus, Hypsiboas albopunctatus, H. pardalis, Scinax eurydice, S. fuscovarius, Phyllomedusa burmeisteri, Leptodactylus fuscus,* and *L. labyrynthicus.* The specimen had opaque eyes, a roseate coloration of the body, and blood vessels visible through the skin. Albinism in anurans has been reported in tadpoles, e.g., *Hypsiboas semilineatus* (Santos et al. 2010. Herpetol.

Fɪɢ. 1. Spider of the Lycosidae family preying on a juvenile *Pyhsalaemus albonotatus*, in the municipality of Vincentina, state of Mato Grosso do Sul, Brazil.

Fɪɢ. 1. Adult male albino *Physalaemus cuvieri* from Minas Gerais, Brazil.

Rev. 41:474), and adults, e.g., *Tomopterna cryptotis* (Wojnowski et al. 2010. Herpetol. Rev. 41:482). Sazima and Di Bernardo (1991. Mem. Inst. Butantan 53:167–173) suggested that albinism should be more frequent in nocturnal and cryptic species, but this hypothesis is difficult to evaluate in anurans (Toledo et al 2011. Herpetol. Notes 4:145–146). The specimen was deposited in the herpetological collection of Museu de Ciências Naturais da Pontifícia Universidade Católica de Minas Gerais (MCNAM 15022), Belo Horizonte, Minas Gerais, Brazil.

RONALD R. CARVALHO JR. (e-mail: ronald.sapiens@gmail.com), **SARA RODRIGUES ARAÚJO** (e-mail: sararaujo@yahoo.com.br), and **LIBIA KENIA PEREIRA** (e-mail: libiajp@hotmail.com), Sapiens Soluções Ambientais Ltda, 30220-260, Belo Horizonte, Minas Gerais, Brazil.

RHINELLA GRANULOSA (Common Lesser Toad), *XENODON MERREMII*. PREDATION. Anurans are important prey for numerous taxa, and are predated in all life stages from eggs to adults (Duellman and Trueb 1994. Biology of Amphibians. Johns Hopkins University Press, Baltimore, Maryland. 670 pp.; Wells 2007. The Ecology and Behavior of Amphibians. Univ. Chicago Press, Chicago, Illinois. 1148 pp.). Toads from the genus *Bufo* (= *Rhinella*) are described as the preferred prey of *Xenodon merremii*, which is immune to their cutaneous toxins (Vanzolini et al. 1980. Pap. Avul. Zool. 34:1–9). This diurnal snake is widely distributed in South America, occurring from the Guianas to Argentina, mainly in open areas (Hoogmoed 1985. Zool. Meded. 8:79–88; Marques et al. 2001. Serpentes da Mata Atlântica - Guia Ilustrado. Editora Holos. Ribeirão Preto, São Paulo. 184 pp.; Vanzolini et al. 1980, *op. cit.*). *Rhinella granulosa* is distributed in

Fig. 1. A) Adult *Rhinella granulosa* being predated by an adult *Xenodon merremii,* in a fragment of the Atlantic Forest in the municipality of Macaíba, Rio Grande do Norte state, Brazil; B) View of the snake and toad after regurgitation.

northeastern Brazil, predominantly in the Caatinga domain, in the states of Minas Gerais, Bahia, Espírito Santo, Alagoas, Ceará, Paraíba, Pernambuco, Piauí, Rio Grande do Norte, and Sergipe (Narvaes and Rodrigues 2009. Arq. Zool. 40[1]:1–7). Here we report predation of an adult *R. granulosa* by *X. merremii*.

On 21 Aug 2011 at ca. 1500 h, at Mata do Olho D'água in the municipality of Macaíba in Rio Grande do Norte, Brazil (93.24142°N, 224.8828°W, WGS84; elev. 40 m), we observed a *X. merremii* on the edge of a trail, under direct sunlight on exposed soil. This snake grabbed a *R. granulosa* by its forelimbs with the ventral region facing upwards (Fig. 1). After the snake totally consumed its prey, both were collected and taken to the laboratory and deposited together in the Herpetological Collection of the Department of Botany, Ecology and Zoology at the Federal University of Rio Grande do Norte, Brazil (CHBEZ 3779). This is the first report of the predation of *R. granulosa* by *X. merremii* in the Northeastern Atlantic Forest.

MATHEUS MEIRA RIBEIRO (e-mail: matheusbiologia@gmail.com), and **ELIZA MARIA XAVIER FREIRE** (e-mail: elizajuju@ufrnet.br), Laboratório de Herpetologia, Departamento de Botânica, Ecologia e Zoologia, Centro de Biociências, Universidade Federal do Rio Grande do Norte, Campus Universitário, Lagoa Nova, 59072–970, Natal, Rio Grande do Norte, Brazil.

RHINELLA JIMI (Cururu Toad). DIET. *Rhinella jimi* is a euryphagous toad that feeds on centipedes, insects, spiders, frog, small snakes, small rodents, and bats (Gouveia et al. 2009. Herpetol. Rev. 40:210; Peña et al. 1996. Rev. Biol. Trop. 19[5]:702; Santos et al. 2010. Biotemas 23[2]:215–218). On 10 May 2011 at 1830 h we captured an adult *Rhinella jimi* (143.5 mm SVL; 340.0 g after prey removal) in Área do Horto Florestal Olho D´água da Bica (6.5°S, 36.73°W, WGS84; 667 m elev.), City of Cuité, Paraíba, Brazil. Upon dissection, we found a *Rhinella granulosa* (37.0 mm SVL, 5.1 g) in the *R. jimi* stomach; the prey had been ingested head-first. Small frogs are infrequent in the diet of adult *R. jimi* (Peña et al. 1996, *op. cit.*). This is the first report of *R. granulosa* in the diet of *R. jimi*. The frogs were deposited in the Herpetological Collection of the Paleoherpetological and Herpetological Laboratory of the Universidade Federal Rural de Pernambuco - UFRPE, Recife, Brazil (CHPUFRPE 979 *R. jimi* and CHPUFRPE 980 *R. granulosa*). This research was authorized by the ICMBio, permit number 23024-1.

MÁRCIO FRAZÃO CHAVES (e-mail: marciochaves@ufcg.edu.br) and **JEAN CARLOS DANTAS DE OLIVEIRA** (e-mail: jeancarlosdo@hotmail.com), Universidade de Campina Grande, UFCG, Campus de Cuité, Centro de Educação e Saúde, s/n, CEP: 58175-000, Cuité, PB, Brazil; **GERALDO JORGE BARBOSA DE MOURA,** Universidade Federal Rural de Pernambuco, Paleoherpetological and Herpetological Laboratory, UFRPE, Rua Dom Manoel de Medeiros, Dois Irmãos - CEP: 52171-900, Recife, PE, Brazil (e-mail: geraldojbm@yahoo.com.br).

RHINELLA MARINA (Cane Toad). DIET. *Rhinella marina* is an opportunistic predator that "will apparently eat almost every animate object it can catch" (Zug and Zug 1979. Smithson. Contr. Zool. 284:1–58). In both its native and introduced range, the diet of non-larval *R. marina* is primarily composed of a wide range of terrestrial invertebrates (Lever 2001. The Cane Toad. The History and Ecology of a Successful Colonist. Westbury Academic and Scientific Publishing, Otley, U.K.), especially beetles, ants, and termites (Murray and Lampo 1996. J. Herpetol. 30:73–76; Strüssmann et al. 1984. J. Herpetol. 18:138–146; Zug and Zug 1979, *op. cit.*). Except for the consumption of smaller conspecifics

(Pizzatto and Shine 2008. Behav. Ecol. Sociobiol. 63:123–133), and the suggestion that Cane Toads actively prey on chicks of Australian ground-nesting bee-eaters (Boland 2004. Biol. Conserv. 120:53–62, but see opposing results in Beckmann 2011. Impacts of the Invasive Cane Toad on Australia's Native Birds. PhD thesis, Univ. Sydney, Sydney), there are few cases reporting small vertebrates in the stomach contents of *R. marina*.

During the course of our studies on *R. marina* in tropical northern Australia we recorded 10 *Ramphotyphlops* sp. (Typhlopidae) in the guts or feces of ten individual toads (Table 1, Fig. 1). The snakes were identified by L. Pizzatto and R. Somaweera using Cogger (1992. Reptiles and Amphibians of Australia, 5th ed. Reed Books, Chatswood, NSW, Australia) as a guide. Specimens that were preserved in ethanol were deposited in the Museum and Art Gallery of the Northern Territory, in Darwin. Our results show that toads in northern Australia consume native *Ramphotyphlops unguirostris* and *R. guentheri* and introduced *R. braminus*. However the frequency of predation of blindsnakes by Cane Toads may be trivial (only 0.6% of the dissected Cane Toads from Lake Argyle contained blindsnakes). The 10 records reported herein are out of > 3,000 Cane Toads collected between 2008 and 2011 that we have dissected to examine gut contents or collected and kept overnight for other studies.

In the Philippines, snakes of the genus *Typhlops* were also found in very low numbers in the stomach contents of *R. marina* (19 out of ca. 5,000 stomachs examined; Rabor 1952. Copeia 1952:281–282). Most of our records of Cane Toads ingesting typhlopids occurred during the wet season (December to April) or early dry season (May), possibly as a result of flooding which induces fossorial snakes to move to the soil surface, rendering them susceptible to predation. In record 10 (Table 1), an entire, undigested *R. braminus* was found in the intestine of a Cane Toad, and in two other cases (records 1 and 3, Table 1) undigested *R. braminus* and *R. guentheri* were found in the feces. We speculate that these burrowing snakes were probably ingested alive, moved through the toad stomach, and found their way to the intestines, where they died from anoxia rather than succumbing to
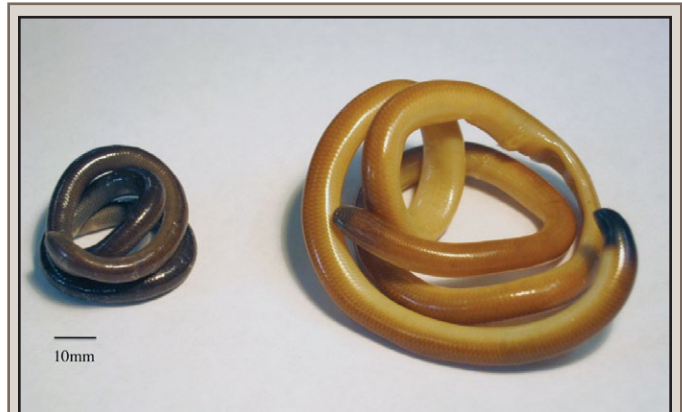

Fig. 1. Whole *Ramphlotyplops braminus* (left; record 9: TL = 101 mm) and *R. guentheri* (right; record 3: TL = 225 mm), recovered from the intestines and feces of Cane Toads (*Rhinella marina*) in northern Australia.

TABLE 1. Typhlopid snakes preyed on by Cane Toads (*Rhinella marina*) in northern Australia. TL = total length, SUL = snout–urostyle vent. NT = Northern Territory, WA = Western Australia.

# Record	Date	Prey species	Prey TL	Location	Comment	Toad SUL	Toad sex
1	28 Feb 2009	*Ramphotyphlops braminus*	94	Darwin, NT 12°24'S, 130°51'E	In feces recovered from calico bag in which toads were kept overnight	—	—
2	2 Mar 2009	Unidentified typhlopid	105	Adelaide River, NT 12°14'S, 130°06'E	In the stomach; snake head was digested	147.2 (without the head)	F
3	4 Mar 2009	*R. guentheri*	225	Beatrice Hill, NT 12°37'S, 131°18'E	As for #1 (Fig. 1)	—	—
4	Nov 2009	*R. braminus*	108	Palmerston, NT 12°30'S, 130°59'E	In the stomach of a road-killed toad	90	M
5	12 Feb 2010	*R. guentheri*	76	Mary River National Park, NT 12°54'S, 130°39'E	Regurgitated live	80	M
6	24 Feb 2010	*R. braminus*	105	Palmerston, NT 12°29'12"S, 130°57'59"E	In the stomach; snake head was partially digested	105.7 (without the head)	M
7-8	Nov 2010	2 unidentified typhlopids	—	Eastern Lake Argyle, WA 16°29'S, 128°75'E	In the intestines of 2 out of 314 toads from same locality; partially digested	104.7, 122.6	F, F
9	Apr 2011	*R. unguirostris*	212	Kununurra, WA 15°39'S, 128°42'E	Regurgitated live	120	F
10	2 May 2011	*R. braminus*	101	Middle Point, NT 12°34'S, 130°18'E	In the intestine (Fig. 1)	123	F

the toad's digestive secretions. The predominance of the exotic *R. braminus* in our samples might reflect local abundance, the relatively smaller body size facilitating consumption, or perhaps specific behavior that facilitates predation.

LIGIA PIZZATTO (e-mail: ligia.oceanica@gmail.com), **RUCHIRA SO-MAWEERA** (e-mail: ruchira.somaweera@gmail.com), **CRYSTAL KELE-HEAR** (e-mail: crystal.kelehear@hotmail.com), and **GREGORY P. BROWN** (e-mail: gp_brown@bigpond.com), School of Biological Sciences A08, University of Sydney, Sydney, NSW 2006, Australia.

RHINELLA MARINA (Cane Toad). **CROCODILE PREDATION.** *Rhinella marina* has had great success in invading new habitats and is considered one of the world's top 100 most invasive species. There are few recorded successful predators of the large, highly toxic adults in its introduced range. Because *R. marina* possess large parotid glands that produce bufotoxins, toxic skin secretions which cause cardiac distress when consumed, it is assumed that few potential predators can safely consume the adult toads (Toledo and Jared 1995. Comp. Biochem. Physiol. A. 111:1–29). There are limited reports of successful predators of adult and large juvenile *R. marina* in the toad's native range of Central and South America (Zug and Zug 1979. Smithson. Contr. Zool. 284:1–58). In Australia, where introduced *R. marina* has attained particularly high adult densities, populations of reptilian anurophagous predators have experienced notable declines (Shine 2010. Q. Rev. Biol. 85:253–291). While some native Australian snake species have begun to evolve morphologies that prevent the ingestion of *R. marina* (Phillips and Shine 2004. Proc. Natl. Acad. Sci. USA 101:17150–17155), Freshwater Crocodiles (*Crocodylus johnstoni*) continue to be negatively affected by *R. marina* consumption (Letnic et al. 2008. Biol. Conserv. 141:1773–1782). Herein we provide evidence that the American Crocodile (*Crocodylus acutus*) found in the native range of *R. marina* is an active predator of adult *R. marina*.

In late June through early July 2011, we observed two juvenile *C. acutus* (~1 m long) around a pond in the Santa Cruz area of Gamboa, Panama. These juveniles were consistently observed around the same pond three to four nights a week for two weeks. On the evening of 1 July 2011, we observed one of the juvenile *C. acutus* with an adult male *R. marina* in its mouth (Fig. 1). Although the fate of the toad is unknown, we did not locate the body of the dead toad on the following day and assume that it was killed and eaten by the juvenile *C. acutus*. After observing the juvenile *C. acutus* with the *R. marina* in its mouth, we continued to see the same two juvenile *C. acutus* around the same pond during the following week, suggesting that ingestion of the adult *R. marina* was not fatal to the crocodile. This observation suggests that, unlike their Australian congeners, *C. acutus* can safely consume adult *R. marina*; however, this apparent difference in the ability to consume *R. marina* deserves further study.

LYNNE BEATY, Department of Biological Sciences, Texas Tech University, Lubbock, Texas 79409, USA (e-mail: lynne.beaty@ttu.edu); **SALLY BEATY**, Livonia Central School District, Livonia, New York 14487, USA.

SCINAX FUSCOMARGINATUS (Brown-bordered Snouted Tree-frog). **AMELIA.** *Scinax fuscomarginatus* is a small tree frog belonging to the *S. ruber* clade (Faivovich 2002. Cladistics 18:367–393; Faivovich et al. 2005. Bull. Am. Mus. Nat. Hist. 294:1–240.). This species occurs from southeastern Brazil to eastern Bolivia, Paraguay, and northwestern Argentina, inhabiting open areas such as those of the Pantanal and Cerrado biomes (Brasileiro et al. 2005. Biota Neotrop. 5[2]:93–109; Toledo and Haddad 2005a. J. Herpetol. 39[3]:455–464; Toledo and Haddad. 2005b. J. Nat. Hist. 39[32]:3029–3037). On 12 Feb 2011 at 1900 h, we observed a *S. fuscomarginatus* froglet without hind legs developed (MZUFV 11193; Fig. 1). The observation occurred in a swampy area (16.1118°S, 45.5451°W, 532 m, SAD 1969) in the rural zone of the municipality of Riachinho, Minas Gerais state, Brazil. The specimen had emerged from the water and was crawling on the grasses at the margin of a permanent pond.

Amphibians are often exposed to agents that cause malformations because they have permeable skin and shell-less eggs whose contents are directly exposed to the environment and readily absorb substances (Blaustein and Johnson 2003. Front. Ecol. Environ. 1[2]:87–94). Malformations that include the partial or total absence of limbs have rarely been reported in Brazilian amphibians (Vizotto et al. 1977. Naturalia 3:35–43). Some studies suggest that selective predation may be sufficient to account for the vast majority of deformities in natural populations of amphibians (Ballengée and Sessions 2009. J. Exp. Zool. 312B: 1–10). This observation occurred in an area highly disturbed by livestock activity.
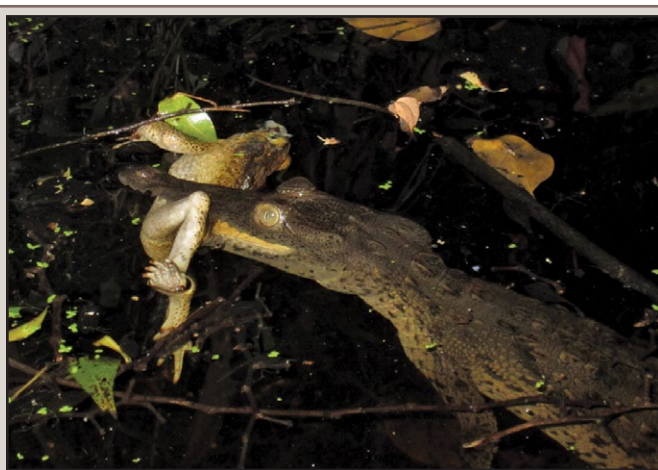
Fɪɢ. 1. Juvenile *Crocodylus acutus* with an adult male *Rhinella marina* in its mouth. Photo taken on the evening of 1 July 2011 in the Santa Cruz area of Gamboa, Panama.

PHOTO BY M. R. MOURA

Fɪɢ. 1. *Scinax fuscomarginatus* (MZUFV 11193) collected in the municipality of Riachinho, Minas Gerais state, Brazil.

RENATA MAGALHÃES PIRANI (e-mail: renatampirani@ gmail.com) and **MÁRIO RIBEIRO MOURA**, Universidade Federal de Viçosa, Departamento de Biologia Animal, Museu de Zoologia João Moojen, 36570-000, Viçosa, MG, Brazil.

TRACHYCEPHALUS NIGROMACULATUS **(Black-spotted Casque-headed Treefrog). PREDATION.** Snakes are well-known predators of frogs (Greene 1997. Snakes The Evolution of Mystery in Nature. Univ. California Press, Berkeley, California. 366 pp.). On 20 Jan 2008 at 1750 h, we observed a *Trachycephalus nigromaculatus* being consumed by the snake *Bothrops leucurus* (Fig. 1) in the Atlantic Forest at Potiraguá Municipality, Bahia, Brazil. When disturbed, the snake immediately regurgitated the frog. This is the first report of predation of *Trachycephalus* by *Bothrops* in Brazil. The *T. nigromaculatus* was verified by Ivan Nunes at Museu Nacional do Rio de Janeiro MNRJ, Rio de Janeiro, Brazil, and is deposited in the amphibian collection of Museu de Zoologia da UFBA, Universidade Federal da Bahia, Salvador, Brazil (MZUFBA 7825).

PHOTO BY THIAGO MIRANDA

FIG. 1. *Trachycephalus nigromaculatus* being consumed by *Bothrops leucurus* in Potiraguá, Bahia, Brazil.

MARCO ANTÔNIO DE FREITAS, Programa de Pós-graduação em Zoologia, UESC (Universidade Estadual de Santa Cruz) CEP 46.500-000 Rodovia Ilhéus/Itabuna, Ilhéus, Bahia, Brazil (e-mail: philodryas@hotmail.com); **TIAGO DE OLIVEIRA LIMA,** Rua São Joaquim n 11, Sagrada Família, CEP 31-700-000, Belo Horizonte, Minas Gerais, Brazil (e-mail: tiagoboidae@yahoo.com.br).

TRACHYCEPHALUS TYPHONIUS **(Milky Treefrog). PREDATION.** *Trachycephalus typhonius* is distributed from the lowlands of tropical Mexico south to northern Argentina (Frost 2011. Amphibian Species of the World. Electronic database accessible at <http://research.amnh.org/vz/herpetology/amphibia/>, American Museum of Natural History, New York). Species of this genus are known to emit a noxious skin secretion when handled, which is extremely irritating to mucous membranes and has been reported as being an antipredator defense (Leary and Razafindratsita 1998. Amphibia-Reptilia 19:442–446; Savage 2002. The Amphibians and Reptiles of Costa Rica: A Herpetofauna Between Two Continents, Between Two Seas. Univ. Chicago Press, Chicago, Illinois. 934 pp.). Probably due to this strategy, few predators have been reported. Two species of snakes, *Leptophis ahaetulla* (Prado 2003. Herpetol. Rev. 34:231–232) and *Liophis poecilogyrus*

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FIG. 1. *Trachycephalus typhonius* being preyed upon by *Leptodactylus labyrinthicus* in Corumbá, Mato Grosso do Sul State, Brazil.

(Albuquerque and Di-Bernardo 2005. Herpetol. Rev. 36:325; Silva Jr. et al. 2003. Herpetol. Rev. 34:69–70) have been reported to prey upon adult *T. typhonius*.

On 27 Oct 2011 at 2000 h, we observed predation of *T. typhonius* by *Leptodactylus labyrinthicus* (Fig. 1) along the margin of the Arigolândia stream, Urucum plateau, in the city of Corumbá, Mato Grosso do Sul State, central Brazil (19.198427°S, 57.635756°W, WGS84). After predation, the *L. labyrinthicus* was observed for one hour to check for any ill effects, and we noted none. This is the first report of predation on *T. typhonius* by an anuran.

PAULO LANDGREF-FILHO, Centro de Ciências Biológicas e da Saúde, Universidade Federal de Mato Grosso do Sul, Laboratório de Zoologia, CEP 79070-900, Campo Grande, MS, Brazil (e-mail: paulograf@yahoo.com.br); **MASAO UETANABARO, INARA KEIKO MORI, DAIENE L HOKAMA,** and **CAMILA AOKI**, Programa de Pós Graduação em Ecologia e Conservação, Universidade Federal de Mato Grosso do Sul, Cidade Universitária, s/n, Bairro Universitário, CEP 79070-900, Campo Grande, MS, Brazil.

UPEROLEIA RUGOSA **(Wrinkled Toadlet). BEHAVIOR.** *Uperoleia rugosa* is a small (20 mm) myobatrachid, native to semi-arid inland areas of New South Wales, Australia. During the breeding season, frogs congregate around temporarily flooded grasslands and semi-permanent ponds. Male territoriality and fighting behavior has been recorded (Robertson 1986. Anim. Rev. 34:763–772). Since then, however, this genus has undergone several revisions and the population for which this behavior was originally recorded is now recognized as a different species (*Uperoleia laevigata*, Davies and Littlejohn 1986. Trans. Royal Soc. South Australia 110:111–143). Here I report on male aggression and fighting behavior for a population currently recognized as *U. rugosa*, several hundred kilometers from the Robertson study site.

On the 29 and 30 Nov 2010, 48 mm of rain fell over the Macquarie Marshes, a semi-permanent wetland, in the arid zone of northern central New South Wales. This was the first significant rainfall for three months. This rainfall filled a grassy depression (30.8619°S, 147.4793°E; GDA 94) on the edges of a Black Box (*Eucaplyptus largiflorens*) woodland to a depth of ca. 5 cm. From 2200–2300 h on 30 Nov, I observed over 20 male-male aggressive interactions and physical combat (air temp. 23°C). The observed behavior was as described in Robertson (1986, *op. cit.*). A calling male would emit a call different from its usual advertisement

FIG. 1. Two male *Uperolia rugosa* engaged in a wrestling bout, Macquarie Marshes, Australia.

FIG. 1. Three large irregularly-shaped *Caretta caretta* eggs documented in a single nest in northeast Florida.

call, and start to move toward another male who had started to call near it. The first male would locate the second with touch, and engage in a wrestling bout (Fig. 1). The males could fight for up to 5 min, throwing each other numerous times. The loser of the battle, the one which was thrown last, would move away and the winner would resume normal calling. Robertson (1986, *op. cit.*) supposed the males to be defending a calling site large enough to prevent acoustic interference from other males, as the territories contain no resources and are not oviposition sites.

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JOANNE F. OCOCK, Australian Wetlands and Rivers Centre, School of Biological, Earth and Environmental Sciences, Univ. New South Wales, Sydney 2052, Australia; e-mail: joanne.ocock@unsw.edu.au.

TESTUDINES — TURTLES

CARETTA CARETTA (Loggerhead Sea Turtle). REPRODUCTION. *Caretta caretta* eggs are classified as either normal or odd shaped. Normal eggs are typically about 4.0 cm long, weigh on average 36 g, and are spherical in shape with slightly flexible shells (Van Buskirk and Crowder 1994. Copeia 1994:66–81). Odd shaped eggs (e.g., dumbbell, elliptical, and pear-shaped) have previously been documented, some with multiple yolks enclosed within varying levels of tapered uninterrupted shell and others without yolk (Miller 1985. *In* C. Gans et al. [eds.], Biology of the Reptilia, Vol. 14A, pp. 269–328. Wiley-Interscience, New York; Miller 1999. *In* K. L. Eckert et al. [eds.], Research and Management Techniques for the Conservation of Sea Turtles, pp. 124–129. IUCN/SSC Marine Turtle Specialists Group Pub. No. 4). Irregularly shaped eggs result from a malfunction within the oviduct (Solomon and Baird 1979. Oceanography and Marine Biology Annual Review 17:347–361).

Herein, we provide documentation of irregularly large (i.e., 2x–3x larger than average) *C. caretta* eggs of varying shape, and length in one nest in northeastern Florida. Three irregular eggs with lengths of 9 cm (122.05 g), 12 cm (156.63 g), and a third, which appeared as though it had hatched, was 15.2 cm long (with a dry weight of 13.59 g) (Fig. 1), were collected from a single *C. caretta* nest deposited on 20 June 2010 and located 16 km N of the St. Augustine Inlet within the Guana-Tolomato-Matanzas National Estuarine Research Reserve, Florida, USA (30.0477°N, 81.3288°W; datum WGS84). Along with these three larger, oddly-shaped eggs, the nest was found to contain 86 hatched eggs, 2 dead hatchlings, 3 pipped (partially hatched) dead, and 65 whole, unhatched, undamaged eggs for a total clutch count of 154 eggs. The clutch depth was 56 cm, measured shortly after oviposition. Hatchlings emerged on 13 August 2010 and the nest was evaluated for reproductive success on 16 August 2010.

SCOTT F. EASTMAN, Guana-Tolomato-Matanzas National Estuarine Research Reserve, 505 Guana River Road, Florida 32082, USA (e-mail: Scott.Eastman@dep.state.fl.us); **CATHERINE B. EASTMAN** Eastman Environmental, 924 Windward Way, Florida 32080, USA (e-mail: CatherineEastman@gmail.com).

GOPHERUS AGASSIZII (Agassiz's Desert Tortoise). SCUTE DYSECDYSIS / SCUTE SLOUGHING. Tortoises have been observed with damaged or missing scutes, sometimes penetrating deep enough to expose the bone of the carapace or plastron. Suggested causes for such damage include disease (e.g., bacterial infection) or toxicosis (Jacobson et al. 1994. J. Zoo Wild. Med. 25:68–81; Seltzer and Berry 2005. Science of the Total Environment 339:253–265, Rose et al. 2001. J. Wildl. Dis. 37:223–228), although in many cases no direct cause has been confirmed. Shell necrosis in aquatic turtles can be caused by algae, fungi, and later stages of bacterial infection (Hunt 1958. Herpetologica 14:45–46). In many instances dysecdysis in tortoises may be secondary to trauma or infection of the integument (Jacobson 1994. J. Zoo Wildl. Med. 25:2–17).

Desert ttortoises of the southwestern U.S. are exposed to numerous detrimental impacts, both natural and anthropogenic. Fire has been documented to cause injuries and mortalities within natural populations of tortoises in the Mojave Desert (Homer et al. 1998. J. Wild. Dis. 34:508–523; Lovich et al. 2011. Fire Ecol. 7:75–87; Woodbury and Hardy 1948. Ecol. Monogr. 18:145–200) and in the Sonoran Desert (Esque et al. 2002. *In* T. R. Van Devender [ed.], The Sonoran Desert Tortoise: Natural History, Biology, and Conservation, pp. 312–333. University of Arizona Press & Sonoran Desert Museum, Tucson, Arizona; Esque et al. 2003. Southwest. Nat. 48:103–111). Herein, we document two instances of tortoise scute injury/ regrowth and dysecdysis due to natural and fire-related damage.

In July 2005, wildfire consumed 2767 ha of Mojave Desert habitat in southern Nevada ~75 km NW of Las Vegas. In 2006, we found 15 tortoises residing within the burned habitat, including two tortoises with fire-related injuries. One adult male tortoise (266 mm midline carapace length) in particular had suffered severe burns, including damage to the scutes and bone of the
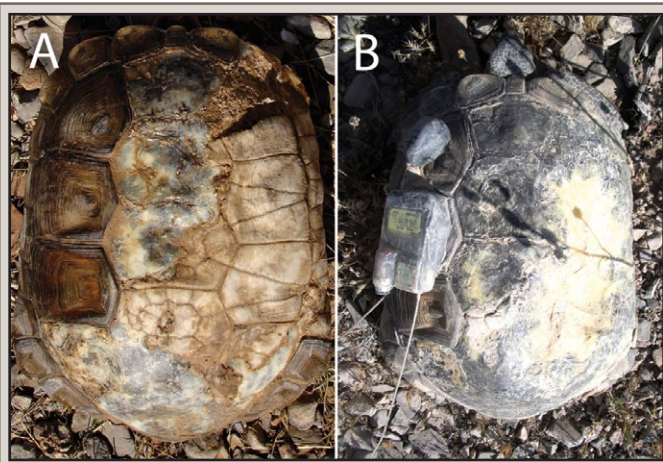
FIG. 1. A) Burned tortoise when first observed in 2006. B) Exposed bone and dermal tissue slowly being replaced with more keratinaceous tissue by 2009.
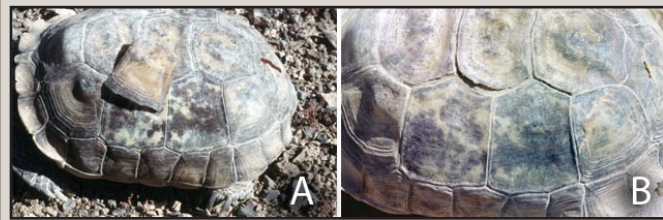

FIG. 2. A) Sloughed costal scutes first observed in 2003. B) Costal scutes in 2006 with vertebral scutes appearing to be loosened.

carapace and to the foreleg where scales appeared to have been melted and fused together (Fig. 1A, B). However, the tortoise's muscle tone and mass appeared to be normal. We attached a radio transmitter and GPS logger to the costal scutes in order to monitor the tortoise's health progress and movements. This tortoise was monitored monthly for the next 3 years. It exhibited annual home-range sizes and movements similar to tortoises that had not been burned but still resided in the same area. Prior to being lost in July 2009 due to transmitter detachment, this tortoise was observed with the bone on its right side becoming depressed and appearing to grow an opaque keratinaceous tissue over the previously exposed bone similar to the scars depicted in Lovich et al. (*op. cit.*), although no evidence of mortality was found.

In a second instance, we documented the sloughing of entire scutes from a tortoise under natural circumstances in Rock Valley, Nevada National Security Site, Nye Co., Nevada, USA, where long-term studies of *Gopherus agassizii* have been ongoing (Medica et al. 1975. Copeia 1975:630–643; Turner et al. 1987. Copeia 1987:974–979; Medica et al. *In press*. J. Herpetol.). In 2003, an adult male tortoise known to be 40 years old was observed with 4 costal scutes (number 2 and 3 on the right and left) that apparently had been sloughed from the lower keratinized fibrillar connective tissue layer. This sloughing of costal scutes exposed a smooth mottled layer very similar to that exhibited by the burned tortoise described above. Subsequently, the 2003 tortoise was recaptured in 2006 at 43 years of age with what appeared to be the initiation of the 3rd and 4th vertebral scutes beginning to slough along their anterior edges (Fig. 2A, B). The cause of the delaminating condition of this tortoise's scutes was not determined.

K. KRISTINA DRAKE (e-mail: kdrake@usgs.gov), **PHILIP A. MEDICA, TODD C. ESQUE,** and **KENNETH E. NUSSEAR,** U.S. Geological Survey, Western Ecological Research Center, 160 N. Stephanie Street, Henderson, Nevada 89074, USA.

MACROCHELYS TEMMINCKII (Alligator Snapping Turtle). GROWTH RATE. *Macrochelys temminckii* is the largest freshwater turtle in North America, but little is known about rates of growth and ages at maturity in the wild (Ernst and Lovich 2009. Turtles of the United States and Canada. Johns Hopkins University Press, Baltimore, Maryland. 827 pp.; Pritchard 2006. The Alligator Snapping Turtle: Biology and Conservation. Krieger Publ. Co. Malabar, Florida. 152 pp.). Studies of specimens collected by commercial harvesters in Louisiana, Arkansas, and Mississippi (Dobie 1971. Copeia 1971:645–658; Tucker and Sloan 1997. Chelon. Conserv. Biol. 2:587–592) indicate these turtles require 11–21 years of growth to achieve sexual maturity. Harrell et al. (1997. Herpetol. Rev. 28:128–129) also reported that recaptured subadults (approximately 240–270 mm straight midline carapace length [CL]) in Louisiana grew a mean 13.3 mm CL per year. No known growth data have been published for *M. temminckii* from Florida. In this note, we provide data regarding growth rates of immature *M. temminckii* captured during a mark-recapture study in the upper Santa Fe River in northern Florida between August 2004 and October 2011. These turtles are part of the genetically unique Suwannee River drainage population that occurs at the southeastern edge of the species range (Roman et al. 1999. Conserv. Biol. 13:135–142).

Five immature *Macrochelys temminckii* were captured multiple times with inter-capture time intervals that allow estimation of growth rate (Table 1). Although absolute annual growth rates (CL) were similar among individuals, the annual percent increase in CL was negatively correlated with CL at first capture (Pearson Correlation, $r = -0.965$, $p = 0.008$). If this small sample is representative of the population in the upper Santa Fe River, approximately 19 years of growth would be required to reach sexual maturity by females (330 mm CL) and 22 years by males (370 mm CL). These data suggest *M. temminckii* in the upper Santa Fe River may exhibit delayed sexual maturity at least as great as reported for individuals in Louisiana, Arkansas, and Mississippi.

TABLE 1. Growth rates (straight midline carapace length [CL]) of five immature Alligator Snapping Turtles (*Macrochelys temminckii*) in the upper Santa Fe River.

CL (mm) (1st capture)	CL (mm) (2nd capture)	Days between captures	Growth rate (mm/day)	Growth rate (mm/yr)	Annual % increase (mm)
125	156	850	.036	13.3	10.6
134	173	1035	.038	13.75	10.3
194	215	401	.052	19.11	9.9
241	258	341	.050	18.20	7.6
290	313	445	.052	18.86	6.5

Our estimates are based on a small sample and certainly need to be supplemented by additional growth data to determine whether they are representative of the Suwannee River drainage population in general. However, the limited available data amplify the importance of continued conservation efforts directed at this genetically unique *M. temminckii* population.

GERALD R. JOHNSTON, Department of Natural Sciences, Santa Fe College, Gainesville, Florida 32606, USA (e-mail: jerry.johnston@sfcollege. edu); **TRAVIS M. THOMAS**, Florida Fish and Wildlife Conservation Commission, Gainesville, Florida 32601, USA; **ANTHONY LAU,** Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, Florida 32611, USA.

MESOCLEMMYS TUBERCULATA (Tuberculate Toad-headed Turtle). BEHAVIOR. In general, chelonian movement patterns can be divided into two groups: intrapopulational (short-range) and extrapopulational (long-range) (Gibbons et al. 1990. Life History and Ecology of the Slider Turtle. Smithsonian Institution Press, Washington, D.C. 368 pp.). The first one is related with feeding, basking, courtship and mating, hiding, and dormancy, while the second one is linked with seeking food resources, nesting, mate seeking, migration, travel from nest by juveniles and departure from unsuitable habitats. Understanding these strategies is important for good conservation planning for these reptiles (Sutherland 1998. Anim. Behav. 56:801–809). However, opportunities for observing these behaviors under natural conditions may be difficult and rare, thus observations made on captive animals may offer important insights. This study describes the climbing ability in *M. tuberculata* under captive conditions. In 2010 and 2011, a group of turtles from the state of Ceará were maintained at the Núcleo Regional de Ofiologia da Universidade Federal do Ceará (NUROF-UFC). At least three times per week, specimens were removed from their indoor enclosures and placed in an outdoor enclosure to allow better thermoregulation. During these events, the turtles were able to move within a pool area with rough wall surfaces (2.7 m x 2.1 m x 0.3 m). Four individual *M. tuberculata* were observed climbing short and medium vertical distances on two of the rough-textured walls. This behavior was initiated when the animals rapidly approached the obstacle and took a vertical stance, with the two front limbs on the vertical surface and the rear feet on the ground; they then started the climbing process. They used their sharp claws to gain purchase on the wall, moving upward with alternate limb movements, until their rear limbs were placed over the top of the wall. In some cases vertical displacement was about four times the animal's length (average carapace length [CL] = 6.2 cm). At times the animals would fall during the action, but would quickly resume climbing again. Stress avoidance may have been an incentive for this behavior. When a turtle was approached when near a wall, it would rapidly turn away from the "stresser" and begin trying to climb the obstacle. However, the *M. tuberculata* also climbed the wall in the absence of obviously stressful stimuli. The ability and willingness to climb vertical surfaces may offer these turtles a potential escape or dispersal method, and thus increased survivorship, in their natural environments.

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JOÃO FABRÍCIO MOTA RODRIGUES (e-mail: fabriciorodrigues303@ gmail.com) and **DIVA MARIA BORGES-NOJOSA** (e-mail: dmbnojosa@ yahoo.com.br), Programa de Pós-graduação em Ecologia e Recursos Naturais, Universidade Federal do Ceará. Núcleo Regional de Ofiologia da Universidade Federal do Ceará (NUROF-UFC) Campus do Pici, Bloco 905, CEP 60455-760, Fortaleza-Ceará, Brazil.

TRACHEMYS SCRIPTA ELEGANS (Red-Eared Slider). REPRODUCTION. Female body size for slider turtles at sexual maturity has been investigated extensively through the use of oxytocin induction, X-rays, or dissection of turtles to differentiate between mature and immature individuals based on the presence of eggs or sufficiently enlarged ovarian follicles. Geographic variation in female size at maturity is reported for populations of *Trachemys scripta scripta* where populations living in a thermally heated lake near a nuclear reactor matured at a plastron length (PL) of 200 mm versus a PL of 160 mm for populations living in a natural habitat (Gibbons and Greene 1990. *In* J. W. Gibbons [ed.], Life History and Ecology of the Slider Turtle, pp. 124–134. Smithsonian Inst. Press, Washington, D.C.). Mature female *T. s. scripta* as small as PL 140–150 mm were reported, although a minimum PL of 160 mm was proposed as the smallest average size for reproductive maturity (Gibbons and Greene 1990, *op. cit.*). Female *T. s. elegans* in Oklahoma were reported to reach maturity at PL 174–193 mm (Webb 1961. Am. Midl. Nat. 65:193–214) and in Illinois, *T. s. elegans* reached maturity at a minimum PL range of 150–195 mm (Cagle 1950. Ecol. Monogr. 20:31–54). Here, we report a successfully completed nesting event by a *T. s. elegans* female with plastron length less than 150 mm.

Populations of six species of turtles including *T. s. elegans* have been monitored since 1996 at Aquarena Center which borders Spring Lake in Hays Co., Texas, USA (Gaertner et al. 2008. J. Wildl. Dis. 44:519–526; Rose et al. 1996. Southwest. Nat. 56:61–65; Rose et al. 1998. Texas J. Sci. 50:89–92). On 3 June 2011, we observed a small female *T. s. elegans* nesting on a golf course at Aquarena Center. Upon completion, the nest was excavated and clutch size consisted of one egg. Plastron length was measured to the nearest 1.0 mm (PL = 146 mm). This nesting event is remarkable due to the small size of the mature female. Discounting this female, the PL range for nesting *T s. elegans* turtles at Aquarena Center is 167–298 mm. The female was marked, measured, weighed, and released.

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BEI DEVOLLD (e-mail: bd1128@txstate.edu) and **JOSEPH C. FLORES,** Texas State University, San Marcos, Texas 78666, USA.

CROCODYLIA — CROCODILIANS

ALLIGATOR MISSISSIPPIENSIS (American Alligator). DIET CORRECTION AND GROWTH RATE. In a note on the diet of *Alligator mississippiensis*, Kim et al. (2011. Herpetol. Rev. 42:269) incorrectly identified an *A. mississippiensis* prey item as *Regina rigida sinicola* (Gulf Crayfish Snake). The snake is actually *Nerodia cyclopion* (Mississippi Green Watersnake), which is already suspected of being a prey item of *A. mississippiensis* (Rossi and Rossi 2003. Snakes of the United States and Canada. Krieger Publ. Co., Malabar, Florida. 520 pp.). To validate the earlier note, we submit here the first report of *R. r. sinicola* as a prey item of *A. mississippiensis*. We also include an estimate of the growth rate from the alligator harvested. The following observation took place at Gus Engeling Wildlife Management Area (GEWMA), Tennessee Colony, Texas, USA.

On 4 June 2011, a female alligator (total length = 1828.8 mm) was harvested during the first annual public alligator hunt at GEWMA (31.939647°N, 95.880145°W; datum WGS 84). After inspection at the hunter check station, the alligator was identified by notched tail scutes as a recapture from an earlier population genetic study at GEWMA (Ryberg et al. 2002. J. Exp. Zool.

Fig. 1. *Regina rigida sinicola* removed from the stomach of a harvested *Alligator mississippiensis*.

PHOTO BY DAVID WIEDENFELD

Fig. 1. Nest of *Caimân latirostris* on a floating "island" of marsh vegetation of about 6 m of diameter at Lagoa do Rio Preto, municipality of Guaratuba, state of Paraná, southern Brazil. Trees and marsh vegetation in the background of the photograph are not part of the floating island, being at ground level and covered by about 2 m of water column.

294:325–333). During that study, this alligator was first captured on 25 July 2000, approximately 1.8 km away from the harvest location (31.936580°N, 95.861038°W; datum WGS 84). The total length of this alligator in 2000 was 1125.0 mm. The alligator grew 703.8 mm over the 10 year, 10 month, 10 day time period (~64.9 mm/year). This growth rate is very similar to those published for wild female alligators of the same size in Louisiana (~60 mm/year; Chabreck and Joanen 1979. Herpetologica 35:51–57). After the alligator was skinned, the stomach was removed and dissected. The only prey item identified was a large female *R. r. sinicola* (SVL = 595 mm; tail length = 149 mm; TCWC 95590; Fig. 1).

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WADE A. RYBERG (e-mail: waryberg@tamu.edu) and **TOBY J. HIBBITTS** (e-mail: thibbitts@tamu.edu), Department of Wildlife and Fisheries Sciences, Texas Cooperative Wildlife Collection, Texas A&M University, College Station, Texas 77845, USA.

CAIMAN LATIROSTRIS (Broad-snouted Caiman). **FLOATING NEST.** The Broad-snouted Caiman (*Caiman latirostris*) is a Neotropical crocodilian that occurs from northeastern Brazil to the Plata River basin in Argentina. Nests of the species are made with leaves and other organic matter taken from the soil, and are established next to marginal vegetation at the rivers and lakes banks. Like other crocodilians, nests of this species are eventually affected negatively by fluctuations of water levels, with the flooding of river margins and lakes leading to a decrease in hatching success (Campos and Magnusson 1995. J. Trop. Ecol. 11:351–358). The nests of South American crocodilians are commonly attacked by several predators, such as tegu lizards (*Tupinambis* spp.), carnivorous mammals (e.g., *Nasua nasua*, *Procyon cancrivorous*, and *Cerdocyon thous*), and ants (Campos 2003. Boletim de Pesquisa e Desenvolvimento, Embrapa Pantanal. 22 pp.; Staton and Dixon 1977. U.S. Dept. of the Interior Fish. Wildl. Serv. Res. Report 5. 21 pp.), and the main protection strategy of the species usually consists of a constant vigilance of the nest by the female. However, this strategy is inefficient against small predators like ants, and is of no use at all to avoid fluctuations in water levels.

On 22 January, 2010, we found a nest of *C. latirostris* in a marsh (Fig. 1) at Lagoa do Rio Preto (25.753333°S, 48.713889°W, ca. 3 m elev.), municipality of Guaratuba, state of Paraná, southern Brazilian coast. The area is subject to periodic increases in water level, and to deal with this an individual *C. latirostris* built its nest in a patch of floating vegetation of about 6 m in diameter and that was >50 m from the surrounding upland margins. The nest consisted of a pile of *Fuirena* sp. (Cyperaceae) and *Panicum mertensii* (Poaceae) of about 1 m high, clustered in an area of about 4 m of diameter. Two weeks later, we found several hatchlings in the area. According to a local resident, *C. latirostris* was observed using nests in floating vegetation at the Lagoa do Rio Preto for several years. This represents the first record of a floating nest constructed by *C. latirostris*. Because floating marshes are not covered by water, including during rainfall (Reinert et al. 2007. Rev. Brasil. Ornitol. 15:493–519), we consider that the placement of a nest in floating vegetation represents an important nesting strategy, as it avoid the effects of fluctuating water levels and attack by predators that do not swim.

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MARCOS RICARDO BORNSCHEIN, Programa de Pós-Graduação em Ecologia e Conservação, Universidade Federal do Paraná, Centro Politécnico, Jardim das Américas, CEP 81531-990, and Mater Natura – Instituto de Estudos Ambientais, Rua Lamenha Lins 1080, CEP 80250-020, Curitiba, Paraná, Brazil (e-mail: bornschein.marcao@gmail.com); **RICARDO BELMONTE-LOPES,** Programa de Pós-Graduação em Zoologia, Dept. de Zoologia, Lab. De Dinâmica Evolutiva e Sistemas Complexos, Universidade Federal do Paraná, Caixa Postal 19073, CEP 81531-990, and Mater Natura – Instituto de Estudos Ambientais (e-mail: rbelmonte.lopes@gmail.com); **BIANCA LUIZA REINERT,** Mater Natura – Instituto de Estudos Ambientais (e-mail: biancareinert@yahoo.com.br); **SÉRGIO AUGUSTO ABRAHÃO MORATO,** STCP Engenharia de Projetos Ltda., Rua Euzébio da Motta, 450, CEP 80.530-260, Curitiba, Paraná, Brazil (e-mail: smorato@stcp.com.br).

SQUAMATA — LIZARDS

AMEIVA BIFRONTATA (Cope's Ameiva). **ENDOPARASITES.** *Ameiva bifrontata* is known from northern Peru, Colombia, Venezuela, Testigo Island, Dutch Leeward Islands, Margarita Island, Aruba, La Tortuga Island (Uetz and Hallermann 2012. The Reptile Database, www.reptile-database.org, accessed 30 January, 2012). To our knowledge there are no reports of helminths from *A. bifrontata*. The purpose of this note is to establish the initial helminth list for *A. bifrontata*.

Eighteen *A. bifrontata* were examined, collected in November 1968 from Bellavista, (5.6622°S, 78.6756°W, WGS84, elev. 195 m), Cajamarca Region, Peru and deposited in the herpetology collection of the Natural History Museum of Los Angeles County (LACM) as: LACM 76864, 76865, 76868, 76869, 76871, 76862, 76874, 76877, 76878, 76880–76885, 76887–76889. A left lateral incision was made through the body wall and the digestive tract was removed. The esophagus, stomach, small and large intestines were opened longitudinally and searched for helminths utilizing a dissecting microscope. The body cavity was also searched. Helminths were cleared in lactophenol, placed on a microscope slide, coverslipped and studied utilizing a compound microscope.

Found were one species of Nematoda, *Parapharyngodon riojensis* (prevalence, number infected/number examined x 100 = 56%, mean intensity, mean number infected lizards = 2.2 ± 1.4 SD, range = 1–4), and one oligacanthorhynchid cystacanth (Acanthocephala) (prevalence = 6%). Helminths were deposited in the United States National Parasite Collection, Beltsville, Maryland as *P. riojensis* (USNPC 105267) and oligacanthorhynchid cystacanth (USNPC 105268).

Parapharygodon riojensis was described from *Phymaturus punae* from the province of La Rioja, Argentina by Ramallo et al. (2002. J. Parasitol. 88:979–982) and has been reported from *Liolaemus buergeri* and *Phymaturus palluma* from Argentina (Goldberg et al. 2004. Comp. Parasitol. 71:208–214) as well as *Liolaemus boulengeri*, *L. rothi*, *L. umbrifer*, *Phymaturus antofagastensis* and *P. zapalensis* also from Argentina (O'Grady and Dearing. 2006. Oecologia 150:355–361). Two South American species of *Parapharyngodon* (*P. riojensis* and *P. senisfaciecaudus*) have been described in which the ovaries are postesophageal. These two species are separated on the basis of egg morphology: egg shell thin and smooth in *P. senisfaciecaudus*, punctate and thick in *P. riojensis*. Our specimens possessed postesophageal ovaries and eggs with thick, punctate shells. Oligacanthorhynchidae is the only acanathocephalan family to possess robust, pseudoannulate cystacanths, an obvious character of our cystacanth specimen. Acanthocephalans utilize an arthropod intermediate host in which the cystacanth larval stage develops (Kennedy 2006. Ecology of the Acanthocephala. Cambridge University Press, New York. 249 pp.). Since development to the adult form does not occur in *A. bifrontata,* it is best considered as a paratenic (= transport) host. *Ameiva bifrontata* represents a new host record for *Parapharyngodon riojensis* and oligacanthorhynchid cystacanths. Peru is a new locality record for *P. riojensis*; however, undetermined cystacanths have been reported from Peru (Bursey et al. 2001 Comp. Parasitol. 68:21–35).

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STEPHEN R. GOLDBERG, Whittier College, Department of Biology, PO Box 634, Whittier, California 90608, USA (e-mail: sgoldberg@whittier. edu); **CHARLES R. BURSEY,** Pennsylvania State University, Shenango Campus, Department of Biology, Sharon, Pennsylvania 16146, USA (e-mail: cxb13@psu.edu).

ANOLIS SAGREI (Brown Anole). **SAUROPHAGY.** *Anolis sagrei* is native to Cuba, the Isla de Juventud, the Bahamas, Swan Island, the Islas de la Bahia, Honduras (Schwartz and Henderson 1991. Amphibians and Reptiles of the West Indies: Descriptions, Distributions, and Natural History. University of Florida Press, Gainesville, Florida. xvi + 720 pp.). It also has been introduced to many parts of the world (Kraus 2009. Alien Reptiles and Amphibians: A Scientific Compendium and Analysis. Springer, [Dordrecht, Netherlands], 563 pp.), including Florida as early as 1887 (Garman 1887. Bulletin of the Essex Institute 19:1–29). In Florida, *Anolis sagrei* is known to consume mostly insects (Meshaka et al. 2004. The Exotic Amphibians and Reptiles of Florida. Krieger Publ. Co. Malabar, Florida. 166 pp.), but it has also been documented consuming lizards such as smaller conspecifics (Cochran 1989. Herpetol. Rev. 20:70) and native Green Anoles (*A. carolinensis*) (Campbell and Gerber 1996. Herpetol. Rev. 27:200). In this note, we report *A. sagrei* preying upon a nonindigenous Red-sided Curly-tailed Lizard (*Leiocephalus schreibersii*) in Florida.

On 14 October 2011 at 1614 h, we observed an adult male *Anolis sagrei* at 24305 SW 142 Avenue, Homestead, Miami-Dade County, Florida (25.540744°N, 80.420585°W, WGS84; elev. 4 m).

Fig. 1. *Anolis sagrei* consuming *Leiocephalus schreibersii* in Florida.

This anole was ca. 1 m above ground on a wooden post facing downward and had a neonate *Leiocephalus schreibersii* in its mouth (Fig. 1). The event was observed for ca. 4–5 min, at which time concluded with the *A. sagrei* consuming the *L. schreibersii*. Photographic vouchers were deposited in the Florida Museum of Natural History (UF 166507). This is the first known predation event on *L. schreibersii* in Florida, but also might provide an example for invasional meltdown by which short-term observations of facilitatory interactions between two species might have long-term consequences (i.e., enhancing the impact and/or probability of establishment and spread of the other) (Simberloff and Von Holle 1999. Bio. Invasions 1:21–32), as Florida has the most introduced and established herpetofaunal species in the world (Krysko et al. 2011. Zootaxa 3028:1–64).

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KENNETH L. KRYSKO, Division of Herpetology, Florida Museum of Natural History, Dickinson Hall, University of Florida, Gainesville, Florida 32611, USA (email: kenneyk@flmnh.ufl.edu); **JOSEPH A. WASILEWSKI**, Natural Selections, 24305 SW 142th Avenue, Homestead, Florida 33032, USA.

ASPIDOSCELIS NEOTESSELATA (Colorado Checkered Whiptail). FRAGMENTED HABITAT. Valco State Wildlife Area (38.259361°N, 104.705824°W, WGS84; elev. 1445 m), managed by the Colorado Division of Wildlife, is immediately adjacent to the north side of Colorado Hwy 96 (i.e., Thatcher Avenue) in the western metropolitan area of the City of Pueblo, Pueblo Co., Colorado, USA. This small gem of reclamation, commonly known as Valco Ponds, receives numerous visitors in the modes of short rest stops from Hwy 96, day-use hiking and sightseeing, fishing, and birding. The ponds, wetlands, and wildlife areas are mostly reclaimed gravel pits and surroundings, two being no farther than ~20–30 m from the south side of the Arkansas River, which were mined out by the Valco Cement Co. located immediately east of the ponds. Because the surroundings did not appear to include suitable habitat for whiptail lizards, my first visit to Valco Ponds during a herpetological expedition to southeastern Colorado in 1999 was as a rest stop from the rigors of the day rather than the expectation of collecting lizards. However, I unexpectedly began to see hatchling lizards almost immediately after stopping there, all of which proved to be triploid *Aspidoscelis neotesselata* pattern class A (Walker et al. 1997. Herpetologica 53:233–259). Subsequently, using large rubber bands as projectiles, I obtained the following specimens of the species from Valco Ponds for study: 6 September 1999 (University of Arkansas Department of Zoology, UADZ 6657–6667, N = 11); 7 September 1999 (UADZ 6668–6672, N = 5); 10 June 2000 (UADZ 6878–6883, N = 6).

This description of the occupancy of Valco Ponds by *A. neotesselata* A is to show that a moderately large (maximum SVL ~100 mm), triploid, hybrid-derived parthenogenetic species not only subsists in a highly fragmented metropolitan environment which is intensively used by humans, but it is represented there in surprisingly large numbers. Parts of the site that I reference herein include the paved parking lot, a 15–40 m wide grove of mainly Eastern Cottonwood (*Populus deltoides*) between the length of the north side of the lot and the south side of the Arkansas River, a narrow riparian forest trail west of the lot along the river, a road/levee from east of the lot to the river, and two sections of roads/levees between the river and three Valco Ponds of 20, 15.5, and 10 acres stocked with game fish (see http://www.cfo-link.org/downloads/pueblo1.pdf). On 6 September 1999,

within minutes of arriving at Valco Ponds, I began to see young-of-year (YOY) of *A. neotesselata* A as I walked along the ~120 m parking lot/Eastern Cottonwood interface. On one occasion I returned to the vehicle where I observed two lizards under it taking refuge from the sun. Lizards were also present along the ~3 m wide forest trail of ~300 m in length running west from the parking lot along the Arkansas River. The only exposed substrate was that of the trail which was critical to the presence of lizards living in this narrow band of habitat where they were frequently forced to retreat from foraging and basking behaviors as humans walk on the trail. Lizards were also observed east of the parking lot on the ~80 m long road/levee north to the river along the west side of the first pond. However, the true extent of the abundance of *A. neotesselata* A at Valco Ponds only became apparent when I explored the elevated narrow road/levee separating the Arkansas River from two of the ponds. This barrier, which is only ~20–30 m in width and 2-3 m above the river, extends eastward ~475 m where it bends northeastward for another ~300 m. Flooding of Valco Ponds by the river is largely prevented by the holding capacity of Pueblo Lake only ~2.05 km upstream to the northwest. The levee supports a complex assemblage of plants consisting of scattered trees (e.g., *Populus deltoides*; non-native Chinese Elm, *Ulmus pumila*; non-native Salt Cedar, *Tamarix ramosissima*, and juniper, *Juniperus* sp.), in addition to growths of grasses and shrubby/tall-growing plants (e.g., Kochia, *Bassia sieversiana*; Sandsage, *Artemisia filifolia*; and Rabbitbrush, *Chrysothamnus nauseosus*) bordering the unpaved road. Ample expanses of well-drained and exposed sandy/gravelly soil on the road, small adjacent areas cleared by ants, spaces among the plants, and gopher mounds provide opportunities for whiptail lizard activities such as foraging, basking, oviposition, and fleeing. A total of ~30 YOY of *A. neotesselata* A, but no second year or older lizards, were observed as I walked back and forth along the levee on 6–7 September 1999. The road/levee is also frequently used by humans, and occasionally by official vehicles, but such interference with lizard activities would be much less severe than on the previously mentioned much narrower west-directed forest trail. During a return visit to Valco Ponds on 10 June 2000, I observed ~20 second year and older individuals of *A. neotesselata* A in less than 2 h (only six collected) on the aforementioned levee, including as many as four individuals in the same field of vision. These older/larger lizards were much more easily approached and collected than were the YOY in the previous year, and the low number obtained in 2000 (N = 6) was by choice.

The Valco State Wildlife Area west of Pueblo Boulevard in Pueblo is among the most dramatic examples of high levels of abundance in a fragmented habitat that I have observed in any parthenogenetic species of *Aspidoscelis*. The habitat available for lizards (which totals ~2.1 ha) and the resulting pattern of lizard distribution at the site can be appreciated by typing in "Valco Ponds, Colorado" on Google Earth and viewing the results. This enclave, which is situated between Pueblo Lake State Park (west), urban Pueblo (east), Arkansas River (north), and Colorado Hwy 96 (south) certainly fits into the pattern of unusual/marginal habitats occupied by parthenogenetic whiptail species in the absence of gonochoristic species (i.e., *Aspidoscelis sexlineata viridis* which occurs elsewhere in the general area) that were discussed by Wright and Lowe (1968. Copeia 1968:128–138). Other nearby sites in the western metropolitan area of Pueblo where *A. neotesselata* A occurs in publicly owned areas extensively altered and used by humans, but not in a fragmented mosaic, also have been reported. Based on published records, the species is abundant

in the extensive surroundings of the Pueblo Raptor and Nature Center (38.270847°N, 104.676536°W; WGS84; elev. 1450 m) on the north side of the Arkansas River at 2.9 km (straight line, SL) east-northeast of Valco Ponds (Walker, *op. cit.*; Taylor et al. 2006. J. Herpetol. 40:294–304), but is not abundant at the type locality of the species in the spacious Juniper Breaks Campground (38.276514°N, 104.755075°W; WGS84; elev. 1498 m) on the north side of Pueblo Lake, Pueblo State Park, at 4.5 km (SL) northwest of the ponds (Walker, *op. cit.*).

Lizards were collected at Valco State Wildlife Area, Pueblo Raptor and Nature Center, and Juniper Breaks Campground in Pueblo County under authority of a permit from the Colorado Division of Wildlife. I am grateful to Tim Hogan who referred me to Dina Clark who identified plants in the photograph, and to Harry Taylor for constructive comments on the manuscript.

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

ASPIDOSCELIS TESSELATA (Common Checkered Whiptail). **NORTHERN LIFE HISTORY.** Since 1988, we have studied life history attributes pertaining to the ecological success of *Aspidoscelis tesselata* (*sensu* Cordes and Walker 2006. Copeia 2006:14–26; Reeder et al. 2002. Am. Mus. Novitat. 3365:1–61; Taylor et al. 2005. J. Herpetol. 39:266–277; Walker et al. 1995. Copeia 1995:650–658; Walker et al. 1997. Herpetologica 53:233–259), a diploid parthenogenetic lizard of hybrid origin (Neaves 1969. J. Exp. Zool. 171:175–184; Parker and Selander 1976. Genetics 84:791–805; Wright and Lowe 1967. Mamm. Chromo. Newslett. 8:95–96), in several areas of its vast latitudinal distribution area (Taylor et al. 1997. Copeia 1997:863–868; Taylor et al. 1999. Herpetol. Rev. 30:205–207; Taylor et al. 2000. Herpetologica 56:45–54; Taylor et al. 2005. Southwest. Nat. 50:258–262; Taylor et al. 2006. J. Herpetol. 40:294–304) extending from eastern-central Chihuahua State, México, to southeastern Colorado (Parker and Selander, *op. cit.*; Smith et al. 1963. Herpetologica 19:205–215; Zweifel 1965. Am. Mus. Novitat. 2235:1–49). This species is a member of many local guilds of whiptail lizards in Chihuahua, Texas, Oklahoma, New Mexico, and Colorado involving various combinations of four gonochoristic (*A. gularis* [including *A. scalaris* and *A septemvittata*; *sensu* Walker 1981a. Copeia 1981:826–849; Walker 1981b. Copeia 1981:850–868], *A. inornata*, *A. sexlineata*, and *A. tigris* [including *A. marmorata*; *sensu* Dessauer et al. 2000. Bull. Am. Mus. Nat. Hist. 246:1–148]) and/or six parthenogenetic (*A. exsanguis*, *A. dixoni*, *A. neomexicana*, *A. neotesselata*, *A. uniparens*, and *A. velox*) congeners in a variety of arid and semiarid habitats, some severely degraded and frequently impacted by presence of humans, over a south-north straightline distance of ca. 1100 km. Latitudinally (i.e., from ca. 27.990227°N, 105.264668°W, datum: WSG84, in Chihuahua to ca. 37.717304°N, 103.514567°W, datum: WSG84, in Colorado; Taylor et al. 2000, *op. cit.*; Taylor et al. 2011. Southwest. Nat. 56:180–186), this is the most extensive natural range for any of the parthenogenetic species of *Aspidoscelis*. Here, we interpret the northern life history of pattern class E of *A. tesselata* (*sensu* Zweifel, *op. cit.*) based on specimens collected between 1996 and 2010 from in and adjacent to the town of Puerto de Luna (see Taylor et al. 2003. Am. Mus. Novitat. 3424:1–40), Guadalupe County, eastern-central New Mexico, where it exists in syntopy with triploid parthenogenetic *A. exsanguis* and *A. velox*. We include data on sample composition (number of generations represented in samples), life cycle (length of annual activity cycle, age at maturity, and life span), reproductive characteristics ($\bar{x} \pm$ SE and range for body mass [BM], SVL, clutch size, yolked ovarian follicle diameter, and oviductal egg diameter and length), and the relationship of clutch size to SVL and BM (of lizards with tails) for *A. tesselata* E at Puerto de Luna. Females were weighed, fixed in formalin, stored in ethanol, and dissected to count and measure oviductal eggs and yolked ovarian follicles. Statistical operations for this study were performed using JMP® 9 (SAS Institute Inc., Cary, NC), provided by a license to the University of Arkansas, with set at 0.05.

We examined 36 specimens of *A. tesselata* from the herpetology collections of the University of Arkansas Department of Zoology (UADZ) and 25 from Regis University (RU) obtained in and near the town of Puerto de Luna: site 1 (34.830833°N, 104.620278°W, datum: WGS84 , elev. 1369 m) (18 August 1996 [UADZ 5740–5741, N = 2]; 16 July 1997 [UADZ 5993–5994, N = 2]; 10 June 2000 [RU 0048–0052, N = 5]; 11 June 2000 [RU 0053–0062, N = 10]; 12 June 2000 [RU 0064–0073, N = 10]; 19 August 2001 [UADZ 7484, 7487, 7489–7495, 7497, N = 10]; 18 June 2010 [UADZ 8648–8651, N = 4]; 19 June 2010 [UADZ 8658–8659, N = 2]; 24 June 2010 [UADZ 8697–8703, N = 7]; 25 June 2010 [UADZ 8715–8721, N = 7]); site 2 (34.819167N, 104.613333°W, datum: WGS84, elev. 1363 m) (24 June 2010 [UADZ 8704, N = 1]); site 3 on east side of Pecos River at highway crossing south of town (34.826634°N, 104.625261°W, datum: WGS84, elev. 1359 m) (19 August 1997 [UADZ 6008, N = 1]).

At Puerto de Luna, most eggs of *A. tesselata* E hatch from late July–early August. This is the same time frame by which subadults from the previous summer and adults, having attained adequate mass and fat reserves to carry them through hibernation, become inactive for the year. On 18 and/or 19 August 1996 (N = 2), 1997 (N = 1), and 2001 (N = 10), all *A. tesselata* E either observed or captured at Puerto de Luna were young-of-year (YOY). The 19 August 2001 sample of *A. tesselata* E consisting of 10 YOY with a 9 mm range of variation in SVL (39, 40, 41 [2], 43 [2], 45, 46, 47, 48; $\bar{x}$ = 43.3 ± 0.98 mm) obviously represents several hatching dates. A similar range of size variation persists as YOY grow rapidly to ca. 50–60 mm SVL as declining fall temperatures in October force them into inactivity for the year, after which these individuals with variable SVLs emerge for their second activity cycle in late April–early May.

Based on the 10–12 June 2000 sample of *A. tesselata* E, it is possible to conclude that sexual maturity is not attained in the second year of life at Puerto de Luna. One group in the sample comprises 19 non-reproductive (i.e., subadult) lizards, hatched the previous year (i.e., in their second activity cycle) with an 11 mm range of variation in SVL (65 [2], 66 [2], 68 [2], 69 [3], 70 [2], 72 [2], 73, 74 [2], 75, 76 [2]; $\bar{x}$ = 70.4 ± 0.83 mm), which is similar to the magnitude of SVL differences among the 2001 YOY lizards. The second group comprises only six adults, all gravid, in their third or subsequent activity cycles with a 7 mm range of variation in SVLs (90 [2], 91, 95]2], 97; $\bar{x}$ = 93.0 ± 1.24 mm). However, based on the 18–25 June 2010 sample of *A. tesselata* E from Puerto de Luna, collected ca. two to three weeks later in the annual activity cycle than in 2000, we infer that some of the earliest hatchlings from 2009 had attained reproductive maturity in their second activity cycle. One subgroup in the sample comprises eight non-reproductive (i.e., subadult) lizards hatched the previous year and several months in their second activity cycle with a 12 mm range in SVLs (67, 72, 73 [2], 75, 77, 78, 79; $\bar{x}$ = 74.2 ± 1.37), and a 5.6 g range in BM ($\bar{x}$ = 10.9 ± 0.73 g). The other subgroup from 2010 comprises 12 gravid females, some apparently in the second activity cycle, others in their third, fourth, and/or fifth cycle, with a 20 mm range of SVLs (75, 76, 77, 79 [2],

82, 83, 90, 92 [2], 93, 95; $\bar{x}$ = 84.4 ± 2.15 mm) and a 13.1 g range in BM ($\bar{x}$ = 17.2 ± 1.42 g). In retrospect, using observations on the 2010 sample of *A. tesselata* E from Puerto de Luna, we infer that some of the larger juveniles in the 2000 sample could have attained reproductive maturity in their second season had they survived.

Gravid females in the early June 2000 sample (90–97 mm SVL) have clutches of 4–5 eggs ($\bar{x}$ = 4.5 ± 0.22, N = 6), and apparently represent year classes three, four, and perhaps five. Gravid females in the mid- to late June 2010 sample (75–95 mm SVL) have clutches of 2–5 eggs ($\bar{x}$ = 3.5 ± 0.34, N = 12), and apparently represent year classes two through four and perhaps five. Pre-ovulatory females (75–95 mm SVL) in this sample have yolked ovarian follicles of 5.5–11.5 mm in diameter ($\bar{x}$ = 9.2 ± 1.04, N = 5); post-ovulatory females (79–92 mm) have oviductal eggs of 10.5–12.5 mm in diameter ($\bar{x}$ = 11.6 ± 0.28, N = 7) and 16.5–19.0 mm in length ($\bar{x}$ = 17.8 ± 0.34, N = 7). For the period 10–11 June 2000, 6 females with data had clutches (sample size in each category in parens) of 4 (3) and 5 (3). For the period 18–25 June 2010, 12 females with data had clutches of 2 (3), 3 (3), 4 (3), and 5 (3). Using the pooled sample of gravid females of *A. tesselata* collected from Puerto de Luna in 2000 and 2010, we observed a strong relationship between clutch size and SVL (based on adjusted r^2 = 0.61, P = 0.0001, N = 18). Surprisingly; however, one noteworthy outlier (UADZ 8719 from 2010) with a SVL of 77 mm and BM of 13.4 g, apparently in only the second activity cycle, possesses two right and two left oviductal eggs. The egg number in this specimen approximates the maximum clutch of five in the largest available specimens of 90–97 mm SVL, some of which could be in the fifth year. Pooling 2010 subadults, some with large fat bodies, and females with clutches of either ovarian or oviductal eggs confirmed the existence a strong relationship between SVL and BM in *A. tesselata* E (based on adjusted r^2 = 0.94, P = 0.0001, N = 20) from Puerto de Luna.

This study indicates that the composition of a single sample of *A. tesselata* E from Puerto de Luna could very well sway an investigator to conclude that the age at which first clutch is produced is a fixed attribute in the species at this site. For example, the RU sample from 2000 points to probable maturity in the third year; however, because hatching dates in the species span almost a month, the sample from 2010 indicates that the earliest hatchlings from the previous year likely produced clutches in the second summer, whereas the later hatchlings would likely produce their first clutch in the third summer.

Puerto de Luna is one of several areas between Santa Rosa Lake, Guadalupe Co., and Sumner Lake, De Baca Co., where the parthenogenetic species *A. exsanguis*, *A. tesselata*, and *A. velox* are syntopic; *A. tesselata* E is by far the numerically dominant species at site 1. Based on observations between 1996 and 2001, the habitat here (e.g., sandy roadsides, a mesquite [*Prosopis glandulosa*] invaded hillside, and mequite anchored dunes) received little in the way of unusual habitat disturbances. However, the dunes have since become heavily used by ATV enthusiasts. The abundance of both subadults and adults of *A. tesselata* E in the ATV tract, frequently criss-crossed by these vehicles, afford a dramatic example of the adaptability of the life cycle of *A. tesselata* E to a highly disturbed area frequented by presence of humans.

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JAMES M. WALKER, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA (e-mail: jmwalker@uark.edu); **JAMES E. CORDES**, Division of Sciences and Mathematics, Louisiana State University Eunice, Eunice, Louisiana 70535, USA (e-mail: jcordes@lsue.edu); **HARRY L. TAYLOR**, Department of Biology, Regis University, Denver, Colorado 80221, USA (e-mail: htwhiptail@gmail.com); **GLENN J. MANNING,** School of Mathematical and Natural Sciences, University of Arkansas at Monticello, Monticello, Arkansas 71656, USA (e-mail: manning@uamont. edu).

ASPIDOSCELIS TESSELATA (Common Checkered Whiptail). SOUTHERN LIFE HISTORY. *Aspidoscelis tesselata* (*sensu* Cordes and Walker 2006. Copeia 2006:14–26; Reeder et al. 2002. Am. Mus. Novitat. 3365:1–61; Taylor et al. 2005. J. Herpetol. 39:266–277; Walker et al. 1995. Copeia 1995:650–658; Walker et al. 1997. Herpetologica 53:233–259) is a diploid parthenogenetic lizard of hybrid origin (Neaves 1969. J. Exp. Zool. 171:175–184; Parker and Selander 1976. Genetics 84:791–805; Wright and Lowe 1967. Mamm. Chromo. Newslett. 8:95–96) having an extensive latitudinal distribution from ca. 27.990227°N, 105.264668°W, datum: WSG84, in eastern central Chihuahua, México, to ca. 37.717304°N, 103.514567°W, datum: WSG84, in southeastern Colorado (Parker and Selander, *op. cit.*; Smith et al. 1963. Herpetologica 19:205–215; Taylor 2000. Herpetologica 56:45–54; Taylor et al. 2011. Southwest. Nat. 56:180–186; Zweifel 1965. Am. Mus. Novitat. 2235:1–49). This species is a member of many local guilds of whiptail lizards in Chihuahua, Texas, Oklahoma, New Mexico, and Colorado involving various combinations of four gonochoristic (*A. inornata*, *A. gularis*, *A. sexlineata*, and *A. tigris*) and/or six parthenogenetic (*A, exsanguis*, *A. dixoni*, *A. neomexicana*, *A. neotesselata*, *A. uniparens*, and *A. velox*) congeners in a variety of arid and semiarid habitats, some severely degraded and frequently impacted by presence of humans, over a north-south straightline distance of ca. 1100 km. Latitudinally, this is the most extensive natural range for any of the parthenogenetic species of *Aspidoscelis*. Here, we contribute to interpretation of the life history of pattern class E of *A. tesselata* (sensu Zweifel, *op. cit.*; Parker and Selander, *op. cit.*) based on specimens collected by us in 1966, 1992, 1993, 1997, and 1998 from the southern extremity of the range in Chihuahua where it typically exists in syntopy with some combination of the parthenogenetic species *A. exsanguis* and gonochoristic species *A. gularis* (including *A. scalaris* and *A. septemvittata*; Walker 1981a. Copeia 1981:826–849; Walker 1981b. Copeia 1981:850–868) and *A. tigris* (sensu Dessauer et al. 2000. Bull. Am. Mus. Nat. Hist. 246:1–148). We include data on sample composition (estimated number of year classes represented in samples), life cycle (length of annual activity cycle, age at maturity, and life span), reproductive characteristics ($\bar{x}$ ± SE and range for body mass [BM], SVL, clutch size, yolked ovarian egg diameter, and oviductal egg diameter and length), and the relationships of clutch size to SVL and SVL to BM (of lizards with tails) for *A. tesselata* E from Chihuahua. Females were weighed, fixed in formalin, stored in ethanol, and dissected to count and measure oviductal eggs and yolked ovarian eggs, and to subjectively evaluate the size of postcoelomic fat bodies. Statistical procedures for this study were performed using JMP® 9 (SAS Institute Inc., Cary, NC), provided by a license to the University of Arkansas, with set at 0.05.

We examined 64 specimens of *A. tesselata* E from the herpetology collections of the University of Arkansas Department of Zoology (UADZ) and 17 from the University of Colorado Museum of Natural History (UCM) obtained from these sites

in Chihuahua, Mexico: south side of Río San Pedro at Meoqui (28.269209°N, 105.480599°W, datum: WSG84, elev. 1148 m) (15 June 1966 [UCM 37417, N = 1]); 21.1 km S of Cd. Delicias (28.056279°N, 105.319368°W, datum: WSG84, elev. 1230 m) (16 June 1966 [UCM 37418–37426, N = 9]); 1.6 km S of Saucillo (28.019581°N, 105.268201°W, datum: WSG84, elev. 1231 m) (16 June 1966 [UCM 37428–37429, N = 2]); 5.0 km S of Saucillo (27.990227°N, 105.264668°W, datum: WSG84, elev. 1231 m) (17 June 1966 [UCM 37430–7434, N = 5]); vicinity of El Pueblito on west side of Río Conchos (29.102227°N, 105.113768 °W, datum: WSG84, elev. 976 m) (30 May 1992 [UADZ 4563–4564, N = 2]; 7 June 1992 [UADZ 4593–4594, N = 2]; 12 June 1993 [UADZ 4841, 4850, N = 2), 10 July 1997 [UADZ 5831–5839, 5842, N = 10]; 11 July 1997 [UADZ 5846–5854, N = 9]; 12 July 1997 [UADZ 5856–5857, 5860–5861, 5863, 5865, N = 6]; 13 July 1997 [UADZ 5866, 5874–5875, 5878-5879, N = 5]; 14 July 1997 [UADZ 5888, N = 1]; 15 July 1997 [UADZ 5891–5892, 5898, N = 3]; 30 July 1998 [UADZ 6105–6114, N = 10]; 31 July 1998 [UADZ 6121–6126, N = 6]; 1 August 1998 [UADZ 6127–6130, N = 4]; 2 August 1998 [UADZ 6153–6156, N = 4]).

The June 1966 sample of *A. tesselata* E includes six subadults (based on lack of developing eggs) with a 5 mm range of variation in SVL (sample size in each category in brackets) (66, 68, 69 [2],70, 71; x̄ = 68.8 ± 0.70 mm), and 11 adults (based on smallest to largest gravid individuals) with a 14 mm range of variation in SVL (77 [2], 78, 79 [2], 80, 81, 85, 88, 90, 91; x̄= 82.3 ± 1.59 mm). We infer that the subgroup of non-reproductive lizards and the smaller individuals among the reproductive individuals are younger (~66–71 mm SVL) and older (~77–81 mm SVL) cohorts of the 1965 year class, respectively. Individuals of ~85–91 mm SVL are likely third and perhaps fourth year individuals. We attribute the absence of females of ~92–100 mm SVL in the sample to a life cycle of four years or less for most lizards of the species at the southern end of the range in Chihuahua, rather than an accident of sampling, based on paucity of this size class in the larger samples of *A. tesselata* E collected in Chihuahua in 1997 and 1998. The June 1966 sample of *A. tesselata* E was apparently collected prior to the hatching of young-of-year (YOY) lizards.

At El Pueblito near the Río Conchos, eggs oviposited by *A. tesselata* E begin hatching in early July. The emergence of hatchlings there is not accompanied by subadults from the previous summer and older adults starting to retire for the year for the winter inactivity period as was reported for pattern class E lizards which hatch in August at Puerto de Luna, eastern central New Mexico, by Walker et al. (2012. Herpetol. Rev., in press).The sample obtained at El Pueblito on 10–15 July 1997 contains YOY, subadults, and adults, whereas samples with YOY collected in August Puerto de Luna never included other age classes of larger individuals. The 1997 sample of *A. tesselata* E includes eight YOY with a 7 mm range of variation in SVL (40 [2], 41, 42 [2], 43 [2], 47; x̄ = 42.3 ± 0.80 mm), a 1.3 g range in BM (x̄ = 1.9 ± 0.15 g), and individuals from several hatching dates. Also present in the sample are five putative subadults (without developing eggs) with a 4 mm range of variation in SVL (73 [2], 76, 77 [2]; x̄ = 75.2 ± 0.92 mm) and a 5.3 g range in BM (x̄ = 12.2 ± 0.90 g), and 19 adults (based on smallest to largest gravid individuals) with a 13 mm range of variation in SVL (78 [3], 79 [3], 80, 81 [4], 83 [2], 84, 87 [2], 88, 91 [2];x̄ = 82.6 ± 0.98 mm) and a 14.8 g range of variation in BM (x̄ = 16.4 ± 0.70 g). Two live adults (UADZ 5891 and 5892) used in skin histocompatibility experiments were not included in the preceding analyses.

We also report an interesting relationship between reproductive status (e.g., not gravid, with developing ovarian eggs,

and with oviductal eggs) and size of postcoelomic fat bodies in adults of *A. tesselata* E collected in 1997 in Chihuahua. That only nine (47.4%) adults from 1997 are gravid indicates that asynchronous clutch production is characteristic of *A. tesselata* E at El Pueblito. This aspect of the life cycle could reflect production of a minimum of two clutches by some lizards; this would result in numerous hatching dates and subsequent maturity dates in ensuing years. None of the three females (81–91 mm SVL) with oviductal clutches possesses discernable fat bodies, whereas six females (78–91 mm SVL) with ovarian eggs have either small (N = 1) or large (N = 5) fat bodies. These observations suggest that clutch development is dependent upon stored resources in fat bodies that are depleted during egg growth. Four size-conditions of the fat bodies were observed among the 10 non-gravid adult females: absent (N = 2), small (N = 1), medium (N = 3), and large (N = 4). This variation points to presence of a refractory period, either between successive clutches or preceding fall hibernation, in which fat bodies are replenished after the last oviposition in southern groups of *A. tesselata* E.

The composition of the sample of *A. tesselata* E obtained at El Pueblito on 30 July–2 August 1998 is quite unlike that of the sample obtained there approximately two weeks earlier in the year in 1997. The 1998 sample included only five non-reproductive lizards, one obvious YOY of 52 mm SVL likely hatched in early July and four lizards that could represent either older YOY or second year juveniles, with a 6 mm range of variation in SVL (62, 66, 67, 68; x̄ = 65.8 ± 1.32 mm). Nineteen adults in the sample (lower limit based on smallest gravid individual) have a 30 mm range of variation in SVL (70 [3], 72 [2], 73 [2], 74, 75, 77, 79, 81 [2], 84, 87, 88, 90, 91, 100; x̄ =79.3 ± 1.98 mm) and a 23.3 g range of variation in BM (x̄ = 14.3 ± 1.31 g). These data necessitate substantial changes in our conclusions about reproduction in *A. tesselata* E from Chihuahua based on the 1966 and 1997 samples. Known minimum size at reproductive maturity is lowered from 77–78 mm and 14.0 g BM to 70 mm SVL and 10.4 g BM, and maximum size attained is raised from 91 mm and 25.0 g to 100 mm SVL and 31.4 g BM. Also, based on the 1998 sample, it is likely that all lizards of 70 mm or greater in the 1966 and 1997 samples could have attained reproductive maturity had they survived. Only five (26.3%) of 19 lizards of adult size in the 1998 sample are gravid. Based on their size (70, 72, 74, 75, 77; x̄ = 73.6 ± 1.21 mm SVL and 10.4–16.5; x̄ = 12.6 g BM), we infer that they are late-season maturing individuals from late-season hatchings of 1997. Larger individuals in the sample had apparently ceased reproductive activity for the year. Dearth of lizards of greater than 90 mm SVL was apparent in each of the four years which could indicate that in Chihuahua *A. tesselata* E has a life expectancy that seldom exceeds three years. Of 81 specimens of *A. tesselata* E examined from the state, only five (6.2%) lizards exceed 90 mm SVL (91 mm for each) and only two (2.5%) were 100 mm SVL.

Gravid females (77–91 mm SVL) in the mid-June 1966 sample of *A. tesselata* E have clutches of 3–5 eggs (x̄ = 3.7 ± 0.29, N = 7), and likely represent year classes two, three, and perhaps four. Gravid females (78–91 mm SVL) in the early to mid-July 1997 sample have clutches of 2–5 eggs (x̄ = 4.0 ± 0.37, N = 9), and likely also represent year classes two, three, and perhaps four. Preovulatory females (78–91 mm SVL) in this sample have yolked ovarian follicles of 3.7–11.5 mm in diameter (x̄ = 6.9 ± 1.14, N = 6); postovulatory females (81–91 mm) have oviductal eggs of 10.0–10.5 mm in diameter (x̄ = 10.2 ± 0.17, N = 3) and 15.0–17.0 mm in length (x̄ = 16.3 ± 0.67, N = 4). Gravid females (70–77 mm SVL) in the late July–early August 1998 sample have clutches of

only 2–3 eggs ($\bar{x}$ = 2.6 ± 0.24, N = 5), and apparently represent only year class two. Preovulatory females (72–77 mm SVL) have yolked ovarian follicles of 4.5–8.5 mm in diameter ($\bar{x}$ = 6.7 ± 1.17, N = 3); postovulatory females (74–75 mm) have oviductal eggs of 9.5–10.5 mm in diameter ($\bar{x}$ = 10.0 ± 0.50, N = 2) and 17.0–17.5 mm in length ($\bar{x}$ = 17.3 ± 0.25, N = 2).

From 1966, seven females with data have clutches (sample size in each category in parens) of 3 (3), 4 (3), and 5. From 1997, nine females with data have clutches of 2, 3 (2), 4 (2), and 5 (4). From 1998, five females with data have clutches of 2 (2) and 3 (3). Using the pooled sample of gravid females of *A. tesselata* collected from Chihuahua in three different years, we found a strong relationship between clutch size and SVL (based on adjusted r^2 = 0.57, *P* = 0.0001, N = 21). We also report an even stronger relationship between BM and SVL (based on adjusted r^2 = 0.86, *P* = 0.0001, N = 58).

Time of collection during the year strongly affects sample composition of *A. tesselata* E from the southern part of the range in Chihuahua. This accounts for the 1966 and 1998 samples being the only significantly different (*P* = 0.05) pair of means for clutch size. Date of collection apparently accounts for the finding of synchronous clutch development in the June 1966 sample, but a finding of strongly asynchronous production in the later mid-July 1997 and late July-early August 1998 samples as second year lizards mature at different times. Minimally, clutch production involves parts of three months (June, July, and August) resulting in a variety of hatching dates and times at which lizards become reproductively mature. Based on an activity cycle from April to November, in Chihuahua, *A. tesselata* E matures in less than a calendar year at a SVL as small as 70 mm.

In the immediate vicinity of El Pueblito, on the west side of Río Conchos, there is a patchwork of agricultural plots, peripheral to and between which are islands of habitat used by whiptail lizards. Three species occur in the area: *A. gularis* (*sensu* Walker 1981a, b, *op. cit.*), *A. tigris* (*sensu* Dessauer et al., *op. cit.*), and *A tesselata* E (*sensu* Zweifel, *op. cit.*). Visits to the area by JEC and FMQ in 1992 and 1993 resulted in collection of large numbers of *A. gularis*, and small numbers of *A. tigris* and *A.tesselata* E. In 1997 and 1998, concentration of effort in disclimax areas along the periphery of fallow fields and pecan groves greatly increased the numbers of *A. tesselata* E observed/collected. As knowledge of the variety of habitats occupied by whiptail lizards at El Pueblito increased, it became possible to maximize collection of any one of the three species present by careful choice of where to expend search efforts. On some occasions, all three species were collected in close proximity; however, in all cases one of the three species was numerically dominant. That *A. tesselata* is occasionally inseminated by a syntopic gonochoristic species at El Pueblito is indicated by our collection of a hybrid of the genealogy *A. tesselata* × *A. gularis* (UADZ 4852) from near the Río Conchos on 12 June 1993 (Walker et al. 2000. Southwest. Nat. 45:527–533).

Live and preserved lizards imported from México by FMQ and JEC and referenced in this report were collected in Chihuahua under the authority of permits SEMARNAT 4295/97 and SEMARNAT 7182/98 granted to FMQ by the government of México. We thank Wade C. Sherbrooke for providing the address of FMQ (deceased).

JAMES E. CORDES, Division of Sciences and Mathematics, Louisiana State University Eunice, Eunice, Louisiana 70535, USA (e-mail: jcordes@lsue.edu); **JAMES M. WALKER**, Department of Biological Sciences, University of Arkansas, Fayetteville, 72701, USA (e-mail: jmwalker@uark.edu);

FERNANDO MENDOZA-QUIJANO (deceased), Instituto Technológico Agropecuario No. 6, Huejutla de los Reyes, Hidalgo, México.

CHALCIDES GUENTHERI (Güenther's Cylindrical Skink). **REPRODUCTION.** *Chalcides guentheri* is known from southern Lebanon, Israel, southwest Syria and northwest Jordan (Sindaco and Jeremcenko 2008. The Reptiles of the Western Palearctic. Edizioni Belvedere, Latina, Italy. 579 pp.). It is reported to be viviparous as are other congeners (Disi et al. 2001. Amphibians and Reptiles of the Hashemite Kingdom of Jordan. Edition Chimaira, Frankfurt am Main, Germany. 408 pp.). The purpose of this note is to provide information on the reproductive cycle of *C. guentheri* in Israel.

A sample of 27 *C. guentheri* consisting of 7 males (mean SVL = 90.9 mm ± 7.4 SD, range = 82–103 mm) and 20 females (mean SVL = 120.7 mm ± 18.7 SD, range = 164–122 mm), collected 1944–1989 in Israel (31.5°N, 34.75°E) and deposited in the Zoological Museum of the Department of Zoology. Tel-Aviv University (TAUM), Tel Aviv, Israel was examined TAUM: 758, 760, 766, 768, 773, 1069, 1476, 2538, 2714, 2903, 3874, 3886, 4681, 5172, 5191, 5537, 5848, 6080, 7438, 8456, 9511, 11107, 11108, 11437, 12867, 13309, 13787.

A cut was made in the lower abdominal cavity and the left testis or ovary was removed, embedded in paraffin, cut into 5 μm sections and stained with Harris hematoxylin followed by eosin counterstain. Enlarged follicles > 3 mm or oviductal eggs were counted. Histology slides are deposited in TAUM.

Three stages were noted in the testicular cycle: (1) recrudescence, a proliferation of germ cells has commenced in the seminiferous tubules for the next period of sperm formation, primary spermatocytes predominate; (2) late recrudescence (just prior to sperm formation), secondary spermatocytes and spermatids predominate; (3) spermiogenesis, lumina of the seminiferous tubules are lined by sperms or clusters of metamorphosing spermatids. One male from December exhibited recrudescence; five males from March exhibited spermiogenesis; one male from April exhibited late recrudescence. The smallest reproductively active male (undergoing spermiogenesis) measured 82 mm SVL (TAUM 760). This is an approximation of minimum size for sexual maturity as no males < 82 mm SVL were examined.

Four stages were noted in the ovarian cycle (Table 1). The presence of one April female with oviductal eggs and concurrent yolk deposition for a subsequent clutch (TAUM 2538) indicates *C. guentheri* may produce multiple clutches. Mean clutch size (n

TABLE 1. Monthly stages in the ovarian cycle of 20 *Chalcides guentheri* from Israel.

Month	N	Inactive	Early yolk deposition	Enlarged follicles >3 mm	Oviductal eggs
January	2	2	0	0	0
February	2	2	0	0	0
March	6	3	2	0	1
April	4	1	0	2	1*
May	2	0	1	1	0
June	1	1	0	0	0
September	1	1	0	0	0
October	1	1	0	0	0
December	1	1	0	0	0

* One female with oviductal eggs exhibited concurrent yolk deposition.

= 5) was 5.8 ± 2.3 SD, range = 3–8. The smallest reproductively active female (undergoing early yolk deposition) measured 85 mm SVL (TAUM 4881) and was collected in March. This is an approximation of minimum size for sexual maturity as no females < 85 mm SVL were examined.

Reproduction of *C. guentheri* in Israel commences in the spring although I am unable to state how long it continues. Reproduction in the congener *C. ocellatus* similarly begins in the spring in Egypt with parturition occurring from April through September (Badir and Hussein 1965. Bull. Fac. Sci., Cairo Univ. 39:179–185).

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STEPHEN R. GOLDBERG, Whittier College, Department of Biology, P.O. Box 634, Whittier, California 90608, USA (e-mail: sgoldberg@whittier.edu).

CYCLURA CYCHLURA FIGGINSI (Exuma Island Rock Iguana). RODENT KILL. Rodents are proficient invaders on a global scale and have been implicated in the extinction and decline of endemic reptiles, particularly on islands (Case and Bolger 1991. Evol. Ecol. 5:272–290; Towns et al. 2006. Biol. Invasions 8:863–891). Most studies (e.g., Towns et al. 2003. Conserv. Biol. 17:1361–1371; Towns et al. 2006, *op. cit.*) have rightfully focused on the negative consequences of non-native rodents on insular reptiles while neglecting neutral or even potentially positive effects. Though unclear if neutral or positive, here we report an Exuma Island Rock Iguana (*Cyclura cychlura figginsi*) attacking and killing a non-native Ship Rat (*Rattus rattus*) on 13.6 ha Gaulin Cay (24.12270°N, 76.40679°W; datum WGS84) in the Exuma Islands, The Bahamas.

During the afternoon of 11 December 2011, one of us (BL) was photographing Exuma Island Rock Iguanas on the western beach of Gaulin Cay when an adult iguana (ca. 30 cm SVL) approached to within 2 m, stopped, turned its head, flicked its tongue, and then lunged its head rapidly under a loose aggregation of flat limestone rocks. A squeal was heard, and a Ship Rat could be seen thrashing before being extracted from beneath the rock. The iguana readjusted his grasp on the rat from the neck to mid-body before slowly walking back to the vegetation (Fig. 1). While walking, other iguanas gave chase, perhaps to steal the

Fɪɢ. 1. Exuma Island Rock Iguana (*Cyclura cychlura figginsi*) walking immediately after killing a Ship Rat (*Rattus rattus*) on Gaulin Cay, Exuma Islands, The Bahamas.

rat, forcing the iguana further inland and out of sight. We cannot confirm that the iguana consumed the rat, though we suspect this to be the case as *Cyclura* iguanas have been documented killing birds (Hines et al. 2002. Herpetol. Rev. 33:306), and eating carrion (Gerber et al. 2002. Herpetol. Rev. 33:133–134).

Rock iguanas of the genus *Cyclura* feed almost exclusively on vegetation (Alberts [ed.] 2000. West Indian Iguanas: Status Survey and Conservation Action Plan. IUCN, Gland, Switzerland. 111 pp.; Auffenberg 1982. *In* Rand and Burghardt [eds.], Iguanas of the World: Their Behavior, Ecology, and Conservation, pp. 84–116. Noyes Publications, Park Ridge, New Jersey) with animal matter typically comprising less than 3% of their diet (Cooper and Vitt 2002. J. Zool. 257:487–517). Predation on vertebrates has been reported infrequently, with only birds reported being killed (Hines et al., *op. cit.*). To our knowledge, this is the first documented report of a *Cyclura* species attacking and killing a mammalian vertebrate in the wild. Rock iguanas and rats have been sympatric on Gaulin Cay since at least 1980 (Iverson, unpubl. data) and the population has been under continuous study by CRK since 1997. The population is considered healthy both genetically (Malone et al. 2003. Conserv. Genet. 3:1–15) and demographically (Knapp, unpubl. data). The extent to which rock iguanas kill or consume rats on Gaulin Cay, and whether such attacks are motivated by potential nutritional benefits, warrants further study.

BANFF LUTHER, 520 Folly Road, Suite P 313, Charleston, South Carolina 29412, USA (e-mail: sailpavana@gmail.com); **CHARLES R. KNAPP,** Daniel P. Haerther Center for Conservation and Research, John G. Shedd Aquarium, Chicago Illinois 60605, USA (e-mail: cknapp@sheddaquarium. org); **DANIEL U. GREENE**, Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, 3911 Hwy 2321, Panama City, Florida 32409, USA (e-mail: dan.greene@myfwc.com); **SANDRA D. BUCKNER,** P.O. Box N-8893, Villa Capulet, Montague Foreshore, Nassau, The Bahamas (e-mail: sbuckner@coralwave.com); **JOHN B. IVERSON**, Department of Biology, Earlham College, Richmond, Indiana 47374, USA (e-mail: johni@earlham.edu).

ELGARIA MULTICARINATA (Southern Alligator Lizard). OVIPOSITION SITE AND EGG ATTENDANCE. Despite being widespread and commonly encountered, observations of oviposition sites, egg attendance and parental care behaviors from wild Southern Alligator Lizards are lacking. Under captive conditions, *Elgaria multicarinata* has been reported to oviposit communally in sand under flat stones (Langerwerf 1981. Brit. Herpetol. Soc. Bull. 4:21–25) and 13 eggs were deposited in the side branch of a captive Ornate Box Turtle (*Terrapene ornata*) burrow in an outside enclosure (Fitch 1935. Trans. Acad. Sci. St. Louis 24:3–38). Other accounts (Gander 1931. Copeia 1:14–15; Burrage 1965. Copeia 1965:512) describe oviposition in captivity but lack physical descriptions of nest sites. Fitch (*op. cit.*) suspected that wild *E. multicarinata* laid eggs in rodent burrows such as *Spermophilus* and *Thomomys*, and a general account (Lemm 2006. Field Guide to Amphibians and Reptiles of the San Diego Region. Univ. California Press. 326 pp.) stated that oviposition occurs in "burrows, rock crevices, and the burrows of rodents such as the pocket gopher (*Thomomys bottae*)." Egg attendance occurred in three captive *E. multicarinata* (Langerwerf, *op. cit.*), but parental care remains undescribed from wild populations. Herein, we describe a natural oviposition site and egg attendance by *E. multicarinata*, and provide a representative thermal profile of the site.

On 30 June 2010, an adult *E. multicarinata* (113 mm SVL; 306 mm TL; 25.5 g) was discovered attending a clutch of eggs in a

FIG. 1. An adult *Elgaria multicarinata* attending a clutch of eggs in an exposed soil crack near Los Vaqueros Reservoir in Alameda County, California.
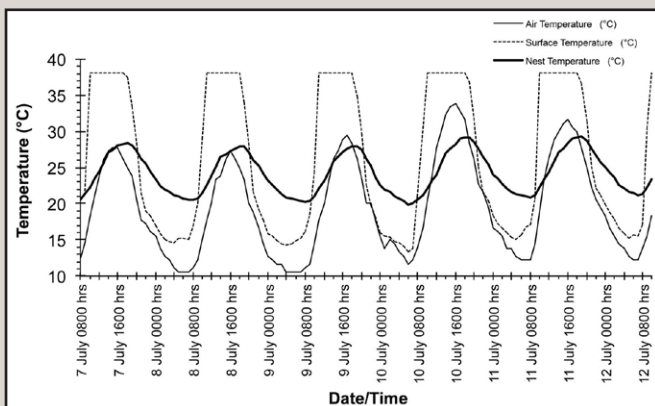

FIG. 2. Thermal profile of an *Elgaria multicarinata* oviposition site in relation to air and surface temperatures from 7 July–12 July 2010.

soil crack (approx. 2 cm wide, 20–23 cm depth) on a north-facing slope (approximately 14°) in grazed grassland near Los Vaqueros Reservoir, Alameda Co., California, USA (Fig. 1; 37.770617°N, 121.737583°W; WGS84; 241 m elev.). The oviposition site was discovered by investigating the soil crack using a shovel in an area proposed for excavation (approximately 2 m^2) with heavy equipment to expose a small portion of a buried natural gas pipeline. The adult lizard (assumed to be a female) was coiled around at least seven eggs (one measured 16.6 mm in length). Care was taken to minimize disturbance by gently replacing clods of dried soil (well-drained Altamont soil type; Nomad Ecology 2008. Wetland delineation and preliminary jurisdictional determination for the gas line 131 project; unpublished report prepared for Pacific Gas and Electric Company, 53 pp.). The surrounding vegetation was composed primarily of non-native annuals including *Brassica nigra, Bromus diandrus, B. madritensis, Carduus pycnocephalus,* and *Hordeum murinum leporinum* as well as *Malvella leprosa,* a native perennial herb (Nomad Ecology, *op. cit.*). The oviposition site was located approximately 15 m southeast of a small permanent wetland supporting *Distichlis spicata, Juncus cf. xiphioides,* and *Rumex crispus* (Nomad Ecology, *op. cit.*).

During two subsequent visits on 6, 7, and 12 July 2010, the adult was attending the eggs, using coils of its body to encircle them, and did not exhibit mouth gaping or attempt to bite. On 7 July 2010, two temperature data loggers (HOBO Optic Stow-Away®, Onset Computer Corporation) were placed at the surface

of and within the soil crack, then removed on 12 July 2010. Air temperatures were obtained during this period from the Remote Automated Weather Station (RAWS) at Los Vaqueros (VAQC1; 37.7883°N, 121.7347°W; 338 m elev.) located 2.0 km N of the oviposition site. Temperatures within the oviposition site (range = 19.84–29.31°C; mean = 24.23°C; SD = 2.90) varied significantly less than air temperatures (range = 10.56–33.89°C; mean = 19.50°C; SD = 6.76; single-factor ANOVA, $F_{(1,241)}$ = 3.88, P<0.0001) and surface temperatures (range = 13.34–38.14°C; mean = 26.26°C, SD = 10.09; single-factor ANOVA, $F_{(1,241)}$ = 3.88, P = 0.034) from 7–12 July (Fig. 2). Surface temperatures during this period reached a maximum of 38.14°C (Fig. 2), likely due to the logger's upper threshold for temperature measurements. Langerwerf (*op. cit.*) reported captive incubation temperatures ranging from 27–30°C with most hatching success at 27°C, which is several degrees higher than the average oviposition site temperature (mean = 24.23°C).

The adult and eggs were not present on 4 August 2010, suggesting that egg attendance had occurred for at least 13 days (30 June–12 July 2010). There were no eggshells in or around the site and two lizard fecal pellets were presumably left by the adult *E. multicarinata*. The absence of eggshells suggests that: 1) the eggs hatched and shells were subsequently displaced or ingested by the parent, or 2) the nest had been depredated.

This observation confirms that egg attendance occurs in wild *E. multicarinata*, a behavior which has apparently not been observed from wild populations but would be expected considering parental care in related *Elgaria kingii* and many other anguid lizards (Greene et al. 2006. S. Amer. J. Herpetol. 1:9–19).

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MICHAEL D. MULROY, Garcia and Associates, 2601 Mission Street, Suite 600, San Francisco, California 94110, USA (e-mail: mmulroy@garciaandassociates.com); **KEVIN D. WISEMAN**, Garcia and Associates, 2601 Mission Street, San Francisco, California, 94110, USA; Department of Herpetology, California Academy of Sciences, 55 Music Concourse Drive, Golden Gate Park, San Francisco, California 94118, USA (e-mail: kwiseman@garciaandassociates.com).

***ENYALIUS CATENATUS.* PREDATION.** On 16 March 2008 a semi-arboreal *Enyalius catenatus* was predated by a young female Yellow-breasted Capuchin Monkey (*Cebus xanthosternos*), at about 10 m high at 1230 h. The predation event was observed at a secondary forest in Una Biological Reserve, Bahia, Brazil (39.050°W, 15.167°S; datum WGS84), one of the largest forest remnants in the Northern Atlantic Forest (~11,400 ha). A young male capuchin monkey begged for sharing, crying and staring at the lizard's body at one meter from the female. Vertebrate flesh seems to be a craved food among primates, as sharing and begging events are common during the consumption of this type of food item (Canale and Lingnau 2003. Herpetol. Rev. 34:136; Perry and Rose 1994. Primates 35:409–415). The female monkey ate the head and all viscera of the lizard, leaving fore and hind limbs, dorsal muscles, and tail intact. Very few specimens of *E. catenatus* have ever been collected, having previously been restricted to Bahia and Pernambuco (Rodrigues et al. 2006. Phyllomedusa 5:11–24). It is endemic to the northern Atlantic Forest, which is the most human-altered region within this biome (Ribeiro et al. 2009. Biol. Conserv. 142:1141–1153).

The lizard was collected and deposited in the Museum of Zoology of the State University of Santa Cruz, Ilhéus, Bahia, Brazil (MZUESC 6552).

GUSTAVO RODRIGUES CANALE, Universidade do Estado de Mato Grosso (Campus Tangaráda Serra), MT 358, Km6, Jd. Aeroporto, 78300-000, Tangaráda Serra, MatoGrosso, Brazil (e-mail: g.canale@cantab.net); **MARCO ANTONIO DE FREITAS,** Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), Rua Maria da Anunciação, 208, Eldorado, Brasiléia, Acre, Cep: 69-932-000, Brazil (e-mail: philodryas@hotmail.com).

***GEKKO JAPONICUS* (Japanese Gecko). DEFORMITY.** On 30 August 2011, a free-living male *Gekko japonicus* was observed on a brick column in East Park of Fukuoka, Japan (33.604561°N, 130.420542°E; datum WGS84). The gecko was found to have multiple abnormalities on the left side of its body. The left forelimb appeared to be hypoplastic, with the overall size of the limb being reduced, and the manus on the affected limb had only two

Fɪɢ. 1. *Gekko japonicus* with multiple deformities found in Fukuoka, Japan.

Fɪɢ. 2. Deformed *Gekko japonicus* exhibiting esotropic strabismus of the left eye.

complete digits with a partial third (Fig. 1.). The left eye of the gecko exhibited esotropic strabismus with very little pupillary light reflex (Fig. 2.). The gecko did not seem to have a full field of view on the affected side; it showed no response when approached from a left posterior angle. However, when approached from the left anterior side of its head, the gecko would readily bite fingers and conspecifics. The gecko ran noticeably slower than normal and was easily caught. Based on data presented by Tochigi (1984. Jap. J. Herpetol. 10:80–88), it is estimated that this gecko, with a SVL of 45 mm, was about one year old at the time of the observation. The presence of a hemipenial bulge, pre-anal pores, and thick cloacal spurs clearly indicated this was a male. The gecko lacked its original tail, but its replacement appeared to be in the latter stages of regeneration. After capture, the gecko was examined and released at the site a few hours later.

In 2011, we observed at least 450 free-living *G. japonicus* in Fukuoka and this is the only specimen we observed with such significant deformities. Injury could account for lack of digits on the manus as well as the defects of the eye. However, although in anurans injury to tadpoles may result in limbs of reduced size (Ballengeé and Sessions 2009. J. Exp. Zool. [Mol. Dev. Evol.] 312B:1–10), we are not aware of any report of injury resulting in overall reduced proportions in the limbs of reptiles. It has been observed that extreme ranges in viable incubation temperature of developing reptile embryos may result in various deformities, including malformation of the eyes as well as limb anomalies (Deeming and Ferguson 1991. Egg Incubation: its Effect on Embryonic Development in Birds and Reptiles. Cambridge Univ. Press, Cambridge, UK. 448 pp.). It has also been suggested that environmental contamination might be linked to deformities in some reptiles (Khan and Law 2005. Proc. Pakistan Acad. Sci. 42:315–323), including malformation of the eyes and limbs (Bell and Congdon 2006. Environ. Pollut. 142:457–465). Genetic determining factors are also known to be responsible for abnormalities seen in reptiles (Olson et al. 1996. J. Evol. Biol. 9:229–242; Velo-Anton et al. 2011. PLoS ONE 6: e18714.doi:10.1371/journal. pone.0018714). In this case, genetic or environmental factors are both plausible causes for the deformities observed in the gecko. Photographs of the *G. japonicus* were deposited in the University of Texas at Arlington Amphibian and Reptile Diversity Research Center's digital slide library (UTADC 719–7193).

KENT R. CALDWELL, 1-22-8 205 Yoshizuka, Hakata-ku Fukuoka-shi, Fukuoka-ken 812-0041, Japan (e-mail: Allosaurus.fragilis@gmail.com); **XI HONG,** 1-1301, Blding #5, Weibohao Jiayuan, Weigongcun, Haidian District Beijing, 10081, P. R. China.

***GERRHONOTUS LIOCEPHALUS* (Weigman's Alligator Lizard). DEFORMITY.** There are no previous reports of a wild adult *Gerrhonotus liocephalus* with deformities. Here we report an adult male observed on 18 July 2008, 453 m NW El Ocote (Aguascalientes, México; 21.787596°N, 102.561382°W; WGS84; 1938 m. elev.) with six digits in each rear limb. We conducted 26 field trips to this location during 2008–2009, finding many individuals of this species, including adults and juveniles, but only this specimen exhibited a deformity. The specimen was deposited in the Herpetological Collection of Universidad Autónoma de Aguascalientes (UAA-CV-00326).

RUBÉN A. CARBAJAL-MÁRQUEZ (e-mail: redman031@hotmail. com)**,** Centro de Investigaciones Biológicas del Noroeste, Mar Bermejo 195, Colonia Palo de Santa Rita, La Paz, Baja California Sur, 23090 México; **ZAIRA Y. GONZÁLEZ-SAUCEDO** (e-mail: zayaglz@hotmail.com), Universidad Autónoma de Querétaro, Facultad de Ciencias. Av. de la Ciencias S/N, Col.

Juriquilla, C.P. 76230 Querétaro, Querétaro, México; **GUSTAVO E. QUINTERO-DÍAZ** (e-mail: gequintmx@yahoo.com.mx), Universidad Autónoma de Aguascalientes, Centro de Ciencias Básicas, Departamento de Biología. Ciudad Universitaria, C. P. 20131, Aguascalientes, Aguascalientes, México.

GONATODES ALBOGULARIS (Yellow-headed Dwarf Gecko). PREDATION. The predation of frogs, lizards, and snakes by spiders in the tropics has been well documented (e.g., Ervin et al. 2007. Herpetol. Rev. 38:468; Jones et al. 2011. Herpetol. Rev. 42:441; Lange 2007. Herpetol. Rev. 38:460; Riehl et al. 2008. Herpetol. Rev. 39:77). In many cases, predatory species of arachnids specialize in capturing reptile and amphibian prey without the use of webs and instead utilize methods such as active foraging or ambush techniques (e.g., Dehling 2007. Herpetol. Rev. 38:444; Ervin et al. 2007. Herpetol. Rev. 38:185; Streicher et al. 2011 Herpetol. Rev. 42:432). Herein we report arachnid predation on *Gonatodes albogularis* by *Nephila clavipes* (Golden Silk Orbweaver Spider). Although spiders of the family Nephilidae (*Nephila* and *Nephilengys*) have been known to attack vertebrate prey (Peloso and Sousa 2007. Rev. Brasil. Ornitol. 15:461–463; Zippel and Kirkland 1998. Herpetol. Rev. 29:46), to the best of our knowledge this is the first account of predation on *G. albogularis*.

On 5 Sept 2011 at 1945 h, at Caño Palma Biological Station (Limon Province, Costa Rica, 10.3537°N, 83.31380°W, 11 m elev.) we observed an adult female *Gonatodes albogularis* in the web of a *Nephila clavipes*. The web was located on a building surrounded by a *Manicaria* palm swamp (Myers 1990. *In* Lugo et al. [eds.], Ecosystems of the World 15: Forested Wetlands, pp. 267–278. Elsevier Science Publishers, Amsterdam). Upon initial observation, the lizard was already subdued and located near the center of the web. The lizard's tail was severed near the midpoint, though the autotomized portion of the tail remained tethered to the body by the *Nephila*'s silk. At this stage there were tears in the lizard's skin, and extensive tissue damage to the left groin area, possibly indicating an envenomation site. There were also signs of previous mastication at the terminal end of the tail stub. We speculate that the exposed *Gonatodes* autotomy tissue would be the spider's access point for consumption. At 1950 h,

FIG. 1. Adult female *Gonatodes albogularis* being predated upon by the spider *Nephila clavipes* at Caño Palma Biological Station, Costa Rica.

the *Gonatodes* had come loose from its original position and fell to the lower portion of the web, forming a pocket where it hung for the remaining duration of observation. Subsequent observations were made every 20 minutes from 1945 h until 2245 h, and then resumed on 6 Sept 2011 at 0500 h until 0600 h. At this stage the observations ceased due the lizard falling out of the web. With the exception of the 2100 h observation, the spider fed consistently on the lizard. By 0500 h most of the remaining tail stub and rear right leg of the *Gonatodes* had been devoured. The spider appeared to be consuming the lizard in a manner which created a widening shallow depression in the lizard's flesh (Fig. 1). It is interesting to note that with the prospect of such a large meal, the *Nephila* made no attempt to re-secure the prey once it shifted position, chancing the loss of such a valuable meal. This may indicate a correlation between energy expenditure from applying additional silk against the potential gain from the meal. The shift of the lizard's position caused damage to the web's structure, though the web was already in need of repairs in the lower portion. Although the initial capture was not observed, it should also be noted that the spider was missing one leg, which was located in the lower extremity of the web. This is possibly a sign of immediate additional energy expenditure on the part of the spider, in the form of limb regeneration and web repairs, thus demonstrating the spider's motivation to conserve silk (Higgins 1987. J. Arachnol. 15:401–417; Weissman and Vollrath 1999. Bull. Brit. Arachnol. Soc. 11:198–203). No kleptoparasitic activity was observed.

DONALD FILIPIAK, 3161 NW 68th Street, Fort Lauderdale, Florida 33309, USA (e-mail: Asydabass@yahoo.com); **TODD LEWIS**, Caño Palma Biological Station, 8 km Norte de Tortuguero, Limon, Costa Rica (e-mail: Ecolewis@gmail.com).

GYMNODACTYLUS GECKOIDES. DEFENSIVE BEHAVIOR. The behavior of lifting up and curling the tail over the body is a strategy employed by some lizards to avoid predation attempts (Pianka and Vitt 2003. Lizards: Windows to the Evolution of Diversity. Univ. California Press. Berkeley. 333 pp.). There are two hypotheses on how this behavior might have evolved. The first assumes that the position adopted exposes the lizard's tail to potential predators and this might result in tail autotomy if any predation attempt is made, distracting attention from the head. The second hypothesis is that the behavior constitutes Batesian mimicry, in which a harmless lizard species performs a display to appear as a harmful species.

Some authors have previously observed lizards that appear to be mimicking scorpions. The mimics include the geckos *Coleonyx variegatus* (Parker and Pianka 1974. Copeia 1974:528–531) and *Teratoscincus roborowskii* (Autum and Han 1989. Chinese Herpetol. Research 2:60–64). In Brazil there are reports of curling the tail over the back for *Gymnodactylus amarali* (Colli et al. 2003. J. Herpetol. 37:694–706), *Coleodactylus brachystoma* (Brandão and Motta 2005. Phyllomedusa 4:139–145), and *Gonatodes humeralis* (Costa et al. 2009. Herpetol. Rev. 40:221). Herein we report similar defensive behavior in another gecko species, *Gymnodactylus geckoides*, from a semi-arid area in Pentecoste municipality, state of Ceará, northeastern Brazil (3.81833°S, 39.33722°W).

FIG. 1. Adult individual of *Gymnodactylus geckoides* exhibiting the defensive display and detail of the banded ventral pattern of the tail.

Gymnodactylus geckoides exhibits terrestrial and saxicolous habits, nocturnal and crepuscular periods of activity, and is distributed in the Caatinga (thorny deciduous tropical savanna) of northeastern Brazil (Vanzolini et al. 1980. Répteis das Caatingas. Academia Brasileira de Ciências. Rio de Janeiro. 162 pp.; Vitt 1995. Occ. Pap. Oklahoma Mus. Nat. Hist. 1:1–29).

During field work from January 2008 to June 2010 we captured 22 individuals of *Gymnodactylus geckoides* by time-constrained search and pitfall-trapping. The specimens collected were deposited in the scientific collection Coleção Herpetológica da Universidade Federal do Ceará (CHUFC). In the field, all lizards (N = 22), including males, females and juveniles, displayed a tail-curling behavior after handling or simply provoked by the approach of other sympatric lizards (*Ameiva ameiva*, *Cnemidophorus ocellifer*, *Diploglossus lessonae*, *Hemidactylus agrius*, *Mabuya heathi*, *Phyllopezus pollicaris*), when confined in the same enclosure with these species. During the displays, the lizards lifted their tails and bent them over their bodies, exposing the ventral coloration of the tail consisting of contrasting light and dark bands (Fig. 1).

We observed at least three abundant scorpion species in the study area, *Bothriurus asper*, *Bothriurus rochai* (Bothriuridae), and *Rhopalurus rochae* (Buthidae). We cannot disregard the possible effectiveness of tail exposition to predators, but five components of our observations support the hypothesis that the behavior represents mimicry of scorpions by *Gymnodactylus geckoides*. First, the body shape of *G. geckoides* during the defensive display resembles that of a scorpion shape in defensive situations. Second, the geckos and scorpions are similar in body size. Third, the banded ventral color pattern of the lizard tail and the tails of sympatric scorpions are similar. Fourth, there is a high abundance of scorpions living syntopically with the lizards. Finally, *G. geckoides* shares the same activity period with the scorpions.

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DANIEL CUNHA PASSOS (e-mail: biologodanielpassos@gmail.com), **PAULO CESAR MATTOS DOURADO DE MESQUITA** (e-mail: pauloc-
mdm@gmail.com), and **DIVA MARIA BORGES-NOJOSA** (e-mail: dmbno-josa@yahoo.com.br), Núcleo Regional de Ofiologia da Universidade Federal do Ceará (NUROF-UFC), Campus do Pici, Centro de Ciências, Bloco 905, Pici, CEP 60.455-760, Fortaleza, Ceará - Brazil.

***HETERODACTYLUS IMBRICATUS*. DIET**. *Heterodactylus imbricatus* is a gymnophthalmid that occurs in southeastern Brazil (Minas Gerais, Rio de Janeiro, São Paulo, and Espírito Santo states) in high altitude areas of the Atlantic Rainforest domain (Dixo and Verdade 2006. Biot. Neotrop. 6:1–20; Rodrigues et al. 2009. J. Herpetol. 43:605–611; Von Hering 1898. Proc. Acad. Nat. Sci. Philadelphia 50:101–109) and riparian forest associated with Cerrado (Novelli et al. 2011. Check List 7:30–31). This species is terrestrial with fossorial habits and lives in leaf litter or low vegetation (Marques et al. 2009. Biot. Neotrop. 9:1–12). Data on the feeding habits of this species are scarce and the few data reported on diet indicate that this species generally feeds on arthropods (Marques et al. 2009, *op. cit.*), but do not detail which groups of arthropods that compose the diet of this lizard species. Here we report the diet of *H. imbricatus* in detail from the analysis of stomach contents of eight adult specimens (five males and three females; CRLZ 000074, 000143, 000183, 000185, 000191, 000238, 000289, 000314) that were deposited in the Coleção de Répteis do Laboratório de Zoologia, Centro Universitário de Lavras (CRLZ) – UNILAVRAS. These specimens are from the Reserva Biológica Unilavras — Boqueirão (RBUB) (21.346389°S, 44.990833°W, datum WGS84; elev. 1250 m) in riparian forest associated with Cerrado plant communities. Food items were identified according to Triplehorn and Johnson (2011. Estudo dos Insetos. Tradução da 7. Edição de Borror and Delong's Introduction to the Study of Insects. Cengage Learning, São Paulo. 809 pp.). All food items present in the stomach contents were identified as belonging to the following arthropod orders: Coleoptera (abdomen and parts of the abdomen, parts of the thorax, antennae, elytra, legs and leg pieces, and wings); Orthoptera (legs, abdomen, mandibles, antennae); Isoptera (wings, legs, parts of the abdomen); Hymenoptera (heads); Blattodea (legs and leg pieces). As many arthropod taxa were detected only as fragments, accurate calculations for percentage by number or volume could not be made. The lack of more detailed studies, such as dietary data, reflects the low population density of *H. imbricatus*. This report is the first detailed record on the diet of *H. imbricatus* belonging to an area of Cerrado Biome in Brazil.

GLENDA FERNANDA MORTON (e-mail: mortongf@yahoo.com.br), **FERNANDO ANTÔNIO FRIEIRO-COSTA** (e-mail: ffrieiro@gmail.com) and **IARA ALVES NOVELLI** (e-mail: iaranovelli27@gmail.com), Núcleo de Pesquisa em Ciências Biológicas, Centro Universitário de Lavras, Rua Padre José Poggel, 506, Centenário, CEP37200-000, Lavras, Minas Gerais, Brazil.

IGUANA IGUANA **(Green Iguana). PREDATION.** The list of known *Iguana iguana* predators is extensive. It ranges from snakes, lizards, and crocodilians to mammals such as wild cats, coatis, tayras, and monkeys (e.g., Rivas et al. 1998. Herpetol. Rev. 29:238–239; Savage 2002. The Amphibians and Reptiles of Costa Rica: A Herpetofauna Between Two Continents, Between Two Seas. University of Chicago Press, Chicago, Illinois. 934 pp.). This species is also known to fall prey to domestic animals such as cats and dogs (Meshaka et al. 2004. The Exotic Amphibians and Reptiles of Florida. Krieger Publ. Co., Malabar, Florida. 166 pp.) as well as being the target of human hunting (Savage 2002, *op. cit.*). The list of known avian predators is equally extensive with

Fɪɢ. 1. A Spectacled Owl (*Pulsatrix perspicillata*) preying upon a sub-adult *Iguana iguana* at La Gamba Field Station, Costa Rica.

raptors, falcons, herons, and toucans serving as a few examples (e.g., Rivas et al. 1998, *op. cit.*; Savage 2002, *op. cit.*). In the southern part of Florida, USA, where the Green Iguana is an established exotic species (Meshaka Jr. et al. 2004, *op. cit.*), there are reports of Burrowing Owls (*Athene cunicularia*) utilizing young Green Iguanas as a prey item (Meshaka et al. 2005. Florida Field Nat. 33:125–127). Herein we report predation by the Spectacled Owl (*Pulsatrix perspicillata*), which to the best of our knowledge has not been previously recorded.

On 22 Aug 2011 at 2150 h at La Gamba Field Station (La Gamba, Puntarenas Province, Costa Rica), we observed a Spectacled Owl consuming a sub-adult *Iguana iguana*. The iguana appeared to be decapitated, though we did not perform a closer inspection to see if the head had been completely removed (Fig. 1). Notably, although *Iguana iguana* utilize arboreal perches for sleeping (Savage 2002, *op. cit.*), the location of consumption was on the ground next to a lagoon. This leads us to believe that either the iguana was captured on its perch and then consumed on the ground, or the lizard made an attempt to escape and dove from its perch, where it was then subdued by the owl. Another interesting observation is the condition of the bird. The owl appears to be wet, however, the 11.5 mm of rain that fell on La Gamba Field Station that day ended before 1800 h. This might suggest that the iguana dove from its perch attempting to escape into the nearby lagoon, causing the owl to pursue its prey into the water. Upon returning to the site 30 minutes later, the owl was in the same location, still consuming the iguana.

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DONALD FILIPIAK, 3161 NW 68th Street, Fort Lauderdale, Florida 33309, USA (e-mail: asydabass@yahoo.com); **GREGOR GEISLER** (e-mail: gregor_geisler@gmx.de); **DENNIS KOLLARITS** (e-mail: dennis.kollarits@gmail.com); **CHRISTIAN WAPPL** (e-mail: christian.wappl@live.at).

OLIGOSOMA CHLORONOTON (Green Skink). **LONGEVITY, SITE FIDELITY.** Ecologically, the reptile fauna of New Zealand is characterized by extended longevity and generally low reproductive rates, which make many species vulnerable to human disturbance and introduced mammalian predators (Cree 1994. New Zealand J. Zool. 21:351–372; Daugherty et al. 1993. TREE 8:437–442). Reptiles of New Zealand can also show extreme site-fidelity (e.g., Lettink and Whitaker 2006. Herpetol. Rev. 37:223–224).

Such knowledge of species biology and longevity is important for effective conservation management (Towns and Ferreira 2001. Biol. Cons. 98:211–222). However, general conclusions about the extended longevity and site fidelity in New Zealand lizards (currently estimated at ~100 known taxa and undescribed entities; Hitchmough et al. 2010. New Zealand J. Zool. 37[3]:203–224) are limited as few studies have followed individually identified lizards in the wild for the time required to trace individuals throughout their natural life span. Among those that have, considerable longevity and site fidelity are evident. For example, the gecko *Woodworthia brunneus* (as *Hoplodactylus maculatus* in Lettink and Whitaker, *op. cit.*) on Motonau Island can live for at least 42 years within 20 m² (Lettink and Whitaker, *op. cit.*), and the diurnal skink *O. lineoocellatum* on North Brother Island can live for at least eight years, but probably no more than 14 years, and all without moving more than 15–60 m (Hoare et al. 2005. Herpetol. Rev. 36:181). Here I augment longevity and site fidelity information on New Zealand reptiles with a report for the rarely observed Green Skink (*O. chloronoton*).

During mark-resight monitoring of critically threatened grand (*O. grande*) and Otago (*O. otagense*) skinks from a mainland site at Macraes Flat, New Zealand (45.4400ºS, 170.4300ºE; elev. 520 m), sightings of *O. chloronoton* were also recorded. From 2006 to 2011 in January and February (austral summer) a 0.5 km² area was visually searched on five fine-weather days spaced over 2–3 wks. The area searched consists of ~70 rock outcrops within native tussock grassland, and includes some native scrub. All lizards of interest (those that are not common) were photographed from the nose to the foreleg region to provide high quality digital images of both lateral sides. The digital photographs can be compared accurately over long time frames to provide individual identification (much like fingerprints in humans) and this technique has been used successfully in many *Oligosoma* species (e.g., Gebauer 1999. Trapping and identification techniques for small-scaled skinks (*Oligosoma microlepis*), Department of Conservation, Wellington, New Zealand. 24 pp.). Four adult-sized (max. 108 mm SVL; Gill and Whitaker 2001. New Zealand Frogs and Reptiles, David Bateman Ltd., Auckland, New Zealand. 112 pp.) *O. chloronoton* were seen during the five year survey and three were resighted at least once. All resighted *O. chloronoton* were within 20–40 m of their original location indicating limited dispersal. One *O. chloronoton* was observed five years after first being sighted as an adult. As New Zealand skinks take at least three years to reach sexual maturity (Whitaker 1976. Forest and Bird 202:8–11), the most conservative estimate for longevity in the wild is eight years. The four *O. chloronoton* were all found on north facing slopes; none were observed on south-facing slopes. All four individuals were seen on low rocks surrounded by vegetation with two present on rocks occupied by both *O. grande* and *O. otagense*.

Oligosoma chloronoton is part of a species complex (Greaves et al. 2007. Mol. Phylogen. Evol. 45:729–739), and is classed as "in decline" under the New Zealand Threat Classification system (Hitchmough et al. 2010, *op. cit.*). Yet, few data are available on its general biology, probably due to its cryptic nature and low capture/sighting rate. The finding that *O. chloronoton* live for at least eight years and have relatively high site fidelity in the wild agrees with data for other New Zealand skinks (e.g., *O. lineoocellatum* can live for 8–14 years within a 15–60 m area; Hoare et al., *op. cit.*), and further supports the suggestion that New Zealand lizards are relatively long-lived in comparison with other lizards (e.g., Read 1998. Aust. J. Zool. 46:617–629). The vulnerability of

reptiles from New Zealand due to habitat loss and introduced predators, along with their low annual reproductive output, extended longevity and limited movement, emphasize the need for on-going and effective conservation management.

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RIKI D. MULES, Department of Conservation, Otago Conservancy, PO Box 5244, Moray Place, Dunedin 9058, New Zealand; e-mail: riki.mules@ visitzealandia.com).

POLYCHRUS MARMORATUS (Common Monkey Lizard). EN-DOPARASITES. *Polychrus marmoratus* is known from Venezuela, Trinidad and Tobago, the Guianas, Brazil, Amazonian Colombia, Ecuador, and Peru (Ugueto and Rivas 2010. Amphibians and Reptiles of Margarita, Coche and Cubagua. Edition Chimaira, Frankfurt am Main, Germany. 350 pp.). There is one report of endoparasites from *P. marmoratus*; Guerrero (1971. Mem. Soc. Ciencias Nat. LaSalle 31:175–230) described the nematode *Pseudostrongyluris polychrus* from *P. marmoratus* from Venezuela. In this note we present a new locality record for *Pseudostrongyluris polychrus* from *P. marmoratus*.

Eight *P. marmoratus* (mean SVL = 103.5 mm ± 6.4 SD, range = 96–114 mm) were collected in June 1964 at Port of Spain (10.66666°N, 61.51667°N, datum WGS84; 0 m elev.), Trinidad and Tobago, and deposited in the herpetology collection of the Sam Noble Museum (OMNH), Norman, Oklahoma, USA as 31718–31720, 32084–32088. Lizards were fixed in 10% formalin and stored in 70% ethanol.

The digestive tract was removed, opened, and the contents were examined under a dissecting microscope. One female and five (two males and three females) nematodes were found in the large intestines of OMNH 31719 and 31720, respectively. They were cleared in a drop of lactophenol on a microscope slide, cover slipped, studied under a compound microscope, and identified as *Pseudostrongyluris polychrus*. Prevalence (percent infected hosts/number hosts examined x 100) = 25%; mean intensity (mean number helminths ± 1SD = 3.0 ± 2.8 SD, range = 1–5). Voucher nematodes were deposited in the United States National Parasite Collection, (USNPC), Beltsville, Maryland, USA as USNPC 105607. Trinidad and Tobago is a new locality record for *Pseudostrongyluris polychrus*. *Polychrus marmoratus* remains the only known host for *Pseudostrongyluris polychrus*.

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STEPHEN R. GOLDBERG, Department of Biology, Whittier College, Whittier, California 90608, USA (e-mail: sgoldberg@whittier.edu); **CHARLES R. BURSEY,** Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, US (e-mail: cxb13@ psu.edu); **LAURIE J. VITT,** University of Oklahoma, Department of Zoology, Norman, Oklahoma 73072, USA (e-mail: vitt@ou.edu); **JEANETTE ARREOLA,** Department of Biology, Whittier College, Whittier, California 90608, USA (e-mail: jarreola@poets.whittier.edu).

PODARCIS MURALIS (Common Wall Lizard). SAUROPHAGY. *Podarcis muralis maculiventris* (Southern Alps lineage) is a medium-sized European lizard from northwest Italy, southern Switzerland, parts of Austria and one location in extreme southern Germany. It has also been introduced in Cincinnati, Ohio with satellite colonies in Kentucky and Indiana. *Lacerta b. bilineata*

Fig. 1. *Podarcis muralis* preying on a *Lacerta bilineata*.

(Western Green Lizard) is a large-sized European lizard that has been introduced in Topeka, Kansas (Burke and Deichsel 2008. *In* Mitchell et al. [eds.], Urban Herpetology, pp.347-353. SSAR Herpetol. Conserv., Salt Lake City, Utah). The natural European range of *L. bilineata* is completely overlapped by *P. muralis*. Here we report on a Common Wall Lizard predating a Western Green Lizard in their natural range.

On 24 August, 2011, MA observed an adult Common Wall Lizard seizing and killing a young Western Green Lizard near the village of Carena in the Morobbia valley, Switzerland, canton of Ticino (46.1777778°N, 9.0977778°E, 967 m elev.) (Fig. 1). The prey individual was approximately two-thirds of the predator's size, a remarkably large prey item. The wall lizard dragged its prey into a wall joint where it could no longer be observed. The only explanation we can offer is that the wall lizard did so in order to eat it, or perhaps parts of it (e.g., the tail). To our knowledge, this is the first documented case of *P. muralis* predating a *L. bilineata*.

Podarcis siculus, a species closely related to *P. muralis*, was reported to be saurophagic; Capula and Aloise (2011. Acta Herpetol. 6:11–14) documented two cases of *P. siculus* preying on small geckos (*Hemidactylus turcicus*). Grano et al. (2011. Biodiv. J. 2:151–152) and Burke and Mercurio (2002. Amer. Mid. Nat. 147:368–375) each documented an adult *P. siculus campestris* eating young of its own species.

We conclude that the saurophagic feeding behavior of these *Podarcis* species should raise concern about possible negative impacts on native lizard species where they are introduced. For instance, Deichsel and Walker (2010. Herpetol. Rev. 36:228–229) reported that introduced *P. muralis maculiventris* (Southern Alps lineage) were replacing *Plestiodon fasciatus* from a habitat in Indiana, and the return of the latter after removal of the introduced species.

GUNTRAM DEICHSEL, Friedrich-Ebert-Str. 62, Biberach, Germany DE – 88400 (e-mail: Guntram.Deichsel@gmx.de); **MICHEL ANSERMET,** Fondation du Vivarium de Lausanne, Chemin de Boissonnet 82, Lausanne, Switzerland CH – 1010 (e-mail: Michel.Ansermet@vivariumlausanne.ch).

SCELOPORUS COZUMELAE (Cozumel Spiny Lizard). REPRODUCTION AND FEMALE COLORATION. There are few reports on the natural history of *Sceloporus cozumelae*, a Mexican species restricted to coastal scrub habitat of the northern Yucatán Peninsula and associated islands (Lee 1996. Amphibian and

Reptiles of the Yucatán Peninsula. Cornell Univ. Press, Ithaca, New York. 500 pp.). Published data on breeding consists of female reproductive status (determined from dissection or palpation) and date of capture. Most females collected in the area of Progreso (Yucatán) in June and July had eggs, and three females captured in mid-December had shelled eggs "in the uterus" (Maslin 1963. Univ. Colorado Stud. Ser. Biol. No. 9, pp. 1–20). Females with vitellogenic follicles have been found in early January in Progreso (F. R. Mendez de la Cruz, pers. comm.). These data, in concert with scattered observations of hatchlings and juveniles, suggest that *S. cozumelae* has an extended breeding season (Lee 1996, *op. cit.*). Here I report observations that, while limited, nonetheless indicate that (1) individuals in populations of *S. cozumelae* on the eastern side of the peninsula are also breeding in late December and (2) females can exhibit an orange reproductive coloration. The eastern peninsula is more mesic than the western side where the above reports for this species were made, but northern storms produce a rainy period in December and January.

Four sets of observations from Isla Contoy (21.4725°N, 86.7891°W) on 27 Dec 2011 are consistent with winter breeding activity on the eastern side of the peninsula. I did not capture the lizards because Isla Contoy is a National Park. First, I observed a mating pair on the south end of the island in the middle of a sandy trail surrounded by dense coastal scrub vegetation (primarily *Suriana maritima*, Sea Lavender; *Coccoloba uvifera*, Sea Grape). The intromission, which was observed in its entirety, was relatively short (<1 min.) and occurred at 1145 h (28.3°C, 0% cloud cover). Second, I observed three large, apparently adult females, and each had a distended abdomen. These females looked like similar-sized *Sceloporus virgatus* I have studied when this species has late-vitellogenic follicles (e.g., Hews et al. 2004. Anim. Behav. 68:1201–1207). Third, I observed a large, apparently adult female with a pair of large, bright orange throat patches. Orange reproductive coloration has not been reported for *S. cozumelae*. Reproductive coloration probably is underreported for many species in this genus, and occurs in a number of phrynosomatid lizards (Cooper and Greenberg 1992. *In* Gans and Crews [eds.], Biology of the Reptilia Vol. 18, Physiology E, Hormones, Brain and Behavior, pp. 298–422. Univ. Chicago Press, Chicago, Illinois). In *S. virgatus* females, throat patch size and intensity increases with ovarian stage, and late-vitellogenic and gravid females have the largest, most-colorful throat patches (Weiss 2002. Ethology 108:793–813). These patches are highly conspicuous against a pure white throat and chest and are easy to observe with binoculars when there is sufficient light and the throat can be viewed; these were the conditions under which I observed the orange patches of the *S. cozumelae* female. Fourth, most adult-sized males viewed with binoculars had an enlarged ventral region at the base of the tail, consistent with enlarged hemipenes. In other *Sceloporus* this androgen-dependent swelling does not occur in subadult males, and regresses in non-breeding adult males (pers. obs. on *S. undulatus* and *S. virgatus*). I saw six males (all with enlarged hemipenes), four females and one juvenile (ca. 40 mm SVL) in 120 min of observation time. Hence, all adult-sized females were in reproductive condition (i.e. seen mating, or with apparently late-vitellogenic and/or with orange color), and all adult-sized males exhibited enlarged tail-base region.

Finally, on 28 Dec 2011, on the nearby mainland (21.291389°N, 86.818889°W) along the coastal Isla Blanca road north of Punta Sam (Quintana Roo), I saw 20 *S. cozumelae* during 100 min of observation time spent in extensive coastal scrub habitat, under windy, overcast (ca. 85% cloud cover) but warm (27–28°C) conditions between 1030 and 1210 h. Two *S. cozumelae* appeared to be the size of juveniles and the remainder appeared adult-sized. A number of apparently adult males were observed on conspicuous elevated perches, consistent with breeding activity of males. Two such males were captured and both had enlarged hemipenes.

DIANA K. HEWS, Department of Biology, Indiana State University, Terre Haute, Indiana 47834, USA; e-mail: diana.hews@indstate.edu.

THECADACTYLUS SOLIMOENSIS. **ENDOPARASITES.** *Thecadactylus solimoensis* is known from parts of Ecuador, Peru, Bolivia, Brazil, and Colombia (Bergmann and Russell 2007. Zool. J. Linn. Soc. 149:339–370.). We know of no reports of helminths for *T. solimoensis* and the purpose of this note is to establish the initial helminth list for this species.

A sample of 18 *T. solimoensis* (mean SVL = 104.0 mm ± 12.7 SD, range: 76–106 mm) collected 1994 and 1998 from the herpetology collection of the Sam Noble Museum (OMNH), University of Oklahoma, Norman, Oklahoma, USA were examined for helminths. Eleven (OMNH 36427–36437) were collected in Sucumbios Province, Ecuador; five (OMNH 37332–37336) were collected in Rondônia State, Brazil; two (OMNH 37635, 37636) were collected in Amazonas State, Brazil. Lizards were fixed in 10% formalin and stored in 70% ethanol.

The stomachs were not available for study. The intestines were removed, opened and the contents examined utilizing a dissecting microscope. Four nematodes were found in the large intestine of OMNH 37335, collected in Rondônia State, Rio Formoso, Parque Estadual, ca. 90.0 ± km N of Nova Mamoré, (10.38333°S, 65.38333°W; datum WGS 84, elev. ca. 147 m). The nematodes were cleared in a drop of lactophenol on a microscope slide, cover slipped, studied under a compound microscope and identified as one male and three females of *Spauligodon oxkutzcabiensis*. Prevalence (percent infected hosts/number hosts examined x 100) = 6%. Helminths were deposited in the United States National Parasite Collection (USNPC), Beltsville, Maryland, USA as USNPC 105345.

Spauligodon oxkutzcabiensis has been reported in lizards from Mexico, Central and South America see (Goldberg and Bursey 2009. Herpetol. Rev. 40:224). Infection presumably occurs by exposure to eggs in fecal contaminated substrate as postulated for the congener *Spauligodon giganteus* (Goldberg and Bursey 1992. J. Parasitol. 78:539–541). *Spauligodon oxkutzcabiensis* in *T. solimoensis* is a new host record.

We thank Jessa L. Waters (OMNH) for facilitating our loan of *T. solimoensis*.

STEPHEN R. GOLDBERG, Whittier College, Department of Biology, P.O. Box 634, Whittier, California 90608, USA (e-mail: sgoldberg@whittier.edu); **CHARLES R. BURSEY,** Pennsylvania State University, Shenango Campus, Department of Biology, Sharon, Pennsylvania 16146, USA (e-mail: cxb13@psu.edu); **LAURIE J. VITT,** University of Oklahoma, Department of Zoology, Norman, Oklahoma 73072, USA (e-mail: vitt@ou.edu).

TROPIDURUS HYGOMI (Reinhardt's Lava Lizard). **PREDATION.** Predation is an important factor influencing ecological community structure (Morin 1983. Ecol. Monogr. 53:119–138). However, such events are rarely reported from natural interactions within the environment due to the rarity of observations (Shepard 2007. Herpetologica 63:193–202). Snakes have very diverse diets, preying on a wide variety of invertebrates and vertebrates (Greene 1997. Snakes: The Evolution of Mystery in Nature.

Fig. 1. *Oxybelis aeneus* preying upon a juvenile *Tropidurus hygomi*, Sergipe, Brazil.

Univ. California Press, Berkeley. 365 pp.). Lizards are potential prey items of snakes in various environments (Silva and Araújo 2008. Ecologia dos Lagartos Basileiros. Technical Books, Rio de Janeiro. 271 pp.).

At 1032 h on 1 June 2008 we observed a Brown Vine Snake (*Oxybelis aeneus*) prey upon a *Tropidurus hygomi* (Fig. 1) in Parque Nacional Serra de Itabaiana, Sergipe, Brazil (10.7488889°S, 37.3419444°W, datum SAD 69; 240 m elev.). The snake was an adult male measuring 910 mm (SVL) and the lizard was a juvenile measuring 40.2 mm (SVL). This took place at the edge of a *Clusia* sp. (Guttiferae) shrub in an area with white sandy soil.

To our knowledge, this is the first report of predation of *Tropidurus hygomi* by *O. aeneus* or by any snake species.

RAFAEL ALVES DOS SANTOS (e-mail: ufsbio@gmail.com), DANIEL OLIVEIRA SANTANA, FRANCIS LUIZ SANTOS CALDAS, and RENATO GOMES FARIA, Núcleo de Pós-Graduação em Ecologia e Conservação, Universidade Federal de Sergipe, 49.000-000, São Cristóvão, Sergipe, Brazil.

UROMASTYX BENTI (Bent's Spiny-tailed Lizard). MAXIMUM ELEVATION. After revisions to the *Uromastyx ocellata* group (Wilms and Schmitz 2007. Zootaxa 1394:1–23), *U. benti* is known from southeastern Yemen and neighboring southwestern Oman. In Oman, it is known only from the immediate vicinity of Mirbat (Seufer et al. 1998. Herpetofauna 20:22–23). Mirbat is a coastal town, and all of these records from the region are from low elevations (e.g., MVZ 242745: elev. 35 m, 17.00933°N 54.70283°E; WGS 84). In Yemen, it is known from Makulla (e.g., NHMW 888:1 and NHMW 16174:1), Ayn Ba Ma'bad near Azzan (e.g., NHMW 21214: 1–2), and Wadi Abr in Hadramaut (e.g., BMNH 1953.1.8.52). All documented localities in Yemen lack elevational data, but the approximate elevation of Makulla is 21 m, Ayn Ba Ma'bad near Azzan is 33 m, and Wadi Abr in Hadramaut is 3 m. Thus, all previously recorded localities of *U. benti* are coastal and at low elevations. We report an adult male and female (MVZ ObsHerp 6 and MVZ ObsHerp 7 photo vouchers) observed basking on a rock at high elevation of 1410 m adjacent to the Arabian Leopard Reserve at Jabal Samhan in the Mirbat Wilayat of the Dhofar Governorate of Oman (17.1337°N, 54.7376°E; WGS 84) on 02 July 2011. This represents the highest elevational record for *U. benti* and may guide further explorations of the range of this poorly sampled species.

TODD W. PIERSON, Odum School of Ecology, University of Georgia, Athens, Georgia 30609, USA (e-mail: twpierso@uga.edu); THEODORE J. PAPENFUSS, Museum of Vertebrate Zoology, University of California, Berkeley, California 94720, USA.

VARANUS PANOPTES (Yellow-spotted Monitor). DIET. *Varanus panoptes* is a large lizard (up to 1.5 m in total length) inhabiting riparian areas and floodplains in tropical Australia (Cogger 2000. Reptiles and Amphibians of Australia. Reed New Holland, Sydney. 808 pp.). It is a generalist carnivore, consuming mammals, frogs, reptiles, fish, invertebrates, and the eggs of reptiles and birds (Blamires 2004. Copeia 2004:370–377; Christian 2004 *In* Pianka and King [eds.], Varanoid Lizards of the World, pp. 423–429. Indiana University Press, Bloomington and Indianapolis; Shine 1986. Herpetologica 42:346–360). Not surprisingly, snakes have been reported in its diet, including the Keelback Snake (*Tropidonophis mairii*), the Brown Tree Snake (*Boiga irregularis*), and a file snake (*Acrochordus* sp.) (Blamires 2004, *op. cit.;* Shine 1986, *op. cit.*). Herein we report on *V. panoptes* feeding on two additional snake species in tropical northern Australia. We discuss the implications of one of these observations for trophic cascades induced by the invasive Cane Toad (*Bufo marinus*) via population declines in *V. panoptes*.

At 1629 h on 26 May 2001, four of us (SD, BG, DR, GD) discovered a *V. panoptes* eating a Water Python (*Liasis fuscus*) on a shaded sand bank along the Daly River, Northern Territory, Australia (13.939836°S, 131.183361°E). About 0.3 m of the tail of the approximately 1 m snake was hanging out of the mouth of the 1.3 m lizard. The monitor moved slowly away from us upon the approach of our boat, and appeared to be unable to swallow the remaining portion of the snake; it made no attempt to further swallow the snake. After 11 minutes of observation there was no change in the proportion swallowed, at which time we departed the site. The weather was clear and sunny with an air temperature of 26.8°C. Because the Water Python is nocturnal and the monitor diurnal, the snake was probably taken from its roost during the day (e.g., from within a hollow log).

At 1300 h on 17 October 2006, one of us (MH) observed a *V. panoptes* eating a Common Tree Snake (*Dendrelaphis punctulata*) in riparian habitat lining the Adcock River at Mornington Wildlife Sanctuary, Western Australia (17.537°S, 126.115°E).

Fig. 1. A Yellow-spotted Monitor, *Varanus panoptes*, eating a Common Tree Snake, *Dendrelaphis punctulata*, from Mornington Wildlife Sanctuary, Western Australia.

Upon discovery, approximately 20 cm of the snake's tail was on the ground near the monitor as it gradually swallowed the snake from the head end (Fig. 1). Both the monitor and snake were >1 m long, and ingestion took more than 6 minutes. The weather was hot and sunny. Like *V. panoptes*, *D. punctulata* is diurnal (Fearn and Trembath 2010. Aust. J. Zool. 58:384–389), suggesting capture during the active period.

Varanus panoptes is one of three species of monitor lizards that suffer severe population-level declines, via lethal toxic ingestion, with the invasion of Cane Toads (e.g., 83–96%, Doody et al. 2009. Anim. Conserv. 12:46–53). Because *V. panoptes* is an apex predator, its marked reduction has been implicated in population or recruitment boosts in several species of its prey, including Gilberts' Dragons (*Amphibolorus gilberti*), Pig-nosed Turtles (*Carettochelys insculpta*), and Freshwater Crocodiles (*Crocodylus johnstoni*) (Doody et al. 2006. Wildl. Res. 33:349–354; Doody et al. 2009, *op. cit.*; Webb and Manolis 2010 *In* Manolis and Stevenson [eds.], Crocodiles. Status Survey and Conservation Action Plan, 3rd ed., pp. 66–70. Crocodile Specialist Group, Darwin, NT). Most recently, marked increases in annual counts of common tree snakes were attributed to the toad-induced decline in *V. panoptes* (Doody et al., *in press*), although published accounts of *V. panoptes* eating tree snakes were lacking. Our observation provides the "smoking gun" for that study by confirming the Common Tree Snake as a prey item of *V. panoptes*. Because this predation event likely reflects both tree snake population regulation by *V. panoptes* and a cascading effect of invasive Cane Toads in the tropical riparian vertebrate community, our observation reinforces the importance of publishing anecdotal accounts of diet.

J. SEAN DOODY, The Orianne Society, 579 Hwy 441 South, Clayton, Georgia, 30525, USA (e-mail: jseandoody@gmail.com); **MICHELLE HALL,** Department of Zoology, University of Melbourne, Victoria, 3010, Australia (e-mail: hall.m@unimelb.edu.au); **DAVID RHIND**, Department of Sustainability, Environment, Water, Population and Communities, PO Box 787 Canberra, ACT, Australia, 2601 (e-mail: David.Rhind@environment.gov.au); **BRIAN GREEN**, Institute for Applied Ecology, University of Canberra, Australian Capital Territory, 2601, Australia (e-mail: bfigreen@gmail.com); **GIL DRYDEN,** Department of Biology, Slippery Rock University, Slippery Rock, Pennsylvania 16057, USA (e-mail: gildryden38@aol.com).

SQUAMATA — SNAKES

***BOA CONSTRICTOR* (Boa Constrictor). DIET.** *Boa constrictor* is a widely distributed species, ranging from Mexico to Argentina. This snake inhabits a remarkable range of habitats, from arid scrub to humid tropical forest, and feeds on lizards, birds and mammals, with endothermic animals comprising a large proportion of the diet of adult specimens (Greene 1983. *In* Janzen [ed.] Costa Rican Natural History, pp. 380–382. Univ. Chicago Press, Illinois; Quick et al. 2005. J. Herpetol. 39:304–307; Pizzatto et al. 2009. Amphibia-Reptilia 30:533–544). On 9 March 2011 an adult *B. constrictor* (CFL-CH-046; total length = 165 cm; 3.5 kg) was captured in the Campus Florestal of the Universidade Federal de Viçosa, municipality of Florestal, Minas Gerais, Brazil (19.87°S, 44.42°W, datum: SAD69; elev. 750 m), at the edge of a forest fragment near a marsh. In the snake's stomach, we found several feathers, some bones, and both feet of an *Aramides saracura* (Slaty-breasted Wood-Rail; Aves: Rallidae). This is a locally common medium-sized rail (ca. 500 g) found in forests and woodlands near marshes and riparian habitats throughout southeastern and southern Brazil, eastern Paraguay and northeastern Argentina (Taylor and Perlo 1998. Rails. Pica Press, Sussex). It is considered endemic to the threatened Atlantic Forest (Brooks and Balmford 1999. Anim. Conserv. 2:211–222).

LEONARDO ESTEVES LOPES (e-mail: leo.cerrado@gmail.com), **MARCOS CÉSAR GURGEL DE OLIVEIRA** and **ANA CAROLINA STEFANO,** Laboratório de Zoologia, Universidade Federal de Viçosa – Campus Florestal, Rodovia LMG-818, km 6, 35690-000, Florestal, Minas Gerais, Brazil.

***BOTHRIOPSIS BILINEATA SMARAGDINUS* (Green Jararaca). REPRODUCTION.** Little is known about the reproduction of *Bothriopsis bilineata smaragdinus*, a relatively small, arboreal, prehensile-tailed pitviper distributed in western Amazonia. In September 2011, a pregnant female *B. b. smaragdinus* was rescued from Santo Antônio Hydroelectric Plant, Porto Velho - RO (08.8022°S, 63.9720°W, datum: WGS84) and sent to the Laboratory of Herpetology at Instituto Butantan, São Paulo, Brazil. The snake was housed in a plastic cage and was fed two *Rana catesbiana* tadpoles every 15 days. On 21 October 2011, the female (SVL = 600 mm; tail length [TL] = 90 mm; 87 g) gave birth to five neonates (two males and three females). Measurements of the male neonates were 230 mm SVL, 40 mm TL, 4.1 g and 210 mm SVL, 45 mm TL, 4.1 g; measurements of the females were 225 mm SVL, 40 mm TL, 3.7 g; 215 mm SVL, 45 mm TL, 3.7 g; and 230 mm SVL, 35 mm TL, 4.1 g. The post-partum mass of the mother was 56.5 g and the combined mass of the living neonates was 22.6% of the mother's pre-partum mass. In previous studies, four eggs were observed in the oviduct of this species (Dixon and Soini 1986. The Reptiles of the Upper Amazon Basin, Iquitos Region, Peru. Milwaukee Publ. Mus., Wisconsin. 157 pp.).

KATHLEEN F. GREGO, WILSON FERNANDES, ANA PAULA CROCE, DANIELA R. VASCONCELLOS, SÁVIO S. SANT'ANNA, Laboratório de Herpetologia, Instituto Butantan, Av. Vital Brazil, 1500, SP,05503-900, Brazil; **JULIANO TUPAN CORAGEM**, Santo Antonio Energia S.A., Porto Velho, Rondônia, Brazil.

***COLUBER CONSTRICTOR* (North American Racer), *PANTHEROPHIS ALLEGHENIENSIS* (Eastern Ratsnake), and *NERODIA FASCIATA* (Southern Watersnake). GOLF CART MORTALITY.** The benefit of golf courses as small-scale refugia and set-aside natural environments for herpetofauna within urban settings have been well documented (Hodgkinson et al. 2007. Biol. Conserv. 135:576–586). An important yet understudied aspect of golf courses is the potential for collisions between herpetofauna and golf carts. Although carts have been implicated in road mortality in at least one study (DeGregorio et al. 2010. Herpetol. Conserv. Biol. 3:441–448), direct evidence for golf cart induced mortality is absent. Here we present five cases in which golf cart collisions directly caused snake mortality on Bald Head Island, Brunswick Co., North Carolina, USA.

On 7 June 2009, we observed a gravid female *Coluber constrictor* (SVL = 826 mm) being struck and subsequently dying from a single collision with a golf cart. We observed a second snake, an adult male *Pantherophis allegheniensis* (SVL = 653 mm), being hit and killed by a golf cart on 1 July 2009. On 29 July 2009, we saw a neonate *C. constrictor* (SVL = 235 mm) get hit on the road and it was presumed dead by the time we arrived, although the body was still twitching. On 10 August 2009, a neonate female *Nerodia fasciata* (SVL = 180 mm) was hit by a golf cart while crossing a paved path on the golf course. Although the snake survived the initial collision, it died two hours later. The fifth observation occurred on 16 September 2009, when a juvenile *C. constrictor* (SVL = 361 mm) was hit by a single golf cart. As in the previous

observation, the snake survived the initial collision but died the following night. Although golf courses may provide benefits to many species of herpetofauna, the potential for increased mortality due to collisions with golf carts should not be ignored.

ERIC J. NORDBERG, Middle Tennessee State University, Murfreesboro, Tennessee, 37132, USA (e-mail: ericjnordberg@gmail.com); BRETT A. DE-GREGORIO, University of Illinois at Champaign - Urbana, 1102 S Goodwin Ave, Urbana, Illinois 61801, USA (e-mail: Baretta66@hotmail.com).

COLUBER (=MASTICOPHIS) FLAGELLUM FLAGELLUM (Eastern Coachwhip). DIET. *Coluber flagellum* is known to be a widely foraging predator, actively preying upon lizards, amphibians, small mammals, and birds (Halstead et al. 2008. Herpetologica 65:268–279; Secor 1995. Herpetol. Monogr. 9:169–186). On 30 April 2010, at 1330 h, we observed a male *C. flagellum* (SVL = 119 cm; tail length = 43 cm; 401 g) attempting to ingest an adult *Columbina passerina* (Common Ground Dove) in beach dune habitat within Guana Tolomato Matanzas National Estuarine Research Reserve (30.125753°N, 81.347092°W; datum: WGS84; elev. 3 m), South Ponte Vedra Beach, Florida, USA. The snake abandoned its prey and fled towards a nearby active *Gopherus polyphemus* (Gopher Tortoise) burrow upon our approach. To our knowledge this represents the first documented observation of *C. flagellum* preying upon *C. passerina*.

ANTHONY LAU, Department of Wildlife Ecology and Conservation, P.O. Box 110430, University of Florida, Gainesville, Florida 32611, USA (e-mail: antlau1@gmail.com); JOSEPH P. BURGESS, Florida Department of Environmental Protection, Guana Tolomato Matanzas National Estuarine Research Reserve, 505 Guana River Road, Ponte Vedra, Florida 32082, USA (e-mail: joseph.burgess@dep.state.fl.us).

EUNECTES MURINUS (Green Anaconda). DIET. *Eunectes murinus* is a generalist predator that ambushes its prey along the edges of aquatic habitats (Rivas 2000. Life History of the Green Anaconda [*Eunectes murinus*], with Emphasis on its Reproductive Biology. Ph.D. Thesis, Univ. Tennessee, Knoxville. 269 pp.). While there are several accounts of the diet of adult individuals there is little information about prey consumed by young anacondas in nature. Here we report two records of predation on diurnal birds by a juvenile *E. murinus* in central Brazil.

At 1715 h on 9 July 1999, we found a juvenile *E. murinus* (CHUNB 12799; total length = 1069 mm; 451 g) along a stream in gallery forest 10 km W of the city of Palmas, Tocantins State, Brazil (10.1667°S, 47.4353°W, datum: WGS84; elev. 230 m). The snake was found under a dead log in a small backwater of the stream and was constricting a female *Rhamphocelus carbo* (Silver-beaked Tanager; total length = 102 mm; 59 g). Upon dissection, we found that the snake had also recently consumed a female *Claravis pretiosa* (Blue Ground-dove; total length = 190 mm; 59 g). The relative size of each prey item was 13% of the snake's body mass and their combined relative mass (26%) was close to those previously reported for other aquatic snakes of comparable size (Andreadis and Burghardt 2005. J. Comp. Psychol. 119:304–310). Small birds may play an important role in the diet of young anacondas before they grow large enough to subdue and kill larger prey (Rivas, unpubl. data).

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MARCELO ARAÚJO BAGNO, Departamento de Zoologia, Universidade de Brasília, Brasília-DF, CEP 70910-900; REUBER ALBUQUERQUE BRANDÃO, Laboratório de Fauna e Unidades de Conservação, Departamento de Engenharia Florestal, Universidade de Brasília, Brasília – DF,
CEP 70910-900 (e-mail: reuberbrandao@yahoo.com.br); AYRTON KLIER PÉRES-JÚNIOR, Seriema Serviços e Estudos do Meio Ambiente. SCLN 412, Bloco "B", loja 40, Brasília – DF, Brazil, CEP 70.867-520.

GYALOPION CANUM (Chihuahuan Hook-nosed Snake). PREDATION. *Gyalopion canum* occurs in the southwestern United States into central New Mexico and west Texas southward into central Mexico in Zacatecas and San Luis Potosí (Tipton 2005. Snakes of the Americas: Checklist and Lexicon. Krieger Publ. Co., Malabar, Florida. xii + 477 pp.). Little is known regarding the predators of this species. During an examination of the stomach contents of a road-killed Kit Fox (*Vulpes macrotis*) collected 10 April 1997 on Sycamore Street, Roswell, Chaves Co., New Mexico, USA (33.7027°N; 104.5683°W; datum: WGS84) a mostly intact adult *G. canum* was found. Habitat was a pecan orchard in an agricultural area on the outskirts of Roswell, generally surrounded by Chihuahuan Desert grasslands and shrublands.

Cypher (2003. *In* Feldhamer et al. [eds.], Wild Mammals of North America, 2nd ed., pp. 511–546. John Hopkins Univ. Press, Baltimore, Maryland) lists snakes and lizards as a component of the diet of *V. macrotis* but does not provide details of the species involved. To our knowledge this is the first report of *G. canum* being preyed upon by *V. macrotis*. Both specimens are deposited into the University of New Mexico Museum of Southwestern Biology (*V. macrotis*, Division of Mammalogy MSB 231268; *G. canum*, Division of Herpetology MSB 61425).

CHARLES W. PAINTER, New Mexico Department of Game and Fish, 1 Wildlife Way, Santa Fe, New Mexico 87507, USA (e-mail: charles.painter@state.nm.us); C. GREGORY SCHMITT, P.O. Box 267, Kirtland, New Mexico 87417, USA (e-mail: dgsschmitt@earthlink.net); ROBERT L. HARRISON, Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131-1091, USA (e-mail: rharison@unm.edu).

HELICOPS ANGULATUS (Watersnake). PREDATION. There are few records of predation on aquatic snakes by invertebrates. Here we report a predation event on a young *Helicops angulatus* by an aquatic ant-lion larva (Corydalidae) in Cavalcante Municipality, Goiás, Brazil (13.8122°S, 47.4342W, datum: SAD6984). At 2200 h on 10 October 2011, we found a neonate *H. angulatus* (CHUNB 67470; SVL = 114 mm) being seized and consumed by a large Corydalidae larvae (total length = 66 mm) under a submerged rock along the margins of São Bartolomeu river. The larva was holding the snake by the neck, while remaining attached to the underside of the rock. The larva held the snake motionless by seizing it with its limbs. When we lifted the rock, the larva released the snake, which attempted to swim away. The snake was collected alive, but subsequently died from a deep injury to its neck.

SUELEM MUNIZ LEÃO, Programa de Pós-Graduação em Ciências Florestais, Departamento de Engenharia Florestal, Universidade de Brasília, Brasília, Distrito Federal, Brazil, CEP 70910-900; REUBER ALBUQUERQUE BRANDÃO, Laboratório de Fauna e Unidades de Conservação, Departamento de Engenharia Florestal, Universidade de Brasília, Brasília, Distrito Federal, Brazil, CEP 70910-900 (e-mail: reuberbrandao@yahoo.com.br).

HETERODON PLATIRHINOS (Eastern Hog-nosed Snake). HIBERNACULA SITE FIDELITY. *Heterodon platirhinos* is a wide-ranging snake in the eastern United States and southern Canada that occurs in greatest densities in locales with well-drained, sandy soils. *Heterodon platirhinos* are believed to brumate individually in mammal burrows and self-excavated dens under rocks, in logs, or under artificial cover and are thought to retreat

to hibernacula late in the fall and emerge early in the spring relative to sympatric snake species (Ernst and Ernst 2003. Snakes of the United States and Canada. Smithsonian Institution Press, Washington D.C. 680 pp.). Aside from these generalities, there is limited information on *H. platirhinos* brumation or factors associated with hibernacula selection.

We conducted a radiotelemetry study of *H. platirhinos* between April 2009 and April 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 sand dune landscape known locally as the Province Lands. Among the 16 animals radiotracked was a female (SVL = 610 mm; total length = 745 mm, 325 g) that was tracked to brumation in 2009 and 2010 and was found to use the same hibernaculum in both years. The hibernaculum consisted of a network of mammal burrows running through the root system of a stunted Pitch Pine (*Pinus rigida*). The snake was first documented underground at this location on 5 November 2009 and emerged between 16 March and 18 April 2010. During the 2010 active season, the snake utilized a large area (17.8 ha minimum convex polygon) and was as far as 466 m from the hibernaculum. The snake returned to the hibernaculum in early October 2010 and emerged between 3 April and 17 April 2011. Although Cunnington and Cebek (2005. Am. Midl. Nat. 154:474–478) documented inter-annual fidelity and clustering of oviposition sites in *H. platirhinos*, this is believed to be the first record of hibernaculum site fidelity in this species. Of three individuals tracked to hibernacula in consecutive years, this was the only instance of hibernaculum fidelity.

Mortality associated with brumation in temperate populations of snakes suggests that hibernacula are a limiting resource and that selection of an appropriate site is critical for survival (Mullin and Siegel 2009. Snakes: Ecology and Conservation. Cornell Univ. Press, Ithaca, New York. 365 pp.). Hibernacula site fidelity is well documented for species that brumate communally and is thought to be in response to limited availability of adequate brumation sites (Gibbons and Semlitsch 1987. *In* Siegel et al. [eds.], Snakes: Ecology and Evolutionary Biology, pp. 404–406. Macmillan, New York). For species that brumate individually (such as *H. platirhinos*), fidelity to successful overwintering sites would also seem to be advantageous, although the fact that they brumate individually may suggest that these species are not as severely limited by hibernacula availability. Of 11 instances where we radiotracked snakes to hibernacula in the fall, all emerged in the spring, suggesting that overwintering mortality is low and that hibernacula are not a limiting factor for *H. platirhinos* in our study area.

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

SCOTT W. BUCHANAN, Department of Biology and Molecular Biology, Montclair State University, Montclair, New Jersey 07043, USA (e-mail: buchanans1@mail.montclair.edu); **BRAD C. TIMM**, Department of Environmental Conservation, University of Massachusetts, Amherst, Massachusetts 01003, USA (e-mail: timm@eco.umass.edu); **ROBERT P. COOK,** Cape Cod National Seashore, Wellfleet, Massachusetts 02667, USA (e-mail: robert_cook@nps.gov); **RICHARD COUSE,** Department of Environmental Studies, Antioch University New England, Keene, New Hampshire 03431, USA (e-mail: rcouse@antioch.edu).

***LAPEMIS CURTUS* (Short Seasnake). DIET.** *Lapemis curtus* is widely distributed throughout tropical and subtropical Indo-Pacific, including coastal habitats in the Persian Gulf, Indian Ocean, South China Sea, Straits of Taiwan, Indo-Australian Archipelago, the Philippines, and the Pacific Ocean (Minton 1975. *In* Dunson [ed.], Biology of Sea Snakes, pp. 233–249. University Park Press, Baltimore, Maryland). It is a dietary generalist, known to consume fish from 33 families and two species of marine invertebrates (cuttlefish and amphipod; Lobo et al. 2005. Copeia 2003:637–641; Voris and Voris 1983. Am. Zool. 23:411–425). In November 2011, I collected 5 dead male *L. curtus* from the bycatch of a shrimp trawler in the coastal waters of Bandar Abbas, Persian Gulf, Iran. Dissection revealed that the stomachs of three snakes contained identifiable prey items. The first snake (Fig. 1; SVL = 72 cm, 331 g) contained a partially digested sardine (*Sardinella* sp. [Clupeidae]) and a Sulphur Goatfish (*Upeneus sulphureus* [Mullidae]; total length = 9 cm). The second snake (SVL = 74 cm, 356 g) contained a *Sardinella* sp. (total length = 13 cm), and the third snake (SVL = 75 cm, 360 g) contained a *U. sulphureus* (total length = 9.5 cm) and an unidentifiable fish. This is the first record of fish in the family Mullidae as prey of *L. curtus*, though they have been reported as prey for *Pelamis platurus* (Yellow-bellied Seasnake; Voris and Voris 1983, *op. cit.*). Fish in the family Clupeidae have been reported as the main prey of *L. curtus* along the western coast of India (Lobo et al., *op. cit.*). Both sardines and goatfish are active swimmers, but goatfish are primarily demersal, whereas sardines are pelagic. Further, investigation feeding habits of *L. curtus* is the Persian Gulf is important because the Persian Gulf represents the western distribution limit for the species and presents unique environmental conditions (e.g., high salinity and high temperature) and fish assemblages.

MOHSEN REZAIE-ATAGHOLIPOUR, Department of Marine Biology, Faculty of Science, University of Hormozgan, P.O. Box 3995, Bandar Abbas, Hormozgan, Iran; e-mail: mohsenra@live.com.
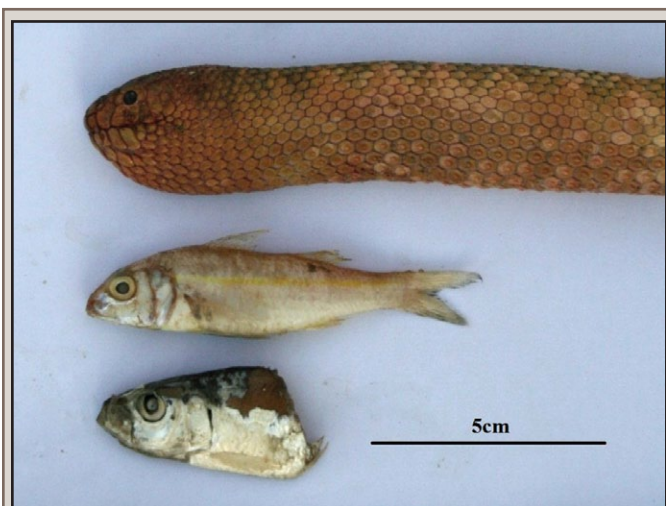
Fɪɢ. 1. Partially digested sardine (*Sardinella* sp.) and a Sulphur Goatfish (*Upeneus sulphureus*) consumed by a *Lapemis curtus* in the coastal waters of Bandar Abbas, Persian Gulf, Iran.

***MICRURUS DECORATUS* (Decorated Coralsnake). DIET.** Coralsnakes (*Micrurus* spp.) typically feed on elongated vertebrates, including amphisbaenians, snakes, legless lizards, and caecilians (Campbell and Lamar 2004. The Venomous Reptiles of the Western Hemisphere. Vol. 1. Cornell University Press, Ithaca, New York. 476 pp.). The last have been reported as prey for several coralsnake species (e.g., Campbell and Lamar, *op. cit.*; Horan et al. 2011. Herpetol. Rev. 42:294–295; Huber and Hödl 2010. Herpetol. Rev. 41:484; Saporito 2007. Herpetol. Rev. 38:199). The distribution of *Micrurus decoratus* is limited to the Atlantic Forest of southeastern and southern Brazil, usually in mid-elevation montane areas (Campbell and Lamar, *op. cit.*; Marques 2002. Amphibia-Reptilia 23:228–232). The two published surveys on the diet of this species (Marques, *op. cit.*; Terribile and Silva Jr. 2005. Herpetol. Rev. 36:457–458) reported only amphisbaenians and caecilians as prey. The latter were identified as *Siphonops* sp. in both studies. Here we report an additional case of *M. decoratus* feeding on a caecilian, and the first in which the caecilian prey was identified to species.

On 12 September 2010, two of us (DV and CCS) recovered a dead male *M. decoratus* (SVL = 510 mm; tail length = 35 mm) from a road at Theodoro de Oliveira (22.373889°S, 42.556667°W, datum: SAD 69; elev. ca. 1100 m), municipality of Nova Friburgo, state of Rio de Janeiro, Brazil. The snake's body had been completely flattened by the passing of cars, but we noticed a piece of a small caecilian protruding from its ruptured venter. Later, we dissected the snake and recovered the remaining pieces of the caecilian, which was identified as a *Siphonops hardyi*. The snake and its prey were deposited in the reptile collection of the Museu Nacional, Rio de Janeiro (MNRJ 19859). *Siphonops hardyi* is a relatively widespread caecilian species in southeastern Brazil, being found both in lowland and in montane sites (Maciel et al. 2009. Check List 5:919–921). To our knowledge, this is the first confirmed report of *S. hardyi* as prey of a coralsnake.

DAVOR VRCIBRADIC, Departamento de Zoologia, Universidade Federal do Estado do Rio de Janeiro, Av. Pasteur 458, Urca, 22240-290, Rio de Janeiro, RJ, Brazil (e-mail: davor@centroin.com.br); **CARLA DA COSTA SIQUEIRA**, Universidade Federal do Rio de Janeiro, Programa de Pós-Graduação em Ecologia, Instituto de Biologia, Av. Carlos Chagas Filho 373 Bl. A, Cidade Universitária, 21941-902, Rio de Janeiro, RJ, Brazil (e-mail: carlacsiqueira@yahoo.com.br); **ADRIANO LIMA SILVEIRA**, Setor de Herpetologia, Departamento de Vertebrados, Museu Nacional / Universidade Federal do Rio de Janeiro, Quinta da Boa Vista, São Cristóvão, 20940-040, Rio de Janeiro, RJ, Brazil (e-mail: biosilveira@yahoo.com.br); **MARLON ALMEIDA-SANTOS** (e-mail: marlon_uerj@yahoo.com.br), and **CARLOS FREDERICO DUARTE ROCHA**, Departamento de Ecologia, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier 524, Maracanã, 20550-011, Rio de Janeiro, RJ, Brazil (e-mail: cfdrocha@uerj.br).

***OXYBELIS FULGIDUS* (Green Vinesnake). DIET.** *Oxybelis fulgidus* occurs from Mexico to Argentina and is common in the Brazilian Amazon. It is an arboreal ambush predator, feeding mainly on lizards and medium to small passerine birds (Martins and Oliveira 1998. Herpetol. Nat. Hist. 6:78–150; Scartozzoni et al. 2009. S. Am. J. Herpetol. 4:81–89). On 19 May 2011, an *O. fulgidus* (ca. 2 m total length) was seen in a young avocado tree (*Persea americana*) in the Maracarana community, along the Uatumã river, south of the Balbina Dam, Brazilian Amazon (2.21°S, 58.83°W; datum NAD83/WGS84). The snake's presence was noticed only after it caught a *Sturnella militaris* (Red-breasted Blackbird) by the neck, causing the bird to emit loud alarm

Fig. 1. *Oxybelis fulgidus* consuming its prey (*Stunella militaris*) head-first after placing it on a horizontal branch.

calls. The bird survived for approximately 5 min. and was subsequently consumed headfirst by the snake (Fig. 1). This is the first record of *S. militaris* in the diet of *O. fulgidus*.

JOÃO MARCOS G. CAPURUCHO, Programa de Pós-Graduação em Ecologia, Instituto Nacional de Pesquisas da Amazônia – INPA, Av. André Araujo, 2936, Aleixo, Manaus, AM, Brazil (e-mail: jmcapurucho@yahoo.com.br); **HENRIQUE CALDEIRA COSTA**, Museu de Zoologia João Moojen, Universidade Federal de Viçosa, CEP 36570-000, Viçosa, MG, Brazil (e-mail: ccostah@yahoo.com.br).

***OXYBELIS FULGIDUS* (Green Vinesnake). DIET.** *Oxybelis fulgidus* is a diurnal arboreal snake that forages among the lower strata of trees and shrubs (Martins and Oliveira 1998. Herpetol. Nat. Hist. 6:78–150). The diet for this species is known to consist primarily of birds and lizards (Beebe 1946. Zoologica 31:11–52; Cunha and Nascimento 1978. Publ. Avul. Mus. Par. Emílio Goeldi 31:1–218; Dixon and Soini 1986. Milw. Publ. Mus. Milwaukee, Wisconsin; Scartozzoni et al. 2009. S. Am. J. Herpetol. 4:81–89). At 1409 h on 1 March 2008, we observed an adult female *O. fulgidus* (INPA-H 21228; SVL = 1170 mm; 250 g) capturing a *Columbina passerina* (Common Ground Dove; 35 g) in a fragment of terra firme forest, in the Parque Residencial Acariquara II, municipality of Manaus, Amazonas, Brazil (03.08433°S, 59.96106°W; datum WGS 84). The snake was seen falling from a shrub with the bird in its jaws but remained anchored to the shrub by its tail, about 1 m off the ground. The snake remained holding the bird by the head for ca. 30 min, until it stopped moving. The long time being held could be associated with envenomation of the prey, a common behavior of opisthoglyphous snakes (Kardong 1982. Mem. Inst. Butantan 46:105–118). Soon afterwards, the snake began swallowing the bird head first (Fig. 1). The available literature reports *O. fulgidus* preying on the bird genera *Pipra, Thraupis, Volatinia, Dendrocincla, Carduelis, Elaenia,* and *Monasa* (Martins and Oliveira, *op.cit.*; Scartozzoni et al., *op.cit.*). This is the first report of *O. fulgidus* preying on birds of the genus *Columbina*.

Fig. 1. *Oxybelis fulgidus* consuming a *Columbina passerina* (Common Ground Dove) in the Parque Residencial Acariquara II municipality of Manaus, Amazonas, Brazil.

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RAFAEL DE FRAGA (e-mail: r.defraga@gmail.com)**, VINICIUS T. DE CARVALHO,** and **RICHARD C. VOGT,** Instituto Nacional de Pesquisas da Amazônia, Coleção de Anfíbios e Répteis, Coleções Zoológicas, INPA – Campus II. Av. André Araújo, 2936, C.P. 2223, CEP 69.970-000, Manaus, Amazonas, Brazil.

PANTHEROPHIS EMORYI (Great Plains Ratsnake). DIET. *Pantherophis emoryi* feeds primarily on small mammals and birds, but may also consume lizards, snakes, and frogs (Ernst and Barbour 1989. Snakes of Eastern North America. George Mason Univ. Press, Fairfax, Virginia. 282 pp.). At 1015 h on 31 July 2008 we collected a female *P. emoryi* (SVL = 53.7 cm; tail length = 10.2 cm; 69.0 g) in a sandstone crack on the northeast side of a bedrock outcrop on the north side of Two Buttes Creek canyon at Two Buttes Reservoir Wildlife Management Area, Baca Co., Colorado, USA. The snake was photo vouchered, with photos deposited in the University of Northern Colorado Museum of Natural History (UNC-MNH 4612). The snake contained an obvious food bulge and was in a loose coil partially sun exposed, likely to facilitate digestion. Upon transport to the field house, the snake voluntarily regurgitated a partially digested mouse (*Peromyscus* sp.) that weighed 18.15 g and was consumed head first. The relative size of meal by mass was 26.3%. The only other previous report of relative meal size for *P. emoryi* was an adult female that consumed a *Sceloporus olivaceus* representing 35.5% of the snake's mass (Ferguson and Dixon 2007. Herpetol. Rev. 38:340).

Our report documents the first prey/predator weight ratio and the largest prey/predator weight ratio for a juvenile *P. emoryi* feeding on mammalian prey. In addition, our note documents only the third *P. emoryi* specimen from Two Buttes Reservoir SWA (Montgomery et al. 1998. Herpetol. Rev. 29:112).

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ANDREA M. GRELLE, JAKE BOLING, JENNIFER L. NEWBY, JOHN ESTES, JULIE HASKENS, LAURA K. GAREY, TONY WILMES, RORY MCKEE, MICHEAL I. KELRICK, and **CHAD E. MONTGOMERY** (e-mail: chadmont@truman.edu), Department of Biology, Truman State University, Kirksville, Missouri 63501, USA.

PHIMOPHIS GUIANENSIS (Troschel's Pampas Snake). DIET. *Phimophis guianensis* is a xenodontine snake that is generally considered crepuscular or nocturnal. This species inhabits lowlands up to 1200 m elevation in Panama and northern South America, including Colombia, Venezuela, the Guianas, and northeastern Brazil (Lancini 1982. Mem. Inst. Butantan 46:95–103; Peters and Orejas-Miranda 1970. Catalogue of the Neotropical Squamata. Part I. Snakes. Bull. U.S. Nat. Mus. 297:1–347). Only a few confirmed diet records exist for snakes in the genus *Phimophis*: *P. scriptorcibatus* was documented feeding on lizards in the genera *Calyptommatus* and *Vanzosaura* (Rodrigues 1993. Pap. Avul. Zool. 38:187–198), *P. guerini* also feeds on lizards, rodents, and amphibians (França and Araujo 2006. S. Am. J. Herpetol. 1:25–36; Marques et al. 2005. Serpentes do Pantanal-Guia Ilustrado. Ed. Holos, Ribeirão Preto. 170 pp.; Yanosky et al. 1996. Herpetol. Nat. Hit. 4:97–110). Although *P. guianensis* has the widest distribution in the genus, few data exist on its natural history, other than suggestions that it feeds on arthropods and lizards (Starace 1998. Guide des Serpents et Amphisbènes de Guyane Française. Ibis Rouge Edit. Guadeloupe-Guyane. 449 pp.).

On 7 July 2004, during a field survey at Parque Nacional Cerro Saroche (10.154°N, 69.527°W, datum WGS84; elev. 765 m), a xeric region in Lara state, Venezuela, we found an adult *P. guianensis* preying on an adult *Ameiva bifrontata* (Fig. 1). We apparently detected the snake just after it had captured the prey. After a few minutes, the movements of the lizard stopped, the snake slowly uncoiled without releasing the lizard's head, and proceeded to consume the lizard. Chippaux

Fig. 1. *Phimophis guianensis* preying on *Ameiva bifrontata* in Parque Nacional Cerro Saroche, Lara state, Venezuela.

(1986. Les Serpents de la Guyane Française. Éditions de l'Orstom XXVII. 165 pp.) found that in French Guiana *P. guianensis* is most active in the late evening and at night. However, our observation suggests that this species may also forage actively during the day.

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JOSÉ ANTONIO GONZÁLEZ-CARCACÍA, Laboratorio de Biología de Organismos, Centro de Ecología, Instituto Venezolano de Investigaciones Científicas (IVIC), Caracas, Venezuela (e-mail: jagonzal@ivic.gob.ve); **VICTOR P. ROMERO,** Departamento de Estudios Ambientales, Universidad Simón Bolívar, Venezuela (e-mail: victor.romero@usb.ve); **GILSON RIVAS,** Museo de Biología, Facultad Experimental de Ciencias, Universidad del Zulia, apartado Postal 526, Maracaibo 4011, Venezuela (e-mail: anolis30@hotmail.com).

RHABDOPHIS SUBMINIATUS HELLERI (Red-necked Keelback). DEFENSIVE BEHAVIOR. Snakes in the genus *Rhabdophis*, a widespread Asian genus, possess unique glands in the nape of the neck called nuchal glands (Hutchinson et al. 2007. Proc. Nat. Acad. Sci. 104:2265–2270). Mori and Burghardt (2008. J. Ethol. 26:61–68) examined several defensive behaviors associated with *Rhabdophis* species. Of the 18 behaviors they examined, three seemed to be closely associated with nuchal glands: 1) dorsal-facing posture, in which the dorsal neck region is directed toward the stimulus and elevated above the substrate; 2) neck arch, in which the chin is directed towards the substrate and the neck is bent upward; and 3) neck butt, in which the snake swings the arched neck so that it is butted up against the stimulus. On 4 August 2011, on Lantau Island, Hong Kong, we encountered an adult *R. subminiatus* in a hole on the side of a wall in a water conduit. Upon being extracted from the hole, the snake immediately arched its neck against our glove and began oozing secretions from the nuchal gland region (Fig. 1). This active "transport" of the nuchal fluid is undocumented. In prior observations of nuchal gland secretion in *Rhabdophis*, physical pressure on the nuchal region was required to induce secretion. Our animal did not experience any physical pressure aside from the mid-body capture we made with a glove. During closer approach of the animal for photographs, the nuchal gland fluid was sprayed into the air, apparently towards the approaching photographer. Explanations for the ease with which the animal expressed the nuchal gland fluid may include thin membranes surrounding the nuchal glands, coupled with flexing of the epaxial muscles during the dorso-lateral flattening of the neck (A. Savitzky, pers. comm.).

KEVIN R. MESSENGER, Alabama A&M University, Huntsville, Alabama 35762, USA (e-mail: kevin.messenger@gmail.com); **DANIEL ROSENBERG**, Kowloon, New Territories, 999077, Hong Kong (e-mail: cowyeow@yahoo.com); **KEVIN K. CALDWELL**, Yuen Long, New Territories, 999077, Hong Kong (e-mail: bemishk@netvigator.com); **WILLIAM L. SARGENT**, North Point, Hong Kong Island, 999077, Hong Kong (e-mail: wsargent88@yahoo.com).

RAMPHOTYPHLOPS BRAMINUS (Brahminy Blindsnake). PREDATION. *Ramphotyphlops braminus* is a Southeast Asian parthenogenic, typhlopid snake, probably indigenous to India and Sri Lanka (Wallach 2008. Bull. Chicago Herpetol. Soc. 43:80–82). Because of its small average size (total length = 130 mm), and ability to be anthropogenically transported in soil (especially in potted plants and mulch), *R. braminus* currently has the most widespread, near worldwide, nonindigenous distribution of any snake (Kraus 2009. Alien Reptiles and Amphibians: A Scientific Compendium and Analysis. Springer, New York. 563 pp.). In Florida, USA, *R. braminus* is rapidly expanding its distribution and is established in numerous counties (Krysko et al. 2011. Zootaxa 3028:1–64). Predators of *R. braminus* in Florida include nonindigenous *Rhinella marina* (Cane Toad), nonindigenous *Anolis cristatellus* (Crested Anole), and endemic *Lampropeltis extenuata* (Short-tailed Snake) (Meshaka 2011. Herpetol. Conserv. Biol. 6:1–101).

On 24 March 2011, a *Dasypus novemcinctus* (Nine-banded Armadillo) was killed on the premises of the Division of Plant Industry (DPI), Florida Department of Agriculture & Consumer Services, 1911 SW 34th Street, Gainesville, Alachua Co., Florida, USA (29.635175°N, 82.370844°W, datum: WSG84). I examined its stomach contents and discovered an intact adult *R. braminus* (total length = 152 mm, UF 166054) which I deposited in the Herpetology Collection, Florida Museum of Natural History (FLMNH), University of Florida. A population of *R. braminus* previously has been documented on the grounds of this facility (Somma 2007. Herpetol. Rev. 38:355–356) and three additional specimens were collected in March and April 2011 (UF 166055–166057).

Dasypus novemcinctus, in Florida, is a nonindigenous, cingulatan mammal that has a primarily insectivorous diet but occasionally preys upon small vertebrates, including reptiles (Carr 1982. Anim. King. 85[5]:40–44; McBee and Baker 1982. Mamm. Species 162:1–9; Nowak 1999. Walker's Mammals of the World. Sixth Ed. Vols. I–II. Johns Hopkins Univ. Press, Baltimore, Maryland. 2015 pp.). In the U.S., *D. novemcintus* is implicated in zoonotic transmission of the 3I-2-v1 strain of leprosy, *Mycobacterium leporae* (Truman et al. 2011. New England J. Med. 364:1626–1633). This is the first record of *R. braminus* in the diet of *D. novemcinctus*. Whether established populations of *R. braminus* can subsidize populations of *D. novemcinctus*, *R. marina*, *A. cristatellus*, or other nonindigenous predators in Florida remains untested at this time.

I thank Jeff Butler for providing the armadillo specimen.

LOUIS A. SOMMA, Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611, USA; e-mail: somma@ufl.edu.

THAMNOPHIS ELEGANS VAGRANS (Wandering Gartersnake). DIET. The feeding ecology of *Thamnophis elegans* is highly variable, with some individuals or populations specializing on a narrow range of prey and others exploiting a wide variety of prey

PHOTO BY DANIEL ROSENBERG

FIG. 1. *Rhabdophis subminiatus* neck arching and expressing nuchal gland toxins.

FIG. 1. Three adult shrews (*Sorex* sp.) ingested by a single, pregnant *Thamnophis elegans vagrans* from Mink Creek, Bannock County, Idaho.

(Rossman et al. 1996. The Garter Snakes: Evolution and Ecology. Univ. Oklahoma Press, Norman. 332 pp.). Overall, the species has one of the broadest diets of any North American snake, including aquatic leeches, desert lizards, noxious slugs, shrews and other small mammals, and even cooked bits of chicken (Arnold 1977. Science 197:676–678; Fitch 1941. California Fish Game 27:2–32; Rossman et al., *op. cit.*; Storm and Ferguson 1954. Herpetologica 11:48). Here we document an additional case of shrew consumption by *T. elegans*, and suggest that predation on shrews is not incidental but likely represents a significant prey source for some *T. elegans* populations.

On 3 June 2007, along Mink Creek in Caribou National Forest, Bannock Co., Idaho, USA (42.734222°N, 112.407250°W; datum: NAD 1983; elev. 1600 m), CRF observed an adult female *T. elegans vagrans* (SVL = 518 mm) foraging on the bank of the creek. The snake was carefully investigating holes in the soil of the well-vegetated bank ~0.5 m above waterline, probing each hole with its head before moving on to the next. Upon being seized, the snake immediately regurgitated a shrew (*Sorex* sp.), and subsequent palpation produced two additional shrews (Fig. 1). The aggregate mass of the prey (13.5 g) was 27.6% of the mass of the snake (49 g), which was pregnant. Examination of tooth wear patterns on the prey suggests that all three shrews were old adults (but the amount of tooth wear prevented confident species identification).

The apparent foraging behavior of the snake and the age of its three prey items suggest the snake acquired the shrews by deliberately hunting. Shrews are highly asocial and maintain separate territories (Churchfield 1990. The Natural History of Shrews. Cornell Univ. Press, Ithaca, New York. 183 pp.), so it seems doubtful that the snake simply chanced upon three old shrews, or a group of shrews. Unlike the great majority of gartersnakes, some populations of *T. elegans* feed substantially on small mammals (Rossman et al. 1996, *op. cit.*) and the species has evolved at least one trait, constricting behavior (Gregory et al. 1980. Herpetologica 36:87–93), that is adaptive for feeding on such prey. These characteristics of *T. elegans* make it all the more probable that the observed snake was deliberately hunting for shrews. The *T. elegans* and its contents were deposited in collection of the California Academy of Sciences (CAS 241911).

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CHRIS R. FELDMAN (e-mail: ophis@unr.edu) and **ALAN DE QUEIROZ** (e-mail: alandqz@yahoo.com), Department of Biology, University of Nevada, Reno, Nevada 89557, USA.

THAMNOPHIS EQUES MEGALOPS (Northern Mexican Gartersnake). DIET AND MORTALITY. *Thamnophis eques megalops* are known to eat amphibians, fish, earthworms, leeches, and occasionally small mammals, lizards, and slugs (Ernst and Ernst 2003. Snakes of the United States and Canada. Smithsonian Institution Press. Washington D.C. 668 pp.). As part of a long-term monitoring project for the species at Bubbling Ponds Hatchery (Yavapai County, Arizona, USA), we observed *T. e. megalops* apparently attempting to prey on nonnative Chinese Mystery Snails (*Cipangopaludina chinensis*) on two separate occasions.

On 18 August 2008, at 1128 h, we encountered an adult *T. e. megalops* (SVL = 505 mm) which had been run over by a vehicle along a hatchery road (34.766°N, 111.896°W; datum NAD83) while apparently attempting to eat a *C. chinensis*. Similarly, on 23 June 2011, at 1920 h, we observed an adult female *T. e. megalops* (SVL = 760 mm; 124 g) out of the water attempting to eat a large *C. chinensis* (Fig. 1; 34.766°N, 111.893°W; datum NAD83). The snake's upper jaw was inside the snail's shell, and appeared to be pinned in that position by the snail's closing operculum, prohibiting escape by either individual. We captured the snake and therefore interrupted the predation attempt. Although *T. eques* are known to occasionally consume slugs, they are not known to feed on shelled gastropods (Macias Garcia and Drummond 1988. J. Herpetol. 22:129–134; Manjarrez 1998. J. Herpetol. 32:464–468). Wood et al. (2005. Herpetol. Rev. 36:328–329) reported a similar instance of mortality in *T. validus celaeno,* in which the snake died of starvation or exhaustion after being unable to extricate its lower mandibles from the shell of the snail *Planorbella subcrenatum.*

We are unsure of why the snakes were attempting to eat the snails, but their lack of experience with this nonnative snail may have been a factor. Bubbling Ponds Hatchery provides a dense and varied *T. e. megalops* prey base of native and nonnative fishes, *Anaxyrus woodhousii, Ambystoma mavortium nebulosum*, and nonnative *Lithobates catesbeianus*, so it is unlikely that food is limited. In both cases, the snake's vision was completely obscured while it attempted to access the snail. The ease with which one snake was captured, coupled with the road mortality, suggests that a shift in diet to include this nonnative prey item might be deleterious.

MEGAN E. YOUNG (e-mail: megan.e.young00@gmail.com) and **VALERIE L. BOYARSKI** (e-mail: vboyarski@azgfd.gov), Nongame Branch, Arizona Game and Fish Department, 5000 W. Carefree Highway, Phoenix, Arizona 85086-5000, USA.

PHOTO BY MEGAN E. YOUNG

FIG. 1. Adult female *Thamnophis eques megalops* from Bubbling Ponds Hatchery, Arizona, attempting to eat a nonnative Chinese Mystery Snail, *Cipangopaludina chinensis.*

***TROPIDOLAEMUS SUBANNULATUS* (Bornean Banded Pit-viper). DIET.** *Tropidolaemus subannulatus* is one of the most commonly encountered snakes in lowland rainforest in Borneo. Despite being a common species there is little information about its diet. It is known to prey on small rodents and birds (Das 2010. A Field Guide to the Reptiles of South-east Asia. New Holland Publishers, London. 376 pp.). On 25 September 2009, at 2230 h, we found an adult male *T. subannulatus* (total length ca. 50 cm) feeding on an adult female *Polypedates leucomystax* in Kubah National Park, western Sarawak, Malaysian Borneo. The snake had already swallowed the head and right arm of the frog (Fig. 1). After another 30 min it had completely devoured its prey.

J. MAXIMILIAN DEHLING, Institut für Integrierte Naturwissen-schaften, Abteilung Biologie, Universität Koblenz-Landau, Univer-sitätsstraße 1, 56070 Koblenz, Germany (e-mail: megophrys@gmail.com); **D. MATTHIAS DEHLING**, Biodiversitäts- und Klimaforschungszentrum Frankfurt, Senckenberganlage 25, 60325 Frankfurt am Main, Germany.

FIG. 1. Adult male *Tropidolaemus subannulatus* feeding on adult female *Polypedates leucomystax*.

***VIPERA BERUS* (Common Adder). DEFENSIVE BEHAVIOR.** *Vipera berus* is a well-studied and often common snake with a wide distribution reaching into the Arctic Circle (Stafford 1987. The Adder. Shire Publications. Aylesbury, U.K. 24 pp.). At 1107 h on 23 April 2011 at Laughton Forest, North Lincolnshire, U.K. (53.4977°N, 0.7242°W, datum: WGS84), I witnessed a previously undocumented behavior by a small (209 mm total length) *V. berus*. The observation took place on a warm (25.6°C) sunny day and the adder was found basking on a patch of gorse (*Ulex* sp.) in a forest clearing with heath vegetation near a drainage ditch. Upon capture, the snake employed typical defensive tactics including hissing, striking, voiding cloacal contents, and hiding its head under body coils (Mori and Burghardt 2008. J. Ethol.

26:61–68). Prior to this, escape was attempted by moving quickly away. During these attempts the adder was observed to repeatedly tense its body in a corkscrew posture (helical rather than a coil) and then straighten out again in quick succession. The behavior was more intense when the individual was touched with a snake hook and superficially resembled the behavior of an earthworm when cut in two. Although this behavior was distinctive and warrants recognition, I can find no reference to corkscrewing in *V. berus*, although it may have been subsumed under more general categories in previous literature (such as Mori and Burghardt's [*op. cit.*] "jerk").

There are two possible reasons for corkscrewing: a functional antipredator mechanism or an aberrant behavior due to poor health. With regards to the latter, Funk (2006. *In* Mader [ed.], Reptile Medicine and Surgery, 2nd ed., pp. 675–682. Saunders Elsevier. St. Louis) briefly described an undiagnosed neurological problem in a captive *Lamprophis fuliginosus* (African House Snake). The snake would move normally until stimulated, at which point it "coiled into a series of loops and rolled across the substrate for 1 to 3 minutes." The accompanying photo of the animal shows a posture similar to the corkscrewing observed here. Although the *L. fuliginosus* apparently held the posture for a few minutes, in contrast to the *V. berus* described herein, I cannot rule out a neurological problem as a cause of the corkscrewing behavior.

Antipredator behaviors can function in a variety of ways. I can suggest three possible benefits of corkscrewing for *V. berus*. First, erratic movement in itself during escape, or "protean behavior," is a well known defensive tactic among animals (Ruxton et al. 2004. Avoiding Attack. Oxford Univ. Press. Oxford, U.K. 249 pp.) and presumably makes the prey difficult to follow or subdue. Second, because of the micro-habitat in which the adder was found, the act of corkscrewing often resulted in it becoming tangled around vegetation, making it more difficult to extract. Third, the combination of the quick movements and the zigzag pattern may result in a motion dazzle effect. This has been shown using simulated prey on a computer screen and human predators to interfere with speed perception and make the prey more difficult to catch (Scott-Samuel et al. 2011. PLoS ONE 6:e20233; Stevens et al. 2008. Proc. Royal Soc. B 275:2639–2643). Despite this evidence however, few empirical, real-life examples have been documented. Further observations and studies may help to establish how widespread corkscrewing in *V. berus* and perhaps other snake species, and also shed light on the function of the behavior.

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KEVIN ARBUCKLE, Institute of Integrative Biology, Biosciences Building, University of Liverpool, Crown Street, Liverpool, United Kingdom, L69 7ZB; e-mail: k.arbuckle@msn.com.