

**Observations on oviposition and reproduction of the cave salamander, *Eurycea lucifuga* (Caudata: Plethodontidae), from Arkansas and Tennessee, USA**

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The Cave Salamander, *Eurycea lucifuga*, is a common inhabitant of caves throughout the Appalachian Valley, Interior Low Plateau, and Ozark Plateaus. Despite its ubiquity, few observations of nest sites have been reported for this troglomorphic species, suggesting that oviposition occurs deep within springs and caves<sup>1,2</sup>. The reproductive biology of *E. lucifuga* is poorly documented, with the bulk of information resulting from a few studies<sup>1,3-9</sup>. Here we report on oviposition and clutches of *E. lucifuga* from two caves in Arkansas and Tennessee.

On 22 November 2002, two of us (DBF and GOG) entered Ott Cave, Sharp County, Arkansas. A shallow stream that ran through the main cave passage had dried to a damp seep in the bed of the stream with occasional shallow pools. Pools were up to 3 cm in depth, but most of the streambed was damp with water seeping between pools. Beginning ca. 10m into the main passage, we encountered several clusters of *E. lucifuga* eggs in an advanced stage of development (Fig. 1). These clusters consisted of 2–3 eggs each, were located within the seep and at the edges of deeper pools, and were strewn across ca. 10m of cave passage. In total, we encountered 35 eggs. The developing larvae within the eggs were all roughly 4–5mm diameter and not yet pigmented (Harrison stage<sup>10</sup> 37; Fig. 1). We also observed a large female *E. lucifuga* ca. 2m beyond the last cluster of eggs, but there is no way to clearly associate her with the egg deposition that had occurred several days prior. One larva was collected and genetically identified by Ron Bonett (University of Tulsa) as *E. lucifuga* to confirm identification of the eggs.

On 23 October 2004, two of us (MLN and BTM) found a female *E. lucifuga* and six eggs in a small water-filled depression, caused by the boot of a caver, in the mud floor of Mead Quarry Cave in Knox County, Tennessee, USA. The pool



**Figure 1.** Developing larvae of the cave salamander, *Eurycea lucifuga*, in Ott Cave, Sharp County, Arkansas. The ring in the image (left) has a 2 cm inner diameter. The larvae are magnified to the right.

was located approximately 30 cm above and adjacent to the main channel of the stream, and approximately 450m from the nearest cave entrance. The freshly laid eggs were whitish, ca. 3mm in diameter, separated from each other, and were not attached to the sides or floor of the pool. Although we found only six eggs, additional ova

were visible through the abdominal wall of the female; however, we refrained from counting in utero ova so as not to disturb the female.

Oviposition in *E. lucifuga* is prolonged, occurring during periods of low stream flow (June through November<sup>6,9</sup>), with peak oviposition occurs during late summer and early fall<sup>9</sup>. However, eggs have been found as late as early January in Missouri<sup>5</sup>. Placement of eggs by ovipositing females apparently is variable in this species as eggs have been reported lying unattached on the floor of small water-filled depression (this study and 6), attached singly by a slender stalk to the sides of small rimstone pools<sup>6</sup>, and to the sides or undersurface of submerged rocks in streams<sup>5</sup>. Intra- and inter-population variation in reproductive behavior has not been examined for this species and it remains unknown whether certain individuals or populations exhibit a particular oviposition strategy (e.g., attached or unattached eggs).

#### Literature Cited:

1. Banta, A.M., & McAtee, W.L. The life history of the cave salamander, *Sperlepes maculicaudus* (Cope). *Proceedings of the U.S. National Museum* **30**, 67–73 (1906).
2. Petranka, J.W. *Salamanders of the United States and Canada* (Smithsonian Institution Press, Washington, (1998).
3. McAtee, W.L. Development of the color pattern in the larvae of *Sperlepes maculicaudus*. *Proceedings of the U.S. National Museum* **30**, 74–83 (1906).

4. Hutchinson, V.H. Notes on the plethodontid salamanders, *Eurycea lucifuga* (Rafinesque) and *Eurycea longicauda longicauda* (Green). *Occasional Papers of the National Speleological Society* **3**, 3–24 (1956).
5. Myers, C.W. Notes on the eggs and larvae of *Eurycea lucifuga* Rafinesque. *Quarterly Journal of the Florida Academy Sciences* **21**, 125–130 (1958).
6. Green, N.B., Brant, Jr., P.B., & Dowler, B. *Eurycea lucifuga* in West Virginia: Its distribution, ecology, and life history. *Proceedings of the West Virginia Academy of Science* **39**, 297–304 (1967).
7. Organ, J.A. Courtship behavior and spermatophore of the cave salamander, *Eurycea lucifuga* (Rafinesque). *Copeia* **1968**, 576–580 (1968).
8. Trauth, S.E., Cox, R.L., Butterfield, B.P., Saugey, D.A., & Meshaka, W.E. Reproductive phenophases and clutch characteristics of selected Arkansas amphibians. *Proceedings of the Arkansas Academy of Science* **44**, 107–113 (1990).
9. Ringia, A.M., & Lips, K.L. Oviposition, early development and growth of the cave salamander, *Eurycea lucifuga*: surface and subterranean influences on a troglomorphic species. *Herpetologica* **63**, 258–268 (2007).
10. Harrison, R.G. Harrison stages and description of the normal development of the spotted salamander, *Ambystoma punctatum* (Linn.), in Harrison, R.G. (ed.), *Organization and Development of the Embryo* (Yale Univ. Press, New Haven, 1969).