

NOTES ON THE NESTS AND NESTING OF THE CAROLINA MOUNTAIN DUSKY SALAMANDER IN TENNESSEE AND VIRGINIA

JOHN THORNTON WOOD AND FRANCES EDMONDS WOOD
University of Virginia, Charlottesville

Dunn (1917) first reported finding nests of the Carolina mountain dusky salamander, *Desmognathus ochrophaeus carolinensis* Dunn, stating that he found two females with eggs in July, that they had 10 to 15 eggs apiece, "a very small batch compared with the 30 eggs of average *fuscus*." One of these nests was found at Brevard, North Carolina, at 2,300 feet elevation, on July 21, and the second was found in Pisgah Forest Reserve at 5,500 feet elevation on July 31. "Females were guarding both batches, and both were in rotten logs on the banks of a stream," (Dunn, 1926). Pope (1924) then reported on a series of 100 nests that were collected on August 18, 21, and 23 near Flat Rock, Henderson County, North Carolina at elevations between 2,100 and 2,300 feet. He measured the snout-vent length of 10 of the females attending these nests, and found them to range from 26.0 to 33.0 mm. The 100 nests contained from four to 18 eggs, averaging 10.25 eggs per nest.

Reported here are egg counts and measurements of 30 nests and attending females, and observations on the state of the ovaries and stomach contents of these females. Ten of the nests were collected at 5,100 feet elevation beside a mountain brook in Indian Gap, Sevier County, Tennessee (in Great Smoky Mountains National Park). King (1939) pointed out that nests are found in the Smokies during late July and August, and our nests were collected July 19, 1947. The stage of development of these eggs ranged from early cleavage and gastrula in two groups to embryos having a total length of 4.0 mm. in three nests, and embryos having first signs of melanophore patterns and ranging in total length to 7.0 mm. in five nests; the last mentioned nests had been developing from 10 days to two weeks, indicating that egg deposition actually occurs at this elevation in early July. King (loc. cit.) states the eggs are found "under moss or leaves quite close to water," and all of our nests were so situated. They were found in groups of two and three among the stems and rhizoids of clumps of moss growing on fallen limbs lying over or in the tiny cascading brook; all of the egg groups were compact like "bunches of grapes" as familiar in *Desmognathus fuscus fuscus*. Nests were almost touching, and only one female was found in two cases attending two closely situated egg groups; seven attending females were found with the eggs. They did not attempt to retreat as soon as they were exposed to light, but soon would slowly back away and retreat into crevices in the

damp rotten wood of the logs. No "guarding" behavior by the females was noted; when uncovered they were found in close proximity to the egg clusters, in most cases lying beneath them, not coiled around them. All of the nests were within two feet of the water surface, in most cases being within a few inches. Pope (1924) pointed out this "love for real proximity to water" of nesting females of this species, and Noble (1931) used this fact as one of the foundations for his view of evolutionary trends in *Desmognathidae*. The habitat surrounding the nesting site was made up of a spruce-fir forest so dense that little sunlight reached the nesting area.

The seven attending females ranged in snout-vent length from 41.0 to 48.0 mm., averaging 45.8 mm. The egg groups contained the following numbers of eggs: 16, 26, 26, 29, 31, 35, 35, 41, 45, and 53, averaging 36.7 eggs per nest. Twenty eggs not included in the above average were gathered singly from the nesting sites after the egg clusters had been carefully removed. The egg cluster containing 45 eggs actually was formed of two separate but closely intermeshed groups, one containing 17 eggs and the other 28. These may have been the product of more than one female, but their intimate relationship and the fact that they were in the same stage of development makes it more probable that they represent the successive voiding of the two ovaries of one female. Two of the seven attending females contained unvoided large ova, one having three and another one; these were in the process of resorption when examined. All stomachs excepting one were devoid of contents; the one exception contained fragments of egg envelopes.

The remaining 20 nests were collected at 2,300 feet elevation about 2.5 miles southeast of Gate City, Scott County, Virginia on September 4, 1951. These nests contained larvae that had recently emerged, larvae about to emerge, and some clusters of embryos in which the melanophore pattern was still little developed, thus they represented an egg-laying season of perhaps four weeks duration. Attending females were found with 19 of these nests, including those in which all larvae had emerged from their egg envelopes. It is unlikely that any larvae had escaped from the nesting sites through their own activity because they had very weak legs, and large abdominal yolk masses, and there was no water at all near the nesting site. This last point is a most remarkable one to encounter in the nesting of this species, yet the nearest area of surface water was over 300 yards from the nesting area. The habitat was a broad, shaded, flat mud brook bed which was moist, yet firm enough for the collectors to walk on without sinking down more than an inch; it ran through a steep-sided beech-wooded ravine, and was situated where it would never receive direct sunlight. The nests were all within three inches of the mud brook bed surface, but

only two were above this surface. One of these was under a thick clump of moss on a stone (actually the cluster was in a crevice near the rhizoids), and the other was in a crevice in a rotten log. The remaining 18 nests were in crevices and depressions beneath logs and stumps that were lying imbedded in the mud. Burrows connected the nest cavities with crayfish "chimneys," and with hollows in the logs, and the females retreated along these burrows and tunnels when the nests were uncovered. The eggs were suspended in the crevices, and were near but not in contact with the earth walls. Most of these sites appeared to have been formed at least in part by the turning movements of the females.

Seven of the nests contained both larvae and eggs in the following numbers: (L.—larvae, and E.—eggs) 1 L, 27 E; 2 L, 11 E; 3 L, 10 E; 9 L, 28 E; 12 L, 0 E; 26 L, 2 E; and 23 L, 1 E. The stomachs of six of the seven attending females were empty, and the seventh contained four recently emerged larvae in the same stage of development as those in the nest she attended.

The 19 attending females ranged in snout-vent length from 41.5 to 49.5 mm., averaging 46.3 mm. All ovaries were entirely devoid of large ova, and all oviducts were distended and convoluted as typical in spawned female salamanders. Of the females attending nests containing only eggs, only one had stomach contents, and she had eaten four eggs that were in the same stage of development as those she guarded. In listing the numbers of eggs and larvae in discrete "nest" groups the ingested eggs and larvae are placed in parentheses after the number representing the specimens in the nest. Nests contained the following number of eggs and larvae: 6 (4); 12; 12 (4); 13; 13; 16; 16; 16; 16; 19; 19; 23; 24; 25; 27; 28; 28; and 37 (averaging 19.7 eggs per nest).

Nesting in the Great Smoky Mountains was gregarious, with several females depositing their egg complements in close proximity, and nesting in Virginia was isolated, with only one or two instances of more than one nest under a log or stump. The size of the females attending nests here described was much greater than that noted in Pope's (1924) study, and the number of eggs in nests was also greater. Wood and Duellman (1951) have shown that there is a direct relationship between the size of a female salamander and her egg complement. The differences between Pope's series and ours are the result of differences in the sizes of females, and our females did deposit the number of eggs that would be deposited by females of similar-sized *Desmognathus f. fuscus*. Baldauf (1947) pointed out an instance of predation of *fuscus* on eggs of its species, involving a female eating eggs she attended. His study was based upon a specimen intermittently disturbed by observations, and it was suggested

that the behavior might have resulted from these aberrant stimulations. There is no question about the cannibalism reported here, as it had all taken place before the nesting habitat was exposed for the first time by collectors.

SUMMARY

Nesting of *Desmognathus ochrophaeus carolinensis* occurred in early July at 5,100 feet in the Smokies; emerging larvae were found at nests at 2,300 feet in Scott County, Virginia, in early September. Nesting was gregarious in the Smokies, and isolated in the Virginia habitat. Nests were near surface water in the Smokies, and remote from it in Virginia. Attending females in the two series ranged from 41.0 to 49.5 mm., and egg groups ranged in size from 10 eggs (6 eggs and 4 in the female's stomach) to 53 eggs. Females attending nests did not exhibit behavior suggesting "guarding," but in three instances out of 30 cannibalism is noted. A few of the females failed to fully void their ovaries of all large ova during egg deposition.

LITERATURE CITED

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August 30. This group exchanged greetings, by air mail and cable, with a similar group meeting in Parma, Italy. The program consisted of two lectures each evening and many other interesting events. Among the lecturers were Ernest A. Jones of Vanderbilt, James R. Lawson of Tennessee A and I, Walter E. Brown of TVA Wilson Dam Laboratories, Wilbur Kaye of Tennessee Eastman Company, Ivar Cooke and Nelson Fuson of Fisk.

Vanderbilt University cooperated with Oak Ridge National Laboratory and Oak Ridge Institute of Nuclear Studies to present a Regional Symposium on "The Nuclear Reactor and the University" at Nashville, November 12 and 13, 1954. James A. Lane, Clarence E. Larson, Arthur H. Snell and Ellison H. Taylor of Oak Ridge National Laboratory, Herman M. Roth and

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