NATURAL HISTORY NOTES

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CAUDATA

AMBYSTOMA MACULATUM (Spotted Salamander). **MORTALITY**. *Ambystoma maculatum* are winter breeders in the southeastern United States. Individuals are often subjected to unpredictable environmental conditions, such as partial freezing of aquatic habitats, during their breeding activities. Adult mortality from partial freezing of aquatic habitat is known (Harris 1980. Copeia 1980:719–722), but has rarely been described. We report here on observations of *A. maculatum* mortality during reproduction after a partial freeze of a wetland in Mecklenburg County, North Carolina, USA during the winter of 2005.

Warm air temperatures (up to 20°C) and precipitation from 25–27 January proceeded and apparently initiated *A. maculatum* breeding activity. On 28 January, a cold front moved through the area and maximum air temperatures remained below freezing (-6°C) until 30 January. A thin (< 2 cm) layer of ice formed over the majority of the wetland, and remained until 8 February. We surveyed the wetland between 2–10 February 2005 and observed 27 dead *A. maculatum*; 21 females (mean SVL = 103.6 mm, SD = 3.82 mm; TTL = 192.3 ± 7.25 mm; N = 19), and 6 males (mean SVL = 99.2 ± 12.77 mm; TTL = 190.33 ± 28.12 mm). Seventeen of the females contained eggs (mean = 65.47 ± 48.59; range 11–182). Nine individuals had various body injuries such as missing pieces of the head and torso, or punctures in the ventral side. We also collected dead individuals of *Rana sphenocephala* (3), *R. catesbeiana* (2), *Pseudacris ferairum* (1), *Acris crepitans* (1), and *Chrysemys picta* (1).

Our observations confirm those of Harris (1980, *op. cit.*), which suggest that freezing of aquatic habitats can lead to mortality in *A. maculatum*, and that mortality is skewed towards females, even though males are often more numerous in breeding ponds (Stenhouse 1985. Copeia 1985:631-637). The reason females are more susceptible than males to freezing is unknown, however, we speculate it might be the result of egg-depositing behavior, sensitivity to reduced oxygen levels, or the reluctance to leave the wetland when gravid. Although we did find several individuals with injuries, we believe it is likely these injuries were induced post-mortem by aquatic invertebrates or other scavengers inhabiting the wetland. This research was supported by the Davidson College Department of Biology, Duke Power and National Science Foundation grant (DEB – 0347326) to MED.

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AMBYSTOMA TALPOIDEUM (Mole Salamander). **DIET**. On 18 March 2003, JGP removed a drowned terrestrial morph adult female *Ambystoma talpoideum* (51.5 mm SVL) from a plastic minnow trap set in a 0.3 ha seasonal wetland on Moody Air Force Base, Lowndes County, Georgia, USA. Upon dissection, the following aquatic invertebrates were removed from the salamander's stomach: nine clam shrimp (Lynceidae: *Lynceus*), three isopods (Asellidae: *Caecidotea*), two unidentifiable mosquitoes (one larva, one pupa; Culicidae), one beetle (Dytiscidae: *Uvarus*), and one beetle larva (Dytiscidae: *Agabus*).

Previous reports of metamorphosed *A. talpoideum* adults feeding while in breeding habitats include Cliburn and Carey (1975. J. Mississippi Acad. Sci. 20:49–52) and McCallister and Trauth (1996. Southwest. Nat. 41:62–64). Conspecific ova were consumed exclusively by the specimens examined by McCallister and Trauth (*op. cit.*). In addition to unidentified amphibian ova, Cliburn and Carey (*op. cit.*) observed aquatic invertebrates in *A. talpoideum* stomachs. Collectively, these three reports of aquatic feeding by metamorphosed adult *A. talpoideum* suggest that this behavior might not be uncommon. Moreover, aquatic feeding by adults might be an important strategy to recover energy reserves expended during the breeding season.

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ANEIDES AENEUS (Green Salamander). **DISPERSAL.** *Aneides aeneus* inhabits cliffs and rockface outcrops at elevations <1340 m in mountainous forests from southwestern Pennsylvania to extreme northeastern Mississippi (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington D.C. 587 pp.). Populations are largely confined to deep crevices within sandstone, granite, and schist formations but occasionally are found under loose bark of fallen trees (Petranka, *op. cit.*). The extent to which *A. aeneus* disperses between isolated rock outcrops is unknown. Individuals are rarely observed in adjacent forest floor habitats even when collecting around rock outcrops with large populations (Snyder 1991. J. Tennessee Acad. Sci. 66:165–169). Although *A. aeneus* has been recorded crossing roads during April–June (Cupp 1991. J. Tennessee Acad. Sci. 66:171–174; Williams and Gordon 1961. Copeia 1961:353), disturbance to forest habitats is thought to limit dispersal between rock outcrops (Petranka, *op. cit.*). Here we report dispersal of *A. aeneus* across an open, disturbed habitat in southern West Virginia.

On 1 October 2004 we discovered a single adult *Aneides aeneus* under an artificial coverboard in an actively grazed livestock pasture at Reba Farm (37°47'31"N, 80°58'30"W), a USDA Appalachian Farming Systems Research Center site near Beaver, Raleigh County, West Virginia, USA. All woody vegetation, coarse woody debris, and rocks had previously been removed from the pasture (884 m elev) to facilitate grazing. Natural ground cover within the pasture was limited to Orchardgrass (*Dactylis glomerata*) and

White Clover (*Trifolium repens*). The coverboard (30 cm × 46 cm × 5 cm), installed flush against the topsoil, was one of 20 white oak boards within the pasture. The coverboard was 54.9 m from the nearest rock outcrop and 45.7 m from the nearest woodland habitat. Surface temperature under the coverboard was 12.7°C. Searches of all habitat within a 150-m radius of the coverboard and all other boards within the pasture revealed no additional *A. aeneus*. Additionally, no *A. aeneus* were found when all coverboards in the pasture were re-sampled on 15 October 2004.

Although mating in West Virginia populations of *Aneides aeneus* occurs primarily during May–June, the timing of our observation coincides with a secondary breeding period that is thought to occur in September–October (Canterbury and Pauley 1994. J. Herpetol. 28:431–434). Our observation is significant as it documents dispersal of *A. aeneus* across non-forested, repeatedly disturbed habitat previously considered unsuitable for the species. Our observation also suggests the possibility that artificial cover objects might facilitate dispersal of *A. aeneus* between rock outcrops by providing suitable microenvironments or refugia within otherwise harsh, open habitats.

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DESMOGNATHUS MONTICOLA (Seal Salamander). **ARBOREAL BEHAVIOR.** On 15 August 2004, ca. 1345 h, an adult male *Desmognathus monticola* was found under the bark of a Yellow Buckeye tree (*Aesculus flava*) ca. 1 m above the ground and 4 m from the water of Indian Creek, Unicoi, Unicoi County, Tennessee, USA (N36°10.572', W82°17.884'). *Desmognathus monticola* is generally associated with streams and is known to ascend wet rocky stream banks (Dodd 2004. The Amphibians of Great Smoky Mountains National Park. University of Tennessee, Knoxville. 283 pp.). Nocturnal climbing, especially during rain, has been noted for other *Desmognathus* species (Hairston 1949. Ecol. Monogr. 19[1]:47–73; Hairston 1986. Am. Nat. 127:266–291; Petranka 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, DC. 587 pp.). However, to our knowledge, this is the first record of arboreality in this species and the first record of any *Desmognathus* using an arboreal diurnal retreat. The individual was collected under Tennessee permit number 1920 issued to Maxim Shpak and is deposited at Yale Peabody Museum of Natural History (YPM 10037).

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EURYCEA CIRRIGERA (Southern Two-lined Salamander). **GILL MORPHOLOGY**. Because larval two-lined salamanders (*Eurycea bislineata* complex) typically inhabit lotic environments (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Inst. Press. Washington, D.C. 587 pp.), little is known about interdemic variation in larval morphology. Herein we report on interdemic variation in gill morphology for *E. cirrigera* larvae from southern West Virginia, USA. Larvae were collected seasonally (April 1994–January 1995) from Fitzpatrick's Branch, an intermittent, first-order stream in Cabell County, West Virginia (Brophy and Pauley 2002. Maryland Nat. 45:13–22) and Trump-Lilly Pond, a small farm pond in Raleigh County, West Virginia (Brophy and Pauley 2001. Herpetol. Rev. 32:98–99).

Captured larvae were anesthetized in chloretone, fixed in a 4% formalin solution, and preserved in 70% ethanol. The following measurements were made on the left side of each larva using a dissecting microscope and ocular micrometer: Fimbria length (FimL) – length (mm) of longest fimbria on 3rd gill arch; Fimbria width (FimW) – width (mm) midway along FimL; Rachis length (RachL) – length (mm) of rachis on 3rd gill arch; and Number of fimbriae (NumFim) – total number of fimbriae on 3rd gill arch. All characters were standardized for body size by regressing each variable against SVL and using the residuals in statistical procedures (Atchley et al. 1975. Am. Zool. 15:829; Atchley et al. 1976. Syst. Zool. 25:137–148). Larvae within each site were grouped across seasons ($N = 95$ for each site) and two-tailed Student's t-tests on the residuals were used to determine whether differences in gill morphology occurred between larvae from different habitats.

Differences in gill morphology were very apparent between larvae from pond and stream habitats. In general, pond larvae had relatively larger gills and a greater number of fimbriae than their stream counterparts. Mean values of the residuals for FimL, FimW, RachL, and NumFim were significantly different between pond and stream larvae ($p < 0.0001$ and $df = 188$ in all cases; FimL: $t = 10.01$; FimW: $t = 9.67$; RachL: $t = 9.62$; NumFim: $t = 5.78$). Mean residual values of pond larvae (positive) were greater than those of stream larvae (negative) for all gill characters. Causes of interdemic variation in gill morphology are unknown in this case, but future studies should investigate dissolved oxygen levels (Bond 1960. Dev. Biol. 2:1–20; Timmerman and Chapman 2004. J. Fish Biol. 65:635–650), temperature (Smith 1990. Ecology and Field Biology, 4th ed. Harper Collins Publ. New York), larval activity rates (McFarland et al. 1979. Vertebrate Life, 1st ed. Macmillan Publ. Co. New York. 875 pp.), and ion concentrations (Timmerman and Chapman, *op. cit.*) as potential causal factors.

We thank Michele L. Brophy, Peter A. Kramer, and James W. Barron for their assistance in the field and lab. All specimens were collected under WVDNR permit numbers 19-1994 and 52-1995, and voucher specimens were deposited in the West Virginia Biological Survey collection at Marshall University (WVBS 6879–6921). This study was partially funded by a research grant to TRB from the Marshall University Graduate Student Council.

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EURYCEA CIRRIGERA (Southern Two-Lined Salamander). **COLORATION.** Herein we report a leucistic larval *Eurycea cirrigera* (24 mm SVL) collected in northern Raleigh, North Carolina, USA (35.8599°N, 78.6733°W; WGS84/NAD83) on 27 May 2004. This individual is believed to be the second observation of a leucistic *Eurycea cirrigera*. Typical larvae are gold in color with extensive dark mottling. The leucistic individual lacked most pigmentation, exhibiting a transparent, cream coloration with faint orange and light brown speckling. The individual was classified as leucistic because of the presence of brassy eyes with dark pupils, instead of the unpigmented eyes of an albino. The light coloration contrasted markedly from other normal individuals; however, similar size, development, and behavior were observed.

We believe this is the second report of a leucistic *E. cirrigera* in North Carolina or elsewhere. Review of files and reexamination of an adult female considered albinistic by Palmer and Braswell (1980. Brimleyana 3:49–52) supports calling it leucistic using current terminology (Bechtel 1995. Reptile and Amphibian Variants: Colors, Patterns, and Scales. Krieger Publ. Co., Malabar, Florida). Although the frequency of leucism is unknown, repeated sampling of 45 sites in Wake County, North Carolina, USA produced 866 observations of *E. cirrigera* larvae, including 58 observations at the site where this specimen was collected. No other leucistic individuals were observed. In addition, only one similar specimen or record of this color variant is present in the North Carolina State Museum of Natural Sciences (NCSM) collection, which documents over 9000 specimens of *E. bislineata* complex from throughout the state. The larva was believed to be one-year old at the time of collection and was lab reared through October of 2004 without metamorphosing. The individual is catalogued as NCSM 66443.

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ANURA

ATELOGNATHUS PATAGONICUS (NCN). **DIET**. Within the life history of a species, knowledge of its trophic habits is essential to draft a conservation strategy. *Atelognathus patagonicus* is an aquatic frog endemic to the endorheic pond system in Laguna Blanca National Park and the surrounding area in northwest Patagonia, Argentina (Cei and Roig 1968. Physis 27:265–284; Gallardo 1962. Neotropica 8:45–68). It is categorized as "Endangered" (IUCN, Conservation International, and Nature Serve. 2004. Global Amphibian Assessment. <www.globalamphibians.org>. 13 Dec 2004). Two forms of *A. patagonicus* have been recognized: "aquatic" and "littoral" (Cei and Roig 1968, *op. cit.*). The "aquatic form" has large interdigital membranes and highly developed cutaneous folds on its trunk and thighs. The "littoral form" lacks these features. The "aquatic form" makes up the largest part of the population, and lives under submerged rocks. The "littoral form" lives out of the water, some distance away from the ponds. The species has disappeared from the largest body of water in the system (Laguna Blanca, 1780 ha), and is currently restricted to 15 bodies of water smaller than 60 ha (Cuello, unpubl. data). The disappearance of *A. patagonicus* from Laguna Blanca has been linked to the introduction of *Percichthys colhuapiensis* (Perca) and salmonids in the mid-1960s. These species rapidly colonize ponds and feed on a variety of aquatic organisms (Ferriz 1989. Iheringia 69:109–116; Macchi et al. 1999. Ecol. Freshw. Fish 8:227–236). Here we report the first qualitative and quantitative data on the diet of the "aquatic form" *A. patagonicus*.

The study was conducted during the austral summer (January 2001) in Laguna del Hoyo (39°00'36"S, 70°25'48"W; ca. 1400 m elev.), a permanent pond in Laguna Blanca National Park. This pond has a surface area of 38 ha, and a perimeter of 2.69 km, 40% of which is rocky, providing an optimal habitat for the frog. A large variety of aquatic arthropods, mainly amphipods, thrive under the rocks. The rooted macrophyte *Miriophyllum quitense*, colonial Nostocaceae algae and filamentous algae are well-developed in the pond. Nine "aquatic form" *A. patagonicus* were captured by hand, immediately euthanized, and fixed in 10% formalin. Body length ranged from 27.1–40.5 mm. Mean body length was 33.4 ± 2.5 mm for males (N = 5) and 33.55 ± 2.1 mm for females (N = 4). The diet was analyzed by examining the digestive tracts (stomach–small intestine). Prey was identified to the lowest possible taxonomic level. The individual volume of each prey item and the number of prey items per digestive tract for each prey category were recorded. Frequency of occurrence of each taxon was calculated as number of digestive tracts in which a certain taxon was found, divided by total number of digestive tracts examined. The large intestine was analyzed qualitatively to obtain additional information.

The diet of the "aquatic form" of *A. patagonicus* was made up of aquatic organisms of phylum Arthropoda. The food consisted of three prey categories found in the stomach-small intestine and two additional prey categories found in the large intestine. The diet was dominated numerically and volumetrically by amphipods of the genus *Hyalella* (87.7% and 92.2%, respectively). *Hyalella* was the most frequent prey, found in 100% of the frogs. Additional prey categories found in the large intestine were caterpillars and insect eggs. From 2 to 19 prey items were found per frog. Size ranged from 2 to 12 mm. The mean length of prey body was 8.1 ± 7.1 mm and the mode was 7 mm. Medium-sized prey was the most numerous and consisted almost exclusively of *Hyalella*. The diet of the larger frogs had the widest range of prey size and the greatest number of food categories. Coleoptera and Hemiptera made up a secondary food source.

The feeding pattern of *Atelognathus patagonicus* "aquatic form" is a consequence of the microhabitat where it lives. Shallow water with a high density of aquatic vegetation, where invertebrate richness is usually high, enables food selection. As a result of our observations, we speculate that the frog shows prey selection, suggested by its high consumption of amphipods. We have noted that frogs in ponds adjacent to Laguna del Hoyo tend to feed on amphipods. Furthermore, from unpublished data available for comparison (Mazzuchelli 1991. Informe Final del Programa Relevamiento preliminar de las comunidades acuáticas del Parque Nacional Laguna Blanca, Unpubl. Report to Administración de Parques Nacionales. Delegación Técnica Regional Patagónica, San Carlos de Bariloche, Argentina. 13 pp.) we know that amphipods were the dominant food item in Perca diet in the early 1990s in

Laguna Blanca, where *A. patagonicus* is now extinct. This suggests that both frogs and Percas may have shared the amphipod resource in the pond.

The information on the feeding habits of *A. patagonicus* presented here is part of an investigation of the interaction between frogs and introduced fish. There is a need to preserve the essential trophic resource for the "aquatic form" of the frog species, and strict official control should prevent any further introduction of fish into these ponds.

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BUFO CALIFORNICUS (Arroyo Toad). **MORTALITY.** On 14 May 2001, in a dry arroyo along a secondary channel of San Ysabel Creek (San Pasqual Valley, San Diego County, California, USA: N33.05.396, W116.58.164, WGS 84) DAK found a freshly-crushed toad carcass pressed into the sand within a tire track of a utility quad (off highway-vehicle [OHV]). The specimen was collected and brought to ELE and RNF for identification. The amphibian was subsequently identified as the federally endangered *Bufo californicus* [42 mm, snout–urostyle length [SUL]: SDSNH 69059]. The body of the toad was vertically compressed with a skin abrasion on the ventral surface and a partially protruding tongue. Based on the injuries sustained we concluded that the cause of death was crushing due to vertical pressure, most likely sustained from the force of impact from the OHV tires. It is unclear whether the toad was run over while on the surface (e.g., foraging) or burrowed under the sand and subsequently writhed to the surface. As evidenced by the abundance of tire tracks along the braided channels and across the sandy upland terraces, the habitat on private and public lands of San Ysabel Creek in San Pasqual Valley (ca. 5.5 × 0.75 km) is subject to intensive use by OHV riders (pers. obs.).

The reach of San Ysabel Creek where the dead specimen was collected supports a large population of *B. californicus* (U.S. Fish and Wildlife Service 1999. Arroyo Southwestern Toad [*Bufo microscaphus californicus*] Recovery Plan. USFWS, Portland, Oregon 119 pp.; pers. obs.). Documentation of this crushed individual demonstrates the vulnerability of this endangered species to incompatible recreational activities within occupied habitats.

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BUFO HOUSTONENSIS (Houston Toad). **JUVENILE DISPERSAL.** *Bufo houstonensis* is an endangered anuran endemic to central-east Texas. Although its breeding behavior has been well documented (Hillis et al. 1984. J. Herpetol. 18:56–72; Price 2003. TPWD report 03-0401), the little published information concerning the juvenile life stages focuses mainly on predation (Freed and Neitman 1988. Texas J. Sci. 40:454–456), coloration (Mays and Freed 1985. Herpetol. Rev. 16:108–109), and growth (Greuter and Forstner 2003. Herpetol. Rev. 34:355–356; Quinn and Mengden 1984 Southwest. Nat. 29:189–195).

A *Bufo houstonensis* egg string was surrounded with an aluminum flashing enclosure during Spring 2004 at the Griffith League Ranch (GLR) in Bastrop County, Texas, USA to monitor post-metamorphic behavior. Upon emergence, 993 individuals were captured and a single toe was clipped to identify the cohort year. The flashing was removed and 100 individuals were dusted with inert fluorescent powder (Radiant Color, T1 pigment) and released as a single group at the point of emergence. Fluorescent pigment was successfully used to track adult *Pelobates fuscus* (Eggert 2002. Herpetol. J. 12:69–74) and the same technique was applied in tracking juvenile *B. houstonensis* dispersal. Toadlets were monitored immediately following release to determine if the pigment caused any malaise, and normal activity was observed. Metamorphs were located with a UV light (Raytech, Raytector–V Portable UV Light) for two consecutive nights and observed during the early morning hours of the day following their pigment-marked release. Metamorph locations were marked with marking flags; the area was left as undisturbed as possible, and the dispersal pattern was not analyzed until after the metamorphs left the pond's edge. It was our intention to follow the juveniles for a longer period, but during the afternoon of the third day, GLR received over 25 mm of rain. We believe this resulted in the pigment powder washing off of the toads as well as washing away trackways from the preceding night's dispersal.

We released the pigment-marked individuals at the point of emergence at the pond's edge. The tracks from individual metamorphs were not distinguishable within 0.5 m of the release site because of the large amount of powder deposited in a small area. However, tracks could easily be distinguished beyond the initial confused area of powder marks. When dispersing from the pond's edge metamorphs did not move in a straight line, but in a seeming random pattern that may have been foraging or shade seeking behavior. The majority of the pigment-marked individuals retreated into the water after release, which is normal behavior for post-metamorphic *B. houstonensis* (Greuter 2003. Unpubl. MS. Thesis, Texas State Univ. San Marcos, Texas. 80 pp.). We were able to track 15 individuals over two days. Within 48 h after emergence, 8 of the *B. houstonensis* metamorphs had dispersed at least 4 m from the pond's edge. Mean dispersal distance was 3.24 m (range 0.7–5.13 m; median distance 3.43 m; N = 15) from the release point. The majority of the individuals (N = 12) were found buried under grass or sedge tussocks. The dispersal pattern did not increase in diameter from 24–48 h after marking. After the rainfall event, no pigment-marked metamorphs were relocated, however, toe-clipped individuals were quickly located, so we assumed the pigment washed off during the rainfall.

During this study, metamorphs did not show any ill effects related to the powder. Using this method was an easy, efficient, and cost effective way to track post-metamorphic juveniles. Nighttime observations of the movements of pigment-marked juveniles were easily monitored using UV light. Metamorphs were also observable during the day as the powder is highly visible, allowing us to observe toadlets without disrupting the point of emergence. We could visually track the individuals during day using binoculars from a distance of 3 m without difficulty. This is particularly relevant given the concentration of individuals at the pond's edge during the emergence period and the consequent care required to prevent accidental mortalities when trying to observe the behavior of these juveniles. We did not observe direct foraging during day or night surveys. Individuals appeared to be moving between shaded cover (daylight) or moving from one resting area to the next (night time). The technique does have an inherent weakness in very wet or rainy areas.

This study was conducted under permits issued to MRJF (USFWS: TE039544-1, TPWD: SPR-0102-191, and TXSTATE-IACUC: HGVMAD_02 and 5Qrs45_02).

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BUFO SPINULOSUS PAPILLOSUS (NCN). **REPRODUCTION**. Information on the reproductive biology of the Patagonian toad *Bufo spinulosus papillosus* is scarce. Species of the genus *Bufo* lay eggs in large clutches and are explosive breeders (Wilbur 1987. Ecology 68:1437–1452). Their eggs are typically laid in strings (Zug et al. 2001. Herpetology: An Introductory Biology of Amphibians and Reptiles. 2nd ed. Academic Press, San Diego, California. 630 pp.). This note provides the first description of the clutch characteristics, egg-laying site, and breeding season of *Bufo spinulosus papillosus* in northwest Patagonia, Argentina. *Bufo spinulosus papillosus* is distributed over the Andean and extra-Andean Patagonia in Argentina and Chile (Cei 1980. Amphibians of Argentina. Monit. zool. ital. [N.S.], Monogr. 2:[i-xii] + 1–609), and is found at altitudes of up to 2000 m (Úbeda, pers. obs.). It inhabits both the open steppe and temperate austral forests and their ecotones (Cei, *op. cit.*). It is common in rivers, streams, and steppe wetlands (*mallines*), and in open areas in the forest, such as lake and river shorelines (Christie 1998. Patagonia Silvestre [Ser.Tec.] 2:27–32).

Bufo spinulosus papillosus populations were studied at two localities. Locality 1 comprises a pond and a collateral arm of a stream, surrounded by semi-xeric thicket (41°10'52"S, 71°19'14"W; 906 m elev.). Locality 2 is a temporary pool located on a river floodplain surrounded by humid *Nothofagus* forest (41°13'52"S; 71°46'17"W; 850 m elev.). Observations were made during austral springs (September–December) from 2001 to 2004. Clutch sites (temperature, depth, substrate, and vegetation) and breeding timing were studied and compared at both localities. Clutch description was based on material from Locality 1. In the field, the duration of embryonic development was recorded for one clutch up to the time of hatching. Total length was measured for 4 clutches, from which segments were collected and preserved in 10% formalin. In the lab, segment length was measured and the number of eggs counted to obtain an estimate, by extrapolation, of the total number of eggs. String and egg diameters were also measured, and colouring described. In addition, 3 clutches were incubated to determine larval stage at hatching (Gosner 1960. Herpetologica 16:183–190). To verify species identity, these larvae were monitored until metamorphosis was complete.

Bufo spinulosus papillosus has a seasonal breeding pattern. It begins oviposition in early austral spring, acting as an early breeder. At Locality 1, a total 39 clutches were recorded (15, 1, 13, and 10 during the years 2001–2004). All eggs were laid from the last week in September to the first week in October, over a period of 4–7 days, except in 2002, when there was a delayed spring, and only one clutch was laid in the first week of November. In contrast, at Locality 2, five reproductive events were recorded from early austral spring to summer (October–December 2001). Although Locality 1 has two environments (pond and stream), which offer different microenvironments, the clutches were all laid in shallow zones (4.08 ± 1.52 cm deep, range 2–8 cm deep, N = 13), with very little or no current, little or no vegetation, on a substrate of silt or pebbles and cobbles. Water temperatures at the clutch sites in the pond in September 2003 were 9.7 ± 1.78°C at 0900 h, and 23.22 ± 4.08°C at 1500 h. Eleven clutches were found along 10 m of pond shoreline, located relatively close to each other (from 5 cm to 2 m apart), averaging 1.25 clutches per linear meter along the shore. Clutches are laid in strings of variable length (from 4–6 m) and very uniform diameter (minimum 8.3 mm), which become increasingly hydrated in contact with water (up to 17.3 mm). Clutches contained from 3250 to 6400 eggs (4480 ± 1348 eggs, N = 4), which are arranged alternately in two rows in the string. Egg diameter is 1.56 ± 0.09 mm (N = 104), and the coloring is dark brown, almost black at the animal hemisphere, fading gradually towards the vegetal pole, which is creamy pale grey. Under natural conditions, tadpoles hatched 4 days after the eggs are laid. Newly hatched tadpoles stay at the bottom of the water body, near the remains of the string. In the lab, they hatched at stage Gosner Stage 18–19 when muscular contraction begins.

The seasonal breeding pattern of *Bufo spinulosus papillosus* matches that of most anuran species in temperate regions of the world (Duellman and Trueb 1986. Biology of Amphibians. McGraw-Hill Book Co., New York. 610 pp.). Like other species of the genus, *B. s. papillosus* has several adaptations to accelerate embryonic and larval development, such as clutches laid in shallow, sunny sites, and highly melanized eggs laid in a gelatinous string which is presumed to have insulating properties. The presence of melanin and the gelatinous string also provide protection against ultraviolet radiation. These characteristics, plus a short larval period, are advantageous for exploiting temporary environments. Regarding the range of clutch size, it may depend on the body size of the females (maximum SVL 10 cm), as has been shown for other anurans (Duellman and Trueb, *op. cit.*). The two breeding strategies (explosive and prolonged), found at the two localities studied, have also been reported for some other *Bufo* species (Wagner and Sullivan 1992. Copeia 1992:647–658). The different strategies found in this study could be related to the difference in spring rainfall (October –December) between localities (100–150 mm at Locality 1 and 400–500 mm at Locality 2). Further studies are needed on the subspecies' breeding behavior prior to egg-laying.

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BUFO SPINULOSUS PAPILLOSUS (NCN). **TADPOLE BEHAVIOR**. Gregarious tadpole behavior has been described for several anuran species (Wassersug 1973. *In* Vial [ed], Evolutionary Biology of the Anurans: Contemporary Research on Major Problems, pp. 273–297. Univ. Missouri Press, Columbia). Aggregates are classified as asocial or simple aggregates (reacting to stimuli other than conspecifics) and biosocial aggregates or schools (reacting to stimuli of conspecifics) (Bragg 1948. Wasman Collector 7:65–79; Wassersug 1973, *op. cit.*).

In this note we describe for the first time gregarious behavior in tadpoles of *Bufo spinulosus papillosus*. Its distribution covers Patagonian forests and steppes, and it typically breeds in ephemeral and semi-permanent environments during spring. We studied a population in a semi-permanent pond in northwestern Patagonia (41°10'S, 71°19'W; 906 m elev., Río Negro Province, Argentina). Observations began when clutches appeared in the austral spring. We recorded water depth, temperature (inside and outside the aggregate), and the characteristics of the substrate and vegetation where the aggregates were found. Aggregation sites were identified and marked. Aggregate density was measured using a ring of known surface area (380 cm^2), and aggregates classified as: low tadpole density (≤ 20 individuals), medium (20–50), and high (> 50). Tadpole behavior within the aggregates was recorded and classified according to three categories: feeding on the substrate, swimming, and resting on the bottom. The composition of developmental stages was analyzed (Gosner 1960. Herpetologica 16:183–190).

Thirteen clutches were found during 5–6 October 2001. After hatching at Gosner Stage 18, individuals remained on the pond sediment under the gelatinous string remains. During the first week, tadpoles reached Stage 24, characterized by active swimming very near the hatching site, without feeding or aggregating. Aggregates were formed at two weeks, when the tadpoles were predominantly Stage 28, on sunny days, when the body of water was thermally stratified. The tadpoles from all 13 clutches formed 9 aggregates that remained together until metamorphosis (Stage 42). Of the 9 aggregates, 3 were high-density, 4 medium-density, and 2 low density. Aggregates were located in the shallowest, warmest zones with silt on the bed (except for two cases where there were pebbles and stones on the bed). Aggregates were found either lined up at the shore or forming irregular patches. Aquatic and paludal vegetation was almost absent from the aggregation sites except at one site where there was a dense stand of rushes. Mean temperature at the aggregation sites was 25°C ± 1.5 (24–28°C). The temperature within the aggregate was over 1°C higher than that of the surrounding water. The tadpoles had a daily migration cycle. During the morning, they were at the bottom of the pond under the vegetation (metaphyton and aquatic plants, e.g., *Myriophyllum*). When the temperature in the shallow zones rose, the tadpoles swam towards the shore and grazed actively on rocks or aquatic plants. Between 1200–1300 h there was maximum tadpole activity during feeding. At about 1400 h, the aggregates formed in the shallow zones, with the tadpoles resting on the substrate near the shore. Aggregates did not form on cloudy days, when the temperature was homogeneous throughout the pond.

Our results suggest that temperature is an important factor in the formation of *Bufo spinulosus papillosus* aggregates, which could therefore be classified as asocial aggregates. Moreover, since these tadpoles are very dark and uniformly colored, and inhabit shallow, sunny environments, their aggregates could fulfill a thermal regulation function, as suggested for other species by Brattstrom (1962. Herpetologica 18:30–46). Nevertheless, we cannot dismiss the possibility that other factors might act synergistically on aggregate formation in this species.

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COCHRANELLA GRANULOSA (NCN). **FIGHTING BEHAVIOR.** In many species of anurans, vocalizations are sufficient to ward off an intruding male, but physical fighting might also be an important aspect in spacing of individuals at breeding sites (Duellman and Trueb 1986. The Biology of Amphibians, McGraw-Hill Co., New York. 670 pp.). Species of Centolenidae breeds in mountain streams of the Neotropics where male frogs exhibit intraspecific spacing and defend territories through vocalizations, and sometimes physical fighting (McDiarmid and Adler 1974. Herpetologica 30:75–78). Because of the lack of observations on centrolenid behavior, very few species have been observed in physical, intraspecific fighting. Fighting behavior has been reported in 5 of the >136 species (Guayasamin and Bonaccorso 2004. Herpetologica 60:485–494), and two of the three centrolenid genera. Males of *Hyalinobatrachium fleischmanni*, *H. valerioi* (McDiarmid and Adler 1974. Herpetologica 30:75–78), *Centrolenella prosoblepon* (Jacobson 1985. Herpetologica 41:396–404), *C. griffithsi* (Duellman and Savitzky 1976. Herpetologica 32:401–404), and *Cochranella buckleyi* (BolÌvar-G. et al. 1999. Alytes 16:77–83) have been observed fighting during the breeding season. Aggressive behavior in Centrolenidae includes vocalizations directed towards the intruder, charging, kicking, shoving, grappling, and wrestling (Duellman and Savitzky 1976, *op. cit.*; Jacobson 1985, *op. cit.*), and such behaviors can be energetically costly and physically damaging BolÌvar-G. et al., *op. cit.*). Herein we report on the fighting behavior of *Cochranella granulosa* and provide a brief description of aggressive vocalizations emitted during the fighting.

We observed two male *C. granulosa* engaged in a fight on 21 Sept 2001 at Río Tigrillo, Conte, Puntarenas Province, Costa Rica (N8°26'27.6", W83°01'30.0" elev. 52 m), near the Panamanian border. Cattle pastures, oil palm plantations, and scattered native trees and leafy herbaceous undergrowth (Heliconiaceae and Marantaceae) bordered the stream. The encounter was filmed using a Sony SONY CCD-TR940 video camera with night vision capabilities, and vocalizations recorded with a Marantz PM 222 shotgun microphone. The two individuals were first observed at

1944 h hanging 2.5 m above the stream, and our observations were concluded at ca. 2215 h. We did not observe the initiation of the bout and were unable to identify the intruder, the resident frog, or the true duration of the bout. When first observed, the frogs were hanging upside down belly-to-belly, one frog was hanging from the leaf by the right foot, while the other frog was hanging by both feet. We heard and/or saw at least 5 additional males calling from the same leafy bush. The typical advertisement call for this species has been described as a high pitched, three-note "creek-creek-creek" (Ibáñez et al. 1999. The Amphibians of Barro Colorado Nature Monument, Soberania National Park and Adjacent Areas, Panama, Editorial Mizarachi y Pujol). The first 24 minutes passed with both animals making soft "peep" calls at different intervals until the frog with both feet on the leaf started using its right foot to kick the second frog's foot off of the leaf. This behavior continued until both frogs, with arms wrapped around one another, fell ca. 1.0 m onto a lower leaf.

At this point the fight became more active and aggressive as both frogs jumped towards each other, collided, and wrestled. Throughout the fighting we observed pushing and kicking of the head and body, with some blows directed directly towards the eyes. Sporadically, after small wrestling bouts, the two frogs would separate for a couple of minutes and then jump towards each other again, repeating the colliding and wrestling. While the frogs were separated between bouts each frog would emitted a short, single-noted "creek" vocalization similar in pitch to the species typical "creek-creek-creek" advertisement call. As one frog produced the "creek" vocalization the second frog became aggressive and attacked the vocalizing frog. During the bout the frogs were continuously falling down to lower leaves until finally they were ca. 1.5 m above the stream. After descending to this point the fighting stopped temporarily as the frogs climbed back up the plant to higher perches. This did not happen simultaneously, but instead one male climbed first, and after several minutes the second male followed suit. Once at this perch, where the two frogs were originally observed, they began the physical fighting again.

During the second bout the frogs wrestled until they were hanging upside down, again apparently trying to knock the other frog off of the leaf. The two frogs fought in the same manner as described above until they were again ca. 1.5 m above the stream. At this point, 2 h and 24 min after the initial observation, the two frogs separated and ceased aggressive, physical combat. As they separated, one of the male frogs climbed through the vegetation near the original perch and began to emit the normal "creek-creek-creek" advertising vocalization. The other male frog, presumably the loser, hopped horizontally into the denser vegetation where we lost sight of him.

During our observations at this site we noticed three distinct calls from *C. granulosa*, including two that are previously undescribed. They were: 1) the advertisement call of "creek-creek-creek"; 2) a short, soft "mew" as the males were grappling belly-to-belly; and 3) a single-noted call—"creek"—similar in pitch to the normal advertisement call, which was heard during times of slight separation. The "mew" call has been described to function as an encounter call in other centrolenid species (McDiarmid and Adler 1974, *op. cit.*; Wells 1977. Anim. Behav. 25:666–693; Greer and Wells 1980. Herpetologica 36:318–326), and appeared to serve the same function in this observation. This is the sixth species of centrolenid known to exhibit fighting behavior, and the second observation in the genus *Cochranella*. Of the other centrolenid species that exhibit fighting, two have parental care in which males guard egg clutches, and three do not have parental care, including *C. granulosa*. In *Hyalinobatrachium*, males repeatedly guard multiple clutches on the same leaf (Jacobson 1985, *op. cit.*, Hayes 1985. Unpubl. PhD. Diss., Univ. Miami) and it could be surmised that the protection of offspring would facilitate fighting behavior. We suspect that in *C. granulosa* fighting behavior is used to establish and defend territory or a calling perch that attracts mates and leads to male–male spacing. It might be possible, as more behavioral observations are documented, to use fighting behavior as a phylogenetic character to organize species relationships in this diverse Neotropical frog family, and to understand how aggressive behaviors affect fitness and the social system of anurans.

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CONRAUA GOLIATH (Goliath Frog). **SKITTERING LOCOMOTION**. Typically, anurans are specialized for saltatory locomotion. This is an excellent mechanism to avoid encounters with potential predators. In frogs, escape behavior usually consists of a single long leap to a secure place, such as from land into water, which is characteristic for ranids (Duellman and Trueb 1986. Biology of Amphibians, McGraw-Hill, Inc., New York 670 pp.). An alternate escape behavior is the unusual skittering locomotion; "bouncing" on the water surface without sinking (Gans 1976. Ann. Zool. 12:37–40), from a perching site on land as described for *Hoplobatrachus occipitalis* (Chabanaud 1949. Copeia 1949:288), *Acris crepitans* (Blair 1950. Copeia 1950:237; Hudson 1952. Copeia 1952:185), and *Hyla cinerea* (Janson 1953. Copeia 1953:62).

We observed skittering behavior in *Conraua goliath* along riverbanks of the Nkebe River, Littoral Province, Cameroon (04°50'N, 09°55'E) during March–April 2004. Generally, frogs were perched on rocks and gravel banks within the river or on solid rock at the edge of large rock pools. Sizes varied from recently metamorphosed froglets (3–4 cm SVL) to juveniles and large adults 20 to ≥ 30 cm SVL. When we approached *C. goliath* within a few meters, most showed a ranid-typical escape behavior of jumping into larger bodies of water with one powerful leap. However, some individuals exhibited a straight-line series of five to seven short leaps in even intervals which kept them on the water surface before finally diving into the water. Frogs always escaped into the water as opposed to land even when approached from the "water side." The frogs' bodies were supported on the water surface by repeatedly and simultaneously striking the surface with both feet, which are fully webbed and possess an exceptionally large surface area. The distance covered on the water surface was 2.5–3.5 m in adults and was comparatively smaller in juveniles and recently metamorphosed individuals. We observed this locomotion during most times of the day and at night (0930–

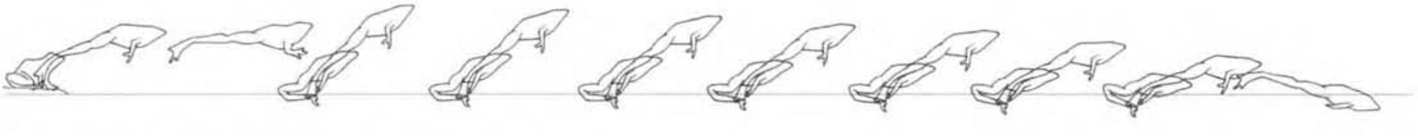

FIG. 1. Skittering behavior in a *Conraua goliath*.

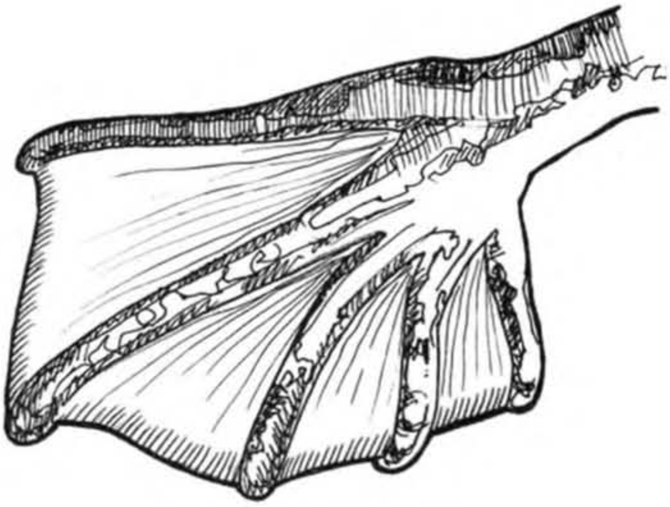

FIG. 2. Fully webbed right foot of a *Conraua goliath*.

2100 h). It seemed unrelated to particular microhabitat structures (i.e., shallow water).

Hudson (1952, *op. cit.*) suggests a selective advantage for skittering locomotion in *Acris crepitans* when predated by fishes. In Goliath Frogs there might be an advantage when dealing with aquatic predators such as fishes, giant ottershrews (*Potamogale velox*), otters (*Aonyx* and *Lutra* spp.), and crocodiles (*Crocodylus* and *Osteolaemus* spp.). These are likely to approach frogs, perched on land, from the water and possibly can follow them under water after their escape with a single leap. The frog's first escape phase on the water surface before submerging, as described here, might aid in confusing the predator and make predation less likely.

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CROSSODACTYLUS CARAMASCHII (NCN). **MORTALITY.** *Crossodactylus caramaschii* is a diurnal, stream-dwelling anuran found in the Serra de Paranapiacaba, state of São Paulo, southeastern Brazil (Bastos and Pombal 1995. Copeia 1995:436–439). The species calls from emergent rocks in forest streams, where their eggs are laid and the tadpoles develop. During Sept 2003 in the municipality of Apiaí (24°33'45"S, 48°48'45"W; 925 m elev.) in the Atlantic Forest of the state of São Paulo, Brazil, five dead or moribund *C. caramaschii* were collected. These frogs were found recently dead on the rocks of the stream (N = 2) or were heard calling and died shortly after collection (N = 3). This situation is similar to the pattern reported from localities where local extinctions have been associated with infection by the chytrid fungus *Batrachochytrium dendrobatidis*, which causes chytridiomycosis (Berger et al. 1998. Proc. Nat. Acad. Sci. USA, 95:9031–9036). Clinical signs of amphibian chytridiomycosis include abnormal posture, lethargy, and loss of righting reflex (Daszak et al. 1998. Emerg. Infect. Dis. 5[6]:735–748). The first record of *B. dendrobatidis* in Brazil was reported from Serra da Mantiqueira in *Hylodes magalhaesi* (Leptodactylidae), a diurnal, stream dwelling frog closely related to *Crossodactylus* (Carnaval et al. 2005. Froglog 70:3). Although the dead or moribund *C. caramaschii* collected were not tested for the presence of *B. dendrobatidis*, the pattern of death observed suggests infection by this fungus. Therefore, *B. dendrobatidis* might be more widespread in Brazil than reported.

Identification of these frogs was verified by Vanessa K. Verdade, and four were catalogued at the Museu de Zoologia da Universidade de São Paulo (MZUSP 133906–909).

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HYLA CALCARATA (Rana de Espolones) and ***HYLA FASCIATA*** (NCN). **DEFENSIVE BEHAVIOR**. Anurans are known to display a wide variety of defensive behaviors to avoid predation. During a study conducted at two field sites (Tambopata Research Centre, Department of Madre de Dios and the Amazon Conservatory for Tropical Studies, Department of Loreto) in Amazonian Peru in May and June 2004, we observed and collected specimens of *Hyla calcarata* and *H. fasciata*. When individuals of these species were stimulated either through tapping on the head or grasped with the hand, we observed an unusual defensive behavior that was similar in both species. This behavior consists of closing the eyes, bringing the forelimbs to the head, positioning the thumb either beneath the lower jaw or beneath the lower edge of the eye, and positioning the remaining fingers splayed straight, either below the lower edge of the eye or at eye level. We have used the term "boo behavior" to describe this behavioral pattern. We observed boo behavior in 11 of 14 *Hyla fasciata* (79%; museum vouchers: MUSM 19326, 19331, 19414, 19445, 19447, 21634, 21635) and in one *H. calcarata* (MUSM 19328). A somewhat similar behavior has been reported for *Boophis albilabris* (Andreone 2002. Herpetol. Rev. 33:299–300), although in the figure provided this species keeps the fingers scrunched together, whereas in *H. calcarata* and *H. fasciata* the fingers are stretched out.

The adaptive value of this behavior might reside in sending an "anti-signal" to potential predators, as it is possible that their search-image may be thrown off by a dramatic change in the familiar frog outline, as suggested by Channing and Howell (2003. Herpetol. Rev. 34:52). Alternately, an "increase" in head size, or making potential ingestion difficult by assuming this posture could account for this behavior. It is possible that this boo behavior might be phylogenetically constrained in *H. calcarata* and *H. fasciata*, but other related species need to be tested, in addition to performing necessary cladistic analyses.

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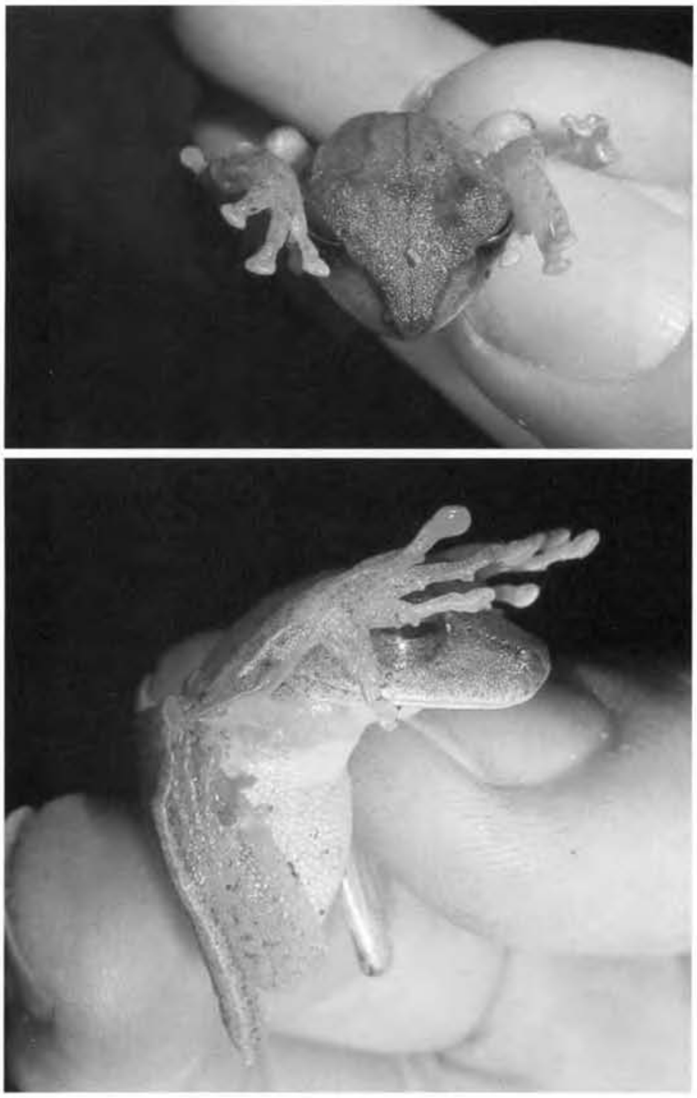

FIG. 1. "Boo behavior" display observed in *Hyla fasciata* (MUSM 19447). Top panel shows frontal view and bottom panel shows lateral view.

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LEPTODACTYLUS LABYRINTHICUS (Labyrinthicus Frog). **PREY**. *Leptodactylus labyrinthicus* belongs to the *pentadactylus* group and is one of the largest Brazilian frogs. Although its diet has been reported to be composed mostly of insects (França et al. 2004. Stud. Neotrop. Fauna Environ. 39:243–248), this species also preys on frogs and small snakes (Cardoso and Sazima 1977. Ciência e Cultura 29:110–1132; Sazima and Martins 1990. Mem. Inst. Butantan 52:73–79). During a bat survey in the Santuário Ecológico da Serra da Concórdia, municipality of Valença (600 m elev.), Rio de Janeiro, southeastern Brazil, we observed an attempt by *L. labyrinthicus* to prey upon a bat. At 2115 h, on 5 April 2005 while one of us was removing a Screaming Bat (*Anoura caudifer*) (mean mass 11 g) from a mist net, another bat, probably of the same species became entangled in the net for a few moments and then flew out a few centimeters above the ground. Immediately, a male *L. labyrinthicus* (340 g) captured the bat and started to ingest it. The bat was not completly swallowed because the wings remained opened. The frog released the bat as soon as the researcher caught it. Although this observation was possible only because of the bat becoming entangled in the net, a large number of small bats were observed in the area and it is possible the frog could catch additional bats.

C. F. Rocha (Ecology Department, UERJ) confirmed the identification of the frog which was deposited in the Museu Nacional, Rio de Janeiro (MNRJ N39310).

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LEPTODACTYLUS MYSTACINUS (Shovel-Nosed Frog). **PARENTAL CARE**. Species of *Leptodactylus* in the *fuscus* group are known to build foam nests in underground chambers (Lescure 1972. Ann. Mus. Hist. Nat. Nice. 1:91–100; Giaretta and Kokubum 2004. Herpetozoa 16:115–126). The observation reported herein was made in Uberlândia, Minas Gerais, Brazil. On 13 October 2004 (ca. 1900 h), we found a courting pair of *L. mystacinus* and followed them until they entered the nest chamber. We returned to the site the following night (1930 h) and found the chamber entrance sealed with soil and an individual (likely a male) of the species nearby (ca. 10 cm). We opened the entrance and found a foam nest within the chamber. We left the site for 1.5 h and upon our return the chamber entrance was sealed again and the frog was even closer (ca. 5 cm) to it. We again opened the entrance (the attendant individual remained motionless meanwhile) and observed the frog's behavior. Within five minutes the frog started closing the entrance of the nest chamber by pushing soil into it with its snout. When the entrance was almost closed, the frog threw loose soil into it by fast kicking to the side. The frog worked ca. 20 min. to completely seal the entrance. The following night (2100 h) the individual was not found beside the nest. The following day (900 h) we found the chamber entrance opened (ca. 20 × 15 mm) and the egg mass missing. Remaining with the egg mass the night after spawning and working to seal the damaged entrance indicate parental care in *L. mystacinus*. There are brief reports on parental care in *L. fuscus* (Lescure, *op.cit.*; Solano 1987. Amph.-Rept. 8:111–128) and chamber sealing in *L. bufonius* (Reading and Jofré 2003. Amph.-Rept. 24:415–427). Although not effective in this report, the parental behavior of *L. mystacinus* might enhance the survivorship of egg/tadpoles in the nest chamber.

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OSTEOPILUS SEPTENTRIONALIS (Cuban Tree Frog). **REPRODUCTION.** Males are often more abundant than females in breeding aggregations of anurans. This sex bias makes competition between males intense, and can promote diverse mating strategies (Anderson 1994. Sexual Selection. Princeton University Press, Princeton, New Jersey. 599 pp.), including amplexus displacement. Here, I document amplexus displacement in *O. septentrionalis*, a tree frog endemic to Cuba, but introduced in Hawaii, Georgia, and Florida (USA), Costa Rica, Puerto Rico, and other islands in the West Indies (Duellman 2001. The Hylid Frogs of Middle America. SSAR Contrib. Herpetol. 18:1–1180 pp.; Meshaka 2001. The Cuban Treefrog in Florida: Life History of a Successful Colonizing Species: University of Florida Press, Gainesville, Florida). Aspects of the natural history of *O. septentrionalis* and the potential detrimental impact of this species in invaded habitats have been studied (Meshaka 2001, *op. cit.*; Smith 2005. Biol. Cons. 123:433–441) but many details of its breeding behavior have not been published.

The following observations were made in a semi-permanent pond in Region San Antonio, Quebradillas, northwestern Puerto Rico (N18°25.113', W66°54.266'). At 0048 h on 14 Aug 2004, I observed a male *O. septentrionalis* (56 mm SVL) trying to remove an amplectant male (55.5mm SVL) from the dorsum of a female (82.5 mm SVL). The individuals were positioned in the top of a scrub (*Aeschynomene sensitive*, Leguminoseae) at a height of 1 m (Fig. 1). The intruder male attempted to pull the amplectant male off of the female, but the amplectant male moved its body and stopped the advance of the intruder male. There was not conspicuous movement of the amplectant male's hind limbs as recorded in other anurans (Davis and Halliday 1979. Anim. Behav. 27:1253–1267). Most of time the males were quiet, resting between movements and pushing attempts. The female did not move except when she jumped to the ground (0139 h) among dense vegetation (*A. sensitive* and *Ipomea tiliasea* Convolvuleaceae). Finally, when the amplectant male was pulled off the female it did not try to resume its amplexus position. This observation lasted for 1 h and 13 min, yet did not begin until after the males were engagement in conflict and the female was bleeding from the left side of her head. These individuals were not collected, but vouchers of the same population are deposited in the Museum of Zoology, University of Puerto Rico, Rio Piedras Campus (UPR 6276–77; 6279; 6283).

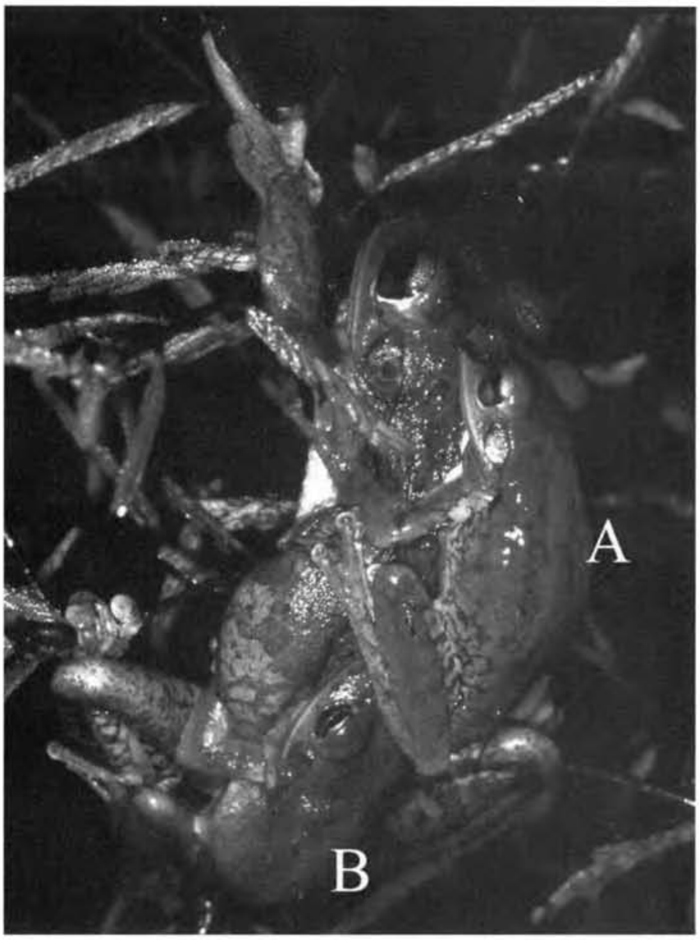

FIG. 1. Amplexus displacement in *Osteopilus septentrionalis*; A = amplectant male, B = intruder male.

Physical interactions between paired and unpaired male *O. septentrionalis* were often observed in breeding aggregations monitored during 2003 and 2004, but only the event described above was successful. Thus, in *O. septentrionalis* amplexus displacement apparently does not play a major role in the reproductive success of males.

I thank Marcos Caraballo and Frank Axelrod for plant identification, and Wilfredo Hernandez Aguiar and Ivan, Irvin, and Edsel Igartua Butler for help with fieldwork. These observations were made during MS thesis fieldwork of the author, which was supported by the University of Puerto Rico and IDEAWILD.

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PHRYNOPUS COPHITES (Cuzco Andes Frog). **REPRODCUTION.** *Phrynopus cophites* is a small leptodactylid frog of the Eleutherodactylinae clade endemic to the Cordillera de Paucartambo in the Peruvian Department of Cuzco (SE Peru). The species is only known from its type locality (Lynch 1975. Occas. Pap. Mus. Nat. Hist. Univ. Kansas 35:1–51); the southern slope of the Abra Acjanaco (13°10'9"S, 71°37'87"W, 3400 m elev).

On 7 Jan 1998 I found a brooding adult female (SVL 26.0 mm) *Phrynopus cophites*. The specimen was under moss in the puna (high Andean grassland), locality Acajanaco, Manu National Park (13°10'8"S, 71°38'05"W [datum: WGS84]; elev. 3410 m), Provincia Paucartambo, Departamento Cuzco, Peru. The nest contained 20 eggs (19 alive and 1 dead), each ca. 4 mm in diameter. I removed the nest and adjacent moss and kept them in a plastic box at ambient temperature. I measured the size at birth of juveniles as they were hatching: 6.3 mm (9 Jan), 6.9 and 6.3 mm (10 Jan), 6.1 mm (11 Jan), 6.2, 6.1, 6.3, and 6.4 mm (12 Jan), 6.6, 6.8, 6.2 and 6.7 mm (13 Jan), 6.8, 6.3, 6.5, 6.1 and 6.3 mm (15 Jan), 6.2 mm (16 Jan), 6.2 mm (19 Jan). Egg diameter a day before hatching varied from 4.8 to 5.3 mm (N = 8 eggs).

Frogs of the genus *Phrynopus* occur in páramo, puna, and cloud forests along the eastern slopes of the Andes from Colombia to Bolivia, where at least 34 species are presently known (Frost 2004. http://research.amnh.org/herpetology/amphibia). Recent descriptions of new species and a review of the genus (Lynch 1975, *op. cit.*) do not document any type of parental care for this genus, although terrestrial clutches and nest attendance have been reported in other eleutherodactylines (Duellman and Trueb 1994. Biology of Amphibians. Johns Hopkins Univ. Press, Baltimore). As far as I know, this is the first report of parental care, clutch size, and size at birth of juveniles for a species of *Phrynopus*.

FIG. 1. Female of *Phrynopus cophites* attending terrestrial eggs.

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PHYLLOMEDUSA DISTINCTA (Leaf Frog). **MULTIMALE SPAWNING.** Multimale spawning in anurans is rarely reported. To date, simultaneous polyandry has been directly observed in six rhacophorids (Coe 1967. Nature 214:112–113; Coe 1974. J. Zool. Soc. Lond. 172:13–34; Fukuyama 1991. An. Behav. 42:193–199; Feng and Narins 1991. Naturwissenschaften 78:362–365; Jennions et al. 1992. Anim. Behav. 44:1091–1100; Kasuya et al. 1996. Research. Pop. Ecol. 38[1]:1–10), one bufonid (Kaminsky 1997. Herpetol. Rev. 28:84), one myobatrachid (Roberts et al. 1999. Anim. Behav. 57:721–726), two leptodactylids (Prado and Haddad 2003. J. Herpetol. 37:354–362), and four hylids in the subfamily Phyllomedusinae (Pyburn 1970. Copeia 1970:209–219; Roberts 1994. J. Herpetol. 28:193–199; Wogel et al. 2005. J. Nat. Hist. 39:2035–2045). Here we describe the occurrence of simultaneous polyandry in another phyllomedusine, *Phyllomedusa distincta*.

Observations were made in two permanent ponds located in remnants of Atlantic rainforest, Brazil. From September 1991 to February 1992, the study was conducted in the Parque Estadual Carlos Botelho, Municipality of Sete Barras, State of São Paulo (24°12'S; 47°55'W), and from August 2001 to October 2003, observations were made in the Municipality of Guaramirim, State of Santa Catarina (26°27'S; 49°00'W).

The observed pairs deposited egg clutches wrapped in leaves above water. During the observations in the Parque Estadual Carlos Botelho, three male *P. distincta* were observed trying to fertilize the eggs of one female. In other occasions, we observed single

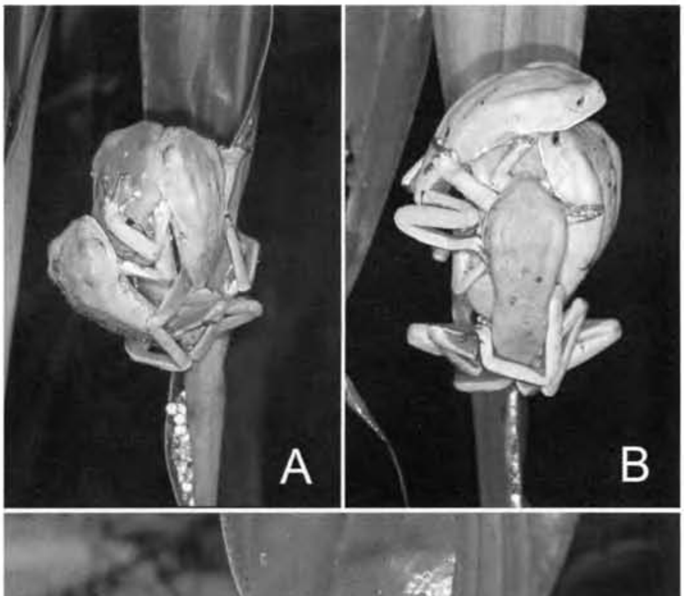

FIG. 1. Multi-male spawning in *Phyllomedusa distincta*. A) One female with two males; B) one female with three males; and C) a female dislodged from the leaf by two males.

males trying to join a pair already in amplexus, but they were not successful. Multi-male spawning in *P. distincta* was observed four times during the study conducted in the Municipality of Guaramirim. In three occasions (August 2001, September 2002, and October 2003) we observed two males spawning with one female (Fig. 1A). In September 2002, we saw three males with a female (Fig. 1B). In these four cases, after entering in amplexus, the female carried the male to an appropriate site to spawn, generally 3–4 m from the calling site. Additional males usually join the pair just before spawning begins; we have never seen a female transporting more than a single male on her back. The opportunistic males try to position their cloacae close to the eggs that are being deposited. After spawning was complete, the males slowly went away and the female remained to conclude the leaf sealing by depositing empty egg capsules to glue the leaf margins and to protect the eggs against desiccation. These clutches were monitored and egg development and hatching succeeded in three of the cases, including that with three males. However, in one occasion, when a female was spawning with two males, their weight disturbed the female by pulling her down and prevented her from sealing the leaf (Fig. 1C). The result was that almost the entire clutch desiccated. Furthermore, simultaneous polyandry was observed several times at Guaramirim, including one observation with four males with one female. The low number of cases of multimale spawning reported for anurans suggests that in general, the costs involved are higher than the advantages (Lodé and Lesbarrères. Naturwissenschaften 91:44–47). However, the advantages for the females could be to increase the chance of fertilization or the genetic diversity of offspring. For the opportunistic males, polyandry could increase the chances of fertilizing at least some eggs. Thus, mating with more than one male may be more common for anurans than reported (Roberts et al. 1999. Anim Behav. 57:721–726) and the recent increase in the number of cases reported seems to confirm this (e.g., Prado and Haddad, *op. cit.*; Wogel et al., *op. cit.*).

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PLEURODEMA NEBULOSA (NCN). **BODY TEMPERATURE.** *Pleurodema nebulosa* occurs in the arid areas of western Argentina, the Catamarca Mountains to the Rio Negro province. This distribution coincides with the Monte Phytogeographic Province (Cei 1980. Amphibians of Argentina. Ital. J. Zool., N. S. Monogr. 2, 609 pp.). The objective of the present work is to investigate selected parameters of the thermal ecology of this species: What is the average cloacal temperature (Tc) of the population? Is there an association between Tc and substrate temperature (Ts) and air temperature (Ta)? Is there a relationship between Tc and SVL?

The study area is located 40 km N of San Juan City on National Route N 40. Elevation reaches 800 m; the region is arid with an annual mean temperature of 16°C. Rainfall occurs mostly during the summer with an annual average of 84 mm.

Thirty-one individual *P. nebulosa* were collected on 21 April 2005; cloacal temperature (Tc), substrate temperature (Ts), and air temperature (Ta) were measured to the nearest 0.1°C. Information was collected on substrate type and whether the individual was in the sun or shade.

Mean Tc was 22.8°C (SD = 2.5, N = 31, range = 19.8–28.4°C). Tc was positively correlated with Ts ($r^2 = 0.75$ $p < 0.0001$, N = 31), and Ta ($r^2 = 0.75$, $p < 0.0001$, N = 31). There was no observed association between Tc and SVL ($p < 0.31$).

The results demonstrate that *P. nebulosa* is a thermal conformist, a mechanism where individuals do not need to invest time and energy actively selecting microhabitats for thermorregulation (Labra and Vidal 2003. *In* F. Bozinovic (ed.), Fisiologia Ecologica y Evolutiva, pp. 207–224. Ediciones Universidad Catolica de Chile. Santiago, Chile).

We thank Alejandro J. Laspiur for assistance in the field.

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RANA AURORA DRAYTONII (California Red-legged Frog). **DEFENSIVE BEHAVIOR**. On 3 April 2004, I observed a subadult (68 mm SVL) *Rana aurora draytonii* exhibit a "hands-up" defensive behavior after I hand-caught the frog. The capture was part of a relocation program of *R. aurora draytonii* under a 404 permit housing development site under construction in the City of Dublin, Alameda Co., California, USA (U.S. Army Corps of Engineers, Permit No. 25144S). The same frog exhibited the behavior a second time approximately two hours after being captured and retained in a plastic bag, holding the position so that I could photograph it. This behavior is similar to that expressed in the Gopher Frog, *R. capito* (Means 2004. Herpetol. Rev. 35:163–164), with the hands raised up to the side of the head and turned outward exposing the palm in an apparent attempt to shield the eyes. The nictitating membranes covered the eyes but the eyelids were not shut. As with *R. capito*, the *R. aurora draytonii* exuded a musty secretion.

Of ca. 800 adult, subadult, and juvenile frogs caught and handled during the three-year relocation effort, only a few (< 10) individuals, all subadults, exhibited this behavior. In contrast, all of the adult frogs (> 84 mm SVL) would either struggle or go limp when handled, and the juvenile frogs (< 65 mm SVL) would tuck the hindlimbs under the body and hold the forelimbs out as in preparation to jump away. Some of the adult frogs also produced a high-pitched, repetitive cry when handled.

Observing this behavior in *R. aurora draytonii* suggests that, although rarely exhibited, it might be more common among other species of ranid frogs than reported.

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RANA BOYLII (Foothill Yellow-legged Frog). **PREDATION**. Select predators of *Rana boylii* are known, although predation by the California Giant Salamander, *Dicamptodon ensatus*, has not been reported. During a study along Big Carson Creek in Marin County, California, USA, I observed predation on *R. boylii* tadpoles by *D. ensatus* larvae.

On 21 March 2005 a *R. boylii* egg mass (Gosner Stage 9) was found attached on the side of a cobble located in a small shaded pool. On 1 April, the egg mass had fully hatched and 15 tadpoles were counted in the pool. Next to the hatched egg mass, a California Giant Salamander larva was preying directly on one of the tadpoles. Twenty minutes later, the *D. ensatus* larva was still immobile next to the egg mass. On 10 April, I observed three *D. ensatus* larvae at the pool; one of them located at the same place where the egg mass was previously attached. At that time, no tadpoles were found on that pool. I have never observed other large predators (fish, Rough-skinned Newts [*Taricha granulosa*], crayfish) at that breeding site excluding Coast Gartersnakes (*Thamnophis elegans terrestris*). Gartersnakes were observed for the first time on 17 April.

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RANA CHIRICAHUENSIS (Chiricahua Leopard Frog) and ***RANA CATESBEIANA*** (American Bullfrog). **REPRODUCTIVE BEHAVIOR**. Reproductive interactions between amphibian species (Christman et al. 2000. Herpetol. Rev. 31:99–100; Kwet 2002. Herpetol. Rev. 33:47–48; Lind and Bettasso 2003. Herpetol. Rev. 34:234–235), families (Smith 2004. Herpetol. Rev. 35:374–375; Jennings et al. 2005. Herpetol. Rev. 36:53), and even orders (Höbel 2005. Herpetol. Rev. 36:55–56) has been well documented in the literature. Herein, we report the first documented observance of reproductive interference by the invasive, exotic *R. catesbeiana* with *R. chiricahuensis*, a species federally listed as threatened under the Endangered Species Act.

On 27 Sept 2003 at 1230 h, a male *R. chiricahuensis* was observed in amplexus with a female *R. catesbeiana* underwater ca. 0.46 m deep in a bedrock pool in Sycamore Creek [UTM Easting 12481804 / Northing 3476893 (NAD 27)], an intermittent stream in Santa Cruz County, Arizona. At the time of our observation, weather conditions were hot (32°C) and humid (ca. 50% RH) with high overcast. The specimens physically separated when we attempted to move them from partial obstruction for the purpose of photo documentation. Sycamore Creek is one of the few remaining strongholds of *R. chiricahuensis* in the United States and periodically is invaded by *R. catesbeiana*. Despite these invasions, *R. chiricahuensis* has maintained a population in Sycamore Creek.

The introduction and spread of *R. catesbeiana* from anthropogenic and natural means into the state of Arizona and throughout the western United States has had serious implications for native herpetofauna because of the risks of predation, competition, and the spread of disease. Reproductive interference is another concern of *R. catesbeiana* invasion. The effects of reproductive interference can be more significant than a temporary interference with a species' reproductive effort. A male *Spea hammondii* was once observed in amplexus with a female *Pseudacris regilla*; the latter died soon thereafter due to an apparent rupture of the abdominal wall (Wright and Wright 1949. Handbook of Frogs and Toads. Comstock Publishing Associates. Ithaca, New York. 640 pp.).

Ranid and hylid frogs as well as thamnophiine snakes have been documented as particularly vulnerable to the effects of *R. catesbeiana* invasion (Rosen and Schwalbe 2002. *In* Tellman [ed.], Invasive Exotic Species in the Sonoran Region, pp. 220–240. Univ. of Arizona Press and Arizona-Sonora Desert Museum. Tucson, Arizona). Reproductive interference is another possible adverse effect of *R. catesbeiana* invasion of *R. chiricahuensis* occupied habitat, a threat that has gone unrecognized to date.

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Submitted by **JEFFREY M. SERVOSS**, U.S. Fish and Wildlife Service, Arizona Ecological Services Field Office, 2321 W. Royal Palm Road, Suite 103, Phoenix, Arizona 85021, USA (e-mail: jeff_servoss@fws.gov); and **KENNETH M. SHARROCKS**, 20437 N. 17th Way, Phoenix, Arizona, 85024, USA (e-mail: freeformdesigns@cox.net).

RANA LUTEIVENTRIS (Columbia Spotted Frog). **REPRODUCTION**. Many amphibians that oviposit in temporary wetlands or wetlands where water levels fluctuate risk having their eggs stranded terrestrially. Terrestrial stranding of egg masses has been described most frequently for the Wood Frog (*Rana sylvatica*; Forester and Lykens 1988. Can. J. Zool. 66:1733–1735; Wright and Wright 1995. Handbook of Frogs and Toads of the United States and Canada, Comstock Publishing Associates, Ithaca, New York, 640 pp.). Many other amphibians have similar breeding habits (e.g., early spring, explosive, oviposit in shallow water), including *R. luteiventris* and its sister species *R. pretiosa* (Licht 1974. Can. J. Zool. 52:613–627), but survival of their eggs and other ranid frogs after stranding has been described less frequently. Herein, I report survival of *R. luteiventris* embryos for ≥ 21 days after becoming stranded.

On 6 April 2005 seven *R. luteiventris* egg masses that were laid communally between 1–5 April were found in ca. 5 cm of water in a wetland near Lost Horse Creek in the Bitterroot Mountains, Montana, USA (46°05'91"N, 114°15'82"W; 1324 m elev.), where breeding activity is monitored annually. A visit on 31 March indicated that breeding had not yet begun. Breeding by *R. luteiventris* in this wetland typically begins shortly after snow melts and the north half of the water's surface is ice free, usually during the first week in April. Most egg masses are deposited in shallow water along the north shore. The egg masses were fully enlarged when I found them but no elongation of the embryos was evident (Gosner Stage < 14; Gosner 1960. Herpetologica 16:183–190). By the next visit on 8 April, the water level had dropped and the egg masses were perched atop a wet clump of dormant vegetation surrounded by mud. Four new masses had been laid on 6–7 April in a slight depression nearby and were in < 5 cm of water. Three of these four masses were laid communally, and the fourth mass was ca. 30 cm away. The group of seven masses was still stranded on 11 April and the four more recent masses were stranded by then as well. All of the masses were still stranded on 18 April but most embryos still looked viable and some were moving inside the egg jelly (ca. Gosner Stage 18). On 21 April I estimated > 90% of embryos in the stranded masses were still viable and development seemed to be proceeding at about the same rate as in non-stranded masses of similar age. Most tadpoles had congregated at the edges and low spots of the egg jelly and some that tried to emerge from the jelly were dehydrated and dead. Most tadpoles in a sample of ca. 20 (Gosner Stages 21–23) taken from the edge of an egg mass started swimming immediately after being placed in a bottle of water, and all were swimming by the next morning. Also on 21 April, tadpoles from egg masses of the same estimated age (laid between 1–5 April) that did not get stranded were free-swimming (Gosner Stages 21–25). On 25 April, all tadpoles in the stranded non-communal mass and most tadpoles in the communal egg masses were dead. However, some tadpoles (est. < 10%) in the two groups of communal masses remained alive in the areas with the deepest jelly and swam when placed in a bottle of water. By then, however, the egg jelly had developed a thick skin on its surface and it is uncertain whether tadpoles could have escaped even if the egg mass was inundated. All tadpoles in the two groups of communal masses were dead on 5 May.

Data from the Twelvemile Creek snow telemetry station (SNOTEL; 1647 m elev.; http://www.wcc.nrcs.usda.gov/snotel) ca. 14 km upstream of the Lost Horse Creek marsh indicate April 2005 was slightly warmer and wetter than the 1989–2004 mean. The average daily temperature was 3°C (range of daily averages: -1 to 8°C) and 7.9 cm of precipitation accumulated as snow and rain on 14 days between 1–25 April, often in increments of < 0.3 cm. The precipitation likely extended the viability of the stranded egg masses (Forester and Lykens, *op. cit.*), but I never found them inundated after they became stranded and the wetland continued to shrink throughout April. Maximum snow water equivalent (SWE; 18.5 cm) in 2005 was only 39% of normal and melted ca. 1 mo. earlier than the 1968–2004 average (48.0 cm), which resulted in a water deficit in the wetland and numerous stranded egg masses despite the periodic precipitation after breeding.

The ability of eggs to survive short-term terrestrial stranding is especially important to species that breed in wetlands where fluctuations in water levels are common. At this same wetland in 2000, I observed *R. luteiventris* tadpoles hatch from an egg mass that had been stranded for ca. 5 days before being re-inundated. Spring 2005 was the second time since 1999 that there has been complete loss of breeding effort at the Lost Horse Creek marsh. Years with complete loss of breeding effort coincided with the lowest (18.5 cm in 2005) and third-lowest (25.65 cm in 2001) maximum SWE at the Twelvemile Creek SNOTEL station since 1968. Licht (*op. cit.*) hypothesized mortality from stranding of egg masses was one of the strongest factors limiting *R. pretiosa* populations. The ability to survive short term terrestrial stranding may become even more important if climate change results in less predictable wetland hydroperiods (Brooks 2004. Wetlands 24:104–114).

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RANA PRETIOSA (Oregon Spotted Frog). **PREDATION**. Greater Sandhill Cranes (*Grus canadensis tabida*) have a seasonally varied diet dominated by grains, tuberous vegetation, and macroinvertebrates (e.g., Davis and Vohs 1992. Trans. Nebraska Acad. Sci. 20:81–86; Mullins and Bizeau 1978. Auk 95:175–178; Reinecke and Krapu 1986. J. Wildl. Manage. 50:71–79). *Grus c. tabida* are reported to take frogs (Barrows 1912. Michigan Bird Life. East Lansing, Michigan Agric. College. 822 pp.; Littlefield *in* Mullins and Bizeau, *op. cit.*; Stern et al. 2002. *In* Marshall, Hunter, and Contreras [eds.], Birds of Oregon: A General Reference, pp. 198–200. Oregon State University Press, Corvallis), but the species taken have not been identified. Herein we report direct observations of *G. c. tabida* predation on *Rana pretiosa* from south-central Washington State.

Our observations were made on 10 March 2005 at Conboy Lake National Wildlife Refuge (CLNWR), Klickitat County (45°55–59'N, 121°15–23'S [datum: WGS84]; elev. 554 m). CLNWR includes part of a ca. 2500-ha seasonal marsh of palustrine emergent wetland habitats (*fide* Cowardin et al. 1979. Classification of Wetlands and Deepwater Habitats of the United States. US Fish and Wildlife Service, Office of Biological Services, FWS/OBS-79/31, Washington, D.C.). The system harbors the largest nesting population (19–20 pairs) of *G. c. tabida* in Washington State (JDE, unpubl. data) and perhaps the largest extant population of *R. pretiosa* across its geographic range (Hayes 1997. Status of the Oregon spotted frog (*Rana pretiosa*) in the Deschutes Basin and selected other systems in Oregon and northeastern California with a rangewide synopsis of the species' status. Report to The Nature Conservancy and US Fish & Wildlife Service, Portland, Oregon. 57 pp.).

At 1045 h, using 12 × 50 binoculars, MPH observed a group of 5 foraging adult *G. c. tabida*. At 1052 h, a large male *G. c. tabida* broke off from the group and began walking directly toward MPH, foraging as he went. Simultaneously, MPH heard the soft calls of several male *R. pretiosa* (see Licht 1969. Can. J. Zool. 47:1287–1299) coming from a shallow pool between himself and the approaching *G. c. tabida* (ca. 8 m in front of MPH). Examination of this ca. 20-cm deep pool through binoculars revealed a calling group of at least 7 *R. pretiosa*. Frogs were mostly calling underwater, but individuals would irregularly surface over several-minute intervals, only to re-submerge within seconds. Besides their eyes being visible, surfacing males produced ripples across the water surface that were evident from a distance. At 1107 h, the male *G. c. tabida* reached a location within 3 m of the *R. pretios*a group, when one of the frogs surfaced and the *G. c. tabida* immediately noticed it. In the typical low foraging posture, the *G. c. tabida* closed the distance between it and the *R. pretiosa* in four steps and struck the frog with a sharp peck just as the frog dove.

The *G. c. tabida* then gave 5–6 additional pecks close to where the *R. pretiosa* dove, and within 30 sec, came up with what was presumably the same frog, positioned sideways with its mottled-orange belly turned upwards in the crane's bill. Less than 10 min later, this same *G. c. tabida* captured a second *R. pretiosa* from the same group. In both cases, the *R. pretiosa* prey appeared to be adult males, ca. 70 mm SVL. After the *G. c. tabida* had moved on, MPH captured and released 4 male *R. pretiosa* at the location of the observations that were 67–74 mm SVL.

Most of the 40-odd sites across *R. pretiosa* geographic range where the species is extant are also used by *G. c. tabida* (Hayes, *op. cit.*; JDE, MPH, unpubl. data). Co-occurrence can be attributed to similarity in species habitat requirements, but our observation suggests that a trophic relationship may need further consideration.

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RANA PRETIOSA (Oregon Spotted Frog). **MAXIMUM SIZE.** As a candidate species for federal listing (USFWS 2005. Federal Register 70:24869–24934), *Rana pretiosa* has been the focus of much recent study (e.g., Marco et al. 1999. Environ. Toxicol. Chem. 18:2836–2839; Watson et al. 2003. J. Herpetol. 37:292–300; McAllister et al. 2004. Northwest. Nat. 85:20–25). Despite these efforts, few data exist regarding variation in *R. pretiosa* body size. Licht (1974. Can. J. Zool. 52:613–627; 1975. Can. J. Zool. 53:1254–1257) reported that female and male frogs in British Columbia mature at 62 mm snout–vent length (SVL) and 45 mm SVL, respectively; and recorded maximum sizes of 80 mm SVL (females) and 64 mm SVL (males). Based on collective data from several populations in Washington State, McAllister and Leonard (1997. Washington State Status Report for the Oregon Spotted Frog. [July] Washington Department of Fish and Wildlife, Wildlife Management Program, Olympia, Washington. 38 pp.) reported that adult males ranged from 46 to 66 mm SVL and adult females ranged from 51 to 89 mm SVL. McAllister and Leonard (*op. cit.*) further added that female *R. pretiosa* exceeding 90 mm SVL are rare, but exist in museum collections. This statement correctly implied that no *R. pretiosa* >100 mm had ever been recorded (K. McAllister, pers. comm.). Although Leonard et al. (1993. Amphibians and Reptiles of Washington and Oregon. Seattle Audubon Society, Seattle, Washington. 168 pp.) reported that Spotted Frogs reach 100 mm SVL, this statement was made before *R. luteiventris* was partitioned from *R. pretiosa* (see Green et al. 1997. Copeia 1997:1–7), making it unclear for which species this maximum was intended. Hence, we add to the data on variation in body size of adult *R. pretiosa* with reports of frogs >100 mm SVL from central Washington State, USA.

Our observations were made at Conboy Lake National Wildlife Refuge (CLNWR), Klickitat County (45°55–59'N, 121°15–23'S, WGS84; elev. 554 m). CLNWR includes part of a ca. 2500-ha seasonal marsh of palustrine emergent wetland habitats (*fide* Cowardin et al. 1979. Classification of wetlands and deepwater habitats of the United States. USFWS, Office of Biological Services, FWS/OBS-79/31, Washington, D.C.). CLNWR represents the only locality across *R. pretiosa*'s geographic range where it has co-existed with *R. catesbeiana* for >50 years (MPH, unpubl. data).

Between 2100 h and 0100 h on the nights of 19–20 and 20–21 August 2005, CJR and MPH systematically collected (i.e., specifically ignoring size) a series of post-metamorphic *R. pretiosa* from the seasonally shrunken remnant of Conboy Lake. We measured SVL (to the nearest 0.5 mm) and mass (to the nearest g) of each frog; the two largest frogs were photographed; and all individuals were subsequently released at their capture sites. Among the 30 *R. pretiosa* captured were 3 adult females >100 mm SVL; the size (and mass) of each female was: 103 mm (82 g), 104 mm (92 g), and 105 mm (97 g). On 11 July 2005, CJR captured an adult female *R. pretiosa* at CLNWR that measured 107.5 mm SVL (100.5 g), but no photograph was taken. Lastly, over the past 8 years, we have captured 12 different female *R. pretiosa* at CLNWR that were in the range of 101–103 mm SVL.

These frogs are all larger than the maximum size of "exceeds 90 mm SVL" reported for *R. pretiosa* (McAllister and Leonard, *op. cit.*), and of the 100 mm SVL reported for spotted frogs in general (Leonard et al., *op. cit.*). Notably, the high proportion (≥ 30%) of large (≥80 mm SVL) adult frogs recorded at CLNWR relative to 15 other *R. pretiosa* populations for which we have data is a pattern we have consistently observed since we began surveys there in 1996 (unpubl. data), and may reflect the unique local conditions influencing *R. pretiosa* size distribution. In particular, relatively long-term (>50 years) co-existence with *Rana catesbeiana* should be considered as a potential driver for this variation.

A photographic voucher for a large female *R. pretiosa* (105 mm, 97 g; Conboy Lake National Wildlife Refuge, Klickitat County, Washington State. UWBM 2301) was deposited (in electronic and hard copy) in the herpetological collection at the University of Washington Burke Museum. The Washington Department of Fish and Wildlife (Habitat Program, Science Division) and the USFWS (Ridgefield NWR Complex) supported this work.

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RANA SYLVATICA (Wood Frog) and ***AMBYSTOMA MACULATUM*** (Spotted Salamander). **BEHAVIOR.** Reports of multiple male anurans simultaneously attempting to mate with a single female of the same species are common, as are reports of male anurans attempting to mate with other anuran species (Vogt 1981. Natural History of Amphibians and Reptiles of Wisconsin.

Milwaukee Public Museum, Wisconsin. 205 pp.; Harding. 1997. Amphibians and Reptiles of the Great Lakes Region. Univ. Michigan Press, Michigan. 378 pp.). However, reports of multiple male anurans simultaneously amplexing with same-sex individuals from a different amphibian class are rare. Although Hobel (2005. Herpetol. Rev. 36:55–56) reported examples of salamander + frog breeding activity, these involved single anurans amplecting with single caudates (*Rana palustris* and *Ambystoma maculatum*). Furthermore, determining the sex of the caudates in these examples was not possible. Herein we report an instance of multiple male anurans simultaneously amplexing with a single male caudate.

On 9 April 2005 (ca. 1100 h) a survey of a woodland wetland near Stevens Point, Portage Co., Wisconsin, USA was being conducted for *Ambystoma maculatum* (which were reported to be breeding there a week prior). This survey yielded high numbers of *R. sylvatica* (calling males and amplectant pairs) and *Pseudacris crucifer* (only calling males), but few *A. maculatum*. After ca. 1 h of surveying, four male *R. sylvatica* were witnessed simultaneously amplexing with an object at the surface of the water among dormant cattails. Further investigation revealed that all were grasping a single *A. maculatum*, determined to be a male by its swollen cloacal lips. This male *A. maculatum* (8.7 cm SVL, 17 g) was lethargic, but alive, and later was released in a moist upland area. All male *R. sylvatica* escaped before further examination could be conducted. No other similar activity was witnessed during the remainder of the survey.

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RANA TEMPORARIA (Common Frog). **MIGRATION**. Mass migration of *Rana temporaria* was recorded in the Eastern Carpathians, Ciuc Basin (46°21'N, 25°46'E), 700 m elev., between 25–28 March 2005. Occasional observations were made before and after this period. We made observations on a 1200-m section of a permanent mountain stream (0.2 m^3/s runoff, 3 m/100 m slope gradient) and on ponds used for reproduction close to the stream, surrounded by a cultural landscape (few houses, mostly hayfields and arable land). The stream flows into an old branch of the Olt River. We made fixed-point counts of drifting frogs at midday (1300–1400 h) and in the evening (2000–2100 h) for 10 minute intervals. We also observed the movement and behavior of frogs along the stream until the inflow, and recorded the presence-absence of frogs in potential breeding ponds known from previous studies (Demeter 2004. A Csíki Székely Múzeum Évkönyve 1:323–333 [in Hungarian]). We recorded up to 1.5 drifting frogs/minute at midday and 2.3–6.5 drifting frogs/minute in the evening. The main migration was observed in the evenings, significant movement of frogs during the day was recorded only on 25 March. The frogs were apparently in a torpid state, flowing passively with the drift. Along the pool sections they actively swam downstream. The migration peaked on 25 March, when in the evening we counted 65 drifting frogs in 10 minutes. The migration probably started a few days earlier, as no migrating frogs were observed on or before 20 March. On 26 March during the evening we counted 23 frogs in 10 minutes, on 27 March 47 frogs in 10 minutes, and on 28 March 24 frogs in 10 minutes. The changes in the number of drifting frogs were parallel with the changes of the stream water temperature measured at midday (5.1°C on 25 March, 2.1°C on 26 March, 5.6°C on 27 March, 4°C on 28 March). Calling choruses of males and frogs departing from the stream were observed between 25–27 March on the lower sections of the stream (1000–1200 m downstream from the location of the fixed-point counts). After 27 March no frogs were observed in the stream. On 28 March we counted 47 egg clumps in a large shallow pond close to the lower section of the stream and 2 egg clumps in another small pond situated 300 m upstream. The weather cooled down in the following days. On 31 March the number of egg clumps in the large lower pond was 350, and in the upstreams pond was 30. No egg clumps or common frog activity was observed in the rest of the ponds situated close to the stream.

The first documented observation of the mass migration of *Rana temporaria* in the Carpathians was made during April 1986 in the Retezat Mountains, at 1300 m elev. (Cogalniceanu 1991. Herpetol. Rev. 22:54). The author observed a synchronous movement of frogs from a terrestrial hibernaculum towards a nearby stream at noon that lasted ca. 30–40 min. The migration coincided with an increase in daytime air temperature to 16°C, while nighttime temperatures were still below 0°C. Our observations provide further evidence that *R. temporaria* uses mountain streams for the spring migration of up to several kilometers. Further studies are needed to document this type of migration rarely described in the literature for this species, and to investigate the geographical range and ecological significance of this behavior.

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SCAPHIOPUS HOLBROOKII HOLBROOKII (Eastern Spadefoot). **ALBINISM**. Herein we report an observation of albinism in *Scaphiopus holbrookii holbrookii*. On 31 March 2003, we observed 65 albino larvae (Gosner Stage 36, Gosner 1960. Herpetologica 16:183–190) in a small diameter (35 m) ephemeral wetland in Gainesville, Alachua County, Florida, USA. The exact locality is withheld to ensure protection of this population. These albino individuals comprised ca. 1% of the entire *S. h. holbrookii* larval population.

The dorsal skin of each tadpole was light orange with a light yellow lyre-shaped marking bordered by a series of darker orange spots. The sides were light orange, and the venter was transparent with scattered yellowish-white flecks. The eyes were entirely orange.

Thirty tadpoles were collected with dipnets and returned to the lab for further study of their behavior, growth, and survivorship. All of these tadpoles successfully completed metamorphosis. One month after metamorphosis, these individuals exhibited coloration similar to the tadpole stage. The metamorphs had entirely orange eyes, a light orange dorsum and sides, and a translucent yellowish-white flecked venter. In addition, the individuals had numerous red tubercles on the dorsum. Some of these tubercles reinforced the border of the light yellow lyre-shaped marking that was evident in the tadpoles. Because of their complete absence of melanin and presence of yellow, orange, and red pigmentation, these individuals fit the description of partial albino with xanthophores and erythrophores (Dyrkacz 1981. SSAR Herpetological Circ. No. 11). Color photos were deposited in the Florida Museum of Natural History (UF 140596).

To our knowledge, this is the second documentation of albinism in *S. h. holbrookii*. Albino tadpoles were previously observed in New Kent County, Virginia (Hensley 1959. Publ. Mus. Michigan State Univ. Biol. Ser. 1:135–159).

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SCINAX FUSCOVARIUS (Snouted Treefrog), ***SCINAX* cf. *RUBER***, and ***PHYSALAEMUS ALBONOTATUS*** (Menwig Frog). **PREDATION**. Predatory events in nature are rarely published (Martins et al. 1993. Amphibia-Reptilia 4:273–296). Birds are generally reported preying on tadpoles (McAlpine et al. 2001. Herpetol. Rev. 32:183–184), but attacks on adult frog are less well documented (Brodie and Nussbaum 1987. Herpetol. Rev. 18:8–9; Master 1998. Herpetol. Rev. 29:164–165; Prado 2003. Herpetol. Rev. 34:231–232). Herein we describe four events of predation on three species of frogs by two birds, Whistling Heron (*Syrigma sibilatrix*, Ardeidae) and Great Kiskadee (*Pitangus sulphuratus*, Tyrannidae) observed during fieldwork in the Cerrado region of Central Brazil. The observations were made in a flooded field in Canaã Farm (20°40'30.4"S, 56°45'20.2"W), Municipality of Bodoquena, State of Mato Grosso do Sul, Brazil.

On three occasions were observed a Whistling Heron preying upon adult frogs in the edge of a flooded field: *P. albonotatus* (5 Dec 2000 at 1350 h), *S.* cf. *ruber* (6 Dec 2000 at 0834 h), and *S. fuscovarius* (6 Dec 2000 at 0944 h). *Physalaemus albonotatus* was hidden in the grass, and *Scinax* cf. *ruber* and *S. fuscovarius* were partially submerged along the edge of the flooded field. On 8 Dec 2000 at 1330 h we observed a Great Kiskadee prey upon *P. albonotatus*.

These birds forage in this temporary environment during the wet season, as many amphibians and fish use these flooded fields for reproduction. This environment is similar to that found in the Pantanal, where the ponds or flooded fields are used as foraging sites by many species of wading birds. Predation at these sites could represent a significant impact on populations of amphibians (Prado 2003. Herpetol. Rev. 34:231–232).

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SPEA HAMMONDII (Western Spadefoot). **PREDATION.** Although predation on adult *Spea hammondii* by American Bullfrogs (*Rana catesbeiana*) has been previously documented (Morey and Guinn 1992. *In* Williams et al. [eds.], Endangered and Sensitive Species of the San Joaquin Valley, California. California Energy Commission. 388 pp.), published documentation of predation on larval *S. hammondii* by *R. catesbeiana* is lacking. On 25 March 2004 we collected and preserved two *R. catesbeiana* from a vernal pool near Orange Cove, Tulare County, California, USA (36°37'30"N, 119°16'00"W). Six *S. hammondii* larvae were recovered from the stomach of one *R. catesbeiana* (68 mm SVL) and five larvae were found in the other (64 mm SVL). Larval total length was 12–30 mm, although Gosner life stages of the larvae were not determined (Gosner 1960. Herpetologica 16:183–190). Several thousand *S. hammondii* and Western Toad (*Bufo boreas*) larvae were found within the pool from which the Bullfrogs were collected. Although this is the first published report of Bullfrog predation on larval *S. hammondii*, predation on larval *S. multiplicata* by *R. catesbeiana* has been observed at a temporary pond in the San Simon Valley along the Arizona/New Mexico stateline (Marie Simovich, pers. comm.).

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STEFANIA EVANSI (Groete Creek Carrying Frog). **REPRODUCTION**. *Stefania evansi* is a large hemiphractine hylid frog restricted to Guyana from Kartabo and Groete Creek, westward to Mount Roraima at elevations of 10–1402 m (Duellman and Hoogmoed 1984. Misc. Publ. Mus. Nat. Hist. Univ. Kansas 75:1–39; MacCulloch and Lathrop 2002. Herpetologica 58:327–346). Like all other *Stefania* species, female *S. evansi* are known to carry eggs and juveniles exposed on their back, adhering to a mucus layer. As noted by Jungfer and Boehme (1991. Rev. fr. Aquariol. 18:91–96), very few female *S. evansi* carrying eggs or embryos are known. Only 4 cases of egg brooding females are known to us: Boulenger (1904. Proc. Zool. Soc. London 1904[2]:106) reported a female with 22 eggs from Groete Creek; Lang (1923. Nat. Hist. New York 24:467–478) reported a female with 24 eggs from Kamakusa; Jungfer and Boehme (*op. cit.*) reported a female carrying 21 juveniles from Ataro River; MacCulloch and Lathrop (*op. cit.*) reported a female with 11 near-term juveniles from the base of Mount Ayanganna.

Here we report a female (97.5 mm SVL—likely a new size record) carrying 25 eggs (Fig. 1). This large, striped morph female (Pattern B of Duellman and Hoogmoed, *op. cit.*), was collected by Festus Marco and two of us (PJRK and PB) at 1500 h on 24 June 2004 on rocks along a cascading stream in primary forest near Tukeit, ca. 150 m elev. in Kaieteur National Park, Guyana.

FIG. 1. Female *Stefania evansi* (IRSNB 13673), 97.5 mm SVL, carrying 25 eggs in the vicinity of Tukeit, Kaieteur National Park, Guyana.

The specimen was deposited in the herpetological collection of the Royal Belgian Institute of Natural Sciences (IRSNB 13673).

Duellman and Hoogmoed (*op. cit.*) indicated that reproduction of *Stefania* species is probably restricted to the wetter times of the year because most females carrying eggs have been collected in the rainy season. These authors also indicated that duration of development and egg brooding is unknown, but should probably require 2–3 months. According to the four literature records and this observation, female *S. evansi* carrying eggs were found in January, June, and late November while females with near-term juveniles were collected in October and early November. There are two distinct wet seasons in Guyana, the first "long" wet season occurring approximately from April to August and the second "short" wet season occurring approximately from November to January. Although breeding activity of *S. evansi* seems to be more common during the two rainy seasons, the available data do not indicate a rigid schedule of breeding.

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TESTUDINES

ACTINEMYS MARMORATA **(Pacific Pond Turtle). NEST ARCHITECTURE/ PREDATION.** Little has been published on the nest architecture of *A. marmorata*. Here we report nest architecture data and nest depredation characteristics of *A. marmorata* nest sites.

On 21 June 2004, approximately 8 depredated *A. marmorata* nests were observed in an approximately 0.202-ha exposed clearing along the western shoreline of a vernal lake in Lake County, California. The nests were concentrated 6–15 m from the high water mark, and the shoreline was characterized by low-stature non-native annual grasses and rocky outcrops. Most of the nests were situated within 3 m of the treeline, characterized by mixed evergreen forest with an understory dominated by manzanita. All of the nests detected showed evidence of depredation, including partially to fully excavated nest plugs, scattered shell remains, irregular shell fragment sizes, puncture holes, and broken edges pointing inward (Ashton et al. 2001. Ecology and Sampling Methods for the Western Pond Turtle. USDA Forest Service. Pacific Southwest Research Station, Redwood Sciences Laboratory. 60 pp.) (Fig. 1). Again on 31 July 2004, two additional depredated nests were observed in the same clearing. Although both showed signs of depredation, upon closer inspection, one nest contained a single undisturbed egg; the second contained 3 undisturbed eggs within the egg chamber. On a return visit 30 July 2005 to this same location, at least 15 depredated *A. marmorata* nests were recorded. All were easily detected based on signs of depredation. Several additional excavated holes and eggshell remains were detected in the immediate vicinity. Of the 15 confirmed nest sites, 7 were closely examined and data were recorded for each on soil compaction and nest characteristics (e.g., extent of depredation-related excavation, presence and number of shell remains, and presence of salient roots or stones within the nest chamber).

Following the study design of Witzell (2005. Herpetol. Rev. 36[1]: 59), each of the 7 nest sites was then carefully excavated by hand of all loose stones and debris, and casts were made of each

FIG. 1. Signs of *Actinemys marmorata* nest depredations include irregular shell fragment sizes, puncture holes, and broken edges pointing inward.

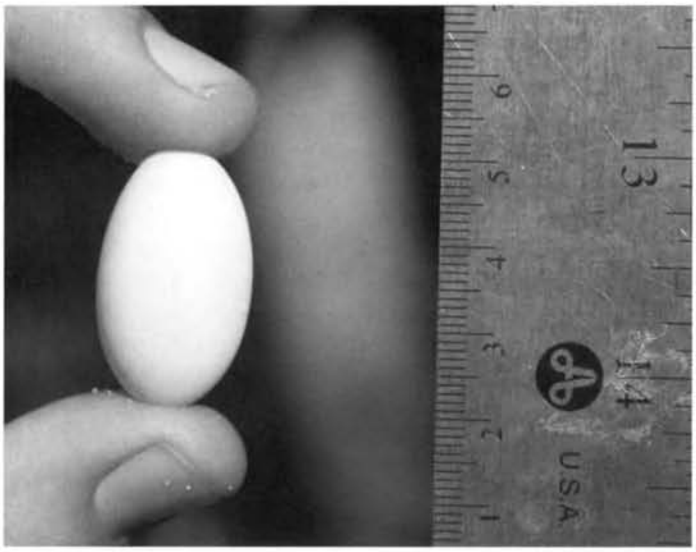

FIG. 2. Typical *Actinemys marmorata* egg recovered from aboveground.

nest chamber using a polyurethane insulating foam sealant. Once the casts had cured, each cast was hand-excavated. The minimum diameter of the neck, the maximum diameter of the egg chamber, and the depth of the egg chamber, measured from the top of the soil to the base of the chamber, were extrapolated from measurements of the casts. Soil compaction data was taken in the field with a single pocket penetrometer reading at the perimeter of each nest opening. One intact *A. marmorata* egg was recovered aboveground along the lake's perimeter close to the depredated nests; however, the immaculate condition of the egg suggests that it might not have been originally deposited inside of a nest chamber (Fig. 2). Those egg remains recovered from nest spoils were markedly soiled, likely due to soil moisture, cloacal mucus, or female turtle urine evacuated during nest construction.

Typical *A. marmorata* nests have been described as "flask or pear shaped" (Rathbun et al. 1992. Southwest. Nat. 37[3]:319–324) or "lightbulb/pear-shaped" (Holland 1994. The Western Pond Turtle: Habitat and History. Final Report. U.S. Department of Energy, Bonneville Power Administration. 303 pp.). Rathbun et al. (*op. cit.*) reported average dimensions of newly excavated, open, empty nests to be 6.5–8 cm deep, 6.5–7 cm maximum diameter across the egg chamber, and 3.5–4 cm maximum diameter across the neck. Holland (*op. cit.*) reported greater nest depths of between 9 to 12.5 cm.

At the Lake County study site, nests were roughly pear- or flask-shaped, but were offset in such a way as to exhibit bilateral rather than radial symmetry (Fig. 3). Several nest chambers were lined with large stones or crisscrossed by roots. The mean depth from the top of the soil to the base of the egg chamber was 8.5 cm (± 1.2 cm), the mean minimum diameter of the neck was 22.1 cm (± 2.8 cm), and the mean maximum diameter of the egg chamber was 22.6 cm (± 2.6 cm). Soil compaction measurements taken at the perimeter of each nest opening ranged between 2 and 3.5 tons/sq ft. Between 1 and 6 eggshell remains that were greater than 50 percent intact were detected at each of the seven nest sites.

Although these architectural dimensions provide some insight into typical *A. marmorata* nests, it is important to point out that these dimensions are based solely on depredated nests sites. The wider neck apertures reported herein may be directly related to the excavation efforts of predators, for example. Given the diffi-

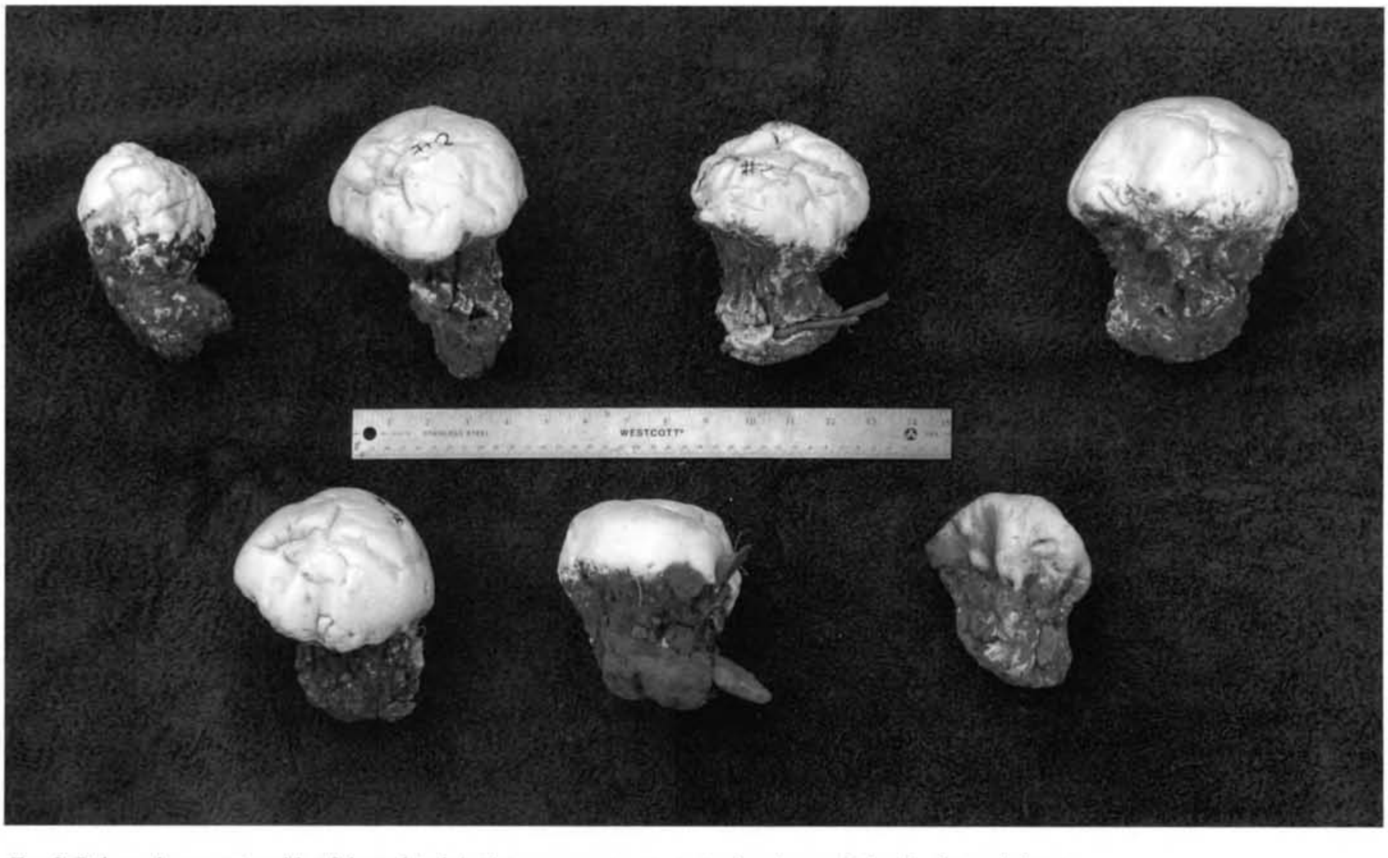

FIG. 3. Polyurethane nest molds of depredated *Actinemys marmorata* nests showing variation in size and shape.

culty involved in human detection of undisturbed nest sites, it is unknown what percentage of the total nests excavated in the 2004 and 2005 breeding seasons these depredated nests represent. If viable nest sites evaded detection by predators, this could be due to architectural dimensions that impede nest detection or depredation (i.e., greater nest depths).

Known predators of *A. marmorata* nests, including Striped Skunk (*Mephitis mephitis*), Coyote (*Canis latrans*), and Grey Fox (*Urocyon cinereoargenteus*) (Holland, *op. cit.*), are known to inhabit the study area. Other known nest predators, such as Raccoons (*Procyon lotor*) and Opossums (*Didelphis virginiana*) (Holland, *op. cit.*), are also likely residents of the area. However, no tracks or sign were evident to suggest what species might be depredating these nests. A study on the sensory perception of two known turtle nest predators, the Striped Skunk and Raccoon (Galois 1996. Turtle Nest Sensory Perception by Raccoon (*Procyon lotor*) and Striped Skunk (*Mephitis mephitis*): An Approach Through Discrimination Learning of Potential Nest Cues. Ph.D. dissertation. McGill Univ, Montreal. 105 pp.) has shown that these species in particular use visual, olfactory, and tactile cues to detect turtle nests. Among the potential cues that may attract such predators are female turtle urine and cloacal mucus deposited during nest construction, soil moisture (related to either urine/mucus or damp soils exposed during excavation), and differences in soil compaction between nest plugs and the surrounding soils (Galois, *op. cit.*).

Special thanks are in order to Sarah Anne Bettelheim and Jerry Roe for their help in the field.

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ACTINEMYS MARMORATA (Pacific Pond Turtle). **NEONATES.** *Actinemys marmorata* historically ranged from Oregon to Mexico, mainly west of the Cascade–Sierra Nevada axis (Ernst et al. 1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington, D.C. 578 pp.; Jennings and Hayes 1994. California Dept. of Fish and Game, Rancho Cordova Final Report, Contract 8023, 260 pp.; Storer 1930. Univ. California Pub. Zool. 32:429–441). Populations of *A. marmorata* in California's San Joaquin Valley are declining and it is currently listed as a California Species of Special Concern (Jennings and Hayes, *op. cit.*). However, we know little about the natural history of this species, especially the neonatal stage. Here, I report dates and locations of neonatal *A. marmorata* captures.

I trapped *A. marmorata* at five sites in the northern San Joaquin Valley, California, USA, near the town of Los Baños. Los Baños Creek and Mud Slough North are in the China Island Unit of the North Grasslands Wildlife Area and Field 26, Field 42, and the Wasteway were in the Volta Wildlife Area. During 2003, Los Baños Creek was trapped from 4 April and 31 May, Mud Slough North from 5 April–17 June, Field 26 from 1 April–24 May, Field 42 from 22 June–22 July and the Wasteway from 21 May–10 August. I captured neonate *A. marmorata* in modified eel pot traps (Casazza et al. 2000. Herpetol. Rev. 31:91–92) set to survey for Giant Garter Snakes (*Thamnophis gigas*) with 50 mm openings on either end. I placed traps 10 m apart along banks and tied them to emergent vegetation or stakes and checked them daily. I batch marked all captured neonates by clipping two V-shaped notches in the marginal scutes on each side of the nuchal scute prior to releasing them at the site of capture. I used dial calipers to measure the mid-line carapace length of three initial captures.

Mid-line carapace length of the initial 3 turtles captured were 23.8, 26.7, and 27.5 mm with additional captures being of comparable size and within the size range given for hatchling *A. marmorata* (Buskirk 2002. Radiata 11:3–30). The shells of all hatchlings caught had not yet hardened, further indicating they had emerged from the nest that year (Ernst et al., *op. cit.*). Neonate capture dates are as follows: Los Baños Creek (12 [2 captures], 20, 23 [1 recapture] April); Mud Slough North (19 April, 11 May, 12 June); Field 26 (13, 15, 19, 20 [2 captures], 22, 24, 29 [2 captures] April, 1 [recapture], 14 May); Field 42 (5 June); the Wasteway (27 June). Additional species captured included Giant Garter Snakes, Common Garter Snakes (*Thamnophis sirtalis*), California Kingsnakes (*Lampropeltis getula*), Gopher Snakes (*Pituophis catenifer*), Bullfrog adults and tadpoles (*Rana catesbeiana*), and various unidentified voles, birds, minnows, and aquatic insects.

Because *A. marmorata* is a California Species of Special Concern it is critical to understand its life history and population dynamics. Earliest captures dates for one site in central California (Alameda Co.) are consistent with our findings (Buskirk, *op. cit.*). Jennings and Hayes (*op. cit.*) reported no recruitment in populations in California's Central Valley. However, later research reported young turtles were caught throughout the Central Valley of California suggesting recruitment in these populations (Germano and Bury 2001. Trans. West. Sect. Wild. Soc. 37:22–36). Understanding the habitat requirements and fates of neonates will improve future assessments of the age structure and stability of Central Valley populations.

I thank C. Dickert for project coordination, J. Brown, J. Schmidt, J. Sloan, and C. Sousa for help with field work, and G. Dayton, J. Sloan, and two anonymous reviewers for valuable comments. Project support was provided by California Department of Fish and Game, Los Baños Wildlife Area and the Grasslands Water District. Animals were handled under the authority of the California Endangered Species Act while I was employed with California Department of Fish and Game.

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GLYPTEMYS INSCULPTA (Wood Turtle). **PREDATION.** Mutilation in the form of missing limbs and shell damage among Wood Turtles has been reported by Harding (1985. Herpetol. Rev. 16:30) and Farrell and Graham (1991. J. Herpetol. 25:1–9). Natural limb loss has been attributed to raccoons, and shell damage to various mammals. Here we report on an incident of predation upon a population of Wood Turtles during hibernation, and suggest that the most likely culprits were otters.

This southern New Hampshire population has been continuously monitored (by DMC) since 1988 (see Tuttle and Carroll 1997. Chelon. Cons. Biol. 2:447–449, and 2003. Chelon. Cons. Biol. 4:656–663, for habitat descriptions), and nearly all of the turtles (≈ 200 during that time) have been uniquely marked. Most have been located in multiple years and multiple times within a year. In late March of 1990, one adult male was found that had recently lost its left front and right hind legs, and a 6–8 yr-old was found dead with two large canine punctures through its carapace. Since 1990, only three instances of attempted predation have been noted, all consisting of limb loss by surviving subadults during the active season. During the spring of 2005, it became evident from observations of emerging turtles that there had been a major predation event during the previous hibernation period. Collections from 25 March 2005 until 11 July 2005 of 45 turtles included 21 (3 dead and 18 injured) that had been attacked. Turtles attacked had straight-line carapace lengths from 7.1 to 18.4 cm. The most common injury was the loss of part or all of one or two limbs, most commonly the front limbs (18 of 23 injuries). Additional undiscovered fatalities are likely, as several turtles that would normally have been located during the first two months after spring emergence had not been found by 11 July.

The portion of the study site where attacks occurred includes stretches of about 100 m and 300 m of two first-order streams ca. 75 m upstream of their confluence, which is in turn about 1.6 km distant from a small river. Undamaged turtles were found both upstream of the 100 m section (1, about 3 km) and downstream (5, about 0.4 km) of the confluence, indicating that this was a localized predation event. Otters (*Lutra canadensis*) are implicated from scats and prints in the area, and the fact that the turtles were submerged in up to 1.5 m of water. The hibernating turtles are often exposed on the bottom, frequently wedged between rocks, among woody debris, or among roots in the banks, which would make them easy prey for an underwater predator. Episodic otter predation upon hibernating Snapping Turtles (*Chelydra serpentina*) has been noted by Brooks et al. (1991. Can. J. Zool. 69:1314–1320), Park (1971. The World of the Otter. J. P. Lippincott Co., New York), and Surface (1908. Zool. Bull. Div. Zool., Pennsylvania Dept. Agric. 6:105–196), indicating that otters are capable of locating and killing hibernating turtles. In the case of Snapping Turtles, otters typically remove them from the water and eviscerate them ventrally, where the reduced plastron makes these turtles vulnerable. We speculate that the otters also removed the Wood Turtles from their hibernacula and took them to the stream banks (one of the three known fatalities was located on a stream bank), but were in most cases unable to do more than mutilate one or two limbs. The abandoned turtles would then have returned to the water.

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HOMOPUS SIGNATUS (Speckled Padloper). **MAXIMUM MALE SIZE.** *Homopus signatus* is considered the world's smallest tortoise species. In the nominate subspecies *Homopus s. signatus* average straight-line carapace lengths (SLCL) of 87.9 mm for females (N = 35) and 77.9 mm (N = 36) for males have been reported (Loehr 2002. J. Herpetol. 36:378–389). The largest specimen recorded was a female with a SLCL of 110 mm; the largest male reported had a SLCL of 89.5 mm and a body mass of 113.0 g (Loehr, *op. cit.*). The southern subspecies *Homopus signatus cafer* is reportedly somewhat smaller. The SLCL range is 69.9–79.8 mm in males and 83.8–95.7 mm in females (Boycott 1986. J. Herpetol. Assoc. Afr. 32:10–16).

On 14 October 2004 we found a male *Homopus signatus cafer* hiding in a rock crevice in the vicinity of Lambertsbaai, South Africa. The SLCL was 93.0 mm, the straight-line plastron length was 71.9 mm, the maximum shell width was 66.2 mm, and the maximum shell depth was 35.1 mm. The body mass of the male was 128.2 g.

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KINOSTERNON SUBRUBRUM SUBRUBRUM (Eastern Mud Turtle). **PREDATOR ESCAPE**. Known avian predators of *Kinosternon subrubrum* include crows and eagles (Ernst et al. 1994. Turtles of the United States and Canada, Smithsonian Inst. Press, Washington, DC; Mitchell 1994. The Reptiles of Virginia, Smithsonian Inst. Press, Washington, DC). Bald Eagles (*Haliaeetus leucocephalus*) are opportunistic foragers capable of exploiting a wide range of prey taxa (Buehler 2000. *In* A. Poole and F. Gill [eds.], The Birds of North America, No. 506, pp. 1–40. The Birds of North America, Inc., Philadelphia, Pennsylvania). Turtles have been documented as regular but uncommon prey primarily within the eastern portion of their breeding range (e.g., Bendell 1959. Can. Field Nat. 73:131–132; Broley 1947. Wilson Bull. 59:3–20; Ganier 1951. Migrant 22:37–39). Quantitative analyses of diets show that turtles account for < 2% of overall prey items taken by Bald Eagles (e.g., McEwan and Hirth 1980. Condor 82:229–231; Hunt et al. 2002. J. Raptor Res. 36:245–255). However, within the Chesapeake Bay, turtle shells are found with some regularity under eagle nests. An evaluation of prey remains collected from nest sites throughout the Chesapeake Bay over a five-year period documented the use of five turtle species (Clark 1981. J. Field Ornithol. 53:49–51). How eagles capture and consume these turtles is poorly understood, and we do not know if predation attempts are always successful. We observed predation of four turtle species during video monitoring of eighteen Bald Eagle nests in eastern Virginia during 2002 to 2003 (Markham and Watts, unpubl. data). Here we report on how one *K. subrubrum* escaped from attempted predation by this raptor.

During one observation on 17 April 2003 at an eagle nest on the York River, Virginia, an adult female eagle brought an adult *K. subrubrum* to her nest at 1114 h EST. She attempted several times to insert her beak enough between the plastron and carapace to grab onto the turtle's flesh. Attempts were made anteriorly and posteriorly over a period of 1 min 40 sec after which she abandoned the turtle and left it lying on its back. Sixty-nine minutes later the turtle turned over and walked to the edge of the nest and fell to the ground.

These observations document that at least some *K. subrubrum* brought to Bald Eagle nests can survive attempted predation. The hinged plastron, the ability of this species to close up its shell or nearly so, and shell thickness prevented the eagle from being able to extract flesh with her beak. We suspect that Eastern Box Turtles (*Terrapene carolina*), with their ability to close their shells completely, are seldom found in eagle nests. Turtles of other species without this characteristic (e.g., *Chrysemys picta*, *Sternotherus odoratus*) are much less likely to survive predation from this large avian predator.

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MACROCHELYS TEMMINCKII (Alligator Snapping Turtle). **FEEDING BEHAVIOR**. Observations of lingual luring in Alligator Snapping Turtles are common in captive specimens but apparently rare in the wild (Ernst et al. 1994. Turtles of the United States and Canada, Smithsonian Institution Press, Washington, DC. 578 pp.; Pritchard 1989. The Alligator Snapping Turtle: Biology and Conservation, Milwaukee Public Museum, Milwaukee, Wisconsin. 104 pp.). Herein, we provide an account of luring by an adult male Alligator Snapping Turtle in a clear-water, riverine environment. The turtle was observed by WRH on 21 September 2004 feeding (i.e., luring using its tongue appendage) at the bottom of the Eleven Point River in Randolph County, Arkansas, USA (N36.39383, W91.11433; NAD 27 CONUS) while we were scuba diving. The turtle was located in ca. 4 m of water and was positioned midstream on the gravel/bedrock interface, which is a typical characteristic of a lateral scour pool. Visibility was ca. 3 m, and the water temperature was 20°C. (The discharge rate was approximately 1000 ft^3/sec—USGS, Ravenden Springs reporting station.) The turtle's head was facing directly upstream with mouth gaping. The ventral portion of his body was resting partially on bedrock and partially on cobble/gravel; one set of his posterior claws was embedded into the gravel, and the other set was grasping to secure a hold on the bedrock. The anterior claws were positioned in a similar manner. The carapace was completely exposed, yet was well camouflaged within the surrounding substrate.

The turtle was captured by hand by WRH and was taken to the herpetology lab at Arkansas State University for photographing and processing. This turtle had a mass of 14.1 kg, a straight-line carapace length of 37.3 cm, a pre-anal tail length of 10.4 cm, and a post-anal tail length of 29.0 cm. An encrypted (AVID® Identification Systems, Inc., Norco, California) PIT (passive integrated transponder) tag was implanted within the dorsal musculature of the tail. The turtle was released back into the river at the point of capture on 23 September 2004.

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LACERTILIA

ANNIELLA PULCHRA PULCHRA (Silvery Legless Lizard). **HABITAT.** Except for a questionable account from Redwood Canyon, Marin County (Rivers 1902. Bull. So. California Acad. Sci. 1:27; Jennings and Hayes 1994. Amphibians and Reptile Species of Special Concern in California. California Department of Fish and Game, Rancho Cordova, California. 255 pp.), the range of *Anniella pulchra pulchra* is known to extend north to the south bank of the San Joaquin River, California, along the river's downstream approach to the San Francisco Bay Delta. Although the species is known to occur in the dunes at the Antioch Dunes National Wildlife Refuge, the East Bay Regional Park District Legless Lizard Preserve, and at scattered locations throughout Antioch, Oakley, and Brentwood, Contra Costa County, little has been published on its habitat requirements in this region beyond the treatment of Miller (1944. Ecol. Monogr. 14:271–289) and the species overview in Jennings and Hayes (*op. cit.*). As both a California Species of Special Concern and a Federal Species of Concern, more complete information on habitat conditions at the northern end of its range are needed. Hence, we help fill that gap with a report of the recent occurrence of 19 individuals in the Antioch/Oakley area, and describe a heretofore undescribed vegetation community—Oakley sand stabilized interior dunes—within which we have recorded this species.

On 28 January 2004, during herpetofaunal surveys of a 2.71-ha portion of sand dune ca. 2.4 km E of the City of Oakley, we found a single *A. p. pulchra* beneath a piece of 0.6 × 1.8 m corrugated sheet metal. A follow-up visit on 29 January 2004 revealed a second *A. p. pulchra* ca. 90 m north of the first sighting beneath a pile of ca. 15 pieces of similarly sized corrugated sheet metal. Also observed on this occasion were a *Coluber mormon* and a *Pituophis catenifer catenifer* between sheets situated higher in the pile. In both these cases, *A. p. pulchra* was observed above ground (i.e., not buried within the sandy substrate) between the substrate-cover interfaces, but each was quick to burrow into the sandy substrate when exposed.

At this same dune, focused follow-up surveys were conducted on 28–29 June and again on 26 July 2004. Focused surveys consisted of excavating target areas with habitat components thought to be important to *Anniella* (e.g., sandy soils in proximity to trees and shrubs and associated leaf litter; see Miller, *op. cit.*) and sifting the sands with a hand cultivator tool. Excavations reached depths of up to 60 cm and were generally confined within the drip-line of trees and consisted of trenches that extended up to 6 m from the trunks. We encountered 11 more *A. p. pulchra* at depths between 15 and 30 cm, typically close to the horizon between deeper moist sand and overlying dry sand. All occurrences were within 90 m of the January occurrences and located beneath the drip-lines of Coast Live Oaks (*Quercus agrifolia*), estimated by CHT to be 50 to 200 years in age.

On 17 March 2005, we focused surveys on an adjacent 0.67-ha portion of dune immediately southwest of the dune searched between January and July 2004. This second location had a well-developed stand of Silvery Bush Lupine (*Lupinus albifrons*) with an understory of non-native annual grassland dominated by such species as Hairy Vetch (*Vicia villosa*), brome grasses (*Bromus* spp.) and filaree (*Erodium* spp.). One *A. p. pulchra* was found beneath a fine layer of sand covered by a discarded steel automobile hood ca. 3 m from the nearest lupine. On 25 April 2005, we found 4 more *A. p. pulchra*. Three were detected by raking the sand beneath a pile of three 1.2 × 2.4 m plywood sheets, and the fourth was partially exposed in sand underneath a 15 × 15 × 121 cm fencepost.

These *A. p. pulchra* occurrences are unique in that the dune complex in which they were found supports a vegetation assemblage that has been poorly recognized and is yet to be adequately described. Holland (1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. California Department of Fish and Game, Sacramento, California. 156 pp.) recorded a similar vegetation assemblage, but based on his specific location on the bank of the San Joaquin River and his inclusion of two plants, Antioch Dunes Evening Primrose (*Oenothera deltoides* var. *howellii*) and Contra Costa Wallflower (*Erysimum capitatum* var. *angustatum*), endemic to a single locality, this description appears to be specific to the Antioch Dunes and effectively excludes other dunes in the region.

In the Oakley area, loose to consolidated sandy soils generally mapped as Delhi sand, Piper sand, and Piper fine sandy loam (USDA 1977. Soil Survey of Contra Costa County, California. Natural Resources Conservation Service) characterize this habitat, which we refer to here as Oakley sand stabilized interior dunes. These soils are on sites often referred to locally as "sand mounds," and are widely distributed in the area. The presence of locally uncommon native plant species including California Croton (*Croton californicus*), Desert Evening Primrose (*Oenothera deltoides* ssp. *cognata*), Small Evening Primrose (*Camissonia* spp.), Slender Buckwheat (*Eriogonum gracile* var. *gracile*), Blue Head Gilia (*Gilia capitata* ssp. *staminea*), Kellogg's Tarweed (*Deinandra kelloggii*), and Valley Lessingia (*Lessingia glandulifera* var. *glandulifera*) characterize the vegetation. The dune flora also often supports the aforementioned *Q. agrifolia* and *L. albifrons*, which, unlike the other plants listed, are also common on other soil types in the region.

Similar, isolated pockets of dune habitat were also present 0.8 km north of the described dune complex, but we observed no *A. p. pulchra* during two months involving over 70 h of surveys and spot checks in January–February 2004. Based on the 1977 NRCS soil survey maps, these outlier dunes were once connected to the eastern boundary of the greater dune system typical of the Antioch/Oakley area. When compared to the NRCS soils survey maps, agricultural fields, well-trafficked roads, irrigation canals, and urban sprawl isolate most such remaining dune habitat.

Documentation of *A. p. pulchra i*n Contra Costa County is recorded from the 1930s to the present, and includes 7 specimens collected in Antioch and a single specimen collected in Oakley (California Academy of Sciences); 36 specimens from 8 indeterminate locations in Oakley, Antioch, and Brentwood (Museum of Vertebrate Zoology); and three Contra Costa County locations identified in the California Natural Diversity Database (www.dfg.ca.gov/whdab/html/cnddb.html), which includes the East Bay Regional Park District Legless Lizard Preserve where on 26 April 2004, MPB found a freshly killed specimen outside of the preserve's perimeter with a puncture wound to its abdomen (CAS 228525).

Based on our observations of the present distribution of sandy soils and plants associated with the Oakley sand stabilized interior dunes vegetation community, together with our *A. pulchra pulchra* occurrences reported here, we surmise that the museum and database records noted from Contra Costa County occurred in locations supporting this habitat type. Understanding the degree of linkage between this association and *A. p. pulchra* distribution will help elucidate *A. p. pulchra* habitat requirements at the northern end of its range.

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ANOLIS PULCHELLUS (Grass Anole). **NECTIVORY.** Nectar feeding has previously been reported in anoles (e.g., Liner 1996. Herpetol. Rev. 27:78). Perry and Lazell (1997. Herpetol. Rev. 28:150–151) argued that, though episodic, it is more common that usually thought, and recent reports (Campbell 2000. Herpetol. Rev. 31:239; Echternacht et al. 2000. Herpetol. Rev. 31:173; Rios-López 2004. Herpetol. Rev. 35:386; Townsend 2004. Herpetol. Rev. 35:141–142) support that view. Here we report on another such case.

On the afternoon of 24 September 2005, we observed an adult (ca. 4.5 cm SVL) male *Anolis pulchellus* licking at a button-like structure near the base of the leaf of a small *Leucaena leucocephala* tree (Leguminosae). The lizard was about 1 m above the ground and the behavior continued for about a minute. Although nectar was not apparent to the naked eye, these structures are known to be extrafloral nectaries (Minu 1991. Acta Botanica Indica 19:49–54).

This is but the second report of lizards using extrafloral nectaries; the first (Rios-López 2004. Herpetol. Rev. 35:386) occurred in a closely related lizard species of similar size that also occurs on the Puerto Rico bank. Anoles also occasionally engage in outright herbivory (e.g., Lazell and Mitchell 1998. Herpetol. Rev. 29: 237), and episodic nectivory also occurs in other lizard clades (e.g., Perry and Ritter 1999. Herpetol. Rev. 30:166–167).

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ANOLIS SAGREI (Brown Anole). **TESTICULAR PATHOLOGY**. At 0822 h on 18 April 2002, GN collected a male *Anolis sagrei* (55 mm SVL, 4.7 g) in an irrigation ditch in an agricultural area of Santzepu, Shuisan District, Chiayi County, Taiwan (23°25'42"N, 120°28'55"E datum: WGS84; elev. 60 m). A paved road and a rice paddy bordered the sides of the ditch. The lizard was emaciated, and easily caught.

Dissection revealed that the stomach contained a hymenopteran, but no abdominal fat was present. The liver index (liver weight/SVL × 100) of this lizard was 0.236, slightly lower than the average (0.268) of the other males collected in that month. It was also noted that the right testis was a grayish-black color, much reduced in size (3.5 mm long, 2.9 mm wide, 0.05 g), and hard, while the left testis was a normal dark mustard color and appeared to be in a normal condition and size (6.2 mm long, 5.2 mm wide, 0.12 g). Both left and right testes, as well as the liver, were fixed in 10% formalin, embedded in wax, sectioned at 5μ and stained with Ehrlich's hematoxylin and eosin (HE), Periodic-Acid-Schiff (PAS) and Ziehl-Nielsen (ZN) stains. The liver was very dark in color and had white nodules on the ventral side near the gallbladder, but no abnormalities were observed during the histological examination. Sections of the left testicular adnexa (Fig. 1) revealed a necrotizing granuloma, composed of central necrosis surrounded by epithelioid to polygonal histiocytes and fibrosis, but adjacent testicular tissue did not appear to be affected and was undergoing spermatogenesis. Sections of the right testis (Fig. 2) revealed only a residual granuloma without any normal testis and adnexal tissue. The granuloma was composed of central necrotic eosinophilic granular materials, surrounded by plump histiocytes. A ring of

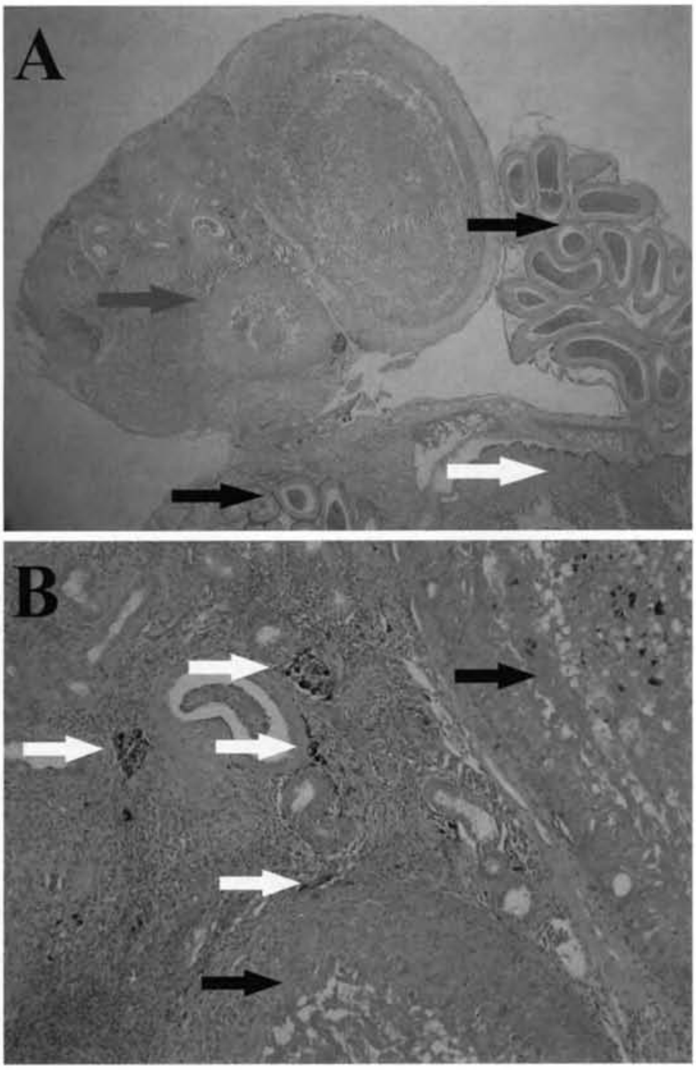

FIG. 1. **A** – A section of the left testicular adnexa (40× magnification, HE stain). Note the lesion in the upper left hand portion of the image; and the spermatozoa in the epididymis (center lower and right hand portion of the image); as well as the reproductively active seminiferous tubules (the lower right hand corner of the image). **B** – The same section (100× magnification, HE stain); note the melanin in the center of the nodule and the necrosis in the lower right hand and upper right hand corner of the image.

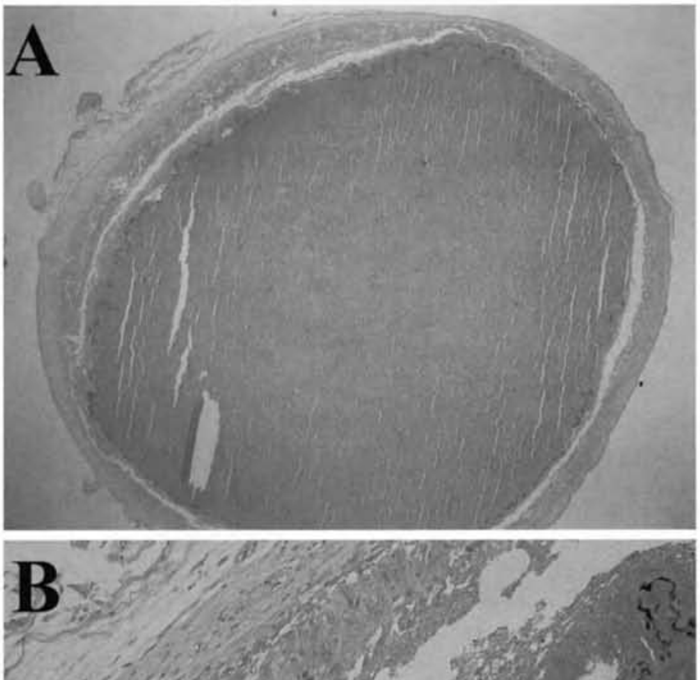

FIG. 2. **A** – A section of the right testis without any normal testis and adnexal tissue (40× magnification, HE stain). **B** – Note the melanin that is surrounding the necrotic tissue (200× magnification, HE stain).

melanin surrounding the necrotic focus suggests that the lesion originated from the testicular adnexa.

In sections of the left and right testes, as well as the liver, treated with PAS and ZN stains, no fungi or acid-fast bacilli were observed; thus, the exact cause of these lesions is uncertain. Since this *A. sagrei* was part of other studies, necessitating that the organs be treated as needed for those investigations (i.e., fixation), culture of fungi and bacteria was not possible. This appears to be the first report of such lesions in *A. sagrei* from Taiwan.

We would like to express our gratitude to Mei-Hsiu Cheng and the other laboratory technicians of the Chiayi Christian Hospital cytology laboratory for preparing the microscope slides, and to Dr. Rod Suepaul for his suggestions.

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COLEONXY BREVIS (Texas Banded Gecko). **COLOR PATTERN.** *Coleonyx brevis* is a nocturnal gecko restricted to the northern and east-central parts of the Chihuahuan Desert, the western and southern edge of the Balconian Biotic Province and most of the Tamaulipan Biotic Province of Texas and Mexico (Blair 1950. Texas J. Sci. 2:93–117); in México, the species occurs in northeastern Chihuahua, most of Coahuila, north and central Nuevo León, and small portions of northwestern Tamaulipas and northeastern Durango (Bartlett 1996. Reptiles 4:48–67; Dixon 1970. Cat. Amer. Amphib. Rept. 88.1–88.2; Stebbins 2003. A Field Guide to Western Reptiles and Amphibians. 3rd ed. Houghton Mifflin Co., New York. 353 pp.). The species is small (maximum SVL = 59 mm [females], 56 mm [males]), and the typical dorsal pattern consists of a series of small spots alternating with dorsal bands (Dial and Grismer 1992. Syst. Biol. 41:178–195; Dixon 1970, *op. cit.*; Klauber 1945. Trans. San Diego Soc. Nat. Hist. 10:133–216). To our knowledge, no aberrant color patterns in *Coleonyx* involving longitudinal dorsal stripes have been reported (see Klauber 1945, *op. cit.*; Dyrkacz 1981. SSAR Herpetol. Circular 11:1–31). Hence, we describe a *C. brevis* with a longitudinal-striped pattern from central Nuevo León, Mexico.

FIG. 1. An unusual pattern in a juvenile male *Coleonyx brevis* from El Carmen, Nuevo Leon, México.

On 22 April 2004, while conducting a herpetological survey on the slopes of Cerro Minas Viejas in a submontane matorral biotic community in the municipality El Carmen (25°56'57.5"N, 100°21'40.9"W, datum: NAD27; 556 m elev.), we found a subadult male *C. brevis* (41 mm SVL; 26 mm tail, 1.8 g) under a 17 x 15 cm rock. It lacked typical dorsal banding pattern on the body, having instead longitudinal stripes (Fig. 1), but the tail had the typical banding pattern. The lizard was photographed and released. Other reptile species are known to have banded and striped morphs (Fox et al. 2003. Lizard Social Behavior. Johns Hopkins Univ. Press, Baltimore, Maryland. 464 pp.; Zug et al. 2001. Herpetology: An Introductory Biology of Amphibians and Reptiles, 2nd. edition. Academic Press, San Diego, California. 630 pp.), but the significance of the striped morph in *C. brevis* will require an understanding of its population-level frequency and its relationship to different habitat conditions.

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CTENOTUS SPALDINGI (NCN). **NEST SITE DISTUBANCE; HATCHING.** The scincid genus *Ctenotus* is a large group of diurnally active insectivorous lizards (Cogger 2000. Reptiles and Amphibians of Australia. Reed Publishing, Sydney, Australia. 808 pp.) that reach among the highest species diversities of any terrestrial vertebrate (Pianka 1986. Natural History of Desert Lizards. Princeton University Press, Princeton, New Jersey. 222 pp.). Still, little is known about the nesting or potential cues responsible for hatching in most members of this genus. Hence, here I report an observation of nesting habitat, nest disturbance and subsequent hatching of the species *Ctenotus spaldingi.*

During fieldwork in the desert uplands of northeastern Queensland, I uncovered a nest containing 5 eggs (mean dimensions; 12 × 11 mm; N = 5) positioned against the wall of a pitfall bucket while checking an established trapping grid. The nest was situated in Mitchell grass (*Astrebla* sp.)-dominated black soil plains habitat (Morgan 1999. *In* Sattler and Williams [eds.], The Conservation Status of Queensland's Biogeographical Ecosystems, pp. 10/1–10/35. Environmental Protection Agency, Brisbane, Queensland, Australia). The nest was relatively shallow with a 4.5-cm covering of dried soil with the entrance to the nest connected to a hole leading into a nearby crack in the soil. In the uncovering process, one of the eggs was inadvertently damaged, and an attempt was made to move the eggs to a suitable incubation site. While moving the remaining eggs, one egg began to hatch;

in just over 4 min, it had fully emerged from its egg, at which point the hatchling was still attached to its yolk sac via the umbilicus. The time between when the eggs were uncovered to when the hatchling fully emerged from its egg was ca. 7 min. Remaining eggs were transferred to a small plastic bag with moist grass and leaves and allowed to incubate at an air temperature averaging 25°C; the remaining viable eggs hatched over the next 4 days. The clutch size and nest depth documented in this observation of *C. spaldingi* is similar to that reported in another study of *Ctenotus* (clutch size: 4–6 in *C. robustus*; 2–6 in *C. taeniolatus*; nest depth: 5 cm in *C. robustus*; 4 cm in *C. taeniolatus*; Taylor 2005. Aust. J. Zool. 52:649–666). However, I am unaware of other reports suggesting that nest disturbance may induce hatching in the genus *Ctenotus*.

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GAMBELIA WISLIZENII (Long-nosed Leopard Lizard). **PREDATION.** Previous observations of *Gambelia wislizenii* have revealed that this lizard preys on large invertebrates and small vertebrates, including other lizards and mammals (e.g., McCoy 1967. Amer. Midl. Nat. 77:138–146; Parker and Pianka 1976. Herpetologica 32:95–114; Pietruszka et al. 1981. J. Herpetol. 15:249–250). Although herpetologists might have often witnessed *G. wislizenii* feeding in the wild, photodocumentation of the predation process is lacking. Here we photodocument the details of a *G. wislizenii* predation event on *Uta stansburiana* from southern Utah, USA.

At 1457 h on 12 May 2004, we witnessed an adult (> 90 mm SVL) *G. wislizenii* (a male based on lack of nuptial coloration) seize an adult (> 40 mm SVL) *U. stansburiana* (also a male based on the bluish throat color and the intensity of the lateral spot behind the forelimbs) and digitally photographed the encounter. The incident occurred just a few meters north of the newly restored Paria Canyon Movie Set in Grand Staircase-Escalante National Monument, Kane County (37°14.237'N; 111°57.498'W; elev. 1450 m). Triassic-age rocks around the site weather readily, producing abundant soft alluvium in the valley. Consequently, sagebrush grows relatively densely, providing ample shade and shelter among rocks and sandy areas for basking.

Our photodocumentation omits the first 30 sec of the assault. During this phase, the *G. wislizenii* grasped its prey by the neck and immobilized it by repeated shaking and visibly clenching its jaw. This process continued, increasingly less vigorously, until the *U. stansburiana* stopped moving. The *G. wislizenii* then rapidly rotated its prey and ingested its entire torso, head first and belly up, within a minute (Figs. 1A–B). Ingestion of the torso was followed by a minute-long pause. The final effort consisted of swallowing the tail. This appeared to be a strenuous process during which the leopard lizard repeatedly contorted its body (Fig. 1C), presumably to roll up the food item in its stomach. During ingestion, our observation distance was 3–4 m. Following prey ingestion, the *G. wislizenii* noticeably slowed its movements, and it tolerated an even closer approach to a distance of 2 m. Based largely on the camera's digital clock, the entire progression from initial attack to completion of prey ingestion took about 3.5 min.

A literature search revealed that detailed descriptions of predation of *Gambelia* spp. are rare since most food habits studies fo-

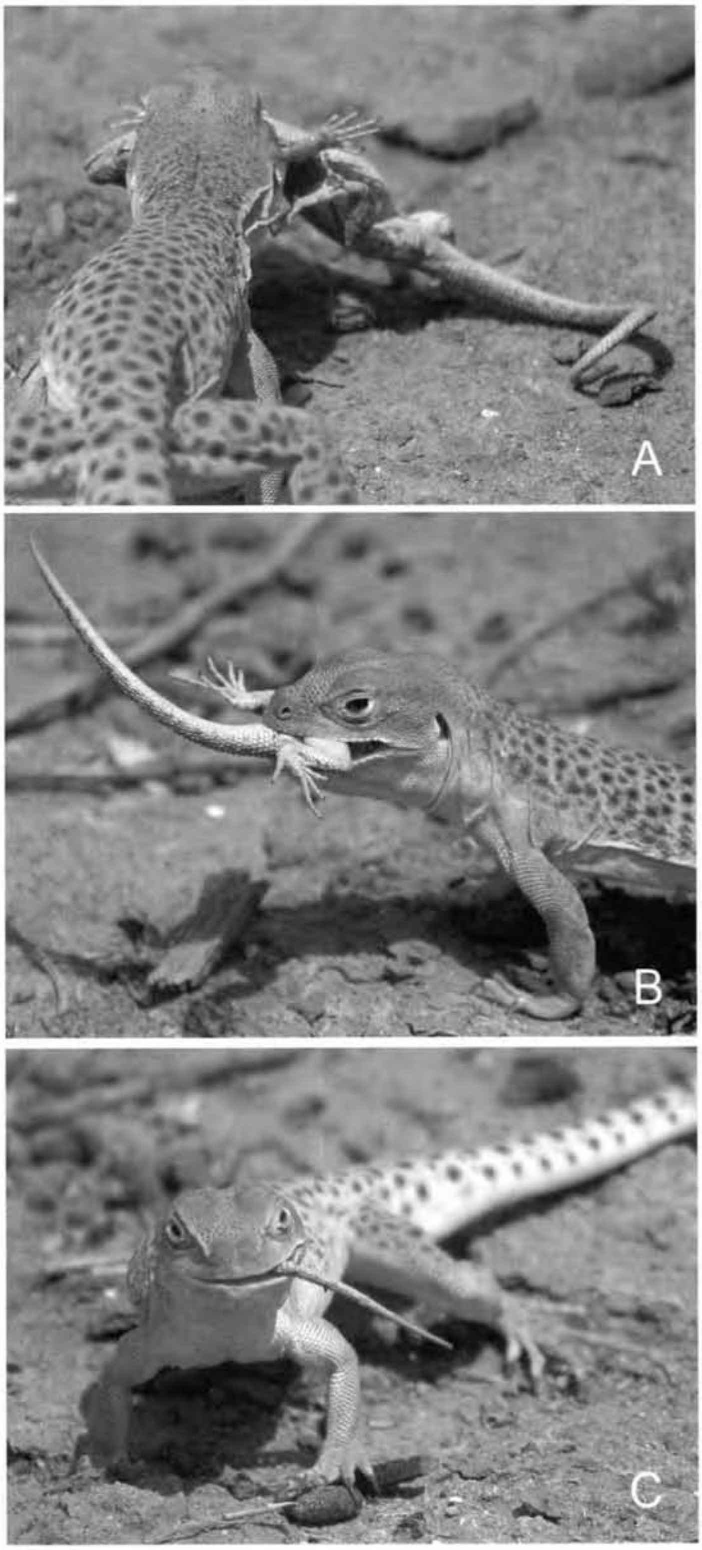

FIG. 1. A) Seven seconds after the observation began, the *Gambelia* has immobilized the *Uta* with repeated shaking and jaw clenching. B) Fifty-three seconds after the observation began, the prey is swallowed head first and belly up. C) To swallow the tail of its prey, the *Gambelia* repeatedly contorts its body; 149 sec after the observation began.

cus on the stomach contents of these lizards (e.g., Knowlton and Janes 1932. Ohio J. Sci. 32:467–470, Knowlton and Janes 1934. Copeia 1934:10–14, Knowlton and Thomas 1936. Copeia 1936:64–66, Milstead and Tinkle 1969. Am. Midl. Nat. 81:491–499). *Gambelia* is a fast, aggressive and tenacious predator that can capture prey running at full speed (Tanner and Krogh 1974. Herpetologica 30:63–72). However, the time needed for swallowing seems to vary greatly. A male *G. sila* caught and swallowed a conspecific hatchling "within a few seconds" (Germano and Williams 1994. Herpetol. Rev. 25:26–27), but the consumption of a pocket mouse *Perognathus* by a juvenile female *G. wislizenii* necessitated more than 1.5 h (Pietruszka et al. 1981. J. Herpetol. 15: 249–250). Large prey is swallowed with the aid of bending movements of the head and body, whereas small prey is masticated before ingestion (Montanucci 1956. Herpetologica 21:270–283).

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GERRHONOTUS LIOCEPHALUS (Texas Alligator Lizard). **MORTALITY**. In México, forest fires occur primarily over two seasonal intervals. One season, which runs January to June, applies to the entire country save the northeast; the other, which begins in May and ends in September, applies to northeastern México. Both coincide with the dry season (SEMARNAP, 2000. Texto Guía Forestal. Subsecretaría de Recursos Naturales, Dirección General Forestal-SEMARNAP. México, D.F., 150 pp.). Forest fires have the potential to negatively affect forest faunas, and in particular, amphibians and reptiles (Bury 2004. Conserv. Biol. 18:968–975). Fire-induced formation of light gaps in forest canopies can favor certain reptiles, but reptiles may have greater difficulty finding refuge in fire-affected sites (Bury, *op. cit.*; Ernst et al. 1995. Herpetol. Rev.26:185–187). However, few data exist indicating the vulnerability of reptiles. Hence, here we provide an observation from Nuevo Leon, México implying that *Gerrhonotus liocephalus* might sometimes be at risk from forest fires.

During a visit to the central part of the Parque Ecológico Estatal Chipinque, in an area known as El Empalme (25°36'16.0"N, 100°21'06.0"W, datum: NAD27, elev. 1270 m) on 25 April 1998, we found an adult female *G. liocephalus* (141 mm SVL; 36 mm tail with a 20 mm regenerated piece; 33.5 g) that died probably due to a forest fire that had passed through the area over the interval 9–22 of April 1998 (fire information online at http://www.jornada.unam.mx/1998/04/11/incendios.html and http://www.horacero.com.mx/130_edicion/30130.html). This female lacked digits on its left front foot, and all metatarsals and phalanges were missing on its right front foot. All digits on the hind feet were incomplete, as the outer portion of each digit up to at least the second phalange was missing. Moreover, the dorsal scales were much darker than normal and sloughed off in alcohol after only two days of preservation, suggesting the lizard was exposed either to fire directly or to a hot substrate. Our visit to the site occurred two days after the fire was brought under control, which suggests that this animal survived the fire but succumbed from fire-related injuries. In this same area we also found under a rock a specimen of *Plestiodon brevirostris pineus* that had not been affected. More information on the vulnerability of fire to reptiles will be needed to determine whether demographic consequences to this sort of mortality exist.

The *G. liocephalus* (UANL 5532) was deposited in the herpetological collection of the Universidad Autonoma de Nuevo Leon, Facultad de Ciencias Biologicas.

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HOPLODACTYLUS MACULATUS (Common Gecko). **SOCIAL ASSISTANCE**. Cooperation, especially parental care, is a significant life history component in many vertebrates (Clutton-Brock 1991. The Evolution of Parental Care. Princeton University Press, Princeton. 368 pp.). However, documentation of parental care in reptiles is sparse, having been reported or inferred for only 3.4% of lepidosaurians (Somma 2003. Parental Behavior in Lepidosaurian and Testudinian Reptiles: A Literature Survey. Krieger Publishing Company, Malabar, Florida. 174 pp.). Moreover, reports of parental care among lepidosaurians are taxonomically biased towards snakes (Shine 1988. *In* Gans and Huey [eds.], Biology of the Reptilia. pp. 275–329. Alan R. Liss, New York), and among lizards are biased towards skinks (Somma, *op. cit.*). Of the nearly 1000 recognized species of geckos (Suborder Gekkota; Pianka and Vitt 2003. Lizards: Windows to the Evolution of Diversity. University of California Press, Berkeley. 333 pp.), parental care has been reliably documented in only 21 (all in the Family Gekkonidae; Somma, *op. cit.*). Further, reports of parental care of post-hatching juveniles (as opposed to eggs) are even less common (Shine, *op. cit.*; but see Evans 1959. Copeia 1959:103–110; O'Connor and Shine 2004. Anim. Behav. 68:1361–1369 for exceptions). Hence, here we report observations of juvenile *Hoplodactylus maculatus* using adult conspecifics to aid in dispersal to foraging grounds from a communal retreat site.

Hoplodactylus maculatus, moderate-sized (to 82 mm SVL) nocturnal geckos endemic to New Zealand (Gill and Whitaker 2001. New Zealand Frogs and Reptiles, David Bateman, Auckland, New Zealand. 112 pp.), are known to form large diurnal aggregations (Hare and Hoare 2005. Herpetol. Rev. 36:179). During a two-week period in November 2004 (austral spring), we observed and video-recorded nocturnal emergence behavior of a diurnal aggregation of ~100 individual *H. maculatus* on Stephens Island, Cook Strait, New Zealand (40°35'S, 173°55'E; elev. 200 m). Geckos (adults, sub-adults, and < 1-month-old neonates) emerged singly from their retreat site at dusk (~2030 h NZDT) from two exits and were seen moving in progression along branches, and between coastal trees to reach the canopy, presumably to forage. Neonate geckos were observed travelling with 1–2 adults on several occasions. More importantly, however, we observed neonate geckos using the body of adult geckos that were bridging the gap between twigs of different trees to make arboreal crossings (Fig. 1).

FIG. 1. An adult *Hoplodactylus maculatus* (large animal in center) forming an arboreal bridge between the twigs of adjacent trees over which a juvenile conspecific (on left) has just crossed.

Two neonate geckos observed attempting to cross from one tree to another without the assistance of adult geckos were unsuccessful in their endeavors to reach the next tree. In a location, such as Stephens Island, with a high density of ground-dwelling nocturnal predators of geckos (Tuatara, *Sphenodon punctatus*, known to prey on *H. maculatus* [Walls 1981. New Zealand J. Ecol. 4:89–97], occur at an average density of 2015/ha in forest habitat; Carmichael et al. 1989. New Zealand J. Zool. 16:269), the risk of mortality as a consequence of falling to the ground during arboreal crossings, or using the ground to move between trees, is likely to be high.

We cannot confirm relatedness of adult and neonate geckos seen travelling together, but our observations provide evidence of social interaction between *H. maculatus* of differing ages and tolerance of neonates by adults. The level of social assistance seen in *H. maculatus* has rarely been reported among reptiles (reviewed by Chapple 2003. Herpetol. Monogr. 17:145–180), and particularly geckos (Shine, *op. cit.*; Somma, *op. cit.*).

Despite *Hoplodactylus maculatus* being frequently observed in diurnal aggregations (Hare and Hoare, *op. cit.*) nocturnal emergence behaviors associated with these aggregating geckos have not been reported. Living in dense aggregations might necessitate dispersal preceding their diel activity period to forage effectively. We encountered geckos in the surrounding coastal forest throughout the night at distances of > 10 m from their diurnal retreat site. Social assistance among conspecific nocturnal geckos might facilitate foraging and predator avoidance of neonates within social aggregations. Clarifying the relatedness among aggregations of individuals and the purpose and extent of social assistance might significantly contribute to knowledge of sociality and parental care in reptiles.

We thank Kelly Hare for comments on the draft. Our research was conducted with New Zealand Department of Conservation approval.

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HOPLODACTYLUS MACULATUS (Common Gecko). **LONGEVITY**. The New Zealand lizard fauna is characterized by extreme longevity, low reproductive output, and high species diversity for its size when compared with other temperate regions in the world (Bannock et al. 1999. New Zealand J. Ecol. 23:101–103; Cree 1994. New Zealand J. Zool. 21:351–372). Longevity estimates for free-living *Hoplodactylus* geckos (*H. duvaucelii* and *H. maculatus*) are currently at least 36 years (Bannock et al., *op. cit.*; Thompson et al. 1992. J. Royal Soc. New Zealand 22:123–130).

Determining the maximum life span for wild geckos is difficult. Growth rate data cannot be used to age geckos once they attain maturity, a process which can take up to eight years (Sheehan et al. 2004. New Zealand J. Zool. 31:109). Longevity estimation therefore requires that identifiably marked individuals be recaptured over long time intervals. Because mark-recapture studies are not usually conducted over decades, return visits to sites where geckos were marked in previous studies provide the only alternative means of extending longevity records. We report here on a visit to one such site and the resulting recapture of five *H. maculatus* of extreme age.

The 3.7-ha Motunau Island in North Canterbury (43°03'S, 173°04'E) supports large populations of seabirds and lizards—the nocturnal gecko *H. maculatus* and the diurnal skinks *Oligosoma lineoocellatum* and *O. nigriplantare polychroma*. *Hoplodactylus maculatus* comprises a cryptic species complex (Daugherty et al. 1994. New Zealand J. Zool. 21:317–323) and the taxon present on Motunau Island has been given the tag-name *H.* aff. *maculatus* 'Canterbury'; however, we use *H. maculatus* here pending formal description of the species.

During ecological surveys carried out from 1967–1975, TW caught and individually marked 133 *H. maculatus* by toe-clipping. Geckos were captured in 25 pitfall traps spaced 5 m apart in a 20 × 20 m grid. The island was revisited in the summer of 1996–1997 and 16 of the original geckos were recaptured, at which time ten were estimated to be at least 36 years old (Bannock et al., *op. cit.*). In March 2005, ML visited the island and recaptured five geckos (two males, three females) originally marked by TW. When marked in 1967–1975 these geckos had snout-to-vent lengths that ranged from 47–73 mm. All except the largest individual could be assigned their approximate age (± 1 yr) by calibrating their SVL at time of first capture against the predicted SVL/age relationship growth curve generated by Bannock et al. (*op. cit.*). The estimated ages of these five 'old' geckos were 36, 36+, 37, 38, and a remarkable 42 years old! Interestingly, none of these geckos was recaptured by Bannock et al. (*op. cit.*). To our knowledge, our observation represents a new global record for longevity in a free-living gecko population. In addition, these geckos were still living within < 20 m of where they were marked more than 30 years earlier, thus implying significant site fidelity.

Our research adds to other observations on longevity and site fidelity in New Zealand geckos. Such studies are not possible without a permanent marking system (e.g., toe clipping, PIT tagging) and long-term study involving different researchers (Hare and Cree 2005. New Zealand J. Ecol. 29:137–142). Despite the extreme longevity of New Zealand geckos, more than 80% are considered threatened or have a 'Data deficient' ranking due to a scarcity of records (36/43 or 83% of species; Hitchmough and Bull [compilers], in press.Threatened Species Occasional Publication, Department of Conservation, Wellington, New Zealand). The vulnerability of New Zealand geckos to introduced predators and habitat loss, coupled with their low annual reproductive output (≤ 2 offspring/female/yr; Cree, *op. cit.*) limit their ability to persist in human-altered landscapes, and highlight the pressing need for on-going and effective conservation management.

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KENTROPYX STRIATA (Striped Kentropyx). **JUVENILE PREDATION**. *Kentropyx striata* is a common lizard in northern Brazil (Ávila-Pires 1995. Lizards of Brazilian Amazonian (Reptilia: Squamata). Zoologische Verhandelinger 299:1–706). Few predators of *K. striata* have been identified (Ávila-Pires, *op. cit.*). Here I describe an observation of Great Kiskadee (*Pitangus sulphuratus*) predation on a juvenile *K. striata* from northern Brazil. At 1150 h on 25 September 2001, I observed a juvenile (ca. 10 cm SVL) *K. striata* running in the backyard of a house in the village of Alter do Chão near the Tapajós River, Santarém, Pará State (2°30'S, 54°57'W, datum: WGS 84; elevation 50 m). Patches of savannah within Amazon forest vegetation characterized this region. A *P. sulphuratus* made an initial unsuccessful attempt to catch the lizard as it ran; it escaped into a pile of bricks. However, the bird caught the lizard on a second pass after pausing on a branch near the lizard's refuge for ca. 30 sec. After the capture, the *P. sulphuratus* carried the *K. striata* to a nearby tree and beat the lizard's head several times on the branch. Using its beak, the bird grabbed the lizard by the head and swallowed it head first. The entire predation episode took 3 minutes.

This observation reveals that small lizards can be vulnerable to smaller predatory birds, like this tyrannid flycatcher. *Pitangus sulphuratus*, a species broadly distributed in Brazil (Sick 1997. Ornitologia Brasileira, Nova Fronteira, Rio de Janeiro, Brazil. 912 pp.), can prey on a variety of animals, such as bats, fish, arthropods, amphibians, and reptiles (Sick, *op cit.*; Argel-de-Oliveira et al. 1998. Rev. Brasil. Zool. 15:1103–1109). This note represents the first record of *P. sulphuratus* predation on juvenile *K. striata*.

Thanks to Fernando Raeder for help with translation.

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LEIOCEPHALUS CARINATUS ARMOURI (Northern Curlytail Lizard). **PREDATION.** *Leiocephalus carinatus armouri* is a well-established exotic species in Florida (Meshaka et al. 2004. The exotic amphibians and reptiles of Florida, Krieger Publishing Company, Malabar, Florida. 155 pp.; Meshaka et al., *in press*, Southeastern Nat. 4); however, few vertebrate predators of this species have been documented within its introduced range (e.g., Smith and Engeman 2003. Herpetol. Rev. 34:245–246; Smith and Engeman 2004a. Herpetol. Rev. 35:169–170; Smith and Engeman 2004b. Florida Field Nat. 32:107–113). To date, only one avian predator of *L. c. armouri*, the Little Blue Heron (*Egretta caerulea*), has been recorded in Florida (Smith and Engeman 2004a, *op. cit.*). Here, we augment the sparse information on avian predators of *L. c. armouri* in Florida with the observation of the probable predation of a juvenile *L. c. armouri* by a Northern Mockingbird (*Mimus polyglottos*).

At 1040 h on 30 April 2005, a clear sunny day (air temperature ca. 25°C), HTS observed an adult Northern Mockingbird perched atop fence-line shrubbery with a small lizard in its bill at the Woolbright Road colony site of *L. c. armouri* located in Boynton Beach (see Smith and Engeman 2003, 2004b, *op. cit.* for site descriptions). Closer examination revealed it to be a juvenile *L. c. armouri* (SVL ca. 5 cm). The lizard, being held sideways by its neck, was completely limp (including tail and limbs), and seemed dead. The lizard remained limp during the 20–30 sec observation period, after which the mockingbird flew out of view with its prey over an adjacent building rooftop. The pliant appearance of the *L. c. armouri* suggested to us that it was taken recently rather than scavenged.

Mockingbirds are generalist omnivores and have been reported to prey on *Anolis* lizards (Derrickson and Breitwisch 1992. *In* Poole et al. [eds.], The Birds of North America, Species Account No. 7, Northern Mockingbird, American Ornithologists' Union, Washington, D.C. and the Academy of Natural Sciences, Philadelphia, Pennsylvania. 26 pp.), and a Rough Earth Snake (*Virginia striatula*) (Sorrell 2004. Herpetol. Rev. 35:75–76).

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MICROLOPHUS ATACAMENSIS (Atacama Desert Runner). **PREDATION**. Interspecific predation, like that between lizards and snakes in the Chilean Atacama desert (Labra and Niemeyer 2004. Ethology 110:649–662), is well documented in reptiles (e.g., Jackson et al. 2004. Zoology 107:191–200). *Microlophus atacamensis*, a lizard endemic to the coastal zones of northern Chile (Donoso-Barros 1966. Reptiles de Chile. Ediciones de la

Universidad de Chile, Santiago, Chile. 458 pp.), feeds on marine (crustaceans and green algae) and terrestrial (isopods, coleopterans, dipterans) prey (Ortiz 1980. Actas I Reunión Iberoamericana Zool. Vert., La Rábida, pp. 355–377). No studies have reported predation on *M. atacamensis,* implying that this species is a top predator (Fariña et al. 2003. Ecol. Appl. 13:1533–1552). Nonetheless, here we describe predation on *M. atacamensis* by *Philodryas chamissonis* (Long-tailed Snake, Chilean Green Racer), a diurnal hunter whose diet consists of anurans, passeriform birds, rodents, lagomorphs, and in particular, lizards of the genus *Liolaemus* (Greene and Jaksic 1992. Rev. Chil. Hist. Nat. 65:485–493).

During diurnal sampling for *M. atacamensis* at 1530 h on 10 July 2005, we encountered a male *Philodryas chamissonis* (667 mm SVL, 105.6 g, 12.8 mm head width) feeding on an adult male *M. atacamensis* (93.5 mm SVL, 89.5 g, 22.7 mm head width). The observation was made in a coastal zone at Arrayán, La Serena, Coquimbo's Province, Chile (29°41'S, 71°19'W, datum: WGS84; elev. 8 m). The habitat corresponds to an arid Mediterranean biome with thorny shrubs (di Castri 1968. *In* Delamare and Rapoport [eds.], Biologie de l'Amérique Austral, pp.7–52. Edition du Centre National de la Recherche Scientifique, Paris), including *Nolana lycioides* (Nolanaceae) and *Heliotropium stenophyllum* (Boraginaceae) as dominant species. When first encountered, the lizard was being ingested by the head, with its hind limbs and tail still exposed. Upon capturing the snake, the lizard was released.

This is the first record of predation on *M. atacamensis* and indicates that this species might not always be a top predator in the trophic web of the northern Chilean coast. Additional observations of this interaction will be required to understand its frequency and relevance to *M. atacamensis* population dynamics.

The snake (SSUC 7233) and lizard (SSUC 7234) were deposited in the collection Prof. Patricio Sánchez Reyes, Pontificia Universidad Católica de Chile. We thank María Victoria Reyna for field assistance and Fondecyt 1040783 for financial support to JMF.

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NOROPS HUMILIS (Ground Anole). **KLEPTOPARASITISM.** Kleptoparasitism, a behavior in which a resource (frequently prey) is stolen from a potential competitor, has been repeatedly documented in birds, fish, mammals, and varied invertebrates, but to my knowledge, only two reports exist of kleptoparasitism among non-avian reptiles (Cooper and Perez-Mellado 2003. Amphibia-Reptilia 24:219–224; Whiting and Greef 1997. Copeia 1997:811–818). Here I augment the sparse data on kleptoparasitism in non-avian reptiles with two observations involving a common leaf-litter anole, *Norops humilis*, in northeastern Costa Rica.

Observations were made at the La Selva Biological Station (10°25'N, 84°00'W, datum WGS84; elev. ~40 m). This site is a 1600-ha primary evergreen wet forest reserve dominated by lowland closed canopy forest with relatively limited seasonality in precipitation (Sanford et al. 1994. *In* McDade et al. [eds.], La Selva: Ecology and Natural History of a Neotropical Rain Forest, pp. 18–33. University of Chicago Press, Chicago. 486 pp.). At ca. 1130 h on 18 July 2003, I observed an adult *Norops humilis* (~ 35 mm SVL) in leaf litter along a trail in primary forest. An unidentified ant (~ 10 mm long) was walking across the leaf litter carrying a lycosid spider (~10 mm SVL). The spider was immobile, presumably having been incapacitated by the ant. The lizard approached the ant and snatched the spider from the ant's grasp and retreated a short distance (~ 20 cm) where it consumed the spider. The ant made no attempt to reclaim its lost prey.

At 0857 h on 17 July 2005, I observed another adult *Norops humilis* (~30 mm SVL) in leaf litter along a trail in secondary forest. An unidentified myrmicine ant (~10 mm long) was walking slowly through leaf litter carrying a small bee (~10 mm long). The lizard approached the ant and snapped at the bee, seized it from the ant, and retreated ca. 20 cm to consume the bee, disregarding the ant. Again, the ant made no attempt to reclaim its prey.

My casual observations suggest that kleptoparasitism may be frequent in *N. humilis*. It was impossible to determine whether or not these lizards actually recognized the presence of the ants, so it is unclear whether this is a unique foraging strategy opportunistically employed by the lizards or if the lizards are simply responding to the behavioral stimuli for prey capture (movement of a small spider or bee across the leaf litter) regardless of the presence of the ants. To my knowledge, this is the first report of any reptile stealing prey from another species; these observations also suggest that opportunities may exist to investigate interspecific interference competition between markedly different organisms.

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PAROEDURA STUMPFFI (Madagascar Ground Gecko). **PREDATION.** *Zonosaurus madagascariensis* is widely distributed in Madagascar (Raselimanana 2003. *In* Goodman and Benstead [eds.], The Natural History of Madagascar, pp. 978–983. Univ. of Chicago Press, Chicago, Illinois). It occurs in dense primary forests on the east coast as well as deforested and cultivated areas on the west coast (Raxworthy 1988. Biol. Conserv. 43:181–211; Glaw and Vences 1997. A Field Guide to the Amphibians and Reptiles of Madagascar. 2nd edition. M. Vences & F. Glaw Verlags GbR, Köln. 480 pp.; Raselimanana, *op. cit.*). All species of *Zonosaurus* are diurnal and forage generally on the ground, although some climb trees (Raselimanana, *op. cit.*; Glaw and Vences, *op. cit.*). Their diet includes mostly insects and fruits (Raselimanana, *op. cit.*). Some *Zonosaurus* are reported to consume small vertebrates (Raselimanana, *op. cit.*), but the genus *Pareodura* has not been reported as prey. Hence, I add to what little is known about the feeding habits of *Zonosaurus* in nature with an observation of predation on *P. stumpffi* by *Z. madagascariensis*.

This observation was made during a field trip to Madagascar in September 2004 on Nosy Komba, a small (2200 ha) island off the northwest coast (48°19'–48°21'S, 13°26'–13°28'E; Andreone et al.

2003. J. Nat. Hist. 37:2119–2149). I became aware of the animals because something was moving rapidly and rustling in the litter near a small limestone formation. A subadult (ca. 10 cm SVL) *Z. madagascariensis* was hunting a small (ca. 4 cm SVL) gecko. The gecko displayed the conspicuous coloration of juvenile *Paroedura stumpffi*: several white cross bands on a dark dorsal ground color. After a few seconds of pursuit, the gecko threw off its tail, but the *Zonosaurus* caught it just behind his head. The *Zonosaurus* slipped between pieces of limestone, where it presumably swallowed the gecko. After several minutes, the *Zonosaurus* emerged again and grabbed the tail of the gecko, which was still moving, and ate it.

In contrast to other Malagasy geckos, some species of *Paroedura* are exclusively terrestrial (e.g., *Paroedura pictus*), and juveniles of most species differ in coloration from adults (Glaw and Vences, *op. cit.*; Bauer 2003. *In* Goodman and Benstead [eds.], The Natural History of Madagascar, pp. 973–977. Univ. Chicago Press, Chicago, Illinois). As *Paroedura stumpffi* frequently utilizes forest-floor habitats on the north and northwest coast of Madagascar, including the nearby island Nosy Be (Andreone et al., *op. cit.*; Glaw and Vences, *op. cit.*; Liebel et al. 2004. Draco 5:28–39) and the Comores (Liebel et al., *op. cit.*), significant opportunity exists for it to serve as prey for the frequently terrestrial foraging *Z. madagascariensis*. This represents the first report of *Pareodura* predation by *Zonosaurus*.

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PHELSUMA MADAGASCARIENSIS GRANDIS (Madagascar Giant Day Gecko). **NECTARIVORY; POTENTIAL POLLINATION.** Some palms (Arecales: Arecaceae) are mainly insect-pollinated (though some may be wind-pollinated), and both pollen and nectar are rewards to their pollinators (Henderson 1986. Bot. Rev. 52:221–259). Day geckos (*Phelsuma* spp.) are reported to be important pollinators by providing plant outcrossings in their native range (Nyhagen et al. 2001. J. Trop. Ecol. 17:755–761) and in their introduced range on Hawaii (Calviño-Cancela 2005. Herpetol. Rev. 36:182–183). Herein, we report nectar consumption and the potential for pollination of non-native coconut palms (*Cocos nucifera*) by non-native *Phelsuma madagascariensis grandis* in the lower Florida Keys.

Phelsuma m. grandis is native to northern Madagascar (Henkel and Schmidt 2000. Amphibians and Reptiles of Madagascar and the Mascarene, Seychelles, and the Comoro Islands. Krieger Publishing Company, Malabar, Florida, 319 pp.) and has been introduced onto five islands in the Florida Keys (Krysko et al. 2003. Florida Sci. 66:222–225; Krysko and Sheehy 2005. Carib. J. Sci. 41:169–172). On 6 July 2003 at 1000 h, we observed an adult (ca. 190 mm total length [TL]) *P. m. grandis* that had climbed onto the flowering spikes of a *Cocos nucifera* on Little Torch Key (24°40.39'N, 81°23.262'W, datum: WGS84; elev. < 1 m). This gecko licked the nectar from male flowers for about 20 min before climbing to a more secluded position on the tree. At 0900 h on 9 July 2003, we observed 3 adults (ca. 200–250 mm TL) of both genders exhibiting this same foraging behavior for ca. 30 min on another *C. nucifera*. These geckos were also observed snapping at hymenopterans as the insects approached flowers. At 0910 h that same day, we observed a neonate (ca. 70 mm TL) *P. m. grandis* licking nectar from male flowers on a nearby *C. nucifera*. This small gecko allowed us to approach it within ca. 25 cm for photography. Since these observations were made, we have noted this foraging behavior on at least 5 occasions suggesting that the behavior is not a rare phenomenon.

Cocos nucifera is normally allogamous, but autogamy may occur (Patel 1938. The Coconut. Government Press, Madras, India; Ohler [ed.] 1999. Modern Coconut Management, Palm Cultivation and Products. Available online: http://ecoport.org/ep?SearchType=earticleView&earticleId=127&page=-2; Meléndez-Ramírez et al. 2004. Agric. For. Entomol. 6:155–163). Climbing on flowers and drinking nectar followed by contact of both stamens and stigmas in the same palm could result in autogamy. If geckos were to simply climb onto a nearby palm, outcrossings might occur as they do in other areas *Phelsuma m. grandis* occurs.

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PHYLLODACTYLUS VENTRALIS (Venezuelan Leaf-toed Gecko). **ECOLOGY; PREDATION.** *Phyllodactylus ventralis* is the only member of its genus in northeastern Colombia and the northern Venezuelan mainland, where it inhabits mostly dry thorn forests and savannahs (Dixon and Huey 1970. Contr. Sci. Los Angeles Co. Mus. Nat. Hist. 192:1–78; Rivas and Barrio-Amorós 2005. Herpetol. Rev. 36: 205–209). Although this is the most common of the three *Phyllodactylus* species in Venezuela, almost nothing is known of its natural history. Ruthven (1922. Misc. Pub. Mus. Zool. Univ. Michigan 8:5–69) and Mechler (1968. Rev. Suisse Zool. 75:305–371) provided a few ecological data on Colombian populations, but the only data for Venezuelan populations are the brief comments in Roze (1964. Mem. Soc. Cienc. Nat. La Salle 69:209–241). Hence, here we report on *P. ventralis* retreat sites from the arid region of north-central Venezuela, on the species that share these microhabitats, and on a snake predator.

Our observations took place at a campground on Camatagua Reservoir in the northern part of the State of Aragua, Venezuela (09°49'3.36"N, 66°46'41.28"W, datum: WGS84; elev. 230 m) between 0900 and 1730 h on 16 May 2001, a hot (> 30°C), dry day with a constant slight breeze. Local vegetation consists of dry thorn scrub. The few buildings in the campground consisted of open picnic shelters with wooden roofs. Numerous corrugated metal panels, other trash, and rocks were on the ground beneath the shelters. Four *P. ventralis* were found under rocks, both those shaded by the shelters and those exposed to direct sunlight. Another 3 *P. ventralis* were observed beneath metal panels and other trash. The wooden roofs and columns of the shelters offered many crevices and potential retreat sites; despite careful inspection, we found no geckos there. All *P. ventralis* were found under terrestrial cover on the ground during the day. Overturned rocks revealed up to three individuals sharing the same retreat site. Under one of these, two adults and a juvenile were found, showing no obvious signs of intraspecific antagonistic behavior. We also found scorpions (*Rhopaulurus laticauda*) sheltering under rocks with many of the geckos; a mouse (probably *Mus musculus*) was found under each of two metal panels with *P. ventralis*. The harsh, arid climate at Camatagua may induce nocturnal animals to share terrestrial retreat sites.

Analysis of the stomach contents of a specimen of the colubrid snake *Leptodeira annulata ashmeadii* deposited in the herpetological collection of the Museo de Historia Natural La Salle, Caracas (MHNLS), revealed a *P. ventralis*. The snake (MHNLS 9818), a juvenile (295 mm SVL), was collected at the Urbanizacion El Tejar, Puerto Piritu, in the northern portion of the State of Anzoategui. Despite its small size, the snake had an adult female *P. ventralis* (73 mm SVL) with a recently broken tail in its gut. Judging from its position in the snake, the lizard was eaten head-first. Duellman (1958. Bull. Amer. Mus. Nat. Hist. 114:1–152) reported mostly frogs and toads from the stomachs *L. annulata*, but he also found one *Gonatodes vittatus*, a smaller diurnal species. Lack of experience often exhibited by young snakes may explain the presence of such a large prey item in this juvenile *L. annulata*. To our knowledge, this is the first record of predation on *P. ventralis* and the second on lizards by the snake *L. annulata*. We thank Aaron Bauer (Villanova University) for his valuable comments and corrections to a preliminary version of this note.

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SCELOPORUS COUCHI (Couch's Spiny Lizard). **SAUROPHAGY**. *Sceloporus couchi*, one of the least known phrynosomatid lizards in México, is restricted to the central-western portion of the state of Nuevo León, and the central eastern portion of the state of Coahuila (Köhler and Heimes 2002. Stachelleguane, Herpeton, Offenbach, Bundesrepublik Deutschland. 174 pp.; Smith 1939. Zool. Ser. Field Mus. Nat.Hist. 26:1–397). Here, we provide a record of saurophagy for *S. couchi* from Nuevo León, México.

At 1030 h on 28 May 2005, while conducting a vertebrate inventory in the municipalities of Dr. Gonzalez, Higueras, and Cerralvo, in the Sierra Picachos (25°58'08"N, 99°53'32"W, datum: NAD27; elev. 794 m), we collected an active adult (58.8 mm SVL, 94.0 mm tail, 5 g) male *S. couchi* male (air temperature 27°C) in a small canyon named Potrero Grande. It was found in an open dry river channel with walls of conglomerate; *Cordia boisieri*, *Pithecellobium pallens*, *Hellieta parvifolia*, *Prosopis glandulosa*, and *Aloysia macrostachya* dominated the vegetation along the channel. When first observed, the lizard was eating a neonate *S. poinsetti poinsetti* (29.8 mm SVL, 1.2 mm tail) with a broken tail. Other sympatric phynosomatid lizards observed in the area included *S. grammicus disparilis and S. parvus parvus*. This is the first observation of saurophagy in *S. couchi*.

The lizard (UANL 6772) was deposited in the herpetological collection of Universidad Autonoma de Nuevo Leon, Facultad de Ciencias Biologicas.

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SCELOPORUS CYANOGENYS (Blue Spiny Lizard). **PREDATION.** The few studies on the biology of *Sceloporus cyanogenys* address reproduction (Kennedy 1960. Southwest. Nat. 5:44–45), general behavior (Greenberg 1977. J. Herpetol. 11:177–195), taxonomy and distribution (Wiens and Reeder 1997. Herpetol. Monogr. 11:1–101), and mite infestation (García-de la Peña et al. 2005. Bull. Chicago Herp. Soc. 40:52–53). Here we add an observation of predation on this lizard.

During a visit to Parque Ecológico Chipinque (municipios of Monterrey and San Pedro Garza Garcia, Nuevo León, México), in an area known as El Estacionamiento (25°37'11.747"N, 100°21'35.171"W, datum: NAD27; elev. 1091 m) on 16 June 2004, we found a small female (311 mm total length, 7.1 g) Southwestern Rat Snake (*Pantherophis emoryi*) that had ingested two-thirds of a 58 mm SVL (4.7 g) female *Sceloporus cyanogenys*. The snake was found DOR, presumably killed by a vehicle before it could swallow the entire lizard. This demonstrates snake vulnerability during ingestion on roadways near human development, and adds *P. emoryi* to the *S. cyanogenys* predator set.

Both reptiles were photographed and deposited (UANL 6349ab) in the herpetological collection of Universidad Autonoma de Nuevo León, Facultad de Ciencias Biologicas.

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SCELOPORUS VIRGATUS (Striped Plateau Lizard). **CLUTCH SIZE**. Mean clutch size in *Sceloporus virgatus* from the Chiricahua Mountains of southeastern Arizona ranges from 7.6 to 10.15 (Abell 1999: J. Herpetol. 33:173–180; Smith et al. 1995. Herpetologica 51:342–349; Vinegar 1975. Ecology 56:172–182). However, virtually nothing is known of clutch size in this species outside of the Chiricahua Mountains.

As part of a study on the herpetofauna of Chihuahua and Sonora (Lemos-Espinal et al. 2004: Introducción a los Anfibios y Reptiles del Estado de Chihuahua, CONABIO. 128 pp.), we collected specimens of *S. virgatus* from Puerto de San Luis, Sierra San Luis, Sonora, México (31°19'12.0"N, 108°45'42.0"W, datum: WGS84; elev. 1417 m). One of these individuals was a gravid female (53 mm SVL) with 4 shelled eggs. The observed clutch size of 4 is less than the 6.77 predicted for a similar-sized female from the Chiricahua Mountains using the regression of clutch size on SVL in Smith et al. (*op. cit.*). This difference, although based on one clutch, implies that significant interpopulation variation in clutch size may exist in *S. virgatus*.

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SERPENTES

AGKISTRODON PISCIVORUS LEUCOSTOMA (Western Cottonmouth). **DIET**. Cottonmouths are opportunistic predators and scavengers that consume a variety of vertebrate prey (Gloyd and Conant 1990. Snakes of the *Agkistrodon* Complex: A Monographic Review. SSAR, Oxford, Ohio. 614 pp, and references therein). Watersnakes (*Nerodia* spp.) are considered a common component of the cottonmouth diet, but few studies have reported which species of *Nerodia* are consumed (Burkett 1966. Univ. Kansas Publ. Mus. Nat. Hist. 17:435–491; Gloyd and Conant, *op. cit.*). Here, we report *Agkistrodon piscivorus leucostoma* attempting to prey upon *Nerodia erythrogaster flavigaster*.

At ca. 1430 h on 3 August 2005 we encountered an adult *A. p. leucostoma* in a dry creek bed (Goose Prairie Creek) in the Caddo Lake National Wildlife Refuge (CLNWR), Harrison County, Texas, USA. Directly adjacent to the cottonmouth was a dead adult male *N. e. flavigaster* (576 mm SVL, 765 cm TL; 139 g). We observed two puncture wounds surrounded by a moist sheen on the dorsum of the *N. e. flavigaster*, ca. 300 mm posterior of the rostrum. *Agkistrodon piscivorus* are known to eject venom from the fangs when releasing prey following envenomation (Kardong 1975. J. Herpetol. 9:169–175) and we speculate that the moist sheen around the bite mark on the watersnake was fresh cottonmouth venom. Shortly following our arrival, the *A. p. leucostoma* crawled out of the creek bed and into adjacent bottomland hardwood forest. We collected the *N. e. flavigaster* for further examination, and it was later deposited in the Campbell Museum, Clemson University, Clemson, South Carolina (CUSC 2291).

Although *A. piscivorus* are known to feed on carrion, including dead watersnakes (Berna and Gibbons 1991. Herpetol. Rev. 22:130–131; Hamel 1996. Herpetol. Rev. 27:143), our observations suggest envenomation of a live watersnake with the intent of consumption. The cottonmouth might have envenomated and held the watersnake at the location at which we encountered the two snakes, or it may have envenomated it elsewhere and trailed it to this location (Kardong 1982. Copeia 1982:337–343; Chiszar et al. 1986. J. Herpetol. 20:269–272). To our knowledge, this is the first account of *Agkistrodon piscivorus leucostoma* envenomating *Nerodia erythrogaster flavigaster*. Although Collins and Carpenter (1970. Proc. Oklahoma Acad. Sci. 49:15–18) reported finding two "yellow-bellied water snakes" in the stomach of a Western Cottonmouth, the scientific name they provided (*Natrix erythrogaster transversa*) and the location from which the cottonmouth was collected suggest these snakes were most likely Blotched Watersnakes (*N. e. transversa*) rather than Yellow-bellied Watersnakes (*N. e. flavigaster*).

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ALSOPHIS PORTORICENSIS ANEGADAE (NCN). **AQUATIC ACTIVITY**. West Indian racers in the genus *Alsophis* are generally characterized as diurnal, primarily terrestrial, actively foraging snakes. Many of the islands on which they live do not have permanent bodies of fresh water and few references address aquatic activity.

In the course of a multi-year study of population structure of *A. portoricensis anegadae* on Guana Island (British Virgin Islands), we recorded four instances of aquatic activity. In October 2003, an adult snake escaped capture by entering and swimming across an intermittent pool of water several meters wide and about 20 cm deep. Three additional observations were made during an unusually pluvial year (2005). On 6 October, an individual (579 mm SVL) attempted to escape capture by diving into a temporary pool near the base of Quail Dove Ghut. Once submerged, it remained motionless with its anterior body adpressed against accumulated debris about 30 cm deep until disturbed by the collector. On 8 October, a female (653 mm SVL) was found near North Beach swimming in a large pool covering a flooded dirt track and adjacent forest. On 9 October, another female (570 mm SVL) was found in the southeastern lowlands resting at the edge of a large puddle with over half of its body in the water, suggesting that it had just crossed the water. Members of the staff residing on the island also reported sporadic observations of snakes swimming in the sea (T. Peliwan, pers. comm.). All but one sighting occurred in shallow water within 20 m of shore, but one snake was reportedly seen swimming toward a nearby island.

We have found no previous records of aquatic behavior in this species, but some exist for congeners (Schwartz and Henderson. 1991. Amphibians and Reptiles of the West Indies: Descriptions, Distributions, and Natural History. Univ. Florida Press, Gainesville. xvi + 720 pp.). Although anecdotal, our observations suggest that *A. p. anegadae* is at least opportunistically aquatic, presumably in much the same fashion as it is facultatively arboreal. Moreover, ocean swimming might explain how some snakes disperse from one Caribbean island to another.

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BOTHROPS JARARACA (Jararaca). **PREY**. *Bothrops jararaca* is a terrestrial, slender, and medium-sized viperid snake widespread in southeastern Brazil (Campbell and Lamar 2004. The Venomous Reptiles of the Western Hemisphere. Cornell University Press, Ithaca, New York. 870 pp.). This species preys mainly on small vertebrates and exhibits an ontogenetic shift in diet: juveniles feed mostly on frogs, commonly attracted by caudal luring, whereas rodents are the main food of adults (Sazima 1992. *In* Campbell and Brodie Jr. [eds.], Biology of the Pitvipers, pp. 199–216. Selva, Tyler, Texas; Martins et al. 2002. *In* Schuett et al. [eds.], Biology of the Vipers, pp. 1–22. Eagle Mountain Publishing, Utah).

Here we present data about previously undocumented prey taxa and habitat use of juvenile *B. jararaca* from Parque Estadual Carlos Botelho, municipalities of Sete Barras and São Miguel Arcanjo, State of São Paulo, southeastern Brazil, in an area of Tropical Atlantic Rain Forest.

On 11 December 1999 (2200 h; 20°C), we observed a juvenile *B. jararaca* (ca. 420 mm SVL) preying on a tree frog, *Hypsiboas bischoffi* (ca. 50 mm SVL) at the edge of a permanent pond. The snake was coiled in the leaf litter, immobile, in ambush posture. Caudal luring was not observed. As the frog jumped toward the snake, the snake struck quickly, seizing the frog until all movements ceased (Fig. 1). The snake then released the frog, inspected it, and began ingestion headfirst. The predation sequence lasted ca. 110 sec. After ingestion, the snake returned to its original position.

On 9 February 2002 (0005 h; 22°C) we encountered another juvenile *B. jararaca* (270 mm SVL) coiled in a tree branch at a height of ca. 50 cm. The snake was apparently inactive. Following manipulation, the snake regurgitated a leptodactylid frog, *Eleutherodactylus binotatus*, with its anterior region partially digested.

Between 2000 and 2002 we observed 10 active juvenile *B. jararaca* in the study area: one were found during the day, two in the evening, and seven at night. Three were observed in leaf litter; seven were encountered in vegetation 30–200 cm above ground (mean = 123.6 cm, SD = 62.7 cm). Our data differ from those reported by Hartmann et al. (2003. Phyllomedusa 2:35–41) in which most juvenile *B. jararaca* observed along streams in one Atlantic Forest area were found active during the day, foraging on diurnal frogs at ground level. Taken together, these observations suggest that juvenile *B. jararaca* are most active at the same time of locally abundant prey.


FIG. 1. Juvenile *Bothrops jararaca* capturing a *Hypsiboas bischoffi*.

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CORALLUS ANNULATUS (Annulated Boa). **OVOPHAGY.** *Corallus annulatus* is a boid whose ecology and behavior are poorly known. Its distributional range extends from Guatemala south to Colombia (Henderson et al. 2001. Stud. Neotrop. Fauna Environ. 36:39–47). In Costa Rica, this primarily arboreal species inhabits the Caribbean versant at elevations up to 650 m, where it generally occupies the upper parts of trees; it has been found at heights from a few meters up to 40 m (Solórzano 2004. Serpientes de Costa Rica/Snakes of Costa Rica. INBio, Santo Domingo de Heredia, Costa Rica. 792 pp.).

Three adult *Corallus annulatus* (1 male, ca. 1 m TL; 2 females, each ca. 1.5 m TL) collected at Guayacán de Siquierres, Limón Province, Costa Rica, were held in captivity at Parque Reptilandia (SW San José Province) for over one year. On 1 November, the male was introduced into the females' enclosure. Within two days the male copulated with both females, and sexual activity continued until 13 November.

On 19 July, prior to 0600 h, the first female gave birth to nine offspring and passed at least five undeveloped ova (= slugs). When the female was first observed, she was eating one of the slugs and apparently had ingested at least two others (Fig. 1). On 4 August,

FIG. 1. A female *Corallus annulatus* eating an undeveloped ovum after parturition.

from late morning to early afternoon, the second female gave birth to 12 offspring. This female also was observed to eat the undeveloped ova.

Captive observations on the post-parturient behavior of certain species of New World boids suggest protective advantages to adults and young after parturition. Females of *Corallus hortulanus*, *Epicrates maurus*, *E. fordii*, *E. s. striatus*, *E. s. strigilatus*, and *Eunectes murinus* have been reported to eat freshly passed undeveloped ova and/or living or dead young (Neill and Allen 1962. Quart. J. Florida Acad. Sci. 25:73–75; Hanlon 1964. Herpetologica 20:143–144; Boos 1976. AAZPA Newsletter 17[9]:13; Huff 1980. *In* J. B. Murphy and J. T. Collins [eds.], Reproductive Biology and Diseases of Captive Reptiles, pp. 125–134. SSAR Contrib. Herpetol. 1; Townson 1978. Brit. Herpetol. Soc. Newsl. 18:11–14; Groves 1980. Brit. J. Herpetol. 6:89–91; Miller 1983. Herpetol. Rev. 14:46–47). Neill and Allen (*op. cit.*) suggested that females might obtain physiologically and metabolically useful substances by ingesting their own birth debris. Groves (*op. cit.*) felt that this behavior might be influenced by captivity, and further suggested that living young are eaten because of poor development or a weakened condition and thus would not have survived. Further, Groves (*op. cit.*) proposed that because this behavior was reported only in species that produce their young in aquatic or terrestrial situations, where chances of predation are high, that it might relate to the protection of young and adults from potential predators by eliminating odors associated with the birth debris. Although Miller (*op. cit.*) reported a captive observation of ovophagy in the arboreal *Corallus hortulanus*, it is unknown whether in nature *C. hortulanus* gives birth to young in terrestrial or arboreal situations.

In view of the observations presented here and those in the literature, it appears that ovophagy is not uncommon in certain boids in captive situations. Because of the debilitated state of female boids after a lengthy gestation and parturition, we concur with Neil and Allen (*op. cit.*) that female snakes might obtain physiologically and metabolically useful substances by ingesting their birth debris. It remains unknown, however, whether in nature arboreal boids like *Corallus annulatus* and *C. hortulanus* give birth in arboreal or terrestrial situations, and thus the suggestions of Groves (*op. cit.*) remain inconclusive.

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CORALLUS HORTULANUS (Amazon Treeboa). **DIET**. *Corallus hortulanus* is an arboreal, nocturnal, forest and forest-edged boid widely distributed in the Guianas and in the Amazon Basin (southern Colombia, southern Venezuela, Ecuador, Peru, Bolivia and Brazil) (Henderson 2002. Neotropical Treeboas: Natural History of the *Corallus hortulanus* Complex, Krieger Publ., Malabar, Florida. 197 pp.). Henderson (*loc. cit.*) summarized the feeding habits of *C. hortulanus* by indicating that the species is euryphagic, feeding on frogs, lizards, birds, bats, rodents and other small mammals.

In early October 2004, a large adult female *Corallus hortulanus* (150.7 cm total length) was killed by itinerant miners living at Menzie's Landing in Kaieteur National Park (05°10'23"N; 59°28'52"W), Guyana, preserved in formalin and donated to us. The snake was found in primary forest, in a tree along the Potaro River and had a remarkable swelling in its abdomen, which proved to be a just-fledged -Paradise Jacamar (*Galbula dea*, Galbulidae). The bird, swallowed headfirst, was partly digested but was still identifiable.

The Paradise Jacamar is a bird known to perch on low to high outer branches of forest-edge trees along water courses (de Schauensee and Phelps 1978. A Guide to the Birds of Venezuela, Princeton University Press, New Jersey. 424 pp.). This environmental setting is similar to the habitat of *C. hortulanus* in Kaieteur National Park.

This report is the first record of *C. hortulanus* eating *G. dea* and the first record of *C. hortulanus* feeding on a bird in the family Galbulidae.

In Kaieteur National Park, active *C. hortulanus* were commonly observed at the beginning of the night in trees along streams. In addition to the aforementioned specimen, two other adult specimens were collected as vouchers by us during our inventory of the park's herpetofauna. Both snakes were foraging in trees along streams around 2100 h, at heights of 2–6 m, and both had empty stomachs.

The *C. hortulanus* and the remnants of the *G. dea* are deposited under the same collection number (IRSNB 17049) in the herpetological collections of the Royal Belgian Institute of Natural Sciences, Brussels, Belgium.

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CROTALUS BASILISCUS (Mexican West Coast Rattlesnake). **PREDATION.** Several species of snakes have been documented as predators of adult rattlesnakes (Klauber 1972. Rattlesnakes: Their Habits, Life Histories, and Influence on Mankind, 2 vols. 2nd ed. Univ. of California Press, Berkeley. 1533 pp.), although the extent of this phenomenon remains unknown. Radio-telemetry research suggests that predation of adult rattlesnakes by other snakes is infrequent, however the number of observations has significantly increased over the past decade with the onset of new technology used to study rattlesnakes. Herein we report on the predation of an adult *Crotalus basiliscus* by an adult Indigo Snake (*Drymarchon corais*).

On 15 August 2005, a large adult *Drymarchon corais* was observed resting along the banks of the Rio Cuchujaqui in southern Sonora, Mexico. The snake was ca. 1675 mm SVL, and was in the middle of ecdysis as its eyes were opaque. Upon being captured and photographed, the snake regurgitated the remains of an adult *Crotalus basiliscus* (ca. 1200 mm TL) with an incomplete rattle with 12 segments. To our knowledge, this observation represents the first published snake predator of *C. basiliscus*. Indigo Snakes are common along the rivers and arroyos in southern Sonora and are likely significant predators of snakes in these regions. Greene (1997. Snakes: The Evolution of Mystery in Nature. University of California Press, Berkeley, California. 196 pp.) provides accounts of Indigo Snakes consuming other large snake species, including rattlesnakes. Observations of predation by snakes on adult rattlesnakes remain infrequent, although with new technology and further research into the diets of large snakes, the number of similar observations might increase.

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DRYMOLUBER DICHROUS (NCN). **OPHIOPHAGY.** A female *Thamnodynastes hypoconia* (SVL = 310 mm; TL = 144 mm) was found in stomach contents of a mature male *Drymoluber dichrous* (SVL = 768 mm; TL = 344 mm) collected in Municipality of Ilhéus, Bahia, Brazil (14°49'S; 39°02'W) (Museu Nacional, Rio de Janeiro; MNRJ 2195) on 5 March 1944. The direction of ingestion was anterior–posterior. Borges-Nojosa and Lima (2001. Bol. Mus. Nac. Zool. 468:1–5) noted that anurans (especially from the family Leptodactylidae) and lizards (Gekkonidae and Gymnophthalmidae) comprised the diet of *D. dichrous* examined from an Atlantic Forest population (Ceará, Brazil). Ophiophagy in *D. dichrous* was previously noted only from Amazonian populations (Cunha and Nascimento 1978. Publ. Avul. Mus. Par. Emílio Goeldi 31:1–218; Cunha et al. 1985. Publ. Avul. Mus. Par. Emílio Goeldi 40:10–92; Dixon and Soini 1986. The Reptiles of the Upper Amazon Basin, Iquitos Region, Peru. Milwaukee Publ. Mus., Milwaukee, Wisconsin), in which the colubrid genera *Oxybelis* and *Drymoluber* were reported as prey.

Species identifications were confirmed by Francisco L. Franco and Ronaldo Fernandes.

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LAMPROPELTIS TRIANGULUM ELAPSOIDES (Scarlet Kingsnake). **OPHIOPHAGY**. *Lampropeltis triangulum elapsoides* is known to take a variety of prey items, including snakes: *Carphophis amoenus*, *Opheodrys vernalis*, *Storeria dekayi*, *Tantilla coronata*, *Thamnophis sirtalis*, and *Virginia striatula* (Williams 1988. Systematics and Natural History of the American Milk Snake, *Lampropeltis triangulam*. Milwaukee Public Museum. 176 pp.; Palmer and Braswell 1995. Reptiles of North Carolina. Univ. North Carolina Press. 412 pp.). Here I report a novel prey item for *L. t. elapsoides*.

On 19 March 2005 at 1603 h, I found a female *L. t. elapsoides* (351 mm SVL, 52 mm tail length, 18 g) under the loose bark of a fallen *Pinus palustris* (Longleaf Pine) in Forrest County, Mississippi, USA. Upon measuring the animal it regurgitated two juvenile *Diadophis punctatus* (124 and 142 mm SVL, 29 and 31 mm tail length, 2.0 and 3.0 g, respectively). The *L. t. elapsoides* was given a unique identification mark (Brown and Parker 1976. J. Herpetol. 10:247–249), and both the snake and the prey items were placed under the bark at the point of capture. On 20 March 2005 at 1700 h, I discovered the *L. t. elapsoides* in the exact same location with a slight bolus in its stomach and both *D. punctatus* were missing. Presumably, the snake re-ingested both prey.

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LAMPROPELTIS ZONATA (California Mountain Kingsnake) **PREDATION**. On 26 September 1999, a dead *Lampropeltis getula* (188 g; CUMV catalog number pending) was found on Bear Creek Road ca. 3 km W of Summit Road in the Santa Cruz Mountains (Santa Cruz County, California, USA). In its stomach were the nearly complete remains of an adult *Lampropeltis zonata* (53 g; CUMV catalog number pending). The range of *L. getula* overlaps or lies adjacent to the range of *L. zonata* (Stebbins 1985. Western Field Guide to Reptiles and Amphibians. Houghton Mifflin, Bos-

FIG. 1. Adult *Diadophis punctatus* swallowing a juvenile *Lampropeltis zonata*, Tuolumne Co., California, USA.

ton, Massachusetts), though habitat associations may render these species largely segregated. Both species are known from the general vicinity of this observation (MVZ 32243, 47168, 50770, 209452). Although *L. getula* is larger and known for preying on other snakes, this is the first record of a predator-prey interaction between these species.

On 15 May 2005 at ca. 1330 h, in the Sierra Nevada (Tuolumne County, California, USA) a *Diadophis punctatus* was observed ingesting a juvenile *L. zonata*. When discovered, the *L. zonata* was approximately half consumed, motionless, and flaccid. The *L. zonata* and *D. punctatus* had a combined mass of 21.3 g. The *L. zonata* was similar in size to young of the previous year at this location (mean mass = 6.1 ± 0.7 g, range 4.8–7.2 g, N = 12). Extrapolating from this, we estimate the original mass of the *D. punctatus* at roughly 15 g. *Diadophis punctatus*, especially *D. p. regalis*, are known for preying on other snakes, although there is only a single record of ophiophagy for a Californian *D. punctatus*, involving the consumption of a *Thamnophis hammondii* (Goodman and Tate 1997. Herpetol. Rev. 28:90). Populations of these two species are often both sympatric and syntopic (Stebbins 1985, *op. cit.*; pers. obs.), suggesting a potential for frequent predator-prey interactions.

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LATICAUDA SAINTGIRONSI (New Caledonian Yellow-lipped Sea Krait). **PREDATION.** *Laticauda saintgironsi* is a newly described species of sea krait that is endemic to the New Caledonian region (Heatwole et al. 2005. Herpetol. Monogr. 19:1–136). It occurs in high density in waters surrounding southern New Caledonia and spends much of its time on land, chiefly on small islets (Ineich and Laboute 2002. Sea Snakes of New Caledonia. IRD Éditions, Paris. 302 pp.; Saint Girons 1964. Terre et Vie 1964:185–214). Its confirmed predators in New Caledonia include Ospreys (*Pandion haliaetus*; Leach 1928. Emu 28:20–42) and Reef Herons (*Egretta sacra*; Bauer and DeVaney 1987. Proceedings of the 4th Ordinary General Meeting of the Societas Europaea Herpetologica. Catholic University of Nijmegen, Nijmegen, pp. 43–48) as well as sharks and other large fishes (Saint Girons 1964, *op. cit.*; Rancurel and Intès 1982. Tethys 10:195–199). At 1230 h on 1 July 2004, a ghost crab (*Ocypode* sp., ca. 80 mm carapace width) was observed actively feeding on a dead juvenile *L. saintgironsi* (ca. 650 mm TL) on the northern sandy shore of Moro, a small islet located ca. 2 km off of the west coast of the Isle of Pines, New Caledonia (22°39'06"S, 167°23'37"E). There was a large laceration on the lateral side of the snake's tail and another behind the head, where the crab was feeding. Although it was not possible to determine whether the snake had been killed or merely scavenged by the crab, predation by a portunid crab (Guinea 1986. Aspects of the Biology and Toxicology of the Common Fijian Sea Snake *Laticauda colubrina* (Schneider). Unpubl. Master's thesis, University of the South Pacific, Suva, Fiji. v + 206 pp.) and injuries consistent with crab predation have been observed in *L. colubrina* in Fiji (Pernetta 1977. Can. J. Zool. 55:1612–1619). This new observation adds further support to the interpretation of decapod crustaceans as potentially important predators of marine snakes in general (Voris and Jeffries 1995. J. Trop. Ecol.11:569–576).

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MASTICOPHIS FLAGELLUM (Coachwhip). **OPHIOPHAGY.** *Masticophis flagellum* is known to have a varied diet, which includes a number of snake species (see Beaman and Harris 2002. Herpetol. Rev. 33:214–215), and the western subspecies *M. f. piceus* has even been reported to prey upon a juvenile *Crotalus adamanteus* in captivity (Klauber 1956. Rattlesnakes: their Habits, Life Histories, and Influence on Mankind, 2 vols. Univ. of California Press, 1533 pp.). Herein we report the first instance, to the best of our knowledge, of a *M. flagellum* preying upon a *C. adamanteus* in the field.

On 28 September 2004 at ca. 1600 h, a large *M. flagellum* (ca. 180 cm total length) was observed ingesting a small *C. adamanteus* (ca. 80 cm total length) in an open grassland habitat on the Camp

Shelby Training Site, Perry County, Mississippi, USA. When first discovered, the rattlesnake was already one-third ingested, and after 10 minutes, it was half ingested. At this point an attempt was made to capture the *M. flagellum*; however, it quickly moved into a Gopher Tortoise (*Gopherus polyphemus*) burrow. For that reason, measurements and sexes of both snakes were not recorded. The entire time the incident was observed the tail of the prey snake was rattling. While traveling to the burrow, the *M. flagellum* had its head elevated with the rattlesnake hanging out of its mouth.

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MASTICOPHIS LATERALIS EURYXANTHUS (Alameda Whipsnake). **HABITAT.** *Masticophis lateralis euryxanthus* have been reported to be associated with a narrowly defined set of habitat characteristics; specifically chaparral and scrub plant communities on northeast, east, southeast, south, and southwest facing slopes (Swaim 1994. Unpubl. Masters Thesis, California State University, Hayward, CA. 140 pp.; United States Fish and Wildlife Service [USFWS] 1997. Federal Register 62:64306–64320; USFWS 2002. Draft recovery plan for chaparral and scrub community species east of the San Francisco Bay, California, Portland, Oregon 306 pp.). However, the USFWS reported that the habitat description for this subspecies "may have been biased" by focused trapping efforts (USFWS 2000. Federal Register 65:58933–58962). Swaim and McGinnis (1992. Trans. West. Sect. Wildl. Soc. 28:107–111) reported finding no *M. l. euryxanthus* on west-facing slopes and suggested a possible relationship to a lack of morning sun. However, Alvarez et al. (ms. in review, Trans. West. Sect. Wildl. Soc.) report that 32% of documented observations place *M. l. euryxanthus* in plant communities other than those described above. Herein, I present evidence that *M. l. euryxanthus* are found on a variety of slope aspects.

One hundred and twenty-seven records of free-ranging *M. l. euryxanthus* (and possible intergrades with *M. l. lateralis*) in Alameda and Contra Costa Counties (California) were reviewed by Alvarez et al. (*op. cit.*). These included specimens in the Museum of Vertebrate Zoology (MVZ) and California Academy of Sciences (CAS), reports from the California Natural Diversity Data Base (CNDDB), publicly accessible consulting reports from survey efforts, and personal communications from knowledgeable individuals (including my own observations). Slope aspect could be reliably determined for 82 of these observations. Data collected were transposed onto a commercial mapping program. Observations were deemed ambiguous (and not usable) if an error polygon associated with the observation placed the animal on multiple slope aspects. I visited every locality in 2004 to determine habitat type and confirm slope aspect. Seventeen of 82 observations (21%) were associated with west, north, and northwest slope aspects. These include three museum specimens (MVZ 128223, CAS 227730, CAS 201051); eight reported in the CNNDB, 13 reported by McGinnis (1990. Survey for the Alameda Whipsnake on the north-facing slope of the Kellogg Creek watershed west of Vasco Road, Contra Costa County, California, Unpubl. ms. 16 pp.), and two of my own observations. In addition to these documented records, two biologists report capturing more than 50 *M. l. euryxanthus* (collectively) on west and north-facing slopes (J. Sheppard and A. Murphy, pers. comm.).

The majority of *M. l. euryxanthus* observations reported in publicly accessible documents, databases, and collections do coincide with slope aspects reported by Swaim and McGinnis (1992, *op cit.*) and Swaim (1994, *op. cit.*). However, observations presented here indicate that *M. l. euryxanthus* uses virtually all slope aspects available, and data presented in Alvarez et al. (*op. cit.*) demonstrate that oak woodlands and annual grasslands are also occupied by these snakes. This information should be incorporated in conservation planning for this federally threatened snake (USFWS 1997. Federal Register 62:64306–64320). Specifically, chaparral, scrub, oak woodland, and grassland plant communities that occur within the range of *M. l. euryxanthus* should be recognized as potentially occupied habitat, irrespective of slope aspect.

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NERODIA FASCIATA (Southern Watersnake). **DIET**. Gibbons and Dorcas (2004. North American Watersnakes: A Natural History. Univ. of Oklahoma Press, Norman, Oklahoma. 438 pp.) summarized the literature on dietary records of *Nerodia fasciata*. The primary prey of this species are fish (e.g., *Gambusia affinis*) and amphibians (primarily frogs) (Gibbons and Dorcas, *op cit.*, Dundee and Rossman 1989. The Amphibians and Reptiles of Louisiana. Louisiana State University Press, Baton Rouge, Louisiana. 300 pp.). Several aquatic salamanders are recorded in the diet of *N. fasciata*, however, of the family Sirenidae, only *Siren lacertina* have been documented in the diet of this species (Gibbons and Dorcas, *op cit.*). This is especially noteworthy because the ranges of sirens and *N. fasciata* overlap extensively (Conant and Collins 1991. A Field Guide to Reptiles and Amphibians of Eastern/ Central North America. Houghton Mifflin Company, Boston, Massachusetts. 608 pp.).

On 14 March 2002 at 2056 h, an adult female *N. fasciata* (SVL 570 mm, TL 162 mm, 197 g without prey item) was found foraging in floating marsh habitat at Jean Lafitte National Historical Park and Preserve, Barataria Unit, Jefferson Parish, Louisiana, USA. The snake had an obvious bulge in its stomach and was retained until the following morning for measurements and determination of stomach contents. The stomach contents were obtained by forced regurgitation. A partially digested *Siren intermedia* (total length 225 mm, 19 g) was found swallowed tail-first. To our knowledge, this observation represents the first documentation of *N. fasciata* predation upon the commonly syntopic prey species, *S. intermedia*.

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OPHEODRYS AESTIVUS (Rough Green Snake). **PREDATION**. Despite their arboreal habits (Plummer 1981. J. Herpetol. 15:425–432) and consequent proximity to the nests of many birds, bird eggs have not been documented in the diet of *Opheodrys aestivus*. By most accounts, diet consists primarily (if not exclusively) of invertebrates (Plummer, *op. cit.*).

On 11 May 2005 at 0945 h, we watched an adult *O. aestivus* (ca. 600 mm TL) depredate the nest of a *Vireo atricapilla* (Black-capped Vireo). The nest was 0.68 m above ground in a *Quercus sinuata* (Shin Oak) and contained two eggs. The *O. aestivus* launched itself 0.76 m towards the nest from a neighboring *Q. sinuata*, where it had been sitting at approximately the same height as the nest. Upon landing in the *Q. sinuata* that held the nest, the *O. aestivus* went directly inside the nest and immediately swallowed an egg. Because *V. atricapilla* is endangered (USFWS 1987. Federal Register 52:37,420–37,423) we removed the *O. aestivus* and released it >1 m from the nest. However, when we checked the nest later that day, the second egg was gone. We assume that the snake returned and ate it.

This observation documents *O. aestivus* predation on eggs for the first time. Further, this observation adds *O. aestivus* to a growing list of snakes that prey on *V. atricapilla* nests (*Agkistrodon contortrix* [Noa 2005. Demographic Differences of Black-capped Vireos (*Vireo atricapilla*) in Two Habitat Types in Central Texas. M.S. thesis, Univ. of Vermont, Burlington. 55 pp.], *Elaphe obsolete*, and *Masticophis flagellum* [Stake and Cimprich 2003. Condor 105:348–357]).

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PHALOTRIS MATOGROSSENSIS (False Coral Snake). **DIET**. Insects, earthworms, molluscs, frogs, lizards, amphisbaenians, and snakes (in captivity) have been reported in the diet of snakes of the genus *Phalotris* (Amaral 1977. Serpentes do Brasil – Iconografia colorida. Ed. Melhoramentos/EDUSP. São Paulo. 247 pp.; Lema et al. 2005. Iheringia Ser. Zool. 95:65–78). However, some of these items need confirmation and there are few reports of feeding observations in wild. Here we report an observation of *P. matogrossensis* feeding in nature.

On 8 December 2000 at 1400 h Fábio R. Luiz encountered a *Phalotris matogrossensis* (310 mm SVL, 6.5 g) in the process of swallowing an *Amphisbaena* sp. (245 mm SVL, 9 g) in an open area at Vale do Formoso farm, Municipality of Ribas do Rio Pardo, Mato Grosso do Sul States, Brazil. The amphisbaenian was collected dead, possibly because of envenomation during subjugation by snake. This is the first record of *P. matogrossensis* eating an *Amphisbaena* sp. The specimens are in the Museu de História Natural Capão da Imbuia (MHNCI), in Curitiba Municipality, Paraná, Brazil (*P. tricolor*, MHNCI 10.446; *Amphisbaena* sp., 10.447).

We thank F. R. Luiz and J. C. Moura-Leite for assistance.

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PHALOTRIS MERTENSI (False Coral Snake) and ***AMPHISBAENA MERTENSI*** (NCN). **PREDATION**. Both *Phalotris mertensi* and *Amphisbaena mertensi* display fossorial habits, and data concerning feeding behavior are rare. Ribas and Brito (2003. Joint Meeting of Icthyologists and Herpetologists, abstract) reported predation on a *A. mertensi* (SVL = 250 mm, tail = 10 mm, mass = 8.78 g) by a *P. mertensi* (SVL = 350 mm, tail = 30 mm, mass = 12.73 g) in Rio Claro, São Paulo state, Brazil. Ingestion was head-first. On July 2002, at ca. 1700 h at Tietê (23°06'S, 47°42'W, São Paulo state, Brazil, 508 m elev.), an adult *P. mertensi*, ca. 500 mm total length, was found swallowing an adult *A. mertensi*, ca. 350 mm TL. Immediately, the snake regurgitated the freshly-killed amphisbaenian and escaped.

I thank Valdir José Germano and Hebert Ferrarezzi, Laboratório de Herpetologia, Instituto Butantan, for verification of snake and amphisbaenian species identification, and Veranice Galha for photography.

Submitted by **MARCELO RIBEIRO DUARTE**, Laboratório de Herpetologia, Instituto Butantan, Av. Vital Brazil, 1500, CEP 05503-900, São Paulo, SP, Brazil; mrduarte@butantan.gov.br.

PHALOTRIS TRILINEATUS (NCN). **PREDATION.** At ca. 1000 h on 30 October 2001 in a swamp-grassland area at Arroio Teixeira, northeast of Rio Grande do Sul, Brazil, I observed a male American Kestrel (*Falco sparverius*) flying with a snake (*Phalotris trilineatus*) in its claws. The kestrel alighted on a wire near a secondary road and started to pluck out pieces of flesh. The snake was still alive when the kestrel started to eat it, an uncommon behavior for this falcon, which usually kills vertebrate preys before eating. As a car drove by on the road, the kestrel flew off, leaving the still-living snake hanging on the wire. When the kestrel returned to its prey, the snake attempted defensive strikes and fell to the ground. The kestrel hovered for ca. 1 min and flew away.

Although *Falco sparverius* is known to prey on small snakes, I am unaware of any reports for predation on *Phalotris trilineatus*. The snake (259 mm total length) was pecked on two body regions: 18 mm and 90 mm behind the rostrum. In both regions the ribs were broken and the viscera and flesh were plucked out. The snake was deposited in the herpetological collection of the Departamento de Zoologia of the Universidade Federal do Rio Grande do Sul (UFRGS 3563), Porto Alegre, Rio Grande do Sul, Brazil. I thank Gilberto Alves de Souza Filho for the snake identification and Paulo Hartmann for comments.

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SIBON NEBULATUS (Common Snaileater). **MAXIMUM SIZE.** *Sibon nebulatus* is one of the larger members of its genus and reaches a maximum length of 850 mm total length (Solorzano 2004. Snakes of Costa Rica: Distribution, Taxonomy, and Natural History. Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica. 791 pp.). At 1830 h on 31 July 2005 we found an adult female *S. nebulatus* crossing Barrigon Road ca. 0.9 km south of Parque Nacional General Omar Torrijos Herrera (Cocle Province, Panama). The live snake measured 779 mm SVL, 234 mm tail length, and weighed 128.0 g. At 1013 mm total length, this specimen (Museo de Vertebrados de la Universidad de Panama; MVUP 1863) is the longest known *S. nebulatus*. In addition, palpation suggested that the female was gravid and contained seven eggs.

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THAMNODYNASTES STRIGILIS (NCN). **PREY**. *Thamnodynastes strigilis* is a terrestrial colubrid distributed from central-western and northeastern Brazil to Uruguay (Franco and Ferreira 2002. Phyllomedusa 1:57–74). The few reports on the feeding habits of snakes in the genus *Thamnodynastes* suggest they feed mainly on anurans (especially hylids and lepdodactylids) but also on rodents, fish, and lizards (Bernarde et al. 2000. Rev. Brasil. Biol. 60:695–699; França and Souza et al. 2003. Herpetol. Rev. 34:378; Kopp and Wachlewski 2005. Herpetol. Rev. 36:71–72; Lema et al. 1983. Comun. Mus. Cienc. PUC-RS 26:41–121; Rocha and Vrcibradic 1998. Cienc. Cult. 50:364–368; Ruffato et al. 2003. Phyllomedusa 2:27–34).

We examined the stomachs of eight specimens (MNRJ 9793 and 13383–13389) of *T. strigilis* (averaging 473.2 ± 80.2 mm SVL) for the presence of prey remains. All eight specimens were collected in and around a temporary pond in secondary Atlantic Rainforest surrounding Vila Dois Rios, Ilha Grande (23°11'S; 44°12'W), off the coast of the state of Rio de Janeiro (Brazil) during the evening (1900–2330 h) over a seven-year period (Apr/96, Dec/97, Oct/98, Jul/99, Oct/99, Oct/02). We discovered prey remains in four specimens. One (MNRJ 9793; female; 518 mm SVL; Oct/02) contained a *Physalaemus signifier* (26 mm SVL) and the tail and 3 limbs of a lizard (*Gymnodactylus darwinii*). A second specimen (MNRJ 13384; male; 565.6 mm SVL; Jul/05) contained the hind limbs of a *Eleutherodactylus guentheri* (leptodactylidae). A third specimen (MNRJ 13387; female; 360 mm SVL; Oct/01) contained a male (37.2 mm SVL) and female (27.3 mm SVL) *Scinax trapicheiroi* (hylidae). The fourth specimen (MNRJ 13383; female; 491 mm SVL; Oct/99) contained a *Chiasmocleis* sp. (Microhylidae; 20 mm SVL).

This is the first report of a microhylid frog (*Chiasmocleis* sp.) in the diet of *Thamnodynastes*. Frogs of the genus *Physalaemus* and the lizard *Gymnodactylus darwinii* have been previously reported as prey of other species of *Thamnodynastes* (Rocha and Vrcibradic, *op.cit.*; Bernarde et al., *op. cit.*; Ruffato et al., *op. cit.*). These observations offer further support for the hypothesis that *Thamnodynastes* are important predators on anurans.

We thank D. Vrcibradic and F. L. Franco for assistance. The Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq provided funding.

Submitted by **CRISTINA VALENTE ARIANI, CARLOS FREDERICO DUARTE ROCHA,** and **MONIQUE VAN SLUYS**, Departamento de Ecologia, Instituto de Biologia Roberto Alcântara Gomes, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier, 524, Maracanã, CEP 20550-013, Rio de Janeiro, RJ, Brazil.

THAMNOPHIS ATRATUS (Aquatic Gartersnake). **PREDATION**. On 30 May 2004, JD and KR were conducting amphibian surveys along a stretch of Bennett Creek in Mendocino National Forest, Tehama County, California, USA (UTM Coordinates 531484 E, 4408974 N, Zone 10,NAD27, 336 m elev). The weather was clear with a light breeze; air temperature was 28°C, and the creek temperature was 22°C. At about 1300 h, two adult *Thamnophis atratus* were found sitting on a wet rock immediately adjacent to a small waterfall in the reek. Both snakes were loosely coiled in a striking posture, and had their heads near the water. The snakes appeared to be intently watching the water. The snakes were observed for 10 minutes during which time both snakes were observed to strike at smal fish as the fish attempted to swim up the waterfall. After one of the snakes was successful, it was captured with the fish still in its mouth. The fish was a California Roach (*Lavinia symmetricus* [=*Hesperoleucus symmetricus*]). The snake was 59.5 cm (SVL); the other snake was also captured and was 50.0 cm SVL. A video recording was obtained along with photographs of one snake catching a fish.

Lind and Welsh (1994. Anim. Behav. 48:1261–1273) reported that *T. atratus* foraging techniques varied ontogeneically, with juveniles (< 44.9 cm SVL) using both ambush and underwater substrate-crawling, and adults using underwater substrate-crawling almost exclusively. The snakes we observed were both adults, yet they were using an ambush style of foraging, somethng that Lind and Welsh found only once in 38 observations of adult *T. atratus* foraging.

Catching small fish as they ascended a small waterfall would require good visual acuity and a rapid strike. Alfaro (2002. Funct. Ecol. 16:204–215) reported that *T. couchii* aerial strike speed was more than five times that of *T. sirtalis*. Drummond (1985. Anim. Behav. 33:206–215) and Schaeffel and De Queiroz (1990. Copeia 1990:50–58) reported that the aquatic specialists *T. couchii* and *T. melanogaster* had superior vision compared with *T. sirtalis* and other *Thamnophis* with more terrestrial foraging modes. Both these factors would suggest that *T. atratus* would be particularly well adapted to the type of ambush foraging that we observed.

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UROTHECA DECIPIENS (Collared Glass-tailed Snake). **DIET**. *Urotheca decipiens* is a small, diurnal, terrestrial snake that is reported to consume amphibians and small lizards (Solorzano 2004. Snakes of Costa Rica. Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica. 791 pp.). At 2000 h on 22 September 2005 we found an adult female *U. decipiens* (240 mm SVL; 37 mm tail length; 6.8 g) moving through the leaf litter after dark in Omar Torrijos National Park (Cocle Province, Panama). A portion of the tail was missing, presumably lost as part of the antipredatory defense that is typical of the genus (Savage 2002. The Reptiles and Amphibians of Costa Rica. Univ. Chicago Press, Chicago, Illinois. 934 pp.). After collection the snake regurgitated the head and neck of a small *Sphaerodactylus* sp. This is the first report of *Sphaerodactylus* in the diet of *U. decipiens*, as well as the first report of *U. decipiens* in Cocle Province and Central Panama. In addition, our observation of the active snake at night suggests *U. decipiens* may not be entirely diurnal. The snake and its gut contents were deposited in the Circulo Herpetologico de Panama (*U. decipiens* CH 5975; *Sphaerodactylus* sp. CH 5976).

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CAUDATA

AMBYSTOMA MACULATUM (Spotted Salamander). USA: TENNESSEE: Cannon Co.: Cooper Hollow. 22 February 2006. J. L. Miller, J. A. Miller, J. H. Miller, and B.T. Miller. Verified by A. Floyd Scott. Austin Peay State University (APSU 18157, color photo). Adult male captured in a minnow trap set in a small, shallow pond adjacent Sinks Miller Rd. ca. 1 km E of Burt Burgen Rd. intersection. New county record (Redmond and Scott 1996. Atlas of Amphibians in Tennessee. Misc. Publ. No. 12, The Center for Field Biology, Austin Peay State Uniersity, Clarksville, Tennessee. 94 pp. Internet version <http://www.apsu.edu/amatlas> contains links to information on Tennessee distribution of amphibians that have appeared since 1996, accessed 23 February 2006).

Submitted by **JOSHUA A. MILLER** and **JACOB H. MILLER**, Saint Rose of Lima School, Murfreesboro, Tennessee, 37085, USA; and **JOYCE L. MILLER** (e-mail: jlmiller@mtsu.edu) and **BRIAN T. MILLER,** Department of Biology, Middle Tennessee State University, Murfreesboro, Tennessee 37132, USA (e-mail: bmiller@mtsu.edu).

AMBYSTOMA TIGRINUM TIGRINUM (Eastern Tiger Salamander). USA: OHIO: Preble Co.: Jefferson Township. Paul McKee Road 0.25 km west of Rawley Road (39°52.857'N, 84° 45.108'W). 16 February 2006. Jeffrey G. Davis and Natalie A. Fath. Verified by John W. Ferner. CMNH 8935. New county record (Pfingsten and Matson 2003. Ohio Salamander Atlas. Ohio Biological Survey, Columbus). Adult male 122 mm SVL, 254 mm TL.

Submitted by **JEFFREY G. DAVIS**, Cincinnati Museum Center, Fredrick and Amye Geir Research and Collections Center, 1301 Western Avenue, Cincinnati, Ohio 45203-1130, USA (e-mail: anura@fuse.net); and **NATALIE A. FATH**, Institute of Environmental Sciences, Miami University, 102 Boyd Hall, Oxford, Ohio 45056, USA (e-mail: fathna@muohio.edu).

NECTURUS MACULOSUS (Mudpuppy). USA: ILLINOIS: Pope Co.: Upstream of Regan Ford in Lusk Creek, end of road 1007 off of Eddyville Blacktop 7 (37°30'35"N, 88°32'19"W). 15 February 2006. Diane K. Shasteen. Verified by Ronald A. Brandon. SIUC H-8323. Juvenile specimen. New county record (Philips et al. 1999. Field Guide to Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Manual 8, Champaign, Illinois. xii + 282 pp.).

Submitted by **DIANE K. SHASTEEN**, Department of Zoology, Southern Illinois University, Carbondale, Illinois 62901, USA.

NOTOPHTHALAMUS VIRIDESCENS LOUISIANENSIS (Central Newt). USA: ARKANSAS: Union Co.: Beech Creek at St. Hwy. 160, ca. 3.2 km E of Mount Holly (Sec. 25, T16S, R18W).