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NATURAL HISTORY NOTES

CAUDATA — SALAMANDERS

***PLETHODON CINEREUS* (Eastern Red-backed Salamander). MORPHOLOGY.** *Plethodon cinereus* is one of the most common salamanders in the Maritime Provinces of eastern Canada (Cook 1984. Introduction to Canadian Amphibians and Reptiles. National Museum of Natural Sciences, Ottawa. 200 pp.; Gilhen 1984. Amphibians and Reptiles of Nova Scotia. Nova Scotia Museum, Halifax. 162 pp.). There are three recognized color morphs: a deep red-striped back with black sides referred to as red-backed; a black pigmented back and sides, referred to as lead-backed; and the rarest of the three morphs, red with varying degrees of black mottling referred to as erythristic (Fig. 1). Morph frequencies in this species, which seem to be influenced by temperature, have attracted growing interest as a proxy for monitoring local and large-scale climate change (Gibbs and Karraker 2005. Conserv. Biol. 20:913–917). The lead-back morph is more closely associated with warmer, drier climates than the red-backed morph and erythristic individuals are reported to replace lead-back individuals at higher elevations (Gilhen 1984, *op. cit.*) There are apparently very few reports of the three morphs co-occurring (one site among 50 reported by Lotter and Scott 1977. Copeia 1977:681–690) and none from Maritime Canada (Cook and Bleakney 1961. Can. Field Nat. 75:53; Gilhen 1984, *op. cit.*). Recently, an area was discovered on 29 April 2011 with all three morphs in the Connecticut Audubon Society Croft Preserve in Goshen, Connecticut, USA (41.8926°N, 73.1914°W) (pers. comm., T. Leenders).

Odell Park is a 160-ha area of mature mixed hardwood and conifer forest situated in the city of Fredericton, New Brunswick, Canada, 20–100 m elev. Here all three morphs co-occur. Among 103 individuals observed in Odell Park between 6 May 2010 and 18 Sept 2011, red-backed morph was the most common (N = 85, 82.5%), followed by the erythristic morph (N = 11, 10.7%), with the lead-backed morph the least prevalent (N = 7, 6.8%). Four voucher specimens were collected from Odell Park and have been deposited in the New Brunswick Museum: two red-backed morphs (NBM 009072, 74), one lead-back morph (NBM 009073), and one erythristic morph (NBM 009071).

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***PLETHODON SERRATUS* (Southern Red-backed Salamander). CICADA BURROW USE.** *Plethodon serratus* is a lungless, terrestrial salamander that is dependent upon ambient moisture for its survival. When surface substrates dry, such as during the summer months or during drought periods, these salamanders must seek refuge in microhabitats with higher moisture content, including soils deeper underground. Although some salamanders have the capacity to dig their own burrows (Semlitsch 1983. Can. J. Zool. 61:616–620), this does not appear to apply to *Plethodon* salamanders (Heatwole 1960. Ecology 41:661–668). Instead, they utilize burrows created by other organisms (e.g., worms and beetles; Ransom 2011. Oecologia 165:745–754), or, as described by Heatwole (1960, *op. cit.*), use their heads as a wedge and force their bodies into cracks or small openings in the substrate by pushing with their feet, and in some instances, their tails.

The spring of 2011 was an emergence year for Brood XIX of the 13-year periodical cicada (Hemiptera: Cicadidae: *Magicicada* sp.) in south central Missouri. Cicada nymphs feed on tree roots at depths that can exceed 60 cm. They excavate and maintain underground burrows, which they abandon when they emerge at the soil surface and disperse in the late spring (Williams and Simon 1995. Annu. Rev. Entomol. 40:269–295), leaving behind abundant access to subterranean microhabitats at about the time *P. serratus* begin to seek underground refuge for the summer (Herbeck and Semlitsch 2000. J. Herpetol. 34:341–347). Annual, or "dog day" cicada nymphs (Hemiptera: Tibiceninae:

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FIG. 1. The three morphs of *Plethodon cinereus*: red-backed, lead-backed, and erythristic.

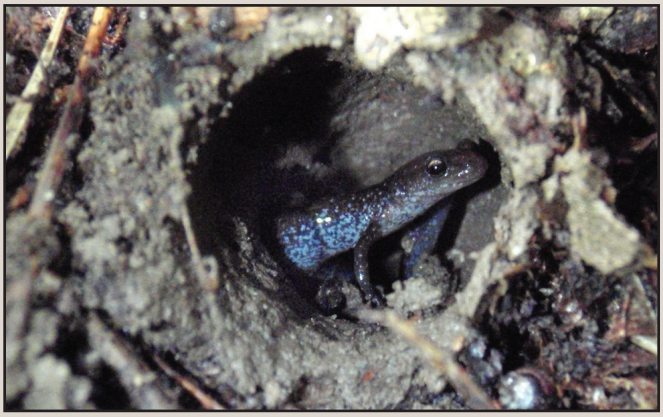

FIG. 1. Adult *Plethodon serratus* encountered in a periodical cicada (*Magicicada* sp.) burrow during the Brood XIX emergence in May 2011 in south central Missouri, USA.

Tibicen sp.) emerge annually in late July and August, not long before *P. serratus* are detected utilizing surface habitats in the late summer/fall (Herbeck and Semlitsch 2000, *op. cit.*).

While conducting leaf litter surveys in the Ozark Mountains for terrestrial salamanders on 25 May and 27 Sept 2011 in the Sinkin Experimental Forest (US Forest Service), Dent Co., Missouri, USA, we encountered adults of *P. serratus* in burrows constructed by cicada nymphs. The salamander encountered in May slipped deeper into the periodical cicada burrow soon after detection, so we were unable to collect morphological data. The salamander encountered utilizing an annual cicada burrow in September was an adult male, 42 cm SVL (Fig. 1). Periodical cicada burrow densities in the spring ranged from 0.3–4.7/m^2 (mean = 1.5/m^2) and cicada burrow densities in the fall ranged from 0–3.1/m^2 (mean = 0.6/m^2) (Drake et al., unpubl. data).

We hypothesize that periodical cicada burrows greatly increase access to deeper subterranean microhabitats for terrestrial salamanders, and that greater access to more hospitable underground habitat via these burrows during inclement periods, such as seen in the summer or dry periods during other seasons, may result in increased survival into the fall.

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***PLETHODON WELLERI* (Weller's Salamander). NESTING LOCATION.** Few nests of *Plethodon welleri* have been found and all observations have been on Whitetop Mountain and Mount Rogers, Virginia, USA, at elevations ≥ 1585 m. Nests were located in surface crevices of downed, decaying logs of *Picea rubens* (Red Spruce) immediately below a layer of moss. Those with eggs were discovered in mid-August while nests with hatchlings were found in late August and early September. The number of eggs or hatchlings in nests ranged from 4–11 (Organ 1960. Copeia 1960:287–297; Hoffman et al. 1948. J. Washington Acad. Sci. 38:106–108).

We report a novel nest location from the north slope of Whitetop Mountain, Virginia at 1494 m. On 1 July 2011 we found a nest of *P. welleri* located in leaf litter composed of *Betula alleghaniensis* (Yellow Birch), *Fagus grandifolia* (American Beech), and *Acer pensylvanicum* (Striped Maple) 4.5 cm beneath the leaf litter surface. Eggs were found in leaves that had fallen from the previous year and were immediately above a layer of decomposed leaves. The nest was 3.5 cm from a downed, decaying Yellow Birch log that was 21 cm in diameter. A female *P. welleri* (35 mm SVL and 67 mm total length) was coiled around two eggs. The embryos had small limb buds.

Our observation documents the first nest of *P. welleri* in a location other than moss covered logs and provides support for the importance of leaf litter for this species. This nest had fewer eggs than had been previously documented. Embryos exhibited mid-term development indicating that deposition was complete and either egg predation had occurred or only two eggs were deposited (Organ 1960, *op. cit.*). Embryo development also suggests that the eggs were likely deposited in mid-June. Egg deposition dates have not been determined but have been suggested to occur in May or June and our observation provides evidence for this time period (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, DC. 587 pp.). This nest was 91 m lower than previously documented nests and in an area without *Picea rubens* which were the only logs in which Organ (1960, *op. cit.*) found nests.

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ANURA — FROGS

***ELEUTHERODACTYLUS CUNEATUS*. PREDATION.** During a one-year study of *Eleutherodactylus cuneatus* (Fong et al. 2010. Biotropica 42:348–354) we recorded three predation events by two different predators: crabs and spiders. The observations were made along a tributary of the Indio River (20.0°N, 75.6°W; NAD 27 Cuba datum) at La Gran Piedra, Santiago de Cuba province, Cuba.

On 18 Aug 2003 at 2024 h, we found a female freshwater crab (*Epilobocera cubensis* carapace length = 46 mm, carapace width = 68 mm) inside a burrow in the bank, on dry land, actively feeding on an adult *Eleutherodactylus cuneatus* (ca. 49.7 mm SVL). When discovered, the crab was pulling out pieces of the frog body, which was approximately half consumed. There was a large laceration on the frog's abdomen and the internal organs; the snout tip, one hind limb, and a half of other two limbs were missing. At 2000 h, water temperature was 20.0°C, air temperature was 21.1°C, and humidity was 94%. The frog was collected and deposited in the herpetological collection of the Centro Oriental de Ecosistemas y Biodiversidad (BIOECO), Santiago de Cuba (BSC.H 3460).

Later that night (at 0040 h), we witnessed a second freshwater crab (62 mm carapace width) consuming another adult *E. cuneatus* (>25 mm SVL). The crab was on dry land, 70 cm from the water's edge. The head of the frog had been eaten and the crab was grasping the prey with a chela and pulling out pieces of the frog with the other chela. The water temperature was 19.0°C, air temperature was 19.6°C, and humidity was 93%.

Although it was not possible to determine whether the frogs had been killed or merely scavenged by the crabs, injuries were consistent with crab predation and no other dead frogs were observed in ca. 8 h of survey in this stream. Predation by crabs is known in other anuran species, and includes egg, tadpole, and adult life stages (Gray and Christy 2000. Crustaceana 73:1023–1025; Hayes 1983. Biotropica 15:74–76;Ryan et al. 1981. Behav. Ecol. Sociobiol. 8:273–278). Considering the scarcity of papers reporting this event, it seems that crabs are opportunistic frog predators.

On 18 March 2004 at 1350 h, a female ctenid spider (*Ohvida vernalis*; 16.3 mm cephalothorax + abdomen length) was sighted motionless and camouflaged in the leaf litter, 137 cm away from the stream's edge, holding and biting a juvenile *E. cuneatus* (ca. 10 mm SVL). While we attempted to collect the spider, it released its prey and the frog escaped, taking refuge in the leaf litter before we could collect it. At 1524 h, the water temperature was 18.5°C, the air temperature was 20.7°C, and humidity was 89%. The spider was collected and deposited in the herpetological collection of the Centro Oriental de Ecosistemas y Biodiversidad (BIOECO), Santiago de Cuba (without a catalog number).

Frogs are common prey for spiders, as documented in recent reviews (Armas 2001. Rev. Ibérica Aracnología 3:87–88; Menin et al. 2005. Phyllomedusa 4:39–47; Toledo 2005. Herpetol. Rev. 36:395–400), but this is only the second record of spider predation on a Cuban frog (see Novo et al. 1985. Misc. Zool. 28:1–2).