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NOTES ON THE SALAMANDERS OF ARKANSAS  
#2 The Status of Desmognathus in Arkansas

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Several workers have at different times dealt with the salamanders of the genus Desmognathus in Arkansas and adjacent states. The most comprehensive work is that of Grobman (1950) who summarizes the information on the distribution of the races of Desmognathus fuscus in the southern states as he could interpret data available up to 1950. He also discusses the color differences between Desmognathus fuscus auriculatus (Holbrook) and Desmognathus fuscus brimleyorum Stejneger in their respective ranges. Grobman lists collections in Arkansas from Eureka Springs (northwest), Walnut Ridge (northeast), Forrest City (east central), as well as several south of the Arkansas River. Dowling (1957) states that it is doubtful whether any species of Desmognathus occur north of the Arkansas River in Arkansas. Rossman (1958) recognizes a new race, Desmognathus fuscus conanti Rossman, with a range that included West Tennessee.

The writer had occasion in the spring of 1958 to make several collections of salamanders in the western part of Arkansas south of the Arkansas River. From several small streams southwest of Hot Springs many specimens of Desmognathus fuscus were obtained. All were of the race brimleyorum according to available literature, (Bishop 1943). In the collections were specimens that were quite like the race auriculatus and some very near the race Desmognathus fuscus fuscus (Rafinesque).

I decided that the problem deserved more study so I made a four-week reconnaissance trip through Mississippi, Alabama, Florida, Georgia, South Carolina, North Carolina, Virginia, and Tennessee to collect specimens. Additional trips into Missouri, Mississippi, Tennessee, and throughout Arkansas were made. Approximately 600 specimens of D. fuscus races were collected. In many cases the number of specimens per collection was small; in others numerous. Taken as a whole the series presents a much clearer picture than would be possible from miscellaneous collections taken at various times by various people.

#### PROCEDURE

Collections were made in small streams and around springs.

Financial assistance provided by Arkansas College is acknowledged.

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Usually it is necessary to stir and move leaves, bark, stones, and moss in order to locate specimens. These are captured by hand or swept into a dip net. Because of their extreme agility, capture is often difficult. Field preservation was in 5% formalin solution, permanent storage in 50% isopropyl alcohol.

Collections were made from the following areas:

Garland County, Arkansas . . . . .	103
Logan County, Arkansas . . . . .	34
St. Francis County, Arkansas . . . . .	9
Cross County, Arkansas . . . . .	185
Baxter County, Arkansas . . . . .	4
Marshall County, Mississippi . . . . .	4
Lauderdale County, Tennessee . . . . .	85
Henderson County, Tennessee . . . . .	2
Tuscaloosa, Alabama . . . . .	21
Alachua County, Florida . . . . .	25
Western North Carolina . . . . .	37

Collections have been made from some of the Crowley Ridge locations at different seasons of the year in order to follow changes in the color pattern.

The following measurements were recorded in millimeters for each specimen: head width, gular to snout length, total length, body length, center of gular to post anal. Figures for each sex were averaged and it was found that measurements of both sexes were about the same so they were combined to arrive at the figures in Table I. This table is made up of ratios and percentages for four subspecies of Desmognathus as indicated, with three population samples of D. f. conanti.

Identification follows Bishop (1943) with the exception of D. f. conanti Rossman. This subspecies was named in 1958 by Rossman (1958). Mr. Rossman has examined the collections from Crowley Ridge, Arkansas; Ripley, Tennessee; and Tuscaloosa, Alabama and has identified them as belonging to the subspecies conanti.

## DISCUSSION

Data in the top row of Table I are from specimens collected in the mountains of western North Carolina. Only 34 specimens were available for measuring, but the data gives an idea of what fuscus is from a morphological standpoint. The gular to snout length in relation to body length is greater than the other races measured and the percentage of tail in total length is less than D. f. conanti and auriculatus, but greater than brimleyorum.

Three populations identified as conanti by Rossman who described the subspecies, were sampled. A total of 280 specimens were collected. The three populations are roughly north to south in orientation. The Crowley Ridge population is about 80 miles west

	Gular to * <u>Snout</u> Head W	<u>Trunk</u> Gular to Snout	<u>Body</u> Head W	Tail % Total Length	% of Popula- tion with Pigmented Venter	% of Popula- tion with Lateral White Dots	Number of Specimens
<u>Desmognathus</u> <u>fuscus fuscus</u> North Carolina	1.28	3.38	5.70	46.	43	58	34
<u>Desmognathus</u> <u>fuscus conanti</u> Lauderdale, Tenn.	1.37	3.45	6.24	47.6	94	75	40
<u>Desmognathus</u> <u>fuscus conanti</u> Tuscaloosa, Ala.	1.31	3.56	6.10	47.8	60	40	21
<u>Desmognathus</u> <u>fuscus conanti</u> Arkansas	1.25	3.62	6.13	47.8	98	29	60
<u>Desmognathus fuscus</u> <u>brimleyorum</u> Arkansas	1.39	3.55	6.35	44.00	93	89	40
<u>Desmognathus fuscus</u> <u>auriculatus</u> Florida	1.22	4.12	6.24	49.3	100	96	26

\* Divided by.

EXPLANATION: Gular to snout is from center of gular fold to tip of snout. Head width is widest part of head. Trunk is from center of gular to post anal. Body is from tip of snout to post anal. Tail measured only where no regeneration obvious. Pigment on venter represents all degrees from light mottling to almost black. Lateral white dots includes those present on body segments between axilla and on sides of tail.

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of the Ripley, Tennessee population, with the Mississippi River between them. The Tuscaloosa population is about 150 miles south and 100 miles east of the Ripley population.

The measurements for the three populations are very close. The Tuscaloosa population is the lightest in color and has more individuals with unspotted throats and venters. For purposes of comparison, the measurements of a population of auriculatus collected near Gainesville, Florida are presented in the bottom row. This race has a shorter head and longer tail than brimleyorum or conanti. The overall coloration approaches black in most specimens, with markings obscured by the heavy dark color. The young are marked about like the young of other races.

Brimleyorum has a slightly narrower head than any other race. The data on brimleyorum from Hot Springs, Arkansas and conanti from Crowley Ridge show that brimleyorum has a shorter tail; otherwise in size and markings they are very similar. Brimleyorum is darker in overall coloration than conanti, approaching auriculatus in this respect, but with more brown than black pigment. Both races have the majority of the individuals with mottled throats and venters and a high percentage of both have a row of white dots on the sides between the axilla and extending onto the sides of the tail.

The collections of Desmognathus from south of the Arkansas River are shown to be distinct from the other recognized races of the species in only one respect; that is, in tail length. This study verifies the work of Rossman (1958) who found brimleyorum to have a tail length less than 46% of total length and conanti greater. Color pattern alone cannot be used for positive field identification of conanti and brimleyorum because the general coloration and pattern are available in both races and in the case of conanti, at least, vary with the seasons.

Collections of conanti were made January 1, March 14, May 16, June 13, August 31, and November 15 from Coldwater Springs or nearby springs on Crowley Ridge. The specimens collected in March, May, and June were generally lighter in overall pigmentation and on most the dorsal pattern is much more distinct than specimens collected in August, November, or January. Also the mottling on the venter is much more pronounced on specimens collected during the winter months.

The Crowley Ridge, Arkansas, western Tennessee, and northern Alabama collections which have been designated as conanti by Rossman are all very close in physical measurements and obviously represent a wide-spread race of the sandy soils of the highlands of the southern states. Measurements of a good number of specimens from one site should provide identification. Conanti can be separated from brimleyorum by the greater tail length and from fuscus by the shorter body length of the latter (body/head w - 5.70 in fuscus, 6:10-6:20 in conanti).

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The general resemblance of brimleyorum in its southern range to auriculatus is more in color than in morphology. The population of auriculatus collected at Gainesville, Florida, has the greatest percentage of tail length of any race in this study and the shortest head (gular to snout/head w ratio - 1.22 auriculatus; 1.39 brimleyorum).

With the finding of the colony of Desmognathus at Flippin in Baxter County, Arkansas, there is no reason to doubt the correctness of the locations at Eureka Springs and Walnut Ridge by Grobman and Bishop as was done by Dowling (1957). The abundance of Desmognathus fuscus conanti in Crowley Ridge removes all doubt about the presence of Desmognathus north of the Arkansas River in eastern Arkansas. This study reveals that the range of conanti extends over at least the northeast fourth of Arkansas.

## SUMMARY

1. Races of Desmognathus fuscus are to be found in all parts of the state.
2. Desmognathus fuscus brimleyorum Stejneger is a form found in the rocky hills and mountains of Arkansas (Ouachita Mountains in southwest, Ozark Mountains in northwest and in the highlands of southeast Atlantic states). At three points Desmognathus has been collected near the Missouri line (Eureka Springs, Flippin, and Walnut Ridge) so it is reasonable to expect that it will be found in Missouri although unreported up to the present.
3. Desmognathus fuscus conanti Rossman is a form found in areas built up of loess or alluvial sand in Arkansas and western Tennessee. This form is closely related to both fuscus and brimleyorum, but this study shows that the three races are distinct morphologically.
4. Populations of salamanders from Arkansas and Tennessee have been compared with populations of auriculatus from Florida and fuscus from North Carolina and their likenesses and differences shown.
5. Coloration is not a reliable guide in the identification of Desmognathus, but furnishes helpful clues to identification established on a morphological basis.
6. This study reveals for the first time the extent of the range of Desmognathus fuscus conanti in a large part of Arkansas.

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