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NOTES ON PLETHODONT SALAMANDERS OF THE  
SOUTHEASTERN UNITED STATES

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IN the summer of 1933 I enjoyed my first collecting trip to the southern Appalachian Mountains. Most of the work was done in the vicinity of Swannanoa, Buncombe County, North Carolina, but, in addition, several type localities were visited. On a short trip the following year a few new localities were visited. In the summer of 1936 a special attempt was made to secure further information on the distribution of the forms of *Plethodon*. With this object in mind likely localities were visited which were not represented in collections. Much of the evidence obtained is negative, but since time did not permit a comprehensive survey of each locality it is far from conclusive. Sufficient information was secured, however, to enable us to redefine the ranges of *metcalfei*, *jordani*, and *shermani*.

The following notes are based chiefly on the collections made on the three trips. Only the more important material is included, and, unless otherwise stated, all specimens were collected by my companions or myself. Localities are in North Carolina unless otherwise stated.

I wish to thank Dr. Doris Cochran for permission to examine certain specimens of *Plethodon* in the United States National Museum collections. To Dr. C. F. Walker, Dr. J. M. Valentine,

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Mr. Ralph Dury, and Mr. R. M. Bailey, who have variously been my companions in the field, my grateful thanks are due for their pleasant companionship as well as their material assistance in collecting. Mrs. Helen T. Gaige, who has been a source of much encouragement and aid, has my sincere gratitude.

*Leurognathus marmorata marmorata* Moore

Thirteen adults and larvae, MZUM.<sup>1</sup> Nos. 76316 and 76318, were taken from a stream in a deep ravine in McDowell County, a mile south of Linville Falls, at an altitude of about 3000 feet. Another, MZUM. No. 76317, was secured about a mile away in Burke County. They were all found under rocks in water and were about equally abundant in pools or in shallow riffles. The larvae are readily distinguished from larval *Desmognathus quadramaculatus* by coloration and pattern. The larvae of *marmorata* have a conspicuous dark margin on the chin, and are nearly black on the dorsum and sides, without a sharp even line of demarcation between the sides and the unpigmented venter. The dorsal pattern appears about the time of transformation. The larvae of *quadramaculatus* have an inconspicuous dark margin on the chin, are much lighter on the dorsum and sides, with a sharp even line of demarcation between the sides and the unpigmented venter. The dorsal markings appear in very young larvae. The tail of recently transformed *quadramaculatus* is relatively shorter than that in *marmorata*. One adult female, 107 mm. in length, has two vomerine teeth on either side. Two other localities are represented by single specimens; one, MZUM. No. 75515, from Flat Creek, above Montreat, Buncombe County, at an altitude of about 3500 feet, and another, MZUM. No. 75584, from Ramseytown, Yancey County, collected by D. Ameel. A specimen was seen in a pool at Banner's Elk, Avery County.

*Plethodon yonahlossee* Dunn

This species was found commonly at the head of a rock-filled ravine near Swannanoa, Buncombe County, between 3200 and

<sup>1</sup> MZUM., the Museum of Zoology, University of Michigan.

4000 feet, MZUM. Nos. 76274, 75493-95. It was not found elsewhere in the vicinity. The large size of the rocks made collecting difficult in the daytime, but on both clear and rainy nights collecting by headlamp proved very effective. This form was also common at 3400 feet, McDowell County, near Linville Falls, MZUM. No. 76275. In Avery County a single specimen, MZUM. No. 76278, was taken at 5000 feet on Grandfather Mountain; another, MZUM. No. 76276, was secured at Banner's Elk. Although these altitudinal limits, 3200 to 5000 feet, are greater than was previously known, this species still appears to be much more restricted ecologically and altitudinally than *metcalfi* or *glutinosus*, which are found with it.

*Plethodon glutinosus* (Green)

This common and widespread species, usually distinct from the rest of its congeners, is a variable form in the mountainous region of southwestern North Carolina and northern Georgia. Little has been published on the variations of *glutinosus*, and as in this area abnormal specimens may lead to erroneous records for other species, I offer the following detailed descriptions.

GEORGIA.—Union County, Blood Mountain, 2500 to 4000 feet, MZUM. Nos. 76334-66. In this series of thirty-four specimens only two show an appreciable amount of dorsal white pigment, and in these it is much reduced from the normal. The lateral white pigment is usually densely concentrated into a band as in *yonahlossee*. The throats, all lighter than normal *glutinosus*, show varying degrees of lightness, and frequently are mottled with white pigment, again resembling *yonahlossee*. This series contains all ages and sexes, there being no apparent correlation with these variations. NORTH CAROLINA.—Graham County, Teyahalee Bald (Johanna Bald), near Andrews, 4000 feet, MZUM. No. 81040. In this series of three specimens a large example lacked the normal white pigment completely. It was first thought to be *metcalfi*, but it is distinctly darker than *metcalfi* of the same size, and the throat is dark. The other two specimens are small, and both show a small amount of white on the sides. Jackson County, Sylva, 2500 to 2800 feet,

MZUM. No. 81036. Eight of twelve specimens, all females, appear to be within the normal range of variation for this species. The remaining four, all males, have reduced dorsal white pigmentation and are decidedly paler on the ventral surface; this paler surface is not uniform as in *metcalfi*, but is somewhat patchy. Cherokee County, Andrews, 1800 feet, MZUM. No. 81041. Two specimens have the throats paler than normal, a male showing a slight weakening of the ventral pigment. Swain County, Rattlesnake Cliff, near Bryson City, 3500 to 4900 feet, MZUM. No. 81039. This series of eighteen specimens varies in reduction of white pigment from normal (two specimens) to only a few tiny white flecks on the side of the throat. The throats exhibit various degrees of pallor, but there is no pigment weakness elsewhere. Macon County, Wayah Bald, 2300 feet, MZUM. No. 75524. A single large female has profuse white pigment restricted to the sides, and the throat is somewhat paler than normal. This specimen was taken with the two *shermani* described below. Graham County, Bee Knob, 2500 to 3500 feet, MZUM. No. 81042. The white pigment on these specimens is reduced, especially on the back, and the throats, though paler than normal, are evenly pigmented.

Within this general area every series of *glutinosus* that I have taken has shown a high proportion of abnormality. No other species of *Plethodon*, with the single exception mentioned above, was taken with any of these collections. The variations for each locality seem to be rather constant, but differ according to locality.

#### *Plethodon shermani* Brimley

Two interesting specimens of *shermani* were taken at Wayah Bald, Macon County, at 2300 feet. These individuals are peculiar in having a considerable amount of white pigment on the sides between the legs. One specimen (Cincinnati Society of Natural History collection) has red on the forelegs only on the humeri, and on each hind leg it is reduced to a small spot. In the other example, MZUM. No. 75514, the red is reduced to a trace on the humeri and there is none on the hind legs. Of forty-seven specimens of *shermani* taken at 2500 feet a few

show only traces of lateral white pigment. No other species of *Plethodon* was taken at the higher level.

A series of thirty-one specimens of *shermani*, MZUM. No. 81031, from Weatherman and Tusquitee Balds, Cherokee County, show no trace of lateral white pigment. This locality, lying between Andrews and Aquone, throws some shadow of doubt upon the type locality. Originally given as "on Nantahala Mt., between Andrews and Aquone," it was later changed by Brimley (1912) to Wayah Bald, in the Nantahala range. This change was made when Mr. Sherman, the collector of the type, with Mr. Brimley collected *shermani* on Wayah Bald at a spot Mr. Sherman thought was the same as that which yielded the original specimens four years earlier. They failed to find it between Andrews and Aquone. Since Wayah Bald is in the Nantahala Mountains it is perhaps best to leave the type locality as corrected by Brimley.

The smallest specimen of this series (snout to vent, 22.5 mm.) has about six distinct red dorsal spots on each side of the midline. The next smallest specimen (snout to vent, 33 mm.) has no trace of such spots. Five small plethodons were taken in Macon County, about half way between Nantahala and Aquone. These specimens were inadvertently destroyed before preservation, but were examined in the field by both Dr. C. F. Walker and myself. Since they lend additional information on juvenile coloration I describe them as accurately as possible from field notes. Two specimens were typical of young *glutinosus*; one had legs distinctly but not abundantly marked with red as in *shermani*; one had legs with a trace of red, and the back had an almost obscured diffuse stripe, as if dorsal spots had fused and faded; the fifth was a uniform grayish with no evident spots of white or red, but was tentatively identified as *shermani*.

*Plethodon shermani*, it would appear, occupies a triangular range bounded on the east by the Little Tennessee River, on the south by the Hiawasse River, and on the northwest by the Valley River and the Nantahalà River where it turns eastward.

*Plethodon jordani* Blatchley

Of nine specimens, MZUM. No. 81030, from Cold Spring Knob, five miles north of Bryson City, Swain County, the two smallest (snout to vent, 22.3 and 24.0 mm.) show faint dorsal areas which might be regarded as the remains of juvenile dorsal spots. Apparently *jordani* is restricted to the Smoky Mountains proper.

*Plethodon metcalfi* Brimley

*Plethodon metcalfi* shows marked altitudinal variation in size, but has little color variation. At lower altitudes the species attains a much greater size. Density of pigmentation is directly correlated with size; at higher altitudes *metcalfi* is both paler and smaller. I have observed this stunting at White Top Mountain in Virginia, Balsam Gap in the Blacks, Craggy Dome in the Craggies, Blackrock in the Plott Balsams, and Grandfather Mountain in North Carolina. Measurements of fifteen males and sixteen females from Blackrock between 4000 and 5800 feet, taken August 3, 1936, are tabulated. These are the sexually mature individuals which have the tail (more or less perfect) longer than the snout-to-vent distance; from a series of one hundred and twenty. Measurements in millimeters.

	<i>Snout to Vent</i>	<i>Tail</i>	<i>Total</i>
Average of 15 males . . . . .	48.2	50.5	98.7
Average of 16 females . . . . .	51.3	55.1	106.4
Largest male . . . . .	59.6	60.0	119.6
Largest female . . . . .	61.5	67.5	129.0

A series of twenty-three large specimens from Swannanoa, Buncombe County, 2300 to 3600 feet, taken in August, are compared below. Only those which have perfect tails are included in the tail and total averages. Measurements in millimeters.

Pope (1928) used the sexual dimorphism of the ratio of tail length to total length as an index to the relationships of *shermani*, *jordani*, *metcalfi*, and *glutinosus*. It may be seen from

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	<i>Snout to Vent</i>	<i>Tail</i>	<i>Total</i>
Average of 11 males . . . . .	69.0	6m. 77.0	6m. 146.7
Average of 12 females . . . . .	70.0	7f. 72.6	7f. 142.8
Largest male . . . . .	73.5	83.0	156.5
Male . . . . .	71.0	83.0	154.0
Largest female . . . . .	75.0	72.0 (imp.)	147.0
Female . . . . .	69.5	83.0	152.5

the above tables that in the stunted Blackrock population the females are both larger and have proportionately longer tails; in the population of large individuals at Swannanoa the females are slightly longer in the snout-to-vent measurement, but the males have the longer tails. Thus it seems that this character is useless in determining relationships. The juvenile pattern and the occasional presence of white pigment on the sides lead me to consider *shermani* more primitive than *jordani* or *metcalfi*. Of more than three hundred of the latter seen alive none has shown a trace of juvenile dorsal spots or white lateral pigment. Both *shermani* and *jordani* are undoubtedly closely related. I agree with Dunn (1926) that *metcalfi* is the most specialized of these three forms, but doubt that any of them have been directly derived from *glutinosus*.

To my knowledge *metcalfi* has never been taken over 6000 feet. Since marked stunting is apparent at much lower altitudes this may well be its altitudinal limit and thus explain its absence from collections from Mount Mitchell. Four specimens were taken at Balsam Gap, Yancey County, about four miles east of Mount Mitchell, between 5200 and 5500 feet, the lowest altitude at which I collected in the Black Mountains. Very likely other herpetologists visiting Mount Mitchell have failed to collect extensively at suitable localities below 6000 feet, since the road to the mountain passes through cut or burned-over land most of the way.

A single young specimen, MZUM. No. 81029, was taken at 4000 feet on Max Patch, Madison County. I found no *metcalfi* in the Tusquitee Mountains while taking the thirty-one *shermani* mentioned above. Brimley (1912) recorded the former

species from these mountains but had lost the specimen. In view of the peculiar *glutinosus* population of that same general area I discredit the record until proved by subsequent specimens. The record given by Holt (1924) for Long Island, Jackson County, Alabama, may likewise be considered erroneous until its occurrence there is proved by additional specimens. The specimen in the National Museum from Brasstown Bald, Union County, Georgia, recorded as *metcalfi* (Dunn, 1926), is in very poor condition, but seems referable to *glutinosus*. Two other National Museum specimens (Nos. 86834-35) from near Vogel State Park, one mile from Blood Mountain, may be *metcalfi*, but they, too, are poorly preserved, being hard and much shrunken. They are more probably *glutinosus*, like my Blood Mountain specimens. A single specimen (USNM. No. 91886) from five miles east of Dillard, Rabun County, is the only unquestionable Georgia *metcalfi* I have seen. The range of *metcalfi* as thus corrected extends west to, but not beyond, the Little Tennessee River in North Carolina, and includes extreme northeastern Georgia.

*Eurycea longicauda longicauda* (Green)

*Eurycea longicauda* is here considered as consisting of two subspecies, *longicauda* and *gutto-lineata*, on the basis of three intermediate specimens from two miles east of Chatsworth, Murray County, Georgia. The two largest (MZUM. No. 76326) seem no closer to one form than to the other. The median dorsal stripe is less regular than in *gutto-lineata*, and has a tendency to break up into single or double spots. It stops at the base of the tail at a point just behind the vent as in *gutto-lineata*. The dorsal light stripes on either side are unspotted in one specimen, and the other has only three or four small spots on these stripes. The dorsolateral dark stripes are not rows of spots as in *longicauda*, but the spots are fused into distinct stripes with irregular edges. The ventrolateral dark lines are intermediate in like manner. The vertical bars of the tail are similar to those in *longicauda*, but are confluent above. One specimen has two or three dark spots on the venter and



slight mottling on the throat, otherwise it resembles the other specimen in having the immaculate underparts of typical *longicauda*. The third and smallest specimen, MZUM. No. 76327, shows variations in the same direction but is closer to *longicauda*. Dunn (1918) describes specimens essentially like these. His specimens were also from Georgia, but without further data. In discussing them he states: "As these specimens are without definite locality, I do not make *E. guttolineata* a subspecies. . . ." Chatsworth is a logical meeting place for the ranges of the two forms. They have been found within a few miles of each other elsewhere, but I know of no place where they are actually found together. They are definitely vicarious forms, and I think it best to consider them subspecies for the present.

A single perfectly normal *longicauda*, MZUM. No. 76328, was taken at Foscoe, Watauga County, at an elevation of 3100 feet. This locality is on the northeast slope of Grandfather Mountain, and well within the Blue Ridge. It constitutes the second record for North Carolina.

*Eurycea quadridigitata remifera* (Cope)

Five specimens, MZUM. No. 67799, of this questionable form were taken one mile east of Waynesville, Wayne (Brantley) County, Georgia, by Edwin Creaser and Herbert Becker. These are darker than any *quadridigitata* at hand for comparison, and the vomerine series average seven to eight teeth on a side.

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