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# Eurycea cirrigera (Southern Two-lined Salamander). Gill Morphology

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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.

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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