

**Article XXIII.**—REPTILE AND AMPHIBIAN COLLECTIONS  
FROM THE NORTH CAROLINA MOUNTAINS, WITH  
ESPECIAL REFERENCE TO SALAMANDERS.

BY EMMETT R. DUNN.

PLATES LVII-LXI.

INTRODUCTORY NOTE.—The department of herpetology of the American Museum was so fortunate as to be able to send Mr. Emmett R. Dunn, instructor in zoology at Smith College (now a volunteer in one of the Federal training camps), for field work in the mountains of North Carolina during the summer of 1916. Collections of amphibians and reptiles were made, especial reference in the work being given to salamanders, since this region is a famous center of distribution for this group and has many rare and peculiar species. Type localities were visited and 853 specimens of salamanders were collected, notwithstanding considerable interference in plans by floods which made localities inaccessible by the usual routes.

The collections contain large and very distinct series of toads of the two species *Bufo americanus* and *Bufo fowleri*, the former found at high elevations and low, the latter at relatively low elevations only, never above 2700 feet. A new turtle, a high altitude race of *Clemmys muhlenbergi*, was unexpectedly found. It was collected as high as 4200 feet. Complete larval series were obtained of *Spelerpes ruber schencki* and *Spelerpes guttolineatus*; several larvæ of the rare *Gyrinophilus danielsi* were found; the larva of *Leurognathus marmorata* is made known to science for the first time; large series of the three species of *Desmognathus* restricted to the southern Alleghenies come into the American Museum collections; and four species of *Plethodon* include a new form larger than *P. glutinosus*.

The illustrations, which give for the first time figures of many forms, both adult and larval, have been made by Mr. Makoto Nishimura under the supervision of the department.<sup>1</sup>

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<sup>1</sup> This brief introduction and summary is prepared by the department, since Mr. Dunn was called away on military service.—M. C. DICKERSON.

## NARRATIVE OF THE TRIP.

The time of the collecting trip in the North Carolina mountains, carried out under the auspices of the American Museum of Natural History in 1916, may be divided into two parts; that spent at Brevard, and the stay at Pineola. Brevard is in Transylvania County, southwestern North Carolina, and all of our collecting in that neighborhood was done in that county. I was accompanied by Mr. Walter S. Nevin, of Haverford College. We reached Brevard on July 1. Thanks to the kindness of Dr. and Mrs. Wallis of that city, we were shown a good camping site, to which we went almost immediately.<sup>1</sup>

This camp was on a hill east of the town, flanked on two sides by the French Broad River and outlined by the roads from Brevard to the two bridges, of which the upper was known as Wilson bridge, and the lower as Elm Bend bridge. This hill was wooded and rose from the river low grounds at 2100 feet, to a little over 2400 feet. It had four small streams rising on it, of which the one that started at our camp spring and went some distance through the low grounds was the only one of any length. The others were on the sides of the hill, and on the low grounds immediately adjacent to it. On the lists of specimens the word "camp" refers to this hill as a whole.

We also collected for some distance in all directions around Brevard. East of the river the highest mountain was Rich Mountain, some 3700 feet in elevation. We took a trip to this and also to See-off, the estate of the Appalachian Club, farther up the river. Along the river itself we went as far as Pisgah Forest and Davidson River, the two stations next to Brevard. Back from the river on the west, we collected on Elk Lodge Mountain, between Pisgah Forest and Brevard, up King's Creek, which enters the river just below Brevard, on Cedar Rock Mountain, and along Cathey Creek which rises on its slopes and enters the river at Selica, the station above Brevard. A longer trip was taken to the Pink Beds Valley, the floor of which is 3200 feet, and from which the Pisgah Ridge rises to 4500 and 5000 feet. In the Pink Beds we met Miss Crystal Thompson, of the University of Michigan Museum, who also was collecting reptiles and amphibians.

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<sup>1</sup> Dr. and Mrs. Wallis were extremely kind to us during our whole stay in Brevard, they did everything in their power to help make our trip a pleasure and a success, and I wish to take advantage of this opportunity to express my gratitude.

I should like also to state my appreciation of the help and companionship of Mr. Walter S. Nevin. He was the best possible comrade, with a sense of humor that counteracted rain and flood and bad luck. What success we had was in considerable part due to his help.

From Brevard we went to Pineola in Avery Co., North Carolina. This is at an altitude of 3800 feet. Grandfather Mountain, the highest in the vicinity, is slightly over 5300 feet. Most of our collecting here was done on a hill between Linville and the Grandfather, although a few specimens were taken between Pineola and Linville, and others in the valley of Lost Cove Creek between Pineola and Edgemont. Most of the neighboring country, however, save that around Grandfather, has been burnt over, and is covered with a scrubby second growth in which locust predominates. In this the salamanders are almost non-existent, and traveling is very hard.

The country owned by the Linville Company shows the primitive conditions of flora and fauna, and being rendered accessible by the splendid Yonahlossee Road, is a paradise for the field naturalist; while that to the other side of Pineola, on the east face of the mountains along Lost Cove Creek, is a dismal and almost impassable waste of cliffs and second growth locust, in which the evils of forest skinning and forest neglect are only too evident.

#### HABITAT ASSOCIATIONS.

There were in the vicinity of Brevard two very distinct faunal associations; that of the low grounds and that of the mountains. The dividing line between the two would be at about 2500 feet, although the mountain salamanders came down farther in the streams.

The low ground fauna was mainly Carolinian. Noticeable birds were the mockingbird, Carolina wren, Carolina chickadee, dove, and tit. Robins and wood thrushes were common. The king snake, Fowler's toad, the cricket frog, and *Spelerpes guttolineatus*, were characteristic of this fauna. The mountain fauna was characterized chiefly by its salamanders, although the milk snake appears to be restricted to it.

A table has been prepared which shows the relations more clearly, and gives for the low grounds the subdivisions as follows: rivers, streams, springs, ditches, swamps, fields, thickets, and woods. For the mountains the subdivisions are as follows: ponds, streams, springs, fields, woods, and "balds" or clearings on the tops or slopes of mountains. Asterisks denote species that occur in both faunas. Of course it must be realized that this arrangement is simply the one into which our specimens fall, and where we have but few records of a species the arrangement may not be indicative of its usual habitat preference.

## Low ground faunal divisions.

	River	Stream	Ditch	Swamp	Spring	Field	Thicket	Wood
<i>Cryptobranchus alleganiensis</i> .....	×	×						
* <i>Notopthalmus viridescens</i> .....								×
* <i>Plethodon glutinosus</i> .....							×	×
* <i>Desmognathus ochrophea carolinensis</i>			×		×			
* <i>Spelerpes ruber schencki</i> .....					×			
" <i>guttolineatus</i> .....			×		×			
" <i>bilineatus</i> .....			×		×			
<i>Bufo fowleri</i> .....				×		×	×	×
* " <i>americanus</i> .....						×	×	×
<i>Hyla versicolor</i> .....				×				
" <i>pickeringi</i> .....				×				
<i>Acris gryllus</i> .....				×				
* <i>Rana clamitans</i> .....		×	×	×				
* " <i>palustris</i> .....		×	×					
" <i>catesbeiana</i> .....	×							
<i>Terrapene carolina</i> .....				×		×	×	×
* <i>Clemmys nuchalis</i> .....			×	×				
* <i>Plestiodon quinquelineatus</i> .....								×
* <i>Sceloporus undulatus</i> .....						×	×	×
<i>Natrix sipedon</i> .....	×	×	×					
* " <i>septemvittata</i> .....		×	×					
<i>Lampropeltis getulus</i> .....						×		
<i>Heterodon platirhinos</i> .....						×		
* <i>Diadophis punctatus</i> .....								×
* <i>Carphophis amoenus</i> .....								×
* <i>Coluber constrictor</i> .....						×	×	

*Mountain faunal divisions.*

	Fond	Stream	Spring	Field	Wood	Bald
* <i>Notophthalmus viridescens</i> . . . . .	×				×	
<i>Plethodon erythronotus</i> . . . . .					×	
“ <i>metcalfi</i> . . . . .					×	
“ <i>yonahlossee</i> . . . . .					×	
* “ <i>glutinosus</i> . . . . .					×	
* <i>Desmognathus ochrophæa carolinensis</i> . . . . .					×	
“ <i>quadramaculata</i> . . . . .		×	×			
“ <i>monticola</i> . . . . .		×	×			
<i>Leurognathus marmorata</i> . . . . .		×				
<i>Gyrinophilus danielsi</i> . . . . .		×	×			
* <i>Spelerpes ruber schencki</i> . . . . .		×	×			
* <i>Spelerpes bislineatus</i> . . . . .		×	×			
* <i>Bufo americanus</i> . . . . .				×	×	×
* <i>Rana clamitans</i> . . . . .	×	×				
* <i>Rana palustris</i> . . . . .		×				
* <i>Clemmys nuchalis</i> . . . . .				×		
* <i>Plestiodon quinquelineatus</i> . . . . .					×	×
* <i>Sceloporus undulatus</i> . . . . .					×	
* <i>Natrix sipedon</i> . . . . .		×				
* “ <i>septemvittata</i> . . . . .		×				
<i>Thamnophis sirtalis</i> . . . . .					×	
<i>Storeria occipitomaculata</i> . . . . .					×	
<i>Lampropeltis doliatus triangulus</i> . . . . .				×		×
<i>Elaphe obsoleta</i> . . . . .					×	
<i>Diadophis punctatus</i> . . . . .					×	
<i>Carpophis amoenus</i> . . . . .					×	
<i>Coluber constrictor</i> . . . . .				×		
<i>Agkistrodon contortrix</i> . . . . .						×
<i>Crotalus horridus</i> . . . . .				×		×

## Class AMPHIBIA.

## Order CAUDATA.

## Family CRYPTOBRANCHIDÆ.

1. **Cryptobranchus allegheniensis** (*Daudin*).

One young one, 180 mm. in length, was taken in Williams Creek, which runs into the east side of the French Broad, about a mile from the river and one quarter mile below Glen Canyon falls. We were seining for minnows at the time and the "water dog" was discovered by turning over a flat rock in a riffle.

Field No.	Am. Mus. No.	Locality	Alt.	Date
502	4504	Williams Creek	2100	Aug. 7

## Family PLETHODONTIDÆ.

2. **Plethodon yonahlossee**, new species.

Plate LVII, Figs. 1-3.

Type: Am. Mus. No. 4634 (Field No. 542), collected near the Yonahlossee Road about  $1\frac{1}{2}$  miles from Linville, N. C., altitude 4200 feet, Aug. 16, 1916.

Diagnosis: Generally similar to *Plethodon glutinosus* (Green), but with much longer vomerine teeth rows, and with a chestnut red dorsal band from base of head to base of tail.

The dentition consists of two long, curved vomerine teeth in each, extending further beyond the choanæ than the width of the choanæ, separated posteriorly by  $\frac{1}{5}$  the length of the series, and from the parasphenoid by  $\frac{1}{4}$  the length of the series. Parasphenoid patches confluent or separated by a narrow groove. The choanæ are large as in *glutinosus*. The teeth are somewhat smaller than in *glutinosus*. This dentition corresponds more closely with that figured by Stejneger for *Plethodon jordani* Blatchley than with that of any other Eastern *Plethodon*. The vomerines agree also with Cope's description of *P. croceater*. The vomerines of *P. glutinosus* are straighter with about 11 somewhat larger teeth.

The coloration of the belly is lighter than in *glutinosus* and darker than in *metcalfi*. It is however uniform as in these species and not mottled as in *erythronotus*. The throat is especially pale. The tail is distinctly bicolor

and reminds one of the tail of *Peromyscus*. The whole surface, dorsal and ventral is sprinkled with tiny unpigmented dots as in *glutinosus*, *metcalfi*, and *shermani*. It lacks the larger spots of white ground color that are irregularly scattered over the belly of *glutinosus*, and which seem to mark the position of mucous glands. *Yonahlossee* has also those spots of white pigment found in *glutinosus* which overlie the black. These are more regular in their distribution than in *glutinosus*, being absent save on the sides and there rather crowded into a band of white. In the young of *yonahlossee* the black pigment is absent in a double series of dorsal patches, there being 4-6 patches in each row. The red of the whole dorsal surface shows much more brightly in these patches. In adults the back is uniformly covered with black pigment, but the red is visible as a dark chestnut patch covering the whole back from the base of the head to the base of the tail. It extends on the sides only as far as a line between the bases of the legs, the space on the sides between the bases of the legs being almost covered by the white pigment spots. Both red and white pigment fade to a great extent in preservation.

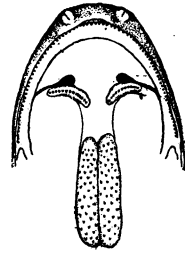


Fig. 1. *Plethodon yonahlossee*, No. 4634. Roof of mouth to show dentition.  $\frac{2}{3}$ .

This form cannot be considered an "erythronotus phase" of *glutinosus* for even if the dentition were the same, the red is visible still when the black covers the back. The difference between *erythronotus* and *cinereus* is solely the absence or presence of black pigment, the red being always present, but not visible as such save when the underlying black is absent.

One cannot avoid comparing these light patches on young *yonahlossee* with the unpigmented larval areas in *Spelerpes* and *Desmognathus*. It is probable that in these patches we have a reminiscence of a larval life. *Plethodon dorsalis* and *Plethodon erythronotus* have a band on the back similar to the patches of young *yonahlossee*, and comparable to the dorsal band of *Desmognathus ochrophaea carolinensis*.

The presence of a melanistic or *cinereus* phase of each is indicative of the loss of the teleological significance of these bands, the character probably Mendelizing.

The red legs of *P. shermani* and the yellow cheek patch of *P. jordani* are similar to the red back of *P. erythronotus* in that the black pigment is absent from these parts, but although these are probably remains of a primitive black-and-red or yellow coloration as in *Spelerpes* or *Desmognathus*, they do not retain traces of a pattern as do *yonahlossee*, *dorsalis*, and *erythronotus*. The color of *glutinosus* is that of *yonahlossee* minus the red and

with white pigment spots on the dorsal surface. It is impossible to correlate the coloration of *P. aneus* with any of the above and it seems in other characters as well (the peculiar feet, the small choanæ) to be the most isolated of our eastern *Plethodons*. Among Western forms *croceator* and *intermedius* resemble *yonahlossee* and *erythronotus* respectively. *P. croceator* has also the red legs of *shermani*. *Glutinosus* and *yonahlossee* seem unique in the possession of white pigment spots.

The tail is as long or longer than the head and body. It may be slightly longer proportionally than the tails of *glutinosus* or *metcalfi*. It has a slimmer tail than *glutinosus*, but in other respects is quite as stout. The head is long entering the body 3.1–3.5 times. The same ratio in *metcalfi* is 3.3–3.7; in *glutinosus* 3.3–4.2. The head of the largest *glutinosus* is 16 mm. long, that of the type of *yonahlossee* is 19 mm. The appressed limbs overlap in young specimens, but in adults are separated by two intercostal folds. The costal grooves are 14, not counting one above the arm or one which is a bifurcation of the last. This is as in *glutinosus* and *metcalfi*. The feet and hands are as in *glutinosus*. The grooves of the side of the head, the gular fold, etc., do not differ from those of *glutinosus* and *metcalfi*. *Yonahlossee* is rather less slimy than *glutinosus*.

*Yonahlossee* is larger than *glutinosus*, a series of 25 ranging from 57–165 mm.; while a series of 80 *glutinosus* ranges from 42–159. Specimens below 65 mm. are apparently in their first year, being comparable to specimens of *glutinosus* and *metcalfi* below 50 mm. These specimens below 65 mm. have the light dorsal patches.

This species was taken only on a hill near Linville. All but one were taken on the upper side of the Yonahlossee Road.

In going from Linville to Blowing Rock, one passes a house on the left, about two miles from Linville. On the left between Linville and the house a wooded hill rises to about 4400 feet (the average altitude of the road is 4100 ft.). On this hill, and most of the time within sight of the road, we got 462 salamanders in three days' collecting, as follows:

<i>Notophthalmus viridescens</i>	44
<i>Desmognathus ochrophæa carolinensis</i>	135
<i>Plethodon erythronotus</i>	48
“ <i>metcalfi</i>	150
“ <i>yonahlossee</i>	23
“ <i>glutinosus</i>	47
<i>Spelerpes bistlineatus</i>	13
“ <i>ruber ruber</i>	1

Under one strip of bark on the ground we found seven salamanders, two *N.*



*viridescens*, two *P. metcalfi*, one *D. o. carolinensis*, one *P. glutinosus*, and one *S. bislineatus*. It may be noteworthy that we never took *yonahlossee* in direct association with *glutinosus*, although it was found with *metcalfi* and *erythronotus*. It was much the most agile of the four *Plethodons* there. We failed to catch several very large specimens. They had burrows extending sometimes for several feet.

*Glutinosus* and *metcalfi* also had similar burrows. On turning over a log or a piece of bark if the *Plethodon* was near the entrance of its burrow, it simply let go all holds and dropped out of sight. If it was not near the entrance it ran for it, and we could usually head off the other three species but *yonahlossee* was often too fast. And when as occasionally happened two of them were under the same piece of bark one was all we could hope to get. Sometimes we dug open the burrows, but we rarely had success in catching the inmates.

I refer to this species two specimens in the U. S. National Museum, collected "between Linville and Blowing Rock," by Mr. Sherman. Brimley refers to these two as having red backs, and on the cloth field tags it is so stated. The red has long ago disappeared, but they are easily identified by the long head, peculiar dentition, and white throat.

A *Plethodon* (*P. wehrlei* Fowler & Dunn) having been recently discovered in the Pennsylvania mountains, which differs from *metcalfi* chiefly in having 17 instead of 14 costal grooves, the fact that a new one is described above, and the fact that many of the described forms are rare in collections and their descriptions scattered, have led me to add a tentative arrangement of the eastern forms.

Four characters seem to me to be indicative of more simple or primitive forms, other things being equal; (1) a low number of costal grooves; (2) a dorsal pattern; (3) a large number of vomerine teeth (4); large size.

In *Desmognathus* and in *Spelerpes*, both of which genera have a black and red or yellow coloration in which the disposition of the black is regulated by the larval areas and forms the pattern, these characters have as a rule the meaning assumed for them in *Plethodon*, some species of which have remains of a black-and-red or yellow coloration.

*Plethodon yonahlossee* is the only eastern form which retains all the above primitive characters. *Glutinosus* lacks the dorsal pattern and indeed all trace of red or yellow. It also has fewer vomerine teeth. *P. jordani* is not well known, but it comes next to *yonahlossee* in regard to vomerine teeth and retains a trace of yellow coloration in the cheek patches.

As noted above *æneus* appears isolated to a remarkable extent.

*P. shermani*, *metcalfi*, and *wehrlei* constitute a group characterized by medium size, and few teeth. *P. wehrlei* is most specialized with 17 costal

grooves and no color. *P. shermani* is the most primitive with red legs and 14 costal grooves.

*P. dorsalis* and *erythronotus* are the smallest forms. They have few vomerine teeth. However, they possess very definite dorsal coloration. There is a melanistic phase of each which almost entirely obscures the red in life, while in preservative there is no trace of it left.

*P. dorsalis* has 16 costal grooves and the dorsal pattern is a zigzag band. A zigzag band is intermediate between spots and the straight-edged band of *erythronotus*. Thus *dorsalis* would appear to be the least specialized. It occurs in Kentucky, Ohio, and Indiana.

Of these nine forms, *erythronotus* and *glutinosus* are by far the widest ranging. *P. metcalfi* occurs all over the North Carolina mountains at high altitudes. *P. æneus* ranges in the Cumberland Mountains from the Alabama line to Virginia and West Virginia. The others are known only from the vicinity of the type localities: *P. jordani* from the Great Smokies; *P. shermani* from the Wayah Bald Mountain in southwest North Carolina; *P. wehrlei* from Indiana Co., Pennsylvania; and *P. yonahlossee* from Grandfather Mountain.

The measurements of the type series follow; I include one of the National Museum specimens.

Length	Head	Body	Tail	U. S. N. M.		
165	19.2	60.8	85	U. S. N. M.		
140	19	58	63	Am. Mus. Type		
142	17	55	72	"		
142	16	54	72	"		
133	16	52	65	"		
117	16	48	53	"		
126	16	50	60	"		
103	15	50	38	"		
95	14	46	35	"		
111	13.5	41.5	56	"		
103	13	40	50	"		
105	13.5	43.5	58	"		
116	13.5	41.5	61	"		
97	11	38	48	"		
92	13	36	43	"		
81	12	38	31	"		
83	10	33	40	"		
81	10	30	41	"		
62	8	25	29	"	Dorsal spots.	
42	9	26	5	"	"	"
61	8	23	30	"	"	"
58	7.5	23.5	27	"	"	"
57	8	23	26	"	"	"
57	7.5	22.5	27	"	"	"

Specimens 23, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
542	4633-44	Linville	4200	Aug. 16
545	4666-7	"	"	" "
559	4711-4	"	"	" 17
575	4853-6	"	"	" 19

3. *Plethodon glutinosus* (Green).

Plate LVII, Fig. 5.

The relationships of this form to *P. yonahlossee* and to *P. metcalfi* have been discussed in the accounts of those forms. We found *glutinosus* common, wherever there were *Plethodons* at all, up to 4000 ft.

The dentition of our specimens is fairly constant. The vomerine series consists of about 11 rather large teeth in a slightly curved line, extending beyond the choanæ, separated from each other by  $\frac{1}{3}$  the length of the series and from the parasphenoid patches by  $\frac{1}{2}$  the length of the series. The parasphenoid patches are separated by a narrow groove.

Where these salamanders were common, their burrows were found to be very extensive, sometimes opening onto the side of a road cutting. I have seen *P. glutinosus* lying in the mouth of its burrow just as a toad does.

Measurements of a series of *P. glutinosus*, including the largest and smallest:

Length	Head	Body	Tail
129	14	60	55
128	16	60	52
155	15	59	81
148	15	58	75
159	16.5	57.5	85
142	15	57	70
146	16	53	77
142	16	53	73
135	14	51	70
108	12	43	53
49	7	21	21
41	6	19	15
45	6.5	18.5	20
42.5	6	16.5	20

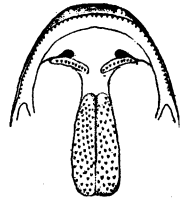


Fig. 2. *Plethodon glutinosus*, No. 4789. Roof of mouth to show dentition.  $\frac{2}{3}$ .

Specimens 80, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
2503	4097	Camp	2200	July 3
2504	4098	"	"	" "
2513	4099-130	"	"	" "
2515	4104	"	"	" "
2604	4114	"	"	" 6
2609-11	4115-7	"	"	" "
2619	4118	"	"	" 8
2620	4119	"	"	" 9
2621	4120	"	"	" 10
2633	4121	Low grounds near Camp	2100	" 11
2637	4122	Camp	2200	" "
2638	4123	"	"	" "
2639	4124	"	"	" "
2647	4125	Across river from Camp	"	" 13
2657	4127	Road to See-off	2700	" "
2671	4129	See-off	3000	" "
2669	4165	"	"	" "
2667	4128	"	"	" "
2687	4341	Elk Lodge Mt.	2700	" 19
2744	4434-6	Pink Beds	3500-4000	July 31
2751	4452	Camp	2200	" 30
2752	4453	Pink Beds	3500-4000	" 31
2770	4471-5	Camp	2200	Aug. 5
546	4668-9	Linville	4200	" 16
543	4645-63	"	"	" "
565	4789-98	"	"	" 17
577	4864-9	"	"	" 19

#### 4. *Plethodon metcalfi* Brimley.

Plate LVII, Fig. 4.

This is a very common and characteristic salamander of the higher mountains. We got it on See-off in company with *glutinosus* at about 3000 ft., at Pink Beds from 3500-5000 ft., with *glutinosus* as far as 4000 ft., and at Linville at 4000-4200 ft., in company with *erythronotus*, *glutinosus*, and *yonahlossee*.

Thus the ranges of *metcalfi* and *glutinosus* overlap to a considerable extent. The two forms, however, remain quite distinct, and I am inclined to think that there is little relationship. The only difference in habits observed was that *metcalfi* was more agile and less slimy than *glutinosus*, less slimy and less agile than the new form, and more agile and more slimy than *erythronotus*.

It differs from *glutinosus* in never having the white spots of that species. From the evanescence of these spots in preservative, from their appearance under a microscope, and from their disappearance at the least touch of caustic potash, Mrs. Harris H. Wilder, of the Smith College zoological department, has suggested to me that they are inclusions of carbon dioxide gas. At any rate they are underlain by the black pigment, and they thus differ greatly from that other white which is simply absence of pigment.

*P. metcalfi* differs from *glutinosus* in the much lighter belly. This holds good for most specimens, but some very small *glutinosus* have the belly very pale. The belly lacks the larger unpigmented dots of *glutinosus*. The pale color of the belly is caused by the weakening of the borders of the minute unpigmented dots which cover the whole surface of *glutinosus*, *shermani*, and *metcalfi*. It is noteworthy that this weakening is in operation on the dorsal surface as well but to a less degree. Still, *metcalfi* is noticeably paler than *glutinosus*, on every part of the body. "Gray ghost" is an appropriate epithet for this species. *P. metcalfi* is smaller than *glutinosus*. Brimley's largest specimen was 140 mm. long, but this must be a very unusual specimen as the range of our series of 160 specimens is 35–119 mm. Our series of 80 *glutinosus* range from 41–159 mm.

Its proportions are almost exactly similar to those given by Stejneger for the type of *P. shermani*. However, the long tail is not so different from the tail of *glutinosus* as in both species the tail may be as much as 53% of the total length. But the tail of *metcalfi* and of *shermani* is much slimmer. The costal grooves are exactly as described for *shermani*; *i. e.* 14 not counting one at axilla and one at groin, neither of which descends to lower surface. The appressed limbs fail to meet by two intercostal folds. The vomerine teeth are in two short, oblique, curved, series which extend a little farther than the outer border of the choanæ, each series consisting of 6–7 rather large teeth.

The distance between the series posteriorly equals about  $\frac{1}{3}$  the length of the series. The distance from the parasphenoid patches is greater than the length of the series. The parasphenoid patches are confluent or divided by a narrow groove. It is probable that this species is most nearly related to *P. shermani* Stejneger. *Shermani* differs in its red legs (the black being absent). The legs of *shermani* are also somewhat larger. The other proportions and the general size and color are the same. The parasphenoid patches are divided in the type of *shermani*, but as another specimen from the type locality has these teeth in one patch, and as two *glutinosus* of the same size from Blantyre, have one a single patch and the other two quite dis-

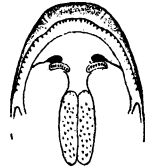


Fig. 3. *Plethodon metcalfi*, No. 4388. Roof of mouth to show dentition.  $\frac{1}{2}$ .

tinct patches, very great importance cannot be attached to this character. On the whole the vomerine series seem much more constant, and in regard to these teeth *metcalfi* and *shermani* resemble each other in having the shortest series with the fewest teeth of any Eastern *Plethodon*, *erythronotus* perhaps excepted.

Length	Head	Body	Tail	Type of
104	11.5	36.5	56	<i>shermani</i>
98	13	48	37	<i>metcalfi</i>
119	13	47	59	"
116	13	46	57	"
115	12	43	60	"
108	12	42	53	"
97	11	36	50	"
96	10	36	50	"
80	11	35	34	"
47	6	20	21	"
48	6	18.5	23	"
42	6	16	20	"
40	6	16	18	"
35	5.5	14.5	15	"

Specimens 160, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
2666	4163	See-off	3000	July 13
2668	4164	"	"	" "
2670	4166	"	"	" "
2738	4428-33	Pink Beds	3500-5000	July 31-Aug. 1
541	4601-32	Linville	4200	Aug. 16
547	4670-1	"	"	" "
566	4799-847	"	"	" 17
567	4848-50	"	"	" "
578	4880-942	"	"	" 19
579	5001-2	"	"	" "

### 5. *Plethodon erythronotus* (Green).

Very common near Linville. Out of 48 specimens collected there, only 2 had black backs. There is no approach to *dorsalis* in our specimens as all have 19 costal grooves and straight-edged bands of red.

Miss Thompson had one at Pink Beds. We did not find it there or around Brevard.

48 specimens as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
536	4536-44	Linville	4200	Aug. 16
551	4677	"	"	" "
560	4715-20	"	"	" 17
581	5011-41	"	"	" 19
582	5054	"	"	" "

6. *Desmognathus quadramaculata* (Holbrook).

Plate LVIII, Figs. 1 and 2; Plate LIX, Fig. 1.

Very common in streams. We never found one away from water. They seemed to us practically aquatic, as we often came upon them wandering around in the water. They are extremely active and hard to catch or hold. It is a surprising sight to see one of these big black salamanders run down a sloping bank into the water, for all the world like a water snake. On several occasions captured specimens attempted biting.

Around Brevard they came down to 2100 feet in large streams, to which they seemed confined. At Linville they occupied both large and small streams. The explanation seems to be that *D. monticola* inhabits small streams which rise at or below 4000 feet, while *D. quadramaculata* follows down streams which rise above that line. This is not an absolute rule, but it holds in most cases and a stream in which *quadramaculata* is common usually contains few *monticola* and vice versa.

Larvæ were caught ranging in size from 37–63 mm. The size of transformed specimens ranges from 49–164 mm. It is noteworthy that both the smallest adults and the smallest larvæ come from Linville where they seem to transform at a smaller size. However the species reaches as great a size at Linville as at Brevard.

The larvæ are easily distinguishable from all others taken by their stout legs and glistening white gills (with the possible exception of No. 4519, which I identify as *Leurognathus marmorata*). The females had developing eggs in their ovaries.

Specimens 84, as follows: 12 larvæ and 72 adults.

Field No.	Am. Mus. No.	Locality	Alt.	Date
2518	4105	Camp	2200	July 3
2562-9	4106-13	Rt. Fork, Cathey Creek	3000	" 4
2648	4126	Road to See-off	2600	" 13
2663	4192	See-off	3000	" "
2699	4352	Rt. Fork, Cathey Creek	2800	" 24
2712	4362	Str. opp. Pisgah Forest	2400	" 25
2713-4	4363-4	" " " "	"	" 24
2734	4388-90	Pigeon Gap, Pink Beds	3200-3500	July 31-Aug. 1
2750	4442-51	Rt. Fork, Cathey Creek	2400-3000	July 24
2766	4464	Williams Creek	2100-2400	Aug. 4
2780	4477	Str. opp. Pisgah Forest	2200-2400	July 25
"	4479-86	" " " "	"	" "
"	4488-91	" " " "	"	" "
509	4511-3	Str. opp. Davidson R.	2500	Aug. 7

Field No.	Am. Mus. No.	Locality	Alt.	Date
518	4522-3	Pineola	3800	Aug. 14
525	4526-30	Rt. Fork Lost Cove Creek	3800	" 14
550	4535	Linville	4200	" 16
537	4545-52	"	"	" "
563-4	4768-88	"	"	" 17
585	5042	Pineola (Mortimer)	2500	" 21

### 7. *Desmognathus monticola* Dunn.

Plate LVIII, Figs. 3-5.

Generally abundant. This species resembles *D. fusca* very closely in its habitat relations. It is not nearly so aquatic as *quadramaculata* and is found only around small streams. The rocky edges of the mountain brooks and springs along the sides of roads simply teem with this species. We sat under a tree on the side of a road during a rain and four or five crossed the road in half an hour. While we were climbing Grandmother Mountain early one morning, one ran across our path with a partly eaten earthworm in its mouth. It wanders more openly than do the other species of *Desmognathus*. One sees *quadramaculata* frequently at large but only in streams. The vertical range was from 2200 to 4000 feet.

No specimens of *monticola* are in any way an approach to *fusca*, to *carolinensis*, or *quadramaculata*. It seems an entirely distinct form.

No larvæ were seen. No eggs were found, although the females had developing eggs in their ovaries. This would indicate a somewhat different spawning time from *fusca*, but a similar duration of larval life.

Specimens ranged in size from 30 to 135 mm.

The oldest and largest males lack the vomerine teeth. However they do not lose these teeth at sexual maturity, as do the males of all the other species of the genus except *quadramaculata*.

One hundred specimens, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
2519	4060	Camp	2300	July 3
2523-49	4061-87	Road along Kings Creek	2500-3000	" 4
2514	4130	Camp	2200	" 3
2641	4176	"	"	" 11
2650-6	4180-6	Road to See-off	2600	" 13
2658-9	4187-8	Creek north from See-off	3000	" "
2661	4190	" " " "	"	" "
2664-5	4193-4	" " " "	"	" "
2675-79	4195-9	See-off	3100	" "
2684-5	4338-9	Elk Lodge Mt.	2500-2700	" 19



Field No.	Am. Mus. No.	Locality	Alt.	Date
2709	4359	Str. opp. Pisgah Forest	2400	July 24
2728-9	4369-70	Elk Lodge Mt.	2400-2700	" 19
2730	4371-8	" " "	"	" "
2736	4392-4402	Pigeon Gap, Pink Beds	3200-4500	July 31-Aug. 1
2737	4419	" " " "	"	" " " "
2748	4440	Brevard (Elk Lodge)	2300	July 29
2766	4463	Williams Creek	2100-2400	Aug. 4
2766	4465-7	" "	"	" "
2780	4478	Str. opp. Pisgah Forest	2200-2440	July 25
"	4487	" " " "	"	" "
503	4505	Williams Creek	2200	Aug. 7
508	4510	Str. opp. Davidson River	2600	" 5
531	4533	Grandmother Mt.	4000	" 15
538	4553-9	Linville	4000	" 16
549	4676	"	"	" "
580	5003-10	"	"	" 19
586	5043	Pineola (Mortimer)	2500	" 21
593	5047	No data		

### 8. *Desmognathus fusca* (Raf.).

Near Midway Mills, Nelson Co., Va., we got specimens of this well-known form at 500 ft. elevation.

Specimens 7, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
593	5044-6	Wingina, near Midway Mills	500	Aug. 29
	5048			
594	5049	" " " "	"	" "
595	5050-1	" " " "	"	" "

### 9. *Desmognathus ochrophæa carolinensis* Dunn.

Plate LVIII, Figs. 6-9.

Not uncommon in the low grounds around Brevard. Common at Pink Beds and at Linville.

At Brevard they are seldom found away from damp places such as *monticola* frequents, rarely occurring together, however, as *monticola* does not come down to the low grounds or below 2200 feet. Higher up in the mountains, at Pink Beds and at Linville, *carolinensis* is almost wholly terrestrial. But occasional exceptions are found. Thus at Linville they were found everywhere from under a rock in water to under bark of a tree five feet above the ground, but by far the greater part were under logs on

the ground. They must be great wanderers, but are very secretive and are never seen abroad.

This is a variable and puzzling form. Some specimens are exactly like northern *D. ochrophæa* in color; others are spotted, and in these the dorsal surface may be red or yellow. Most of the larger specimens are uniform purplish. Northern *ochrophæa* are always striped.

There is an unmistakable trend toward *fusca* in the French Broad Valley specimens. This is doubtless correlated with the difference in habitat mentioned above. At Asheville, in the French Broad Valley, *fusca* occurs. It is quite possible that intergradation takes place, but until it is proved I think it best to let *carolinensis* stand as a subspecies of *ochrophæa* because I believe *ochrophæa* to be derived from *carolinensis* rather than from *fusca*. At any rate, the form *carolinensis* is intermediate between the form *fusca* and the form *ochrophæa*.

Brevard specimens of *carolinensis* are much smaller than *fusca*; their coloration is like that of the mountain specimens in frequently having the immaculate dorsal stripe, which *fusca* never has; the tails of about half the specimens are cylindrical, half have the tail somewhat flattened, and a few of the smallest have a dorsal keel. Typical *fusca* has a decidedly flattened tail with an evident dorsal keel. Asheville specimens are like ordinary *fusca* but seem slightly smaller.

Females with eggs were found twice; one 69 mm. long, at 2300 feet at Brevard, July 21: and one 55 mm. long, at 3500 feet, at Pink Beds, July 31. Each had 10-15 eggs, a very small batch compared with the 30 eggs produced by average *fusca*. The Brevard eggs were more advanced than those at Pink Beds, which were in the first stages of division. The former eggs contained large embryos on which a pattern of spots could be made out. Unfortunately I tried to keep them to hatch and a large *D. monticola* was probably responsible for their entire disappearance. Both females were found in rotten logs on the banks of a stream.

No larvæ were found and it is to be doubted whether there is any definite aquatic larval stage.

The range in size was from 25-96 mm.

We caught 213 specimens, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
2550-4	4088-92	King's Creek	2500-3000	July 4
2556-8	4093-5	" "	"	" "
2502	4096	Camp	2200	July 3
2516	4131	"	"	" "
2521	4132	"	"	" "
2583-96	4133-46	"	"	" "

Field No.	Am. Mus. No.	Locality	Alt.	Date
2607	4167	Camp	2200	July 6
2627	4169	"	"	" 10
2640	4175	"	"	" 11
2642	4177	"	"	" 12
2646	4178	East side River near Wilson Br.	2100	" 13
2649	4179	Road to See-off	2600	" "
2662	4191	Creek north of See-off	3000	" "
2686	4340	Elk Lodge	2700	" 19
2688	4342	Camp	2200	" 20
2697	4350	East side R. (with eggs)	2300	" 21
2698	4351	Rt. Fork Cathey Creek	2400	" 24
2710-1	4360-1	Str. opp. Pisgah Forest	2400	" "
2716	4366	" " " "	"	" "
2737	4403-18	Pigeon Gap, Pink Beds	3300-4500	July 31-
"	4420-7	" " " "	"	Aug. 1
2745	4437	" " " " (with eggs)	3500	July
2765	4462	Williams Creek	2300	Aug. 4
2766	4468-9	" " "	"	" "
2754	4455-7	Pigeon Gap, Pink Beds	3300-4500	July 31-Aug. 1
2780	4492-3	Str. opp. Pisgah Forest	2200-2400	July 25
2782	4494	Elk Lodge	2500	" 19
2786	4497	Camp	2200	" 28
2796	4500	Between Pisgah Forest and Elk Lodge	2200	" 29
2800	4503	Brevard (Elk Lodge)	2300	" "
507	4509	Opp. Davidsons River	2600	Aug. 7
523	4525	Pineola	4100	" 14
539	4573-98	Linville	4200	" 16
548	4672-5	"	"	" "
561	4721-64	"	"	" 17
562	4765-7	"	"	" "
579	4943-5000	"	"	" 19

10. *Leurognathus marmorata* Moore.

Plate LIX, Fig. 3.

I refer one larva caught in Grandmother Creek just below the lake to this species. Moore's statement that *L. marmorata* is more aquatic than *Desmognathus quadramaculata*, the absence of adults or larvæ in small streams near Linville which we searched thoroughly, and this larva from Grandmother Creek, all go to show that this species inhabits large streams. On several occasions we noticed salamanders in the Linville River. All those we could catch however, turned out to be *Desmognathus quadramaculata*. The larva shows Desmognathine affinities in its stout hind legs,

glistening white gills, and dorsal fin only on the tail. No larvæ known have all these characters save those of *Desmognathus*. It is much too large (63 mm.) for *monticola*, which transforms at 30 mm., or *carolinensis* which is even smaller. In size and general appearance it agrees with larvæ of *D. quadramaculata* collected at Brevard and Linville. It differs however, in the much longer tail, the shorter and slimmer head, and the slimmer body.

Comparison of proportions of several larvæ:

Length	Head	Body	Tail	
63	8	24	31	<i>Leurognathus marmorata</i>
48	6	22	20	<i>Desmognathus quadramaculata</i>
52	8	23	21	" "
55	8	24	21	" "
59	9	25	25	" "
63	10	26	27	" "
63	10	31	22	" "

The eyes are larger and farther apart. The head of a *quadramaculata* larva bears more resemblance to that of a pig, while this unique larva rather resembles a squid with its great staring eyes.

The color is much darker, although the pattern seems about the same. There is no light line from the eye to the angle of the jaw, which line is quite evident in both larval and adult *quadramaculata*. Finally the under side of the throat is pigmented, reminding one of the larva of *Gyrinophilus danielsi*. The throat of *quadramaculata* larvæ is unpigmented.

While I think there can be no doubt that this larva is distinct from *D. quadramaculata*, I hesitated for some time before referring it to *Leurognathus marmorata*. *L. marmorata* differs very slightly in proportions from *D. quadramaculata*, and the color is usually lighter especially in young specimens. Thus the larva on hand would seem to differ from *L. marmorata* more than *D. quadramaculata* does. However there are only two possibilities; either this is the larva of *L. marmorata*, an animal known only from 5 specimens (4 of which are from the Atlantic drainage on the slopes of Grandfather Mountain), or there exist in the Atlantic drainage on the slopes of Grandfather Mountain two rather aquatic salamanders, much resembling *D. quadramaculata*, and known only from four adults and one larva respectively.

Field No.	Am. Mus. No.	Locality	Alt.	Date
515	4519	Grandmother Creek, just below the lake, Pineola, N. C.	3800	Aug. 13

11. *Gyrinophilus danielsi* (Blatchley).

Plate LIX, Fig. 4.

The larvæ of this species were not uncommon near Brevard, but we saw no adults save one, which Miss Thompson caught near Pink Beds.

They may be easily told from the larvæ of *Spelerpes ruber schencki* by their longer heads and slimmer bodies, by the pigmentation of the sides of the throat and middle of the chin, and by their not having the middle row of unpigmented larval areas so numerous or so close together. They reach a much larger size than do the larvæ of *S. r. schencki*. The characters given above will also serve to distinguish the larvæ of *G. porphyriticus* from those of *S. ruber*.

Examination of the skull of an adult in the National Museum has disclosed separate pre-maxillaries, and led to the reference of this species to the genus *Gyrinophilus*, confirming a suspicion which I had previously entertained on account of the coloration and general form of both adult and larvæ.

This species differs from *G. porphyriticus*, which it seems to replace in the Alleghenies south of Virginia and West Virginia, in having a spotted instead of a clouded coloration, and in having two distinct lines, a black and a white, from the eye to the nostril, whereas *porphyriticus* has only the light line distinct.

All the specimens were taken in the water of small streams, usually hiding under a half-submerged log or stone.

They range in size from 56 to 92 mm.

Specimens 7, all larvæ, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
2571	4147	Camp	2200	July 3
2570-1	4149-50	Rt. Fork Cathey Creek	3000	" 4
2715	4365	Str. opp. Pisgah Forest	2400	" 24
2735	4391	Pigeon Gap, Pink Beds	3500	Aug. 1
2746	4438	" " " "	"	" "
2773	4476	Camp	2300	" 5

12. *Spelerpes ruber schencki* *Brimley*.

Plate LIX, Fig. 5; Plate LX, Fig. 1.

We got 8 adults, 3 transforming young and 17 larvæ of red *Spelerpes*. All but one were taken near Brevard and are evidently of the form *S. r. schencki* *Brimley*.

Compared with *ruber* from Pennsylvania they have longer heads, shorter tails, and blacker chins. The dorsal coloration is somewhat clearer in that the edges of the spots do not run together as in specimens of *ruber* from Haverford, Pa. They are about the same size as Haverford *ruber* but seem to transform at a smaller size as the larvæ range from 28–59 mm., the transforming young from 57–72 mm., and the adults from 95–123 mm. Haverford larvæ reach a length of 110 mm., adults there ranging from 80–134 mm. I can detect no difference in the dentition between Brevard and Haverford specimens.

It will be noted that *schencki* agrees much more closely with Haverford *ruber* than with the Raleigh, N. C., form with which Brimley compared his types. This is explained by the fact that red *Spelerpes* from Raleigh agree in every particular with the type of *Spelerpes montanus* (Baird) in the National Museum, and should be referred to that species. *Montanus* has a dark ground color, very few spots, a very short head, and a very long tail. The series of vomerine teeth are closely approximated in front.

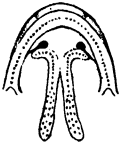


Fig. 4. *Spelerpes ruber schencki*, No. 4458. Roof of mouth to show dentition.  $\frac{2}{3}$ .

Series of red salamanders have been examined from Raleigh and Brevard, N. C., Alexandria, Va., Haverford, Pa., and Deer Island, Maine. Specimens from the last four localities agree in dentition, differing from Raleigh specimens in having the two vomerine series distinctly separated; while they also agree in general coloration, differing from Raleigh specimens in having many spots and no ground color.

Those from the last three localities agree with one another and differ from the Brevard specimens in lacking the black chin and in having the spots of adults somewhat diffuse and running together. Thus, adults of Haverford *ruber* approach in color adults of Raleigh *montanus*, but by a different process. In *montanus* the ground color grows dark and the spots have little to do with the general effect, being few and far between; while in *ruber* the ground color is practically lacking and the spots nearly cover the dorsal surface.

In proportions, Brevard specimens have the longest heads and the shortest tails. Maine and Raleigh specimens have the shortest heads and the longest tails. Specimens from Alexandria and Haverford are intermediate, those from Virginia being closest to those from Brevard. Thus there is a gradual change in the proportions of *Spelerpes ruber* from the North Carolina Mountains to the Maine Coast.

At Linville one specimen was taken. This lacked the black chin of *schencki*, but agreed with it in other respects. It is a rather young one

and thus the dorsal spots are noncommittal. However as Brimley states that specimens from Burnsville and Cane River also lack the black chin, it is probable that *schencki* as such is restricted to the mountains south of Asheville.

The habits of this form were quite similar to those of *ruber* as I have observed them at Haverford. Most of the adults and all of the larvæ and transforming young were taken in swampy springs. The Linville specimen and one adult from Brevard were found under logs some distance from the water. I have occasionally found *ruber* away from water at Haverford.

A noticeable difference was that *schencki* specimens were much less active and more easily caught than typical *ruber*. They seemed to be somewhat nocturnal, as several were caught wandering in the camp spring at night. This also agrees with observations made on *ruber* at Haverford.

The differences between larvæ of *S. r. schencki* and larvæ of *Gyrinophilus danielsi* have been dwelt on in the discussion of the latter. Save for the smaller average size there seems to be no difference between larvæ of *schencki* and larvæ of *ruber* from Alexandria and Haverford.

Specimens 27, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
2522	4148	Camp spring	2200	July 4
2597	4151	" "	2200	" 6
2598-600	4152-4	" "	"	" "
2617	4161	" "	"	" "
2628	4170	Low ground spring near Brevard	2100	July 10
2635	4162	Side of road near Camp	2200	" 11
2662	4189	See-off	3000	" 13
2689	4343	Camp spring	2200	" 20
2696	4349	Southeast of Brevard	2200	" "
2702	4355	Spring near Yonway (east side of river)	2700	" 21
2705	4358	Spring near Yonway (east side of river)	"	" "
2733	4386-7	Pigeon Gap, Pink Beds	500	Aug. 1
2746	4439	" " " "	"	" "
2749	4441	Camp spring	2200	July 29
2762	4458	Williams Creek	2100	Aug. 4
2764	4460-1	" "	"	" "
2768	4470	Low ground spring near Brevard	2100	" 5
2784-5	4495-6	Camp spring	2200	July 28
2797	4501	Near Pisgah Forest	2200	" 29
504	4506-8	Williams Creek	2100	Aug. 7
510	4514	Camp spring	2200	" "

13. *Spelerpes ruber ruber* (Daudin).

While I have not seen Daudin's original description of *Salamandra rubra*, there is no doubt that the form occurring at Philadelphia is the one which has borne the name for many years. As noted above, the specimen from Linville agrees more closely with the northern race of *Spelerpes ruber*, to which I therefore refer it.

One specimen, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
574	4852	Linville	4100	Aug. 19

14. *Spelerpes guttolineatus* (Holbrook).

Plate LIX, Fig. 6 and 7; Plate LX, Fig. 2.

We caught this beautiful salamander only at Brevard below 2500 ft. It seemed to be nocturnal and a good deal of a wanderer. On our night trips after frogs we saw this species several times. They could be found after the flood under debris at high water mark, where they had been driven from the low ground ditches which formed their natural habitat. They were more agile and difficult to catch than even *Desmognathus quadramaculata*. "Guttos," "quads," and the big new Linville plethodons we called "Yonahlossees" (sp. nov. *Plethodon yonahlossee*), always gave us an exciting chase before we got them in the bucket or gave them up for lost.



Fig. 5 *Spelerpes guttolineatus*, No. 4157. Detail of mouth to show dentition.  $\frac{2}{1}$ .

While probably most nearly related to *S. longicaudus* (their ranges are adjoining and do not overlap) as will be shown in the discussion of larvæ, they differ in the greater agility, the larger size, and the much greater amount of black pigment. The markings of the one are easily derivable from those of the other, as Cope showed.

The vomerine teeth of this species are in two long series which practically touch at the posterior end. In one specimen they parallel each other for  $\frac{1}{4}$  of their length, approaching the parasphenoid series to the same distance.

We got quite a series of larvæ, and as the larva of this species has not to my knowledge been described before (McAtee in the 'Life-history of *Spelerpes maculicaudus*' mentions large larvæ of *S. guttolineatus*, but by the description of these it is probable that they were specimens in the National Museum so labeled, which, while resembling *guttolineatus* in color to a remarkable degree, differ widely from it in structure, and are in fact



larvæ of some species of *Ambystoma*; I refer to U. S. N. M. No. 3733, from New Madrid Co., Missouri), I may be pardoned for entering into a discussion of the stages in the development of its coloration, and a comparison with other *Spelerpes* larvæ. The larvæ ranged in length from 19–38 mm. A specimen in some stage of transformation 45 mm. long was also taken.

In the small 19 mm. larva the three series of unpigmented larval areas are quite evident. There are 10 in the upper row, 11 in the middle, and about 25 in the lower. The numbers of areas in a row are more or less variable in all the species I have examined, so that their condition or fate is more characteristic than their number. The areas of the lower row are nearly confluent. Pigment is present in a band ventral to this third row.

In *bislineatus* larvæ of the same size the third row is not apparent. In larger larvæ of *bislineatus* it appears as a very indistinct row ventral to most of the pigment. The third row in larvæ of *longicaudus* is quite indistinct (only large larvæ have been seen), but when evident appears to be confluent as in *guttolineatus*, the difference being chiefly in the amount of pigment ventral to it, which is much greater in *guttolineatus*.

In later stages of *guttolineatus* the third row is confluent and forms a distinct light line between the bases of the legs. The pigment ventral to it remains a stripe until metamorphosis when it spreads over the belly. The middle row is the least distinct of the three in *guttolineatus*. It is always composed of small areas, and is seen most plainly in transforming specimens or young adults as a row of light spots on the lateral dark band. Its condition in *bislineatus* is quite similar but it does not appear until later. It is very indistinct in *longicaudus*, and is scarcely visible after metamorphosis, owing to the breaking up of the lateral dark band into a row of spots. The dorsal areas become confluent at a very early stage in both *guttolineatus* and *longicaudus*. They are not entirely confluent in *bislineatus* until metamorphosis. Furthermore in *guttolineatus* and *longicaudus* the pigment gathers as a band ventral to the dorsal row, while in *bislineatus* the pigment gathers between the areas of the dorsal row, forming an interrupted stripe. Thus the prominence of the third row distinguishes *guttolineatus* from either *longicaudus* or *bislineatus*, while the early confluence of the dorsal areas distinguishes the first two from the latter. The indistinctness of the middle row distinguishes *longicaudus* from large larvæ of *bislineatus*.

The three larvæ discussed above can easily be told from larvæ of either *schrencki* or *danielsi* by the lightness of the dorsal region as compared with the sides.

It will be apparent that the coloration of larval as well as adult *longicaudus* can be derived from that of *guttolineatus* by the simple subtraction of black pigment. *Longicaudus* apparently replaces *guttolineatus* in the Appalachian Valley and other limestone regions.

In regard to the frequent statement of the close relationship between *longicaudus* and *maculicaudus*, it should be noted that they remain distinct while occurring together throughout a great part of their range. The spotting of adult *maculicaudus* agrees more closely with that of *ruber* as Cope stated. The ground color of both is red and not yellow. So far as I know *ruber* and *maculicaudus* do not occur together. It may be pertinent in this connection to refer to Blatchley's specimen from eastern Tennessee, which according to his description, could be referred to either *ruber* or *maculicaudus* with equal propriety.

While the relationships of the species of *Spelerpes* are quite uncertain as yet, it seems to me that the above suggestion has some probability to recommend it and should at least be investigated more thoroughly.

Specimens 20, 8 adults, 1 transforming, 11 larvæ, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
2612	4156	Low grounds near Brevard	2100	July 6
2613	4168	" " " "	"	" "
2622	4157	" " " "	"	" 10
2625-6	4158-9	Low ground spring near Brevard	"	" "
2629-32	4171-4	" " " " "	"	" "
2644	4160	River Road across from Brevard	"	" 13
2691-5	4344-8	Low ground spring near Brevard	"	" 20
2727	4368	Elk Lodge Mt.	2400	" 9
2763	4459	River Road across from Pisgah Forest	2100	" 25
2791	4498	Ditch in low grounds, Brevard	"	" 29
2798	4502	Under plank on hillside near Pisgah Forest	2200	" 29
2690	4710	Low ground spring near Brevard	2100	" 20

### 15. *Spelerpes bislineatus* (Green).

Plate LIX, Figs. 2 and 8; Plate LX, Figs. 3 and 4.

We found the larvæ of this species common in every small stream examined, and even in those as large as the Linville River. Adults were found rarely at Brevard. Only one adult and one transforming specimen were taken near there. At Linville both adults and larvæ were common, but adults were found only on land under logs in situations similar to those chosen by various *Plethodons* and by *Desmognathus o. carolinensis*, in fact often in company with these species.

There is great variability in color among the 13 adults collected at Linville. Some have a more sharply defined black band than any northern

specimens seen; others are uniformly sprinkled with small spots and there is little or no trace of a band. These extremes grade into each other. They differ, however, from northern specimens in the very narrow head, and the usual absence of dark mottling ventral to the black stripe. This definiteness of marking in the striped specimens makes them very beautiful. On the tail the stripe is broken up into a row of spots.

It is with some doubt that I let this form stand as *bilineatus*. The existence of specimens without stripes and others which have the sides mottled indicates a variability in color which exceeds that of northern specimens in any direction. The fact that the stripe is broken up on the tail in all the specimens seems constant but is scarcely sufficient to serve as a basis for a new race.

This might also be merely a summer form, and the color differences the effect of a land residence. The head is narrow in all the specimens, and nearly all have marked labial cirri. Contrary to Cope's supposition this is not a larval character and is not homologous with the balancers of *Ambystoma* larvæ. Larvæ of *Spelerpes* do not have these cirri (or balancers either, so far as known) and the cirrus itself is a projection of the outside edge of the naso-labial groove, which groove is not present in larvæ, and is only found in adults of the Plethodontidæ. Cirri are individual characters of no systematic importance in *S. guttolineatus*. Their value in each form, however, must be determined for that form as far as possible and not through analogy.

The adults ranged from 36-75 mm. in length; larvæ from 17-37 mm.; a transforming specimen was 40 mm. long.

Specimens 38: 14 adults, 1 transforming, 23 larvæ, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
2608	4155	Camp	2300	July 6
2681-3	4335-7	Spring near Pisgah Forest	2200	" 19
2700-1	4353-4	Cathey Creek	2800	" 24
2703-4	4356-7	Yonway Spring (across from Brevard)	2700	" 21
2753	4454	Pink Beds	3500-4000	Aug. 1
2792	4499	Low ground ditch near Brevard	2100	July 29
516	4520-1	Grandmother Creek	3800	Aug. 13
540	4599-600	Linville	4100	" 16
544	4664-5	"	"	" "
552	4678	"	"	" "
557	4699-701	"	"	" 17
558	4702-9	"	"	" "
576	4857-63	"	"	" 19
597	5052	Midway Mills, Va.	500	" 29
602	5053	" " "	"	" 30

## Family SALAMANDRIDÆ.

16. *Notophthalmus viridescens Rafinesque.*

I cannot agree with Brimley's statement that "this species would appear to live in water only during the cooler portions of the year and to æstivate on land under dead logs and similar hiding places," for we found both land and water forms common in midsummer, and all of the land form were small immature specimens, ranging from 63–95 mm. in length; while the water form was larger: 92–120 mm. in length.

We got 50 specimens, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
2717	4367	Camp (Land form)	2200	July 14
2731	4379–85	Pink Beds (Water form)	3000–3200	" 31–Aug. 4
514	4515–18	Grandmother Lake (Water form)	3800	Aug. 13
520	4524	Near " " (Land form)	3800	" 14
526	4531–2	Lost Cove Creek (Water form)	2300	" "
532	4534	Grandmother Mt. (Land form)	3500	" 15
535	4560–72	Linville (Land form)	4100	" 16
554	4679–98	" " "	"	" 17
573	4851	" " "	"	" 19

## Order SALIENTIA.

## Family HYLIDÆ.

17. *Hyla pickeringi (Storer).*

We heard peepers nearly every night we were at Brevard; *i. e.*, from July 1–Aug. 5. Specimens caught were up in bushes in swampy places about five feet from the ground.

Two specimens, as follows:

4270	July 18	Brevard low grounds, alt. 2100 ft.
4307	Aug. 5	" " " " " "

18. *Hyla versicolor Le Conte.*

These tree-frogs also were heard all the time we were at Brevard. Specimens caught were on vegetation in swamps not more than a foot from the water.

Four specimens as follows:

4271–2	July 18	Brevard low grounds, alt. 2100 ft.
4313–4	Aug. 5	" " " " " "

19. *Acris gryllus* (*Le Conte*).

Heard nearly every night at Brevard. Some were caught in flooded pastures on grass just above water.

In the five specimens, the hind foot less tarsus is equal to or less than half of the length of head and body. The stripe on the femur is quite distinct. Thus these specimens do not fill the requirements of either *A. g. gryllus* or *A. g. crepitans*, but are intermediate.

5 specimens, as follows:

4308-12 Aug. 5 Brevard low grounds, alt. 2100 ft.

## Family BUFONIDÆ.

20. *Bufo americanus* *Le Conte*.

Common at Brevard and as high as we went on the mountains. One caught on top of Green Knob in the Balsams at 5000 feet was identified in the field as this species, but it got out of the collecting bag and was lost. All that we caught were solitary, silent, and away from water.

In view of the difficulty of separating specimens of this form from the quite distinct *Bufo fowleri*, it may be as well to give the characters used in separating the North Carolina mountain series in order of their constancy in that series.

1. In *americanus* the post-ocular ridge sends a projection back at a right angle to meet the short, thick parotoid. In *fowleri* the long narrow parotoid is approximated to the post-ocular ridge itself, and there is no projection from the ridge to the parotoid.

2. The snout of *americanus* is much more flaring than the snout of *fowleri*. That is, the angle made by the top and sides of the head is greater in *americanus* than in *fowleri*. Thus in looking at the head from above, the muzzle can be seen around the eyes of *americanus* while the eyes of *fowleri* form part of the outline. This character is especially emphasized in old specimens of *americanus*.

3. The warts of *americanus* are larger and often arranged singly in a dorsal spot, while in *fowleri* the warts are smaller and usually arranged 3-7 in a spot.

4. The crests of *americanus* are much more pronounced than those of *fowleri*. This is more noticeable in comparing adults of the two species.

5. *Americanus* is larger than *fowleri*.

6. The belly of *americanus* is usually more spotted than the belly of *fowleri*.

Specimens 18, as follows:

Am. Mus. No.	Date	Locality	Alt.
4039	July 2	Camp	2200
4040	" 3	"	"
4043	" 5	"	"
4047	" "	"	"
4050	" "	"	"
4052-3	" 6	"	"
4055	" "	"	"
4057	" 11	"	"
4274	Aug. 1	Pink Beds	4000
4275-6	July 21	Rich Mt.	3000
4278	Aug. 4	Glen Canyon	2500
4280	" 5	Camp	2200
4317	" 7	Davidson River	2200
4322-3	" 15	Grandmother Mt.	4000
4324	" 21	Pineola (Mortimer)	3000

#### 21. *Bufo fowleri Putnam.*

Heard nearly every night at Brevard. There were great choruses of the males in the recently flooded low grounds. Now and then a solitary voice was raised from some small swamp or ditch. They did not range above 2700 feet.

Specimens 41, as follows:

Am. Mus. No.	Date	Locality	Alt.
4041	July 3	Camp	2200
4042	" 4	Chestnut Knob	2700
4044-6	" 5	Camp	2200
4048-9	" "	"	"
4051	" "	"	"
4059	" 6	"	"
4273	" 18	Low grounds	2100
4279	Aug. 5	Camp	2200
4281-306	" "	Low grounds	2100
4325	" 21	Pineola (Mortimer)	2700
4326-8	" 23-5	Midway, Va.	500

Family RANIDÆ.

22. *Rana palustris* *Le Conte.*

Not uncommon at Brevard and at Linville. The note was not heard. Specimens 5, as follows:

Am. Mus. No.	Date	Locality	Alt.
4269	July 17	Brevard	2100
4277	" 21	"	"
4329	Aug. 13	Pineola	3000
4333	" 17	Linville	4200
4334	" 30	Midway, Va.	500

23. *Rana clamitans* *Daudin.*

Common at Brevard and at Linville. We heard the characteristic croak of this species at both places. None of the specimens has the yellow or whitish stripe from the nostril to the angle of the mouth, which Rhoads mentions in referring green frogs from Roan Mt. to *Rana clamitans melanota* (Rafinesque).

Specimens 4, as follows:

Am. Mus. No.	Date	Locality	Alt.
4054	July 6	Brevard	2100
4058	" 11	"	"
4331	Aug. 14	Lost Cove Creek	2000
4332	" 17	Linville	4200

24. *Rana catesbeiana* *Shaw.*

Common at Brevard. Its powerful bass note formed part of the chorus that serenaded us every night from the flooded low grounds.

Specimens 3, as follows:

Am. Mus. No.	Date	Locality	Alt.
4056	July 6	Brevard	2100
4315	" 29	"	2200
4330	Aug. 14	Lost Cove Creek	2300

## Class REPTILIA.

## Order TESTUDINATA.

## Family CHELYDRIDÆ.

25. *Chelydra serpentina* (Linn.).

A shell was seen on the railway embankment at Hendersonville.

## Family EMYDIDÆ.

26. *Clemmys nuchalis*, new species.

## Plate LXI.

Type: Am. Mus. No. 8430 (Field No. 569), collected on side of Yonahlossee Road, about 3 miles from Linville, North Carolina, August 17, 1916. Altitude, 4200 feet.

Diagnosis.—Very similar to *Clemmys muhlenbergi* (Schoepff), but with a longer nuchal plate, with the temporal blotch forked ventrally, and the female, at least with a flatter and broader shell.

The above differences are quite small, but as there is at present a con-



Fig. 6.



Fig. 7.

Fig. 6. *Clemmys nuchalis* sp. nov., No. 8430. ♂.

Fig. 7. *Clemmys muhlenbergi*. ♂.

siderable gap between the known distribution of the two forms, I think it best to emphasize their probable distinctness.

We collected four specimens of this form, three females from Brevard and a male from Linville. Of *C. muhlenbergi* 19 specimens, 13 males and 6 females, have been examined. These included the entire collection of the



American Museum of Natural History, the Philadelphia Academy of Natural Sciences, the National Museum, and Smith College. Thus probably most of the specimens of *C. muhlenbergi* in collections have been seen. They come from the following localities, to which I have added such records as I could find in literature.

Rhode Island: Newport.<sup>1</sup>

New York: Cayuga Lake Basin.<sup>2</sup>

New Jersey: Tenafly, Gloucester Co.; Hackensack; Palermo;\* Trenton;\* Medford;\* Sayreville, Middlesex Co.; Audubon, Camden Co.\*

Pennsylvania: West Bradford; Kenneth Square, Chester Co.; Tinicum;\* Upper Darby, Delaware Co.

Murphy does not give it in his list of Long Island turtles in Copeia 33, nor does Fowler give it in his list from Cecil Co., Maryland. The Pennsylvania records from Chester County are the only ones from more than 100 feet elevation.

The range in length of carapace of *C. nuchalis* is in the females 79–93 mm., the male measuring 98 mm.

In *muhlenbergi* the same measurement gives for females 60–90 mm., and for males 84–98.

The sexes of either form may easily be told by the size and length of the tail which is much longer and thicker in males. The proportions of the shell of the two sexes are also different, the males being narrower and lower.

With age, females of *muhlenbergi* show a gradual decrease in proportional width. They are always proportionally higher than female *nuchalis*. When small, female *muhlenbergi* are as broad as female *nuchalis*, but the adults are narrower. Thus in females of *muhlenbergi* the width forms 72.22 to 81.6 per cent of the length. The same ratio in female *nuchalis* is 75.93 to 78.65 per cent. If however, we omit the smallest two *muhlenbergi*, leaving in our ratios only those of both forms over 79 mm., we have for *muhlenbergi* 72.22 to 75.08, and for *nuchalis*, 75.93 to 78.65. The height forms 44.11 to 46.66 per cent of the length in female *muhlenbergi*, and 41.23 to 43.85 per cent in female *nuchalis*. The height of female *muhlenbergi* does not seem to change with age as the extremes of the above ratios are represented by the two small ones. The ratio of height to width for female *muhlenbergi* is 55.55 to 63.33 per cent, for *nuchalis* 52.42 to 57.74 per cent, but omitting again the two small specimens of *muhlenbergi*, we have for that species 59.25 to 63.33 per cent.

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\* From literature.

<sup>1</sup> Babcock, H. L. Copeia, No. 42, April, 1917, p. 32.

<sup>2</sup> Reed, H. D., and Wright, A. H. Proc. Amer. Phil. Soc., Vol. 48, p. 409.

The length of the nuchal plate ranges from 6 mm. to 7.1 mm. in female *nuchalis*, and from 4 mm. to 6 mm. in female *muhlenbergi*. It is included in the length of carapace of female *muhlenbergi* from 13.6 to 16.4 times, and in that of female *nuchalis* from 12.7 to 13.2 times. No variation with age is apparent.

The one male agrees in bodily proportions with male *muhlenbergi*, as will be apparent from the following table:

Male <i>C. muhlenbergi</i>		Male <i>nuchalis</i>
Ratio of height to length	36.17-43.18	39.79
Ratio of width to length	63.15-75.51	72.44
Ratio of height to width	49.27-61.29	54.92

The nuchal plate of the one male is 8 mm. long. Nuchals of male *muhlenbergi* range from 4.9 to 7 mm. in length. They are contained in the carapace 12.8 to 19 times, while that of *nuchalis* is included 12.2 times.

In the four specimens of *nuchalis* the temporal blotch is almost cut in two by a deep narrow invasion of the ground color from the ventral side. This is rather different from the state of affairs in the *muhlenbergi* I have seen, in which the blotch is at most kidney-shaped and usually has no indication of a ventral notch.

Probably the specimens of "*Clemmys muhlenbergi*" which Yarrow recorded from Statesville, North Carolina, were this form. They are now lost. It may be worth while to add that Brevard is Mississippi drainage, whereas Linville and Statesville are Atlantic. The first is on the French Broad River, and the two latter on branches of the Catawba and Yadkin respectively.

Of the Brevard specimens, one was caught in a swamp, one in a shallow ditch, and one was given to us, having been caught wandering on a lawn. All three were found at about 2100 feet. The Linville specimen was caught away from the water, on the side of the Yonahlossee Road at 4200 feet.

Sex	Am. Mus. No.	Field No.	Length of Carapace	Width	Height	Nuchal
Female	8264	2643	89	70	36.7	7
"	8389	2720	79.2	62	33.7	6
"	8403	2767	93.5	71	41	7.1
Male	8430	569	98	71	39	8

### 27. *Terrapene carolina* (Linn.).

Very common around Brevard, but does not seem to range above 2500 feet.

Specimens 5, all from the neighborhood of Brevard, Nos. 8263, 8386, 8387, 8388, 8429.

Order SAURIA.

Family IGUANIDÆ.

28. **Sceloporus undulatus** (*Latreille*).

Common at Brevard. Not seen at Pink Beds or Pineola. It ranges up to 3000 feet on See-off, and to about the same altitude along Lost Cove Creek between Pineola and Mortimer. Young were seen first on August 14.

Specimens 6, as follows:

Am. Mus. No.	Locality	Date	Alt.
8338	See-off	July 13	3000
8390	Brevard	" 17	2300
8391	Camp	" 20	2200
8392	"	" 26	"
8393	Brevard	" 29	2300
8431	Lost Cove Creek	Aug. 14	2500 (young of the summer)

Family SCINCIDÆ.

29. **Plestiodon quinquelineatus** (*Linn.*).

Generally distributed around Brevard. All seen had light stripes and a blue tail except one specimen which Miss Thompson had at Pink Beds. Our altitude record for *P. quinquelineatus* is 3800 feet on Cedar Rock, where one came out from and went back under a rock which was sheltering at the same time a rattler and a copperhead. One specimen was taken near Mortimer, on Aug. 21, at 2000 feet, No. 8432.

Order OPHIDIA.

Family NATRICIDÆ.

30. **Natrix septemvittata** (*Say*).

We found these snakes common at Brevard, where they frequent small streams and lie on willow trees over the water. Near Pineola two were caught together under a railway tie in an abandoned logging road some

distance from water. Both were females, and one of them gave birth to 11 young. Birth was somewhat premature in this case and the characters of the young could not be recorded. Not so with a female caught at Midway, Va., which gave birth, after arrival in New York, to eight well-developed young. In color the specimens are quite uniform and show no approach to the pattern of *grahami*. The strong sexual difference in the subcaudals is noteworthy. The young varied in length from 188 mm. to 200 mm. The tail of each of the three females was 50 mm. in length, those of the five males ranged from 55 mm. to 60 mm.

Specimens 13, as follows:

Am. Mus. No.	Sex	Locality
8395	Female	Brevard
8396	Male	"
8422	Female	Pineola
8421	"	"
8427	"	Midway
8428	(young of 8427)	

No.	Length	Tail	Ventrals	Caudals	Labials	Oculars	Temporals	Scale-rows	Navel
8395	226	53	133	66	6-7/10	2-2	1-2	19-17	118
8396	297	81	135	81	7/10	"	"	"	118
8422	610	153	139	70	"	"	"	"	
8421	550	134	136	67	"	"	"	"	
8427	485	130	136	67	"	"	"	"	
8428	Female		137	68	"	"	"	"	120
"	"		137	72	"	"	"	"	119
"	"		143	74	"	"	"	"	124
"	Male		136	80	7/8-9	"	"	"	118
"	"		139	82	7/9-10	"	"	"	122
"	"		138	85	7/8-10	"	"	"	121
"	"		142	86	7/10	"	"	"	125
"	"		137	82	7/9-10	"	"	"	120

### 31. *Natrix sipedon* (Linn.).

Common at Brevard. (Miss Thompson had several at Pink Beds.) Captured four specimens, all from near Brevard. The oculars and temporals are the same throughout the series and are 1-3.

No.	Length	Tail	Ventrals	Caudals	Labials	Scale-rows	Bands on Neck
8336	419	54	134	?	8-9/10	21-23-17	14
8339	1042	245	136	63	8/10	23-17	10
8394	267	67	133	67	8/10	23-17	9
9397	940	223	137	72	8/10	23-25-17	7

32. **Thamnophis sirtalis** (*Linn.*).

Besides specimens taken at Pink Beds and Linville, we saw a dead one near Brevard at 2500 feet. The scale counts of the four garter-snakes are given. The coloration was that of typical *sirtalis*. I would like to call attention to the number of scale-rows, 21-17 in the Pink Beds specimen. Ruthven says that 598 out of 600 *sirtalis* examined had the count 19-17. The other two, from Florida, had 19-21-17. Hence this specimen has the highest scale count known in *sirtalis*.

Specimens 4, as follows:

No.	Length	Tail	Ventrals	Caudals	Labials	Oculars	Temporals	Scale rows
♀ 8374	545	130	145	63	7/8-9	1-3	1-3, 2	19-17
♀ 8400	611	122	146	63	7/9-10	1-4	1-2	21-17
♀ 8424	493	70	140	35	7/9	1-3	1-3, 2	19-17
♀ 8425	536	105	142	48	7/10-9	1-3	1-2	19-17

Nos. 8374, 8424, 8425 were from Linville, alt. 4200 feet; no. 8400 was from Pink Beds, 4000 feet.

33. **Storeria occipitomaculata** (*Storer*).

We got one at Pineola (alt. 3800 feet) (and Miss Thompson had one at Pink Beds).

No.	Length	Tail	Ventrals	Caudals	Labials	Oculars	Temporals	Scale-rows
♀ 8416	210	55	116	56	6/7	2-2	1-2	15

34. **Coluber constrictor** (*Linn.*).

Two were seen but not caught near Brevard (alt. 2200 feet). A shed was seen near Linville at 4100 feet. A black snake was seen near Mortimer, at 2000 feet.

35. **Elaphe obsoleta** (*Say*).

We caught one on Green Knob Mountain, altitude 3500 feet.

No.	Length	Tail	Ventrals	Caudals	Labials	Oculars	Temporals	Scale-rows
♀ 8399	1551	348	230	83	8/11-12	1-2	2-3	25-27-19

36. *Lampropeltis getulus* (Linn.).

A dead one found near Brevard, at 2300 feet, is our only record.

37. *Lampropeltis triangulum* (Boie).

We caught one coiled under a flat rock in an open field near Chestnut Knob Mountain, at 3500 feet, and one at Pineola at 3800 feet. (Miss Thompson had one at Pink Beds.)

In color the two specimens are examples of Cope's "*triangula*" and "*collaris*." The body spots of the "*collaris*" (No. 8258) reach the second row of scales anteriorly and posteriorly and the fourth row in the middle of the body. It seems futile to attempt to split the forms of milk snake with light postocular bands into subspecies, for no definable range can be given such forms. I think it best to regard these specimens (and others from the southern mountain) as simply rather variable representatives of the regular northern milk snake, extending southward in the mountains, as do so many other northern forms. In this I follow Dr. Stejneger.

	No.	Length	Tail	Ventrals	Caudals	Labials	Oculars	Temporals	Scales	Locality
♂	8258	558	71	207	41	7/9	1-2	2-3	21-18	Brevard
♂	8420	740	97	190	36	7/9	1-2	2-3	21-17	Pineola

38. *Diadophis punctatus* (Linn.).

Very common everywhere. We caught them from 1300 feet, near Collettsville, to 4200 ft., at Pink Beds and at Pineola. Usually found under bark of decayed logs. Four were caught in one such log on Cedar Rock. One or two others were roaming about.

The fifteen specimens vary chiefly in the color of the belly. In four there is a median series of spots, which in one specimen extends on to the anterior part of the tail. In two there are many scattered spots on the ventral surface and in one of these specimens the throat is spotted also. These six specimens are nos. 8417, 8426, 8408, 8410, 8411, 8419 in the order named. Three are large and three are small. Three are males and three are females. Hence this is not correlated with sex or age. The other nine specimens are immaculate beneath. The neck ring is interrupted dorsally in two of the smallest specimens.

The upper labials are usually eight but in other species seven. One of our specimens shows how this may take place, as it has seven on one side and eight on the other. The addition occurs anterior to the eye by the

splitting of the third plate, or contrariwise the reduction is caused by the dropping out of the third plate in specimens with eight.

1 2 3 4 eye 5 6 7 8  
 1 2 4 " 5 6 7 8

The lower labials may be 8 or 9. Here also the change occurs anterior to the eye, and is a matter of whether 5 or 6 plates touch the anterior genials.

1 2 3 4 5 6 | 7 8 9  
 1 2 3 4 6 | 7 8 9

It is odd that there should be so little difference between the caudal count of males and females. The scale rows are always 15, and the oculars are quite constantly 2-2.

No.	Length	Tail	Ventrals	Caudals	Labials	Temporals	Locality
♀ 8398	242	59	151	59	8/8	1-1	Pink Beds
♀ 8404	274	60	157	57	"	1-2	Brevard
♀ 8407	317	74	157	51	"	1-1	Cedar Rock
♂ 8408	330	80	161	57	"	1-1	" "
♀ 8409	350	71	162	52	"	"	" "
♂ 8410	283	70	151	57	8/9	"	" "
♂ 8411	322	84	153	62	8/8	"	" "
♂ 8412	381	90	151	59	8/9-8	"	Pineola
♂ 8413	382	87	158	56	8/8	"	"
♀ 8414	370	90	151	59	"	"	"
♂ 8415	372	92	151	58	"	"	"
♀ 8417	176	40	157	58	"	"	Linville
♀ 8418	194	50	163	60	8/9	"	"
♀ 8419	226	50	156	53	8-7/8	"	"
♀ 8426	324	90	165	50	8/8	"	Adako

### 39. *Carphophis amœnus* (Say).

Fairly common near Brevard. We always got it under slabs of bark on the ground in woods. Although most of our collecting at Linville was in exactly such localities, we did not find it there.

Labials 5/6, oculars 1-1, temporals 1-1, scale-rows 13.

No.	Length	Tail	Ventrals	Caudals	Locality	Altitude
♂ 8257	190	35	123	37	Chestnut Knob	3000
♂ 8261	226	43	123	37	See-off	3000
♂ 8262	242	46	116	37	"	"
♂ 8405	220	43	125	37	opp. Pisgah Forest	2500
♀ 8406	190	27	126	29	" " "	"

40. *Heterodon platirhinos* Latreille.

One was caught in the low grounds near Brevard. A dead one seen on the railroad track between Mortimer and Collettsville was very large (well over three feet) and entirely black save for the mid portions of the ventrals which were white. They were reported as very common in the French Broad low grounds, but the high water prevented our searching for them. and in all probability this high water caused great mortality among snakes. This species is interesting because the scale rows in dropping from 25-19, are not lost in the manner of the usual *Coronelline* or *Natricine* snake as Ruthven and J. C. Thompson have ascertained it, but in the manner given by Thompson for the snakes of the family *Boiginae*.

The formula for *Heterodon* as derived from this specimen and three others (Raleigh, N. C., 1; Nelson Co., Va., 2) is 27-V, 25-IV, 23-XIII, 21-IV.

In a normal *Coronelline* or *Natricine* snake the rows dropped are adjacent ones, but in *Heterodon* and the back-fanged snakes a row on each side of the median is dropped at about the level of the gall-bladder.

No.	Length	Tail	Ventrals	Caudals	Labials	Oculars	Temporals	Scale-rows
♀ 8337	248	45	126	55	8/10-11	11-10	3-3	25-19

## Family CROTALIDÆ.

41. *Agkistrodon contortrix* (Linn.).

The copperhead (here called "pilot") is well known but not common. We saw only one specimen at 3800 ft. on Cedar Rock. It went under a slab of rock which we were unable to move. On a collecting trip of similar character and duration in the mountains of Virginia, we should probably have taken more copperheads than any other kind of snake.

42. *Crotalus horridus* Linn.

Rich Mt. (2500 ft.), Green Knob Mt. (4000 ft.), and Cedar Rock Mt. (3800 ft.). The last specimen was not captured as it was under a great slab of rock. Poking around the edges caused it to retreat into a hollow underneath, and brought to light a skink and a copperhead which also escaped into the interior. In regard to the scale row count of the two speci-



mens it is noteworthy that *Crotalus* shows the same type of row dropping evinced by *Heterodon*, and according to Thompson, by the *Boiginæ*.

The formula is: — 23–XI, 21–V, 19 cont.

No.	Length	Tail	Rattle	No. of Rattles	Ventrals	Caudals	Scale-rows
♀ 8401	1155	55	75	13	171	18	23–19
♀ 8402	985	50	50	11	170	18	23–19

*Reptilian Eggs.*—Two sets of eggs were found. One set consisted of 20 eggs, 32 by 22 mm., found on July 13 under a rock in a field east of the river near Brevard at 2100 feet. A shed of the blacksnake (*Coluber constrictor*) was under the same rock. Development had not advanced far enough to permit of the identification of the embryos beyond the fact that they were snakes. The second batch was of 3 eggs, 27 by 7 mm., found under a rock in a field near Chestnut Knob Mt., at about 3000 feet, July 3. In these the embryos were so undeveloped that it was impossible to tell whether they were lizards or snakes.

No. 8259, 3 eggs      No. 8260, 19 eggs.

EXPLANATION OF PLATES LVII–LXI.

Drawn by Makoto Nishimura.

PLATE LVII.

Figs. 1 and 2. *Plethodon yonahlossee* sp. nov., Am. Mus. No. 4634, in side and dorsal views, slightly under natural size.

Fig. 3. *Plethodon yonahlossee*, Am. Mus. No. 4666.  $\frac{1}{2}$ .

Fig. 4. *Plethodon metcalfi*, Am. Mus. No. 4838.

Fig. 5. *Plethodon glutinosus*, Am. Mus. No. 4789, slightly under natural size.

All from Linville, 4200 ft. elevation.

PLATE LVIII.

Figs. 1 and 2. *Desmognathus quadramaculata*, Am. Mus. Nos. 4768, Linville, 4200 ft., and 4364, stream opposite Pisgah Forest, 2400 ft.  $\frac{1}{2}$ .

Fig. 3. *Desmognathus monticola*, Am. Mus. No. 4375, Elk Lodge Mt., 2400–2700 ft.  $\frac{1}{2}$ .

Fig. 4. *Desmognathus monticola*, Am. Mus. No. 4555, Linville, 4000 ft.  $\frac{2}{3}$ .

Fig. 5. *Desmognathus monticola*, Am. Mus. No. 4060, Brevard, 2300 ft.  $\frac{3}{4}$ .

Figs. 6, 7, 8, and 9. *Desmognathus ochrophæa carolinensis*, Am. Mus. Nos. 4950, 4948, 4955, and 4980, Linville, 4200 ft.  $\frac{2}{3}$ .

## PLATE LIX.

Larvæ. All twice natural size.

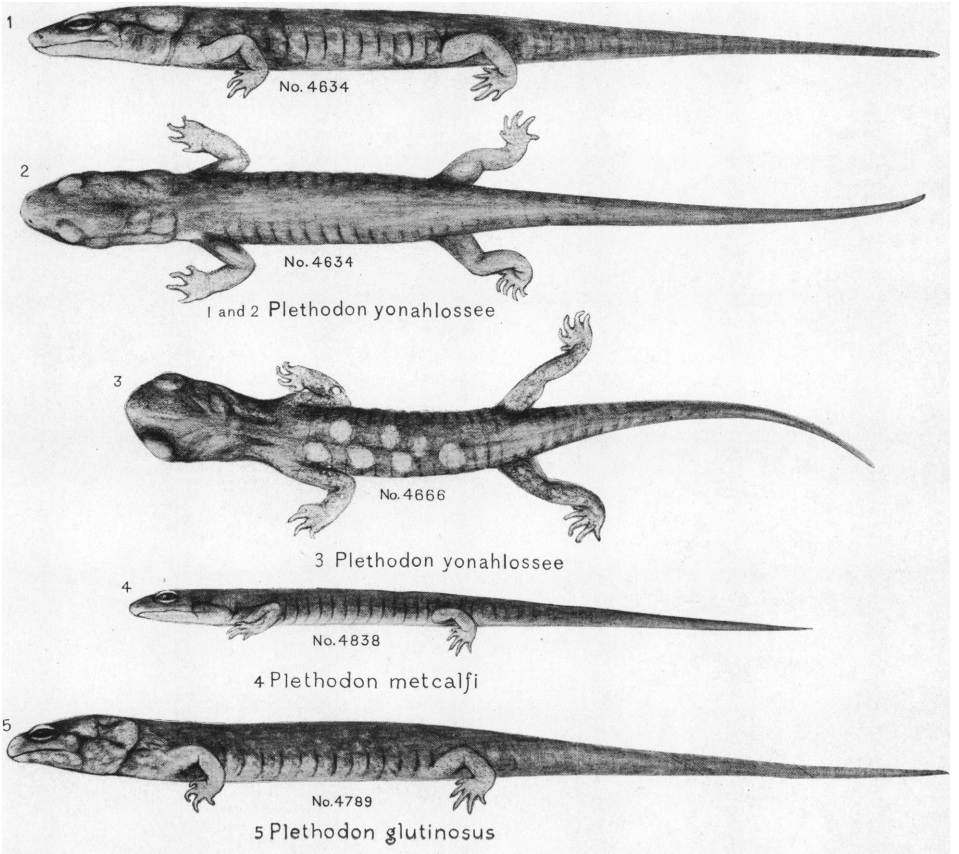
- Fig. 1. *Desmognathus quadramaculata*, Am. Mus. No. 4550, Linville, 4200 ft.  
 Fig. 2. *Spelerpes bislineatus*, Am. Mus. No. 4499, Brevard, 2100 ft.  
 Fig. 3. *Leurognathus marmorata*, Am. Mus. No. 4519, Pineola, 3800 ft.  
 Fig. 4. *Gyrinophilus danielsi*, Am. Mus. No. 4391, Pigeon Gap, Pink Beds, 3500 ft.  
 Fig. 5. *Spelerpes ruber schencki*, Am. Mus. No. 4343, Brevard, 2200 ft.  
 Fig. 6. *Spelerpes guttolineatus*, Am. Mus. No. 4348, Brevard, 2100 ft.  
 Fig. 7. *Spelerpes guttolineatus*, Am. Mus. No. 4498, Brevard, 2100 ft.  
 Fig. 8. *Spelerpes bislineatus*, Am. Mus. No. 4520, Grandmother Creek, Pineola, 3800 ft.

## PLATE LX.

- Fig. 1. *Spelerpes ruber schencki*, Am. Mus. No. 4458, Williams Creek, 2100 ft. Slightly under natural size.  
 Fig. 2. *Spelerpes guttolineatus*, Am. Mus. No. 4157, near Brevard, 2100 ft. Slightly under natural size.  
 Fig. 3. *Spelerpes bislineatus*, Am. Mus. No. 4857, Linville, 4100 ft.  $\frac{3}{4}$ .  
 Fig. 4. *Spelerpes bislineatus*, Am. Mus. No. 4600, Linville, 4100 ft.  $\frac{2}{3}$ .

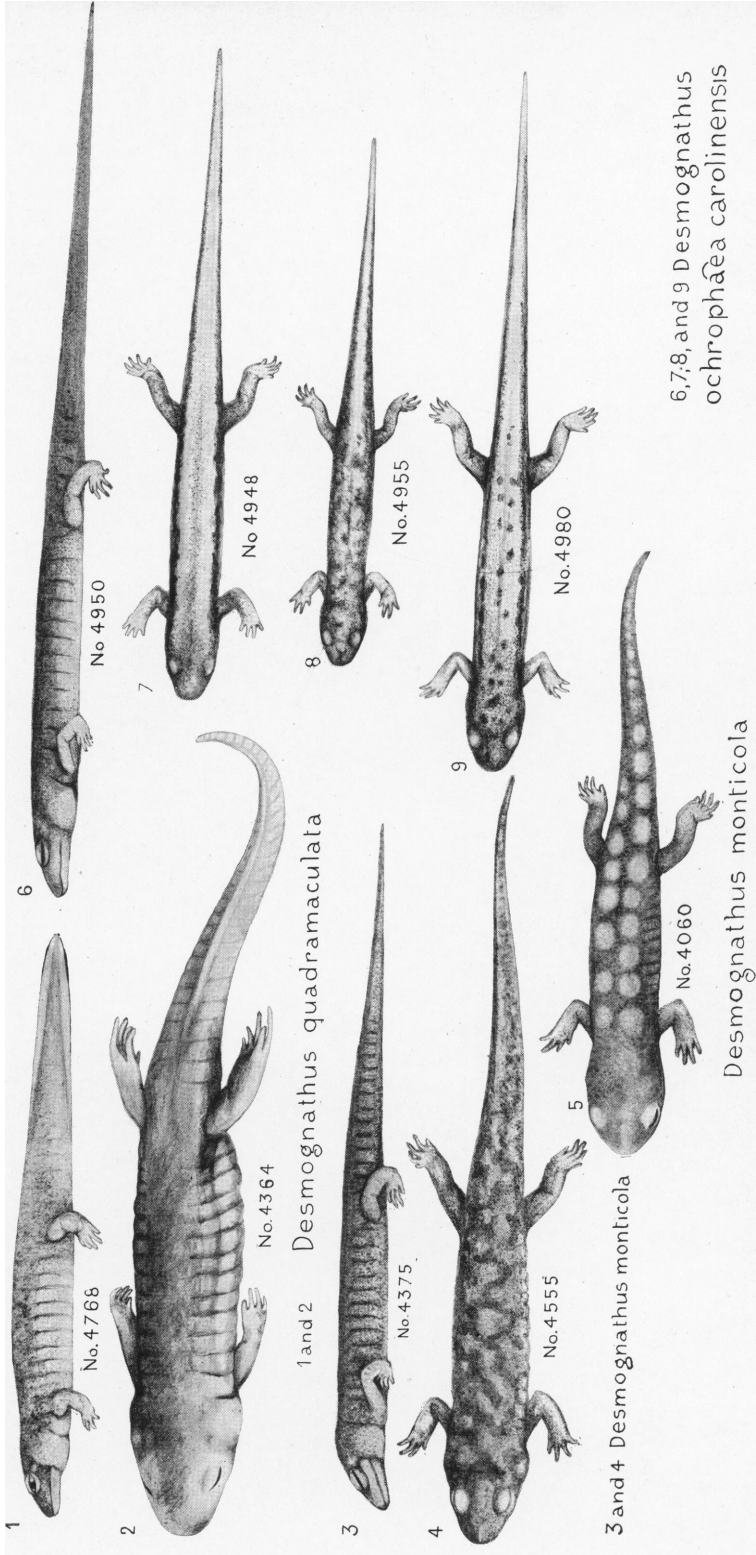
## PLATE LXI.

- Clemmys nuchalis*, sp. nov. Type, Am. Mus. No. 8430, Yonahlossee Road, near Linville, North Carolina, altitude 4200 ft.  $\frac{2}{1}$ .

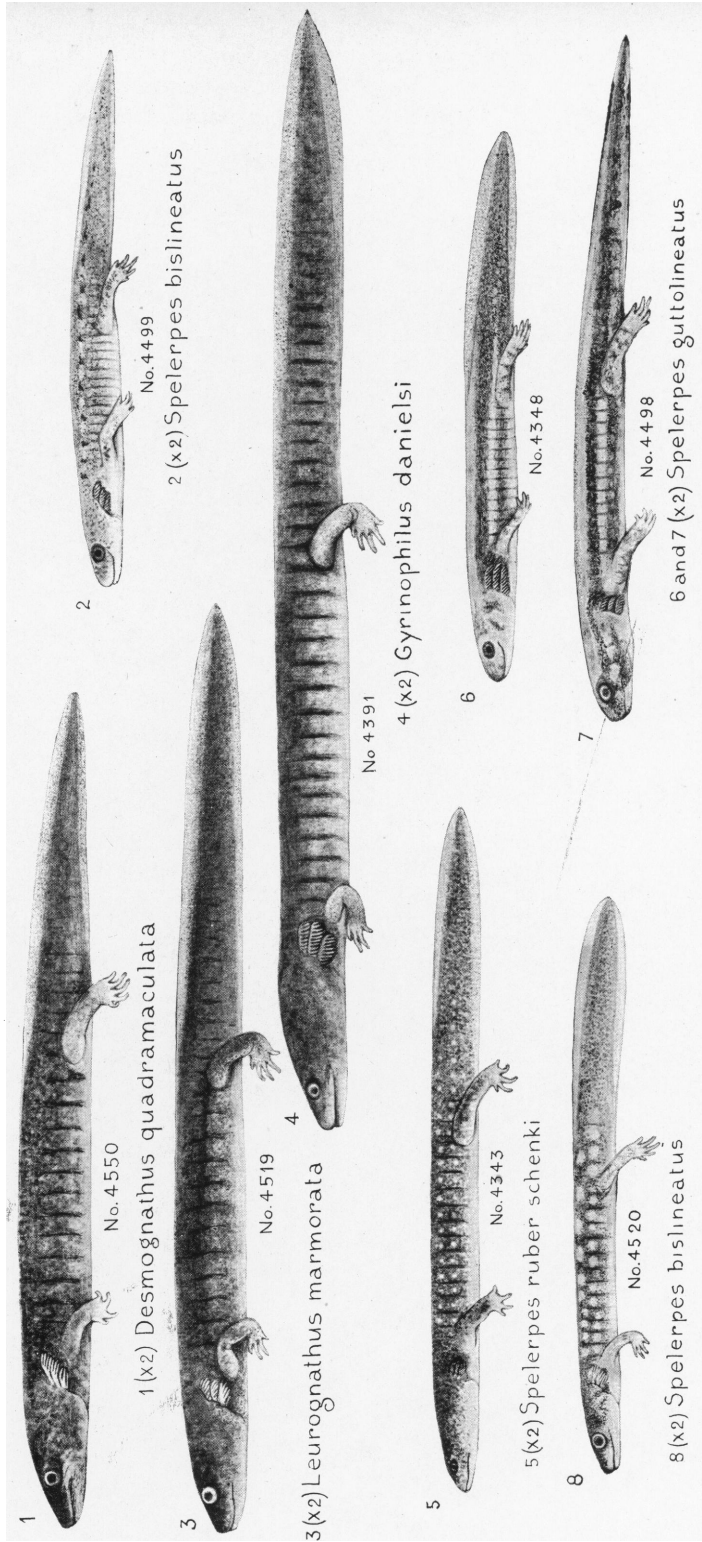


SALAMANDERS FROM MOUNTAINS OF NORTH CAROLINA.





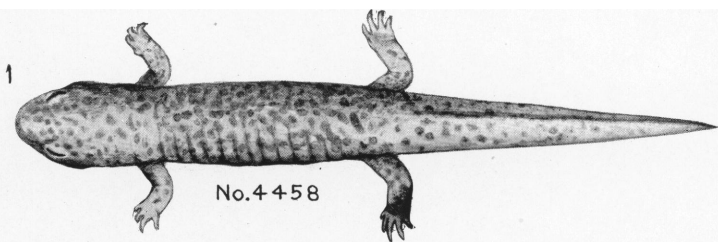




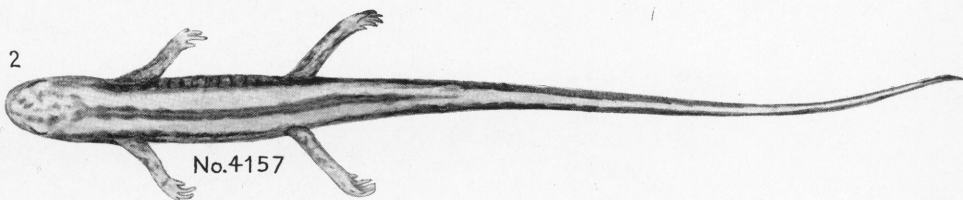
LARVÆ OF SALAMANDERS FROM MOUNTAINS OF NORTH CAROLINA.



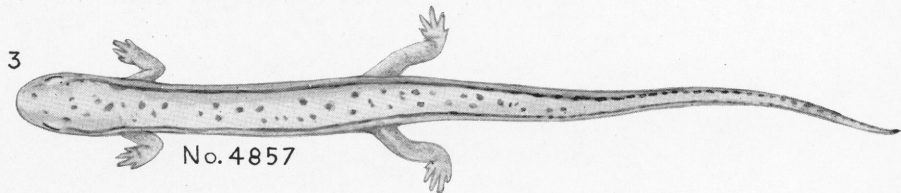




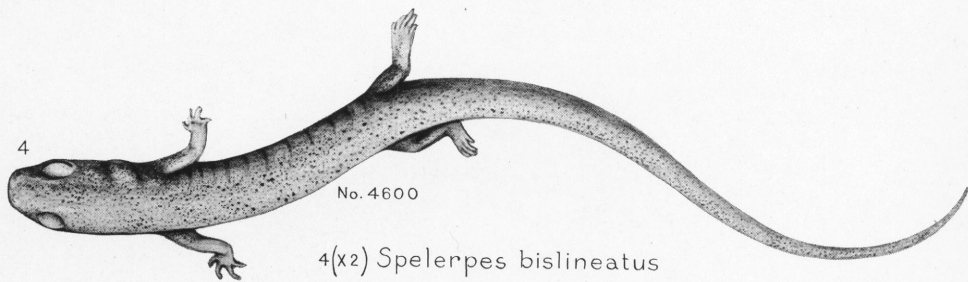
1 *Spelerpes ruber schencki*



2 *Spelerpes guttolineatus*

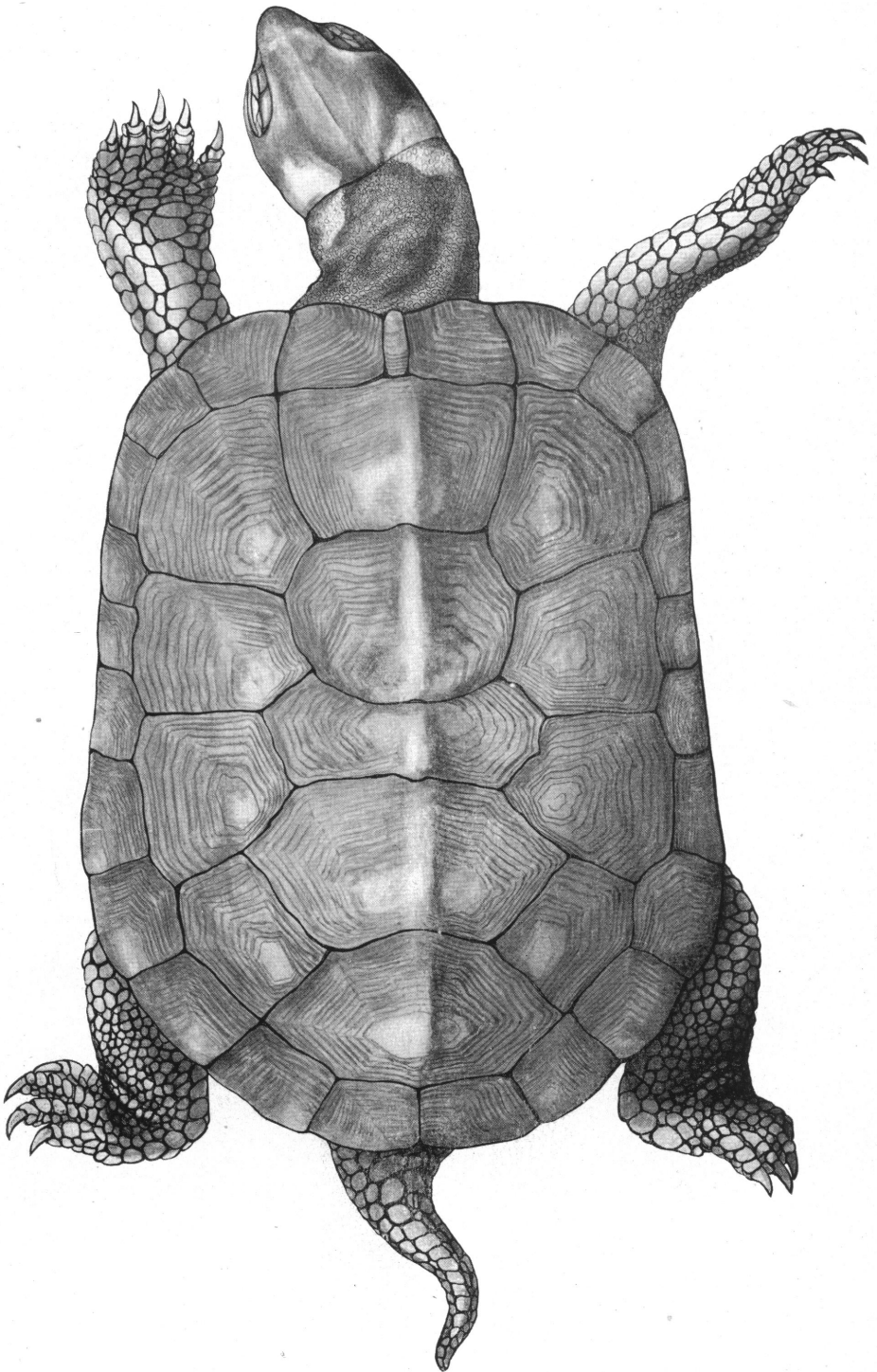


3 *Spelerpes bislineatus*



4(x2) *Spelerpes bislineatus*





CLEMMYS NUCHALIS sp. nov. × 2.

