

OCCASIONAL PAPERS OF THE MUSEUM OF
ZOOLOGY

UNIVERSITY OF MICHIGAN

ANN ARBOR, MICHIGAN

UNIVERSITY OF MICHIGAN PRESS

NOTES ON SALAMANDERS WITH DESCRIPTIONS
OF SEVERAL NEW FORMS

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WHILE preparing the manuscript for a handbook of the salamanders of the United States and Canada, several new species and subspecies have been found and some notes accumulated which should appear in advance of the publication of that work. In the nomenclature of the handbook it is proposed to follow the Stejneger and Barbour *Check List*, except as additional information concerning certain species makes it advisable to depart from that standard.

Three subspecies of *Triturus viridescens* are currently recognized from South Carolina, *viridescens* from the mountains and Piedmont and *louisianensis* and *symmetrica* from the coastal plain. The name *symmetrica* has been applied at times to all three forms, early writers used it to designate the newt which is now recognized as typical *viridescens*, Schmidt (1924: 67), to indicate a southeastern newt having no black rings about the faint dorsal spots (*louisianensis*); the third and fourth editions of the *Check List* and other authors apply it to the newt of the Southeast having interrupted black-bordered dorsolateral red stripes. I have long been of the opinion that *symmetrica* is a synonym of *T. v. viridescens*.

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In Harlan's original description of *Salamandra symmetrica* (1825: 157) there is no mention of stripes, but there is a specific note of "a row of deep orange-coloured spots on each side of the spine, symmetrically arranged." A little farther along in the same account, the spots are even more specifically described as "a row of deep orange-coloured oval spots, nine or ten in number, lining each side of the spine." From this description it is evident that *symmetrica* should not be applied either to Wolterstorff's newt, *louisianensis*, or to the broken-stripe newt from the Atlantic coastal plain. In the original description, the locality for *symmetrica* was given simply as: "Inhabits South Carolina. Presented by Dr. Blanding," but the introduction to Harlan's paper makes it clear that the specimens came from the vicinity of Camden, Blanding's home.

In 1829 Harlan (1829: 101) described *Salamandra dorsalis*, also from the vicinity of Camden. This obviously refers to a species with elongate spots or broken stripes, for it was described as having "a row of whitish coloured oblong spots on each side of the dorsal line." It was doubtless described from preserved specimens on which the red had faded and is the oldest name available for a newt from the Southeast having elongate spots or broken stripes. *Diemyctylus v. vittatus* Garman is a synonym.

To confirm these views I have recently examined the supposed types of *symmetrica* and *dorsalis* in the Philadelphia Academy. Two specimens, Nos. 1582 and 1584, are typical *viridescens* and have the circular black borders which formerly surrounded the red spots still faintly discernible. These specimens are probably the types of *symmetrica*. Three smaller specimens, Nos. 1583, 1585, and 1586, are so badly faded that no spots of any kind are evident. Fortunately, they possess certain structural features which indicate they may well represent the broken-stripe newt and cannot be *louisianensis*. Females of *louisianensis* lack the pits on the side of the head back of the eye, whereas typical *viridescens* and the broken-stripe newt possess them. The five specimens in the Academy

collection possess the pits, and since No. 1586 is a female it cannot be *louisianensis*. The reasonable assumption is that these three faded specimens are the types of *dorsalis* and that name should be used for the newt of the Atlantic coastal plain having broken, black-bordered red stripes. Camden is on the fall line, and it may be conjectured that *symmetrica* came from above the falls, where typical *viridescens* is known, and *dorsalis* from below the falls, where the broken-stripe newt has been taken a number of times.

The present known range of *T. v. dorsalis* extends from Harnett and Onslow counties in North Carolina south to Kershaw and Georgetown counties, South Carolina. Intergrades between *dorsalis* and typical *viridescens* have been examined from the collections of C. S. Brimley from Moore, Harnett, Wake, and Craven counties, North Carolina.

While it has been the general practice to regard all red-striped newts from the southeastern states as belonging to a single subspecies, a recent study of all available material from this region demonstrates rather conclusively that the striped newts from southeastern Georgia and northern and central Florida are not only distinct structurally and deserve full specific recognition, but are apparently not in contact at any place with the more northern race, *dorsalis*.

The striped newts of the Atlantic coastal plain are abundant only in certain localities, and I have been unable to find specimens in any collection from the region between Georgetown County, South Carolina, and Charlton and Camden counties, Georgia. In April, 1941, Mr. Arnold B. Grobman and Mr. M. T. Mittleman made a special effort to collect newts in this area, but without success, and Mr. E. B. Chamberlain of the Charleston Museum, who has collected for years in that general vicinity, has not found striped newts south of Georgetown County.

Triturus perstriatus, new species

(Pl. I, Fig. 2)

DIAGNOSIS.—A small, slender species with complete dorso-lateral red stripes not black bordered but with a few separate

black dots along the margins; venter immaculate or sparsely flecked with small black points; pits on sides of head of male 3-3, lacking on female.

TYPES.—Holotype, male, U.M.M.Z.¹ No. 89761, total length 70 mm.; allotype, female, U.M.M.Z. No. 89762, total length 60 mm.; and paratypes as follows: Bish. coll. from the type locality, 6 adults; U. Fla. No. 43, 15 adults of both sexes collected Feb. 14, 1933, in a pond at Sugarfoot, Alachua County, Florida; C.U. No. 965, 28 adults of both sexes collected June 30, 1922, 2 miles south of Chesser's Island, Okefinokee Swamp, Georgia; U.M.M.Z. No. 74434 (5), Lake Jackson, Lion County, Florida; No. 74437 (5), near Gainesville, Alachua County, Florida.

TYPE LOCALITY.—Dedge Pond, 2 miles east of Chesser's Island, Charlton County, Georgia; February 14, 1936.

DESCRIPTION.—The head is widest opposite the posterior angle of the eyes, the sides behind this point nearly straight and slightly converging posteriorly, in front tapering more abruptly to the bluntly pointed snout; cranial ridges poorly developed or lacking, when present they arise on a line about midway between the anterior angle of the eye and the nostril and extend to the back of the skull. They are nearly parallel to a point opposite the posterior angle of the eye, where they diverge slightly, then round to a blunt point posteriorly. On each side of the head of the male at the level of the eye, a series of 2-3 elongate pits, partially overhung by a low ridge. On the female these pits are lacking, in this respect differing from typical *viridescens* and *dorsalis* and resembling *louisianensis*. The trunk is somewhat compressed, the costal grooves not developed. The hind legs of the males are noticeably larger than the forelegs and provided along the posterior margin with a thin, fleshy keel; when appressed to the side the tip of the longest toe nearly or just reaches the elbow of the foreleg. Toes, 5-4, those of the hind feet, 5-1-2-4-3, the fifth

¹ University of Michigan Museum of Zoology; other abbreviations used in this paper are: Bish. coll. = Bishop collection; U. Fla. = University of Florida; C.U. = Cornell University; and C.M. = Carnegie Museum.

very short and webbed at base, the first thickened and rounded at tip; toes of fore feet, 1-4-2-3. Tail strongly compressed, in the aquatic adults with a dorsal keel which arises above the insertion of the hind legs, reaches its greatest width a short distance behind the vent, and tapers evenly to the tip; ventral keel arises just behind the vent and continues evenly to the tip; vent of the male large, strongly protuberant, the opening directed obliquely downward and backward and lined with many slender filaments; tongue small, elongate oval; vomeropalatine teeth in 2 long series which arise opposite the hind margin of the inner nares and extend, narrowly separated, in parallel lines for two-thirds their length, then diverge abruptly.

COLOR.—The ground color above, compared with that of *T. v. viridescens* and *T. v. dorsalis*, is much more uniformly developed, dark brown to olive green. On either side a narrow dorsolateral stripe which varies from bright red to red strongly suffused with dusky. On the majority of individuals, these light stripes arise on the head between the eyes and continue unbroken for the length of the trunk and on the basal half of the tail; on the distal half of the tail they may be lacking or broken into separate spots. Often there is a middorsal line lighter than adjoining parts but not red. The dorsolateral red stripes may have separate black flecks on either side, but the heavy black border of *T. v. dorsalis* is lacking. In some specimens there are a few small red spots on the lower sides between and slightly above the level of the legs. In the majority of specimens there are a few small, black flecks scattered over the dorsal, pigmented areas; in some these flecks are mainly restricted to series which extend along either side of the middorsal light stripe and the bases of the tail fins, sometimes a few on the tail proper and on the sides of the vent. The dorsal and lateral pigmented areas extend on the side of the head to the level of the eye, on the trunk to pass just above the legs, and on the tail at different levels in different individuals but mainly restricted to the upper two-thirds. The ventral surfaces are light yellow, usually with a few, small, widely

separated black flecks; an occasional individual may be more heavily spotted, and in about 25 per cent of all specimens the belly is immaculate. The upper half of the limbs are pigmented like the sides.

This is by far the smallest species of the genus, 86 sexually mature adults of both sexes from Georgia and Florida average only 63.4 mm., with extremes of 52 mm. and 79 mm.

The terrestrial efts are known both from Georgia and Florida. The dorsolateral red stripes are present as in the adults, but the general ground color is orange red, the skin is roughened, the tail less compressed. Specimens I have examined varied in length from 43 to 51 mm. in total length. Larvae usually have a dorsolateral series of pale spots and scattered dusky spots on sides and fins of tail; they vary in length, in the series available, from 25 to 37 mm. Often neotenic individuals are found, and these attain the size of the aquatic adults. A female with large eggs taken March 15, 1935, at Aesopus Pond, Alachua County, Florida, by Henry G. M. Jopson, had a series of pale spots within a continuous dorsolateral light band and ground color essentially like that of adults.

Little is known of the breeding habits of this species. I collected, near Chesser's Island, Okefinokee Swamp, Georgia, Feb. 14, 1936, a number of adult males on which the sexual excrescences were developed, and in the Cornell University collection are a number of specimens of both sexes from the same locality which were in breeding condition June 30, 1922.

Among some salamanders collected and sent me by Mr. C. E. Mohr from Texas is a series of 20 specimens taken in a small lake at the head of the San Marcos River, Hays County, June 22, 1938. These represent a hitherto undescribed species of *Eurycea*, the smallest yet known.

Eurycea nana, new species

(Pl. I, Fig. 1)

DIAGNOSIS.—A small, slender, neotenic species uniformly light brown above with a dorsolateral row of pale spots on

either side of the mid-line; yellowish white below; 16 or 17 costal grooves.

TYPES.—Holotype, male, U.M.M.Z. No. 89759, 49.5 mm. total length; allotype, female, U.M.M.Z. No. 89760, 48 mm. long. Paratypes, 3 males, 3 females mature, and 12 larvae, 20 to 41 mm. in length, in Bish. coll.

TYPE LOCALITY.—Lake at the head of the San Marcos River, at San Marcos, Hays County, Texas.

DESCRIPTION.—The head is narrow, the sides back of the eyes parallel, in front converging gently to the broadly rounded snout. The eyes are of moderate size, partly or completely surrounded by a dark ring, the long diameter about $1\frac{1}{4}$ in the snout; the iris dark with only a few light flecks. Gills well developed and highly pigmented, the rachises flattened above and increasing in length posteriorly, the filaments slender and pigmented nearly to the tips. Trunk slender, somewhat compressed, flattened above and with an impressed median dorsal line which extends from the base of the tail to the dorsal surface of the head, where it forks and sends a branch to each eye. There are 16 or 17 costal folds, these counts about equally represented in the series examined, and 6 to 7 intercostal folds between the toes of the appressed limbs. The tail is subquadrate in section at base, slender and compressed beginning a short distance behind the vent, and with a dorsal keel that arises behind the posterior end of the vent; ventral tail keel limited to the distal third. The legs are small and slender; toes, 5-4, long, slender, those of the hind feet 1-5-2-4-3 in order of length from the shortest; toes of fore feet 1-4-2-3. Tongue and teeth larval in character. The teeth on the premaxilla average 11 and vary from 10 to 13 in most individuals. In a single sexually mature female 50 mm. long, these teeth are enlarged and the number reduced to 7; vomerine teeth average 11.7 and vary from 9 to 14; pterygoid teeth average 4.8 and vary from 4 to 6. In 2 sexually mature males, 44 and 49.5 mm. long, respectively, the teeth on the pterygoid are reduced to 2 on each side, suggesting incipient metamorphosis which may or may not be completed.

MEASUREMENTS

Sex	Length in mm.		Head		Costals	Inter-costal	Teeth		
	Total	Tail	Length	Width		Folds	Premaxillary	Vomerine	Pterygoid
♂	49.5	22	4.5	3.5	16	6	13	11-12	2-2
♂	48.0	21	5.0	3.5	16	6	13	11-12	5-5
♂	44.0	16*	5.0	3.5	17	6	12	10-11	2-2
♂	41.0	16	4.5	3.5	16	6	11	9-11	4-4
♀	50.0	20	5.0	4.5	17	7	7	11-12	5-5
♀	48.0	21	5.0	3.5	16	6	12	12-14	5-5
♀	44.0	19	5.0	3.5	16	6	12	12-12	4-5
♀	41.0	18	5.0	3.5	17	6	10	10-10	5-6

* Tip lost.

The specimens are remarkably uniform in color and pattern. The general color above is light brown, the dark chromatophores grouped into little clusters separated by inconspicuous, narrow, light lines. The pigment extends on the side of the head to the level of the base of the first gills and involves the upper jaw and posterior part of the lower jaw; on the sides of the trunk to involve the upper half of the legs and on the tail nearly to the ventral keel. The ventral surfaces are white, tinged with yellowish on the tail. Along each side of the midline of the back is a series of 7 to 9 small, irregular light spots and rarely, a second incomplete series on the sides above the insertion of the legs. A few small light spots regularly invade the middorsal region. The testes are strongly pigmented with black, and the peritoneum of both sexes is spotted with scattered black chromatophores.

The sexes may be distinguished by the size and shape of the vent which is larger in the male and has the opening lined with short papillae. In the female the vent is a simple slit with the sides anteriorly thrown into narrow folds. Both males and females are mature at a length of 41 mm.

Eurycea nana differs from *E. neotenes*, the only other species of the genus from the general locality, in its smaller

size, in its uniformly light brown dorsal color relieved only by a few small light spots, and in its more slender form and longer, more slender toes.

Early in April, 1941, I received a collection of 24 living *Necturus* from Lake Winnebago, Wisconsin. A majority of these differ markedly from *Necturus m. maculosus* from the Allegheny River (Ohio drainage basin) and tributary streams of Lake Ontario in color, pattern, and certain structural features, a few are intermediate in character.

Necturus maculosus stictus, new subspecies

(Pl. II, Figs. 3-4)

DIAGNOSIS.—A broadheaded *Necturus* with darkly pigmented dorsal and ventral surfaces and with few or no large black spots but many round black dots.

TYPES.—Holotype, male, U.M.M.Z. No. 89765, total length 316 mm.; allotype, female, U.M.M.Z. No. 89766, total length 310 mm.; paratypes, 7 males and 15 females, in Bish. coll.

TYPE LOCALITY.—Lake Winnebago, Wisconsin, April 1, 1941; collected by J. Pawlack.

DESCRIPTION.—The head is broad and flat, widest immediately in front of the gills, the sides converging slightly to the angle of the jaws and more abruptly from this point to the broadly truncated snout. The eye is small, the horizontal diameter about $4-4\frac{1}{2}$ in the length of the snout, the iris blotched or flecked with yellow above and below the pupil. Gills short and brushy, the third longest. The trunk is stout, flattened above and below, rounded on the sides. Tail short, comprising from 27 to 31 per cent of the total length in the males and from 29 to 32 per cent in the females, broadly oval in section at base and with a dorsal keel that arises opposite the hind margin of the vent as a thick cordlike ridge and becomes compressed and thin-edged at about one-half the length; ventral fin thin distally becoming thickened at about the distal third. The legs are relatively short and stout. Toes 4-4, short, broad, and blunt tipped, usually 1-4-2-3 in order

of length from the shortest, sometimes 1-2-4-3. There are usually 15 costal grooves, occasionally 16, and about 6 intercostal spaces between the toes of the appressed limbs. The head width averages 86.5 per cent of the head length as compared with 81 per cent in a series from the Allegheny River, Cattaraugus County, New York, and 82 per cent in a similar series from Salmon Creek, Monroe County, New York. There are significant differences in the number of teeth, the pterygoids averaging 6.2 and ranging from 5 to 8 in a series of 20 from Lake Winnebago, compared with 5.2 and a range of 5 to 7 in a similar series from Salmon Creek and 5.3 in a series from the Allegheny River. The premaxillary teeth average 10.7, as compared with 11.8 in specimens from the Allegheny and Salmon Creek. Another distinguishing structural difference is to be found in the form of the vent which, in the male, is lined with slender finger-like papillae and limited behind by a transverse groove and a pair of fleshy triangular lobes directed mesally. In *N. maculosus maculosus*, the vent is provided posteriorly with a pair of nipple-like papillae directed inward and backward.

MEASUREMENTS

Sex	Length in mm.		Head		Head in length	Teeth			Costals
	Total	Tail	Length	Width		Premaxillary	Vomeropalatine	Pterygoid	
♂	320	90	50	42	6.4	9-9	11-12	5-5	15
♂	299	88	48	40	7.0	9-10	11-12	5-6	15
♂	298	83	48	41	6.2	10-11	12-12	7-7	15
♂	256	71	35	32	7.3	9-10	11-12	6-7	15
♀	362	111	56	51	6.7	14-15	15-14	8-8	16
♀	308	92	46	42	6.7	10-12	13-12	6-6	15
♀	298	88	45	40	6.6	10-11	12-13	6-7	15
♀	293	91	42	37	7.0	12-12	11-11	6-6	15
♀	253	77	38	31	6.7	10-9	11-12	5-5	15
♀	238	75	36	30	6.6	11-10	11-11	6-6	15

The general ground color is dark gray, almost black. In life there is a superficial layer of tan chromatophores, which obscures the ground color in varying degrees in different indi-

viduals. The light chromatophores may be small, very numerous, and evenly distributed, giving a uniformly tan specking over the dark ground, or, in a few individuals, the light pigment may be lacking in circular areas on the back and sides, permitting the dark ground color to show through. These dark spots, when present, vary from a few to 30 or 40. In addition to the large dark spots there are a multitude of small round black dots mainly confined to the dorsal surfaces, but in a few specimens continued on the sides and ventral surfaces. These small black dots are absent in typical *maculosus*. The ventral surfaces are very dark, with only the slightest suggestion of a lighter area along the mid-ventral region in a few individuals. In some there are a few large dark spots on the belly, and in many a scattering of small tan flecks, most abundant along the sides. The upper surface of the limbs is colored like the back, the lower like the belly. The margins of the tail fins are sometimes tinged with ocher in irregular blotches. On small specimens there is a dark bar which extends from the nostril through the eye on the side of the head to the base of the middle gills; in old dark specimens, this bar is obscured in the general coloration of the sides of the head.

In preserved specimens the tan fleckings nearly or quite disappear, and the general color is deep gray against which the dark dots and larger black blotches are relatively inconspicuous.

The important differences between this subspecies and typical *maculosus* may be briefly summarized as follows: in the Winnebago specimens the ground color is much darker, the large dark spots usually absent and when present fewer and larger, a multitude of small black dots generally scattered over the dorsal and sometimes on the lateral and ventral surfaces. Structural differences are to be seen in the greater width of the head in proportion to the length, in the larger number of pterygoid teeth, fewer premaxillary teeth, broader blunter toes, and the form of the vent of the male.

Viosea (1937: 129) has figured this subspecies, the female being typically marked, the male with a larger number of spots than is usual.

Mr. Arnold B. Grobman has examined specimens in the University of Michigan collection, and a specimen, No. 82104 from Mackinac County, Michigan, seems to represent this subspecies.

For many years I have had 3 specimens of a *Desmognathus* from Demorest, Georgia, which is strikingly different in appearance from any described species. Recently, some additional specimens from this same general region have been examined and appear to be intermediate in character between the Demorest specimens and *Desmognathus quadramaculatus*.

Desmognathus quadramaculatus amphileucus
new subspecies

(Pl. I, Fig. 3)

DIAGNOSIS.—A small *Desmognathus* with snout, distal half of tail, and the limbs white or very lightly pigmented.

TYPES.—Holotype, female, U.M.M.Z. No. 89767, total length, 90 mm. Paratypes, 2 females from the same locality in Bish. coll.

TYPE LOCALITY.—Demorest, Habersham County, Georgia, April, 1926, M. E. Phillips, collector.

DESCRIPTION.—The head has the sides back of the eyes gently converging to the lateral extensions of the gular fold, in front more abruptly narrowing to the bluntly pointed snout. The eyes are large and very strongly protuberant, the horizontal diameter slightly less than the length of the snout. The trunk is somewhat depressed, and with an impressed middorsal line; the sides rounded. Costal grooves 14 counting 1 in the axilla and 2 that run together in the groin, and only a single intercostal fold between the toes of the appressed limbs. Tail subquadrate in section at base becoming compressed and provided with a thin keel above immediately behind the vent; ventral tail keel narrow and limited to the distal third. Legs moderately stout. Toes, 5-4, long, slender and tapering, those of the hind feet, 1-5-2-4-3 in order of length from the shortest, clearly webbed at base; toes of the forefeet, 1-4-2-3. Tongue

broadly heart-shaped, thin at the margins and free at the sides and behind, the plicae narrow and radiating from the center toward the sides and anterior margin. Vomerine teeth, 7-7 in short series which arise slightly behind and inside the inner margin of the inner nares and curve inward and backward toward the mid-line where they are separated by about the diameter of a naris. Parasphenoid teeth in 2 long, slender, club-shaped patches slightly in contact anteriorly and separated from the vomerine by about twice the diameter of a naris.

The white on the dorsal surface of the head includes the eyes and extends backward in a triangular point between them; on the sides of the head to include the jaws and part of the neck and on the ventral side from the tip of the lower jaw half way to the gular fold. The distal half of the tail is white, and the limbs are very lightly pigmented. The back of the head, the dorsum and upper sides of the trunk, and the basal half of the tail deep brown with only a suggestion of lighter markings along the costal grooves, the vertical grooves of the tail, and the anterior part of the dorsal tail fin. The lower sides are mottled, yellowish white and brown, the ventral surfaces lightly pigmented with brown except as indicated above. Total length, 90 mm.; tail, 41 mm.; head length, 13 mm., width, 9 mm.

The 2 paratypes are marked essentially as the type. The first, 81 mm., total length, tail, 35.5 mm., has 7-7 vomerine teeth as in the type. The second, 80 mm., tail, 29 mm. (tip lost), has 8-10 vomerine teeth.

REMARKS.—Specimens which I regard as intermediate in character are from the following localities:

Liberty, South Carolina, May-June 1928. 3 females, J. F. Allen coll.
Aquone, North Carolina, April 19, 1938. 1 male, Bish. coll.

½ mile south of Jack's Gap, Union County, Georgia, June 8, 1934, 1 female, Francis Harper coll.

Headwaters of Town Creek, Union Co., Georgia (near Soapstone Gap), June 8, 1934, Francis Harper coll.

Headwaters of Helton Creek, 1 mile northwest of Frogtown Gap, Union County, Georgia, June 1, 1934, 1 male, 1 female, Francis Harper coll.

Head of Frogtown Creek, Frogtown Gap, Lumpkin County, Georgia, May 30, 1934, 1 female, Francis Harper coll.

Between Lake Toxaway and Cashiers, Transylvania County, North Carolina, May 3, 1933, 2 females, Francis Harper coll.

These individuals are intermediate in size between typical *quadramaculatus* and *amphileucus* and have the head, tail, and limbs lightly pigmented.

In April, 1938, I visited the Cascade Caverns in Carter County, Kentucky, and collected, among other salamanders, a single *Pseudotriton*, which differed markedly from the species known to me. Recently, in examining rather extensive series from various collections, additional specimens have been found which justify the recognition of this form as a subspecies of *Pseudotriton montanus*.

Pseudotriton montanus diastictus, new subspecies

(Pl. II, Figs. 1-2)

DIAGNOSIS.—A *Pseudotriton* having a clear ground color in life, light coral pink, clear brilliant red or light brown above, marked with well-separated rounded black spots concentrated along upper sides and never extending below the level of the legs; venter light, entirely without darker markings except, rarely, the extreme margin of the lower jaw.

TYPES.—Holotype, male, in Bish. coll., total length, 142 mm. Paratypes, U.M.M.Z. No. 75886 (3), Bell County, Kentucky; C.M. Nos. 19401, 19407, 17482, 10615, Cabell County, West Virginia; 13000, 15399-400, Mercer County, West Virginia; 17577, Wayne County, West Virginia; 18082, Lincoln County, West Virginia; 7459, 19238, Kanawah County, West Virginia; 19448, Putnam County, West Virginia; 17575, Boyd County, Kentucky; 16967, Laurel County, Kentucky; C.U. No. 3087, Sandy Creek, Jackson County, West Virginia.

TYPE LOCALITY.—Cascade Caverns, Carter County, Kentucky, April 15, 1938.

DESCRIPTION.—The head is rather small, the sides back of the eyes nearly parallel, in front tapering to the bluntly truncated

snout; head not strongly convex above, back of the eyes, as in typical *montanus*, but depressed or slightly rounded over; eye small, the horizontal diameter about twice in the snout; a slightly impressed line from the posterior angle of the eye to the lateral extension of the gular fold, a short vertical groove from this line to the angle of the jaw; trunk less stout than in typical *montanus*; 17 costal grooves counting 1 in the axilla and 2 that run together in the groin, occasionally 16, and $5\frac{1}{2}$ to $6\frac{1}{2}$ intercostal folds between the toes of the appressed limbs, in adults; tail subquadrate in section at base becoming broadly oval a short distance behind the vent and compressed and sharp-edged above distally; no ventral tail keel; legs stout, toes 5-4, those of the hind feet, 1-5-2-3-4 or 4-3 in order of length from the shortest; toes of forefeet, 1-4-2-3; vomero-parasphenoid series continuous, vomerine usually 12 to 15 in series that arise behind or just outside the outer margin of the inner naris and sweep inward in a broad curve toward the midline, then backward for a short distance, nearly parallel, before joining the parasphenoid; parasphenoid patches narrow anteriorly, club-shaped, and well separated.

In life, the type was clear, brilliant red above, the dark spots jet black. The dark spots usually larger and fewer than in typical *montanus*, more nearly uniform in size and confined to the dorsal surface of the head, trunk, tail, and limbs and sides of trunk and tail to a line which passes above the legs; ventral surfaces lighter, entirely lacking in darker markings and in this strikingly distinct from most adults of typical *montanus*. The dark spots are generally uniform in size, occasionally smaller on the sides above the level of the legs, and often somewhat concentrated dorsolaterally.

In 1820 Rafinesque (p. 4) described *Triturus hypoxanthus* from Kentucky, and Dunn (1926: 286) has included this name, doubtfully, in the synonymy of *P. montanus montanus*. I have examined Rafinesque's original description, which is as follows: "Brown above, yellow beneath; tail acute, slightly compressed, one-half of the total length. . . ." "This species is found in Kentucky, where it is called Ground Pippet, be-

cause it is often found in the lobster's holes in moist ground; total length six to eight inches." This is the complete description, and there is nothing in it to identify the salamander with the subspecies described above. No mention is made of the black spots, and the size, six to eight inches, indicates a species much larger than *P. montanus diastictus*, thirteen adults of which average only $5\frac{5}{16}$ inches, with extremes of $3\frac{3}{16}$ inches and $6\frac{1}{2}$ inches. This subspecies is apparently limited to the unglaciated plateau country of southern Ohio, central and eastern Kentucky, southwestern West Virginia, western Virginia, and eastern Tennessee.

In 1936 I had the opportunity to travel through the Pacific states and was able to collect several hundred newts at various localities from southern California to the Olympic Peninsula in Washington. While studying this material it became apparent that the newts which have been regarded as *Triturus granulosis* readily split into northern and southern groups on the basis of structural and pigmentation differences. Specimens from south of San Francisco Bay, in Santa Clara and Santa Cruz counties, represent the southern form at its best development; others from Ukiah, Mendocino County, northward, the northern form. Individuals which appear intermediate in character have been examined from Marin, Napa, and southern Mendocino counties.

Triturus granulosis twittyi, new subspecies

(Pl. I, Figs. 4-5)

DIAGNOSIS.—A rough skinned newt having many brown tipped tubercles on back and belly; pigment on lower sides involving only the upper half or two-thirds of the legs; average ratio of pigmented dorsal and lateral areas to unpigmented venter as 60 to 40; finger and toes moderately long and slender.

TYPES.—Holotype, male, U.M.M.Z. No. 89763, total length 181 mm.; allotype, female, U.M.M.Z. No. 89764, total length 160 mm.; paratypes as follows: Bish. coll. 8 males and 10 females from Saratoga, California, May 20, 1936; U.M.M.Z.

Nos. 55277-84, Corralitos Creek, Santa Cruz County, California; U.M.M.Z. No. 66654 (3), 3 miles north of Corralitos Creek; U.M.M.Z. No. 66655 (4), Bodfish Canyon, Santa Clara County, California. All University of Michigan paratypes collected by Dora L. Dice.

TYPE LOCALITY.—Saratoga, California, May 20, 1936; collected by V. C. Twitty, Margaret Wright, and S. C. Bishop.

DESCRIPTION.—Viewed from above, the sides of the head back of the eyes broadly rounded to the lateral extensions of the gular fold, in front tapering to the bluntly pointed snout. The eyes are of moderate size, the horizontal diameter about twice in the snout; eye crossed by a dark horizontal bar, the iris above silvery, below mottled silvery and black. Trunk stout, rounded above and on the sides, flattened below. Tail subquadrate in section at base, becoming compressed and sharp-edged above a short distance behind the vent and strongly compressed distally; dorsal tail keel of breeding males high and extending above level of back. Legs and feet stout. Toes, 5-4, moderately long and slender, except in the breeding season when they become somewhat depressed, widened at base, and pointed distally; toes of hind feet, 1-5-2-4-3 in order of length from the shortest, toes of forefeet, 1-4-2-3. Except in case of adults in actual breeding condition the skin is roughened and finely tuberculate, the brown tipped tubercles abundant on the belly, usually fewer on the back and sides. Tongue small, nearly circular in outline and slightly free at the sides. The palatine teeth in 2 lines united anteriorly, diverging slightly for one-half their length, then more strongly so that the rearmost are separated by about the distance between the inner nares. Vent of female small, conelike, the opening directed obliquely downward and backward; vent of male large, strongly protuberant; in the breeding season, the opening lined anteriorly with fleshy folds tipped by short papillae. Males in breeding condition often with soles of feet and undersurface of thighs black.

COLOR.—The general ground color above varies from dark yellowish brown to burnt umber, the dark pigment covering

the dorsal surfaces and the sides to involve the upper half or two-thirds of the legs, the upper three-fourths of the tail, the sides of the head to just below the nostril and eye. The ventral surfaces vary from yellow to orange, less bright than in *T. g. granulosus*. Usually the pigment of the lower sides is somewhat diffuse, the line of separation between the unpigmented venter and pigmented sides rather irregular. Occasionally, in the male, a lobe of pigment encroaches on each side of the vent.

This subspecies differs from *T. g. granulosus* mainly in its larger average size, in having many more brown tipped tubercles, and in the pigmentation of lower sides never involving the ventral surface of legs. When series of specimens are measured, the proportion of the pigmented dorsal and lateral areas to the unpigmented venter averages 60 per cent compared to 62 to 70 per cent in typical *granulosus*.

J. R. Bailey (1937: 4) has called attention to the variability exhibited by individuals of *Plethodon glutinosus* from the mountainous regions of southwestern North Carolina and northern Georgia. I have collected in these areas on two occasions and have encountered some individuals in the Nantahalas which cannot be assigned to *Plethodon glutinosus* because, while superficially resembling that species, they also exhibit many of the characters of *Plethodon shermani*. On April 19, 1938, I collected with Dr. U. B. Stone and Mr. Robert Van Auken along Wine Spring Creek, about a mile north-northeast of Aquone, North Carolina. There beneath logs and slabs of rock we took 10 specimens, each of which possessed red in greater or less amount on the legs and white spots on the sides of the head, trunk, and tail. The dorsal surfaces had the ground color intermediate between that of *shermani* and *glutinosus*, but closer to the latter. The ventral coloration was again intermediate with the throat nearly as light as typical *shermani* and with the belly darker than in *shermani* but not so black as in *glutinosus*. In *shermani* the vomerine teeth average 8.11 per series (18 series); in *glutinosus* from the same general region the average is 11.61 for the same number of

specimens. The specimens of intermediate character from the Nantahalas, 4 males and 6 females, average 8.44, and are nearer to *shermani* in this respect. Typical examples of these species, both present in the Nantahalas but not taken at this precise locality, differ conspicuously in head shape, *shermani* having the head oval in outline and *glutinosus* having the sides of the head back of the eyes nearly parallel. In the specimens from near Aquone the head shape is again intermediate, but nearer that of *glutinosus*. East of the Nantahalas I have taken both species, but here there was no evidence of intergradation. Bailey (1937: 4) mentioned 2 specimens of *shermani* from Wayah Bald, which had a considerable amount of white pigment on the sides between the legs. In view of the intermediate character of the specimens from near Aquone, I regard *shermani* as a subspecies of *Plethodon glutinosus*.

While studying *Eurycea l. longicauda* and *E. melanopleura* in my own collection, I found some specimens from Imboden, Arkansas, and from several localities in eastern Missouri to be intermediate in character between these forms. Altogether 10 specimens from the localities indicated below were found to be intergrades.

Imboden, Lawrence County, Arkansas (5)

Cave Springs Caverns, Carter County, Missouri (1)

Big River Heights, Washington County, Missouri (1)

Merdmec Highlands, St. Louis County, Missouri (3)

These localities lie on a north-south line, where the eastern boundary of the range of *melanopleura* is narrowly overlapped by the westernmost range of *longicauda*. Typical *melanopleura* has the sides of the trunk next to the dorsal light stripe dark brown, usually with small light dots or dashes, and the sides of the tail nearly uniform reddish brown or brown spotted or mottled with yellow. In *longicauda* the upper sides of the trunk are yellow or orange with black dashes, and the sides of the tail are marked with vertical crescentic or dumb-bell-shaped bars. The intergrades have the upper sides marked somewhat like *longicauda* on a ground color like *melanopleura*,

while the sides of the tail show some development of vertical dark bars combined with the spotting of *melanopleura*.

In view of the intermediate character of these specimens, it is proposed to regard *melanopleura* as a subspecies of *longicauda*.

Plethodon clemsonae was described by C. S. Brimley in 1927 (pp. 73-75) from Jocasse, South Carolina. This species was recognized in the third edition of the Stejneger and Barbour *Check List* and dropped from the fourth, on the assumption that it was not distinct from *Plethodon metcalfi*.

On April 8, 1941, Arnold B. Grobman and M. T. Mittleman collected at the type locality with Dr. Franklin Sherman and found 2 adult specimens which agree in all essential details with Brimley's description of the species and differ markedly from *P. metcalfi*.

In life the ground color above is blue-black. Scattered over the dorsal surface of the head, trunk, and basal part of the tail are many large, irregular light gray, lichen-like patches. On the head and base of the tail the patches may be tinged with brassy. The patches extend to the lower sides, but are absent on the ventral surface, except a few at the gular fold and lower surface of the forelegs. The legs are dark on the basal joints, lighter distally, and tinged with brownish. The throat and soles of the feet are light gray, the belly and ventral surface of the tail black, fading slightly toward the tail tip.

Manculus quadridigitatus remifer Cope.—I cannot recognize this subspecies as distinct from the typical form.

ACKNOWLEDGMENTS.—I am indebted to many individuals and institutions for the loan of critical material and especial thanks are due the following: C. M. Bogert, American Museum of Natural History; A. F. Carr, University of Florida; E. B. Chamberlain, Charleston Museum; Doris M. Cochran, U. S. National Museum; Helen T. Gaike, University of Michigan Museum of Zoology; C. J. Goin, University of Florida; Arthur Loveridge, Museum of Comparative Zoology, Cambridge; C.

E. Mohr, Academy of Natural Sciences of Philadelphia; G. S. Myers, Stanford University; M. G. Netting, Carnegie Museum; K. P. Schmidt, Field Museum; V. C. Twitty, Stanford University; and A. H. Wright, Cornell University. Thanks are also due Mr. Arnold B. Grobman of the University of Rochester, who has been helpful in many ways, and Mr. Ray Maas, technician of the Department of Biology, University of Rochester, for his skilled help in photography.

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PLATE I

- FIG. 1. *Eurycea nana*. Paratype, male; actual length, 39 mm.
FIG. 2. *Triturus perstriatus*. Paratype, male; actual length, 63 mm.
FIG. 3. *Desmognathus quadramaculatus amphileucus*. Type, female;
actual length, 90 mm.
FIG. 4. *Triturus granulosus twittyi*. Paratype, female. Saratoga, Cali-
fornia. V. C. Twitty coll. Natural size.
FIG. 5. Same, ventral view.

Figures 1-3 from preserved specimens.

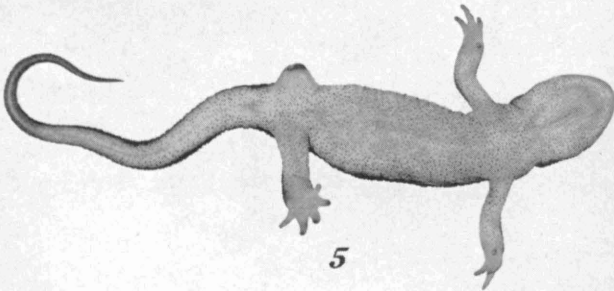
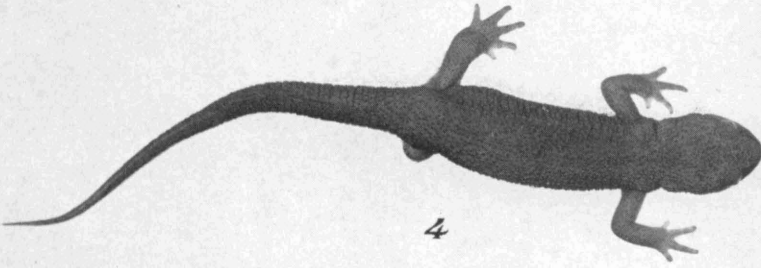
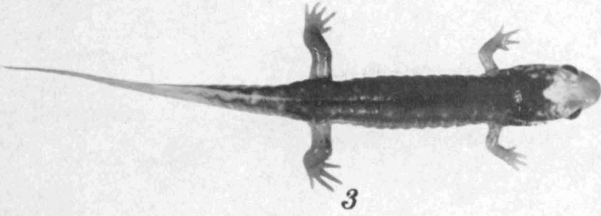
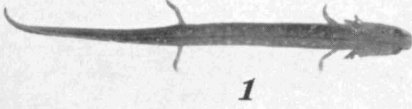


PLATE II

- FIG. 1. *Pseudotriton montanus diastictus*. Type, male; actual length, 142 mm.
- FIG. 2. Same, ventral view.
- FIG. 3. *Necturus maculosus stictus*. Paratype, female; actual length, 363 mm.
- FIG. 4. Same, ventral view.

Figures 1-2 from preserved specimen.

