

NOTES ON SALAMANDERS ASSOCIATED WITH
DESMOGNATHUS OCOEE NICHOLLS

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Apparently the small salamander, *Desmognathus ocoee* Nicholls, is a species of the lower altitudes, presumably usually below a thousand foot elevation but probably higher in the suitably dry habitat which occurs westward of its type station on the Ocoee River. Its association with the other low altitude species would seem to indicate that this is true. The following species of salamanders have been collected by us to date there within one quarter mile of the type station of *D. ocoee* in Polk County, Tennessee: *Desmognathus phoca* (Matthes), *Desmognathus ochrophaeus carolinensis* Dunn, *Gyrinophilus danielsi dunni* Mittleman and Jopson, *Desmognathus fuscus fuscus* (Rafinesque), *Eurycea longicauda longicauda* (Green), and a low altitude form of *Plethodon glutinosus glutinosus* (Green). The first three species named above range up to the highest local altitudes, approximately 5,500 feet which lie about twenty-five airline miles distance. All three give indications of being near their extreme low altitude limits. The last three species named above all range to the westward, which is an area of generally low elevation, and indications are that they are near their eastern range edge and their upper altitude limits. Only one, *Desmognathus fuscus fuscus* (Rafinesque), has been found farther east, its range having been delineated by exhaustive collecting and found to extend only twenty-five miles airline to the east along river bottoms to the vicinity of Murphy, North Carolina.

Desmognathus phoca (Matthes) was collected in a strong, permanent seepage 100 yards east of the type station and in all of several branches and creeks both east and west of the type station. Most specimens show numerous strong white fleckings on dorsum and sides, a characteristic of specimens of this species from low altitudes and from the southernmost extensions of its range. So apparently this species, which ranges hundreds of miles to the east and north, is near its lowest altitudinal limit and near its westernmost geographical range. It is replaced at lower altitudes and farther west by *Desmognathus fuscus fuscus* (Rafinesque), as our collections in that area demonstrate. Apparently it ranges westward only another five miles or so, ending where the low flat limestone rolling plain begins. Since the range for *Desmognathus phoca* (Matthes) as given in the *Handbook of the Salamanders*, by Sherman C. Bishop, does not include this southeastern corner of Tennessee, and we have not seen elsewhere mention of its being reported from here, this may be a new record. While the actual range extension is only some thirty miles westward, it is of value as seemingly indicating the westernmost possible limit of the range of this species.

Desmognathus ochrophaeus carolinensis Dunn was found in a small seepage about 300 yards east of the type station, just 50 feet east of a small creek. The specimens found were much smaller and weaker than the specimens of the same species found at higher, wetter altitudes. This is characteristic of the specimens of this species found at low altitudes in the southern extensions of its range. These specimens found here also exhibited another characteristic of southern low altitude populations, namely the white dorsal and lateral fleckings, the general greyish and yellowish coloration, and the spotted patterns. There were no specimens with the straight edged patterns and other patterns found at higher altitudes, nor with the reddish colorings or with the extreme darkening of old males characteristic of higher altitude populations. Apparently this species is also near its lowest altitudinal and westernmost geographical range limits for this area. Our collection findings for this species coincide almost exactly with its range as given in the *Handbook of Salamanders* by Sherman C. Bishop. It would be expected that the limestone plain to the west would limit its range to exactly the same area as that of *Desmognathus phoca* (Matthes) in this region. This tendency of higher altitudinal species to develop white flecking, general light colors in a spotted or highly broken pattern, and very small size, in their low altitude, southernmost range extensions (in which general coloration and pattern *Desmognathus ocoee* Nicholls shares) would seem to be a general adaptation necessitated by the hotter, drier environment, and developed by natural selective processes over the years. Thus a close mimicry of species has developed between *Desmognathus ocoee* Nicholls and *Desmognathus ochrophaeus carolinensis* Dunn in this area.

Desmognathus fuscus fuscus (Rafinesque) was collected from both a small branch 300 yards east of the type station and a small creek one-quarter mile west of it. It is also found in most of the branches and small creeks on both sides of the type station, but always in small percentages (perhaps 5%) of the total salamander population of those branches. Our collecting would indicate that it is the only *Desmognathus* species found in the limestone plain creeks five miles to the west. Sherman C. Bishop (1943) indicates that this species ranges solidly across the western North Carolina mountains, but our collecting has shown, as mentioned above, that the species has only fingerlike range extensions into the mountain country along the deepest and largest river gorges.

Gryinophilus danieli dunni Mittleman and Jopson was collected in the hollow of a small branch one-quarter mile west of the type station. This species is never found in the large numbers of most species of salamanders, and only a single specimen has been collected there. It was an exceptionally large female containing large ovarian eggs, and was found moving on the surface during a light rain, at 8:30 P. M. on November 14, 1948. It was only 15 feet from a dried up water course where underground water was undoubtedly seeping

along bedrock a foot or more below the surface. The altitude was approximately 950 feet elevation. This specimen exhibits much more numerous and larger sized white flecking on the sides than is usual throughout the higher altitudes of its range. It is a low altitude, southern range extension characteristic of this species. We believe this to be a new low altitude record for this species in Tennessee. Of course, the type station for this species is lower, being a branch back of Professor Franklin P. Sherman's home at Clemson, South Carolina. This seems to be the most western range extension of this species for no previous report of its being collected south of the Little Tennessee River in the southeastern corner of Tennessee has been found. As with *Desmognathus phoca* (Matthes), the range given for *Gyrinophilus danielsi dunni* Mittleman and Jopson ends thirty miles to the east of this station. So this represents an actual range extension of thirty miles westward. Also, as with *Desmognathus phoca* (Matthes), it is of value as seemingly indicating the westernmost possible range limit of this species in this area, because the limestone plains beginning five miles to the west provide unsuitable habitats for this species. Therefore, it would seem that this species is near its lowest altitudinal and its westernmost geographical range limits.

The *Plethodon glutinosus* (Green) form found one-quarter mile west of the type station in the same hollow as the *Gyrinophilus danielsi dunni* Mittleman and Jopson is a lowland form collected many times below the one thousand foot altitude at many stations in northwestern Georgia and eastern Tennessee, but never in any part of North Carolina. Apparently it is near its upper altitudinal limit and its eastern range limits for this area.

Eurycea longicauda longicauda (Green) has been found in this vicinity at two stations only. One adult specimen was seen but not captured in a large deep crevice in a deep niche in the cliff 200 feet west of the type station. A single half-grown juvenile specimen of this species was found to be actually in company with specimens of *Desmognathus ocoee* Nicholls at the type station. This was very close to the center of the thickest population and in the mouth of a large crevice in a particularly badly shattered section of the cliff. It may be that this species is a predator on *Desmognathus ocoee* Nicholls. Since our collecting has shown us that *Eurycea longicauda longicauda* (Green) prefers caves and tunnels with narrow crevices in shale rock where seepage is present on rock surfaces, it would be logical to find it commonly associated with *Desmognathus ocoee* Nicholls because of the similarity of their habitats. We have collected this species of *Eurycea* frequently in such cave and tunnel habitats at low altitudes to the west and north of this area. We have never found it in other habitats nor to the east of this station. Sherman C. Bishop (1943) gives the range for this species to barely include this area. We believe that this range was assumed on the predication that it should exist in this area because the species had been

found to the southwest and to the northeast. This collection probably constitutes the first authentic record of its existence in this area. Apparently this species is near its upper altitudinal and easternmost range limits for this area.

Eurycea bislineata wilderae Dunn has not been found in the streams on either side of the type station. The amount of collecting that we have done over the past four years should have detected it if it were present. It could well occur at higher altitudes on the adjacent mountains, perhaps in only a one-half mile distance, since it is found on all of the ten to twenty mile distant high knobs. It would of course not occur in the limestone plain five miles to the west. Bishop (1943) barely includes this area within the known range.

Eurycea bislineata cirrigera (Green) has also, and unexplainedly, not been found in the nearby streams. At approximately twelve miles airline west of the type station, we have collected the larvae of this species and at stations in the vicinity of both Murphy and Andrews, North Carolina, we have collected the adults. Apparently this species has fingerlike extensions of its range along the deep gorges of the larger rivers cutting through the high mountain chain along whose crest the Tennessee-North Carolina state line runs. Its range extends somewhat farther than that of *Desmognathus fuscus fuscus* (Rafinesque), going fifteen miles farther east than that species to Andrews, North Carolina, a distance of forty miles airline east of the type station. This is a fifty miles east range extension for this species beyond the known range as given by Bishop (1943).

Other species of salamanders whose known geographical ranges and altitudinal dispersions would indicate that they should exist in this same area are: *Pseudotriton ruber ruber* (Latreille), in a geographical race quite distinct from the northern specimens of this species, *Eurycea longicauda guttolineata* (Holbrook), *Hemidactylium acutatum* (Schlegel), *Desmognathus aeneus* Bishop, *Aneides aeneus* (Cope), *Plethodon cinereus dorsalis* (Cope), *Ambystoma maculatum* (Shaw), *Ambystoma opacum* (Gravenhorst), *Ambystoma talpoideum* (Holbrook), *Triturus viridescens viridescens* (Rafinesque), *Cryptobranchus alleganiensis* (Daudin), *Necturus maculosus maculosus* (Holbrook). We have collected all of these species within a few miles radius of the type station.

Our conclusions drawn from this species association of *Desmognathus ocoee* Nicholls is that this species is a low altitude, western-ranging form whose type station is near its upper altitudinal range limit, and near the eastern limit of its geographical range. It will probably not be found ranging much higher nor much farther east in this area, but will probably be found ranging at lower altitudes and much farther westward, northward, and southward, where suitable dry clifflike terrain is frequently encountered. Doubtless it will be found at higher altitudes in the hotter, drier climate existing in all three of those directions.

Companion Species. *Desmognathus ocoee* Nicholls is most unusual in that never, in four years of observation in spring, fall, and summer, with but a single exception, have specimens of any other species of salamander been observed in company with the many specimens of it seen during that period. Most species of salamanders of this mountain region are usually in company (within a few inches, or in the immediate vicinity occupying the identically same habitat) with two to five other species of salamanders, and sometimes eight to ten other species. The single exception was the halfgrown juvenile of *Eurycea longicauda longicauda* (Green). Although there is a small culvert under the highway at the type station to carry off immediate surface flow of rainfall, there is no constant flow of water down to Ocoee Lake to furnish suitable habitat for the larger, predator species of *Desmognathus phoca* (Matthes), *Desmognathus fuscus fuscus* (Rafinesque), *Desmognathus ochrophaeus carolinensis* Dunn, *Pseudotriton ruber ruber* (Latreille), and *Gyrinophilus danielsi dunnii* Mittleman and Jopson, all of which probably would prey upon *Desmognathus ocoee* Nicholls if they came in direct contact with it. The seepage over the rock cliffs of the type station sinks into the talus slope at the foot of the cliffs and drains off as subsurface water. We believe that similar water drainage will probably be found to exist in nearly all stations where this species may be found. The local form of *Plethodon glutinosus glutinosus* (Green), although encountered within a hundred feet, apparently does not inhabit the crevices occupied by *Desmognathus ocoee* Nicholls, presumably because the water from the seepage discourages it.

Records. It would seem that our collections in the years 1946, 1947, 1948, and 1949 of the following species constitute the first records of their existence in both Polk County, Tennessee, and the southeastern Tennessee area bounded by the Little Tennessee River on the north, the Tennessee River on the west, the Georgia state line on the south, and the North Carolina state line on the east: *Desmognathus phoca* (Matthes), *Desmognathus fuscus fuscus* (Rafinesque), *Desmognathus ochrophaeus carolinensis* Dunn, *Gyrinophilus danielsi dunnii* Mittleman and Jopson, *Eurycea bislineata cirrigera* (Green), *Eurycea longicauda longicauda* (Green), and *Plethodon glutinosus glutinosus* (Green).

LITERATURE CITED

- Bishop, Sherman C. 1943. *Handbook of salamanders: The salamanders of the United States, of Canada, and of Lower California.*