THE SALAMANDERS OF PUTNAM COUNTY

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Indiana has had a fairly prominent role in American herpetology. especially that of a taxonomic type, yet a survey of the literature reveals little in the way of reports from Putnam County. With the intention of supplying records from this county, which we believe may well serve as a type for other counties similarly located and having the same general topography, we wish to present the first of a series of reports aiming at listing the complete herpetological fauna of the county, together with accurate studies of the diagnostic characters and habitat relations of the various species.

This paper may be considered as the first part of one dealing with the caudate Amphibia. Later reports will be made on the Salientia and Reptilia, as well as on other aspects of the present order.

Putnam County lies about 35 miles due west of the center of the state and has an area of about 475 square miles. It is generally rolling country, becoming quite level in the northern section where it borders on Montgomery County and rough and hilly in the south and west in the areas adjacent to Parke, Clay and Owen counties.

One hundred and fifty years ago the county was a primeval hardwood forest, the habitat of an abundance of wild life. Man was represented only by the aborigines whose numbers were never great, and whose mode of life did not seriously interfere with the processes of nature. Primarily they were a nomadic people, subsisting largely by hunting. Cultivation of the soil was limited to a few fields of native maize.

With the advent of civilized man into the county in the early years of the last century, all its former aspects began to change. All large and dangerous animals were destroyed or driven away. The forest was cleared and the land cultivated. Domestic animals gradually replaced wild game until now we find no large wild animals occurring, the oldest forest of second growth, and that represented only by scattered patches, and most of the land under cultivation.

These changes have greatly interfered with all native animals and their habitats. We can be reasonably sure that the clearing and cultivation of the land has brought about great changes in atmospheric humidity and moisture content of the soil. Since these factors have such an intimate connection with the habitat selection of Amphibia, we can safely assume the present-day abundance and range of any species to be but a fraction of its former extent. The dense forest was the natural home of these animals; the wood-lots and stream borders of today offer the only remaining suitable conditions to their continued existence and these only to those species adaptable to modified habitat.

Hence we find *Plethedon cinereus*, probably having greater adaptive powers than any other, by far the most abundant and exhibiting the widest range, having been taken under such widely varying conditions as are characteristic of dry watersheds and stream borders. Its relative abundance is clearly shown by a list of specimens taken from a typical salamander habitat in the county in which we find 144 individuals of

this species listed, to 36 and 30 examples, respectively, of the two other most common forms.

A survey of records from 15 different localities in the county show *P. glutinosus* ranking second both in abundance and range. It seems to select a more moist habitat than *P. cinereus*, never having been taken so far from water. Consequently its range is more restricted, tending to confine it, in this county, to the above mentioned areas along streams.

P. dorsalis, usually outranked in point of numbers by *P. cinereus* in a ratio of at least 25 to 1, might be said to have the same general habitat as *P. glutinosus*, though it is probably capable of living in drier situations, comparing favorably with *P. cinereus* in this respect.

The members of the genus Eurycea, occurring in this county, namely *E. bislineata*, *E. longicauda*, and *E. lucifuga*, seem to show a more definite preference for a semi-aquatic habitat than the preceding species. They are chiefly taken from the borders of small streams in the ravines draining into the major water courses, about springs, etc. *E. bislineata* is the most abundant, outranking *P. glutinosus* in many localities. *E. longicauda* and *E. lucifuga* are common only in restricted localities, the latter being the most rarely encountered of the common species of the county.

Ambystoma tigrinum is so rare that we have records of only three individuals ever having been taken in the county. These were all in moist situations. From laboratory observations, it is probable that *A. tigrinum* makes burrows in the dry season, lying in wait at the mouths of these for passing prey. It is quite capable of devouring small toads and frogs, as we have observed.

Necturus maculosus, the only aquatic species takent in the county to date, is fairly common in the larger streams where pools of still water are formed.

Thus we find that nearly all of the specimens used in compiling the data given in this paper were taken in or near the wooded areas bordering the major water-courses of the county, as it is only in such areas a suitable environment may now be found.

The data, presented below, representing observations on a number of specimens from each species taken in Putnam County, are not presented with any special claim to newness or originality. They rather represent a careful study of the specimens with a view to presenting the commonly accepted characters in fairly exact terms.

Observations were made, for the most part, under a Bausch and Lomb binocular miscroscope equipped with 5x oculars and with 3x and 6x objectives. The living animals, anaesthetized with ether, were used in making most of the studies. Etherization required about 30 to 60 seconds for small forms like *Plethodon cinereus* or *Eurycea bislineata*, while a larger form like *Plethodon glutinosus* required from one minute to one minute and 45 seconds. The animals all recovered without obvious effect and are still living. All measurements listed below are expressed in millimeters and all body weights in grams.

The correctness of our identifications has been checked on typical specimens placed in the hands of Mr. Karl P. Schmidt of the Field Museum of Natural History. Mr. Schmidt confirmed our classifications.

Specimens examined are as follows:

1. *Necturus maculosus* Rafinesque.

This large aquatic species, belonging to the perennibranchiate family Proteidae, has a ground color of chocolate brown interspersed with small white specks. In this ground color are occasional large black spots, round or oval, and 2 to 5 mm. in diameter.

The general body proportions may be visualized from the following measurements:

Length	Head	Body	Tail	Costal Grooves	Greatest Head Width	Greatest Body Width
277.2	35.3	168.0	83.0	14	36.4	34.5
345.5	36.9	201.6	107.0	14	44.3	38.0

Head and body are depressed, the head tapering dorso-ventrally so that the muzzle is fairly flat. Viewed dorsally, the muzzle is truncate, ending bluntly anteriorly. At the posterior lateral margins of the head are three paired external gills. Paired gill slits occur between the first and second, and second and third gills.

In terms of greatest head width, the body length is 4.6 in the first case listed above and 4.5 in the second. Likewise in the first case the distance between the front and hind legs is 120 mm. as against 148.1 mm. in the second.

The depressed body changes from a horizontal oval to a vertical oval behind the posterior appendages. The tail is definitely compressed.

2. *Ambystoma tigrinum* (Green).

Of all the species taken, this one has individuals exhibiting the most stout, stocky bodies and most efficient legs. The ground color is black or very dark brown. Large yellow spots, mostly oval in shape, occur on the sides and back. Ventro-laterally the dark color gives way to a yellow belly. In some cases faint dark spots occur on the belly. In both specimens measured, the legs were 61 mm. apart. Other measurements follow:

Length	Head	Body	Tail	Costal Grooves	Body Weight	Greatest Head Width	Greatest Body Width
182.3	25.0	81.5	75.8	12	37.5	20.9	23.9
197.4	22.8	86.8	87.8	12	34.8	21.0	25.0

This species belongs to the family Ambystomidae which is characterized by stout bodies, possession of lungs, presence of a ypsiloid apparatus, and absence of a naso-labial groove.

We now turn our attention to the family Plethodontidae, which by way of contrast, have slender bodies, absence of lungs, and no ypsiloid apparatus, but have naso-labial grooves.

3. *Plethodon glutinosus* (Green).

As to general proportions of individuals of this species, the body is stout, with well-developed amphibian legs. The tail is round in cross-section, the body more or less round, and the head depressed. The tail is longer than the head and body, as the following measurements will show:

Length	Head	Body	Tail	Costal Grooves	Body Weight	Remarks
148.9	15.9	64.0	69.0	14	10.4 gms.	Heaviest specimen
151.8	15.0	57.5	79.3	14	6.8 gms.	Longest specimen
125.2	14.0	48.03	64.8	14	4.87 gms.	Average of 10 specimens

The costal groove count proved remarkably constant, no variation being seen in the specimens studied.

As to color, the animal is usually described as being black with white or silvery spots. When the skin is viewed under the binocular, it appears to be overlaid with a gelatinous layer of glassy appearance, undoubtedly of a secretory nature. This layer is pitted, and immediately under the pits are seen small translucent light-colored areas devoid of black pigment. Thus the black pigment due to the melanophores constitutes a sort of "continuous phase" in which are enmeshed these small translucent areas. At intervals are found the white spots, which, under the binocular, seem to consist of patches of white crystalline material. These are due to the guanophores, or white pigment cells, which contain guanine, a substance allied chemically to uric acid (Noble, 1931, page 141).

4. *Plethodon dorsalis* (Cope).

The individuals of this species are much smaller than those of the preceding one. Comparison of the measurements above with those given here will emphasize this fact.

Length	Head	Body	Tail	Costal Grooves	Body Weight	Remarks
85.7	8.0	35.4	42.3	17	0.8 gm.	Typical large individual
82.5	8.3	36.0	38.2	17	1.2 gm.	Typical large individual
67.39	7.27	28.46	30.64	17	0.64 gm.	Average of 10 specimens

The individuals of this species have blackish-brown pigment laterally. This dark lateral strip merges into a light color ventrally, and dorsally it becomes interrupted by a band which is zigzag in shape, and reddish, brownish, or yellowish in color. The zigzag dorsal band extends from the back of the head to the level of the hind limbs and continues nearly the length of the tail as an even-edged stripe.

The tail is round in cross-section, and in length it never exceeds the length of the body and head. The body length, on the other hand, approaches the length of the tail.

5. *Plethodon cinereus* (Green).

The salamanders of this species are of the same general size as those of *P. dorsalis*, being just a trifle larger. The species exists in two distinct color phases, the light or striped and the dark or unstriped.

The striped or light phase is the typical red-backed salamander. It is characterized by an even-edged, light reddish stripe extending from the back of the head almost to the tip of the tail. This dorsal stripe interrupts lateral dark bands of dark brown color, which merge ventrally into a light-colored, mottled belly.

The unstriped or dark phase has the same grayish, mottled ventral surface, but the rest of the body has a practically uniform coloration of blackish-brown. There is no indication of a stripe. Some forms are occasionally found which might best be described as "intermediate" in color, since they have a faint indication of the dorsal stripe, and the same ground color as the unstriped phase. Measurements of both phases follow:

Length	Head	Body	Tail	Costal Grooves	Body Weight	Remarks
88.4	8.0	35.3	44.6	19	.....	Large striped specimen
88.3	8.2	36.7	43.4	19	1.1 gm.	Large striped specimen
80.9	8.1	34.7	39.7	19	0.8 gm.	Aver. of 10 striped animals
85.6	8.5	35.9	41.2	19	1.1 gm.	Lge, intermediate specimen
87.0	8.0	36.0	43.0	19	0.8 gm.	Lge, intermediate specimen
81.1	8.5	36.8	35.8	19	1.1 gm.	Large, unstriped individual
79.3	8.5	32.0	38.8	19	0.9 gm.	Large, unstriped individual
76.01	8.04	32.79	35.18	19	0.74 gm.	Average of 10, both unstriped and intermediate specimens

These measurements will confirm the above statement to the effect that *P. cinereus* is somewhat larger than *P. dorsalis*. The tail is round in cross-section, and in length it approaches or equals the length of head and body. *Cinereus* has at least one, and usually two more costal grooves than does *dorsalis*.

It may be interesting to note that in one field trip to the Fern Cliffs

locality, specimens of *Plethoson cinereus* were collected in the following ratio: 118 striped, 7 unstriped, and 3 intermediate.

It is deemed advisable at this point to refer to the authorities on the salamanders, especially in their statements concerning the last three types of *Plethodon* mentioned. Cope (1889) lists all three. Under the genus Plethodon Tschudi he keys *P. cinereus* (disregarding the characters of the mouth cavity) as a *Plethodon* with a cylindrical tail, 16-19 costal grooves, belly brown marbled, above plumbeous or with a red longitudinal band. He then describes under the designation *Plethodon cinereus cinereus* Green an animal that we would at once recognize as dark-phase *P. cinereus:* upper half of the body dark liver-brown, dirty whitish beneath. He then lists *Plethodon cinereus erythronotus* Green and makes the statement: "I am unable to detect any difference in structure, proportions, and general character between this supposed species and *P. cinereus.* The only difference, if any there be, is to be found in the color of the back, that of the side and belly being very much the same". He then describes the red dorsal stripe of *P. cinereus.* We may infer from the reference to the "supposed species" above that Cope had his doubts as to its rank as a species. Dunn (1923, page 165) and Pratt (1923, page 158) regard the two phases as varieties of the same species.

Cope (1889, page 138) describes under the name of *Plethodon cinereus dorsalis* Baird the species now recognized as *P. dorsalis*, with the opening statement: "This subspecies has the size and proportions of body and limbs as in *P. erythronotus*, but may be readily distinguished by the smaller number of costal grooves, shorter body, and different character of the dorsal stripe". Dunn (1926, page 162), after describing the species makes the statement: "I cannot see my way clear to do other than to recognize *dorsalis* as a full species". Pratt (1923, page 158) treats it in the same manner.

6. *Eurycea bislineata* (Green).

In common with all members of the genus Eurycea Rafinesque found in this county, this species has a compressed tail, in contrast to the round tail of the members of the genus Plethodon Tschudi. The tail is longer than the head and body.

Length	Head	Body	Tail	Costal Grooves	Body Weights	Remarks
104.1	8.0	33.6	62.5	14	1.4 gms.	Large individual
93.0	8.0	35.0	50.0	14	1.5 gms.	Large individual
87.0	7.7	34.3	45.0	14	1.3 gms.	Large individual
84.15	7.9	33.4	46.0	14	1.3 gms.	Average of 11 specimens

The ground color of the animals seems to be clear yellow. On the sides there is a lateral dark stripe which is most intensely pigmented latero-dorsally where the dark stripe is interrupted by a dorsal light

stripe, dirty yellowish-white in color. A few small black spots may occur in the dorsal median line, forming a thin discontinuous band.

Our specimens conform to the characters listed by Dunn (1926, page 297) for *E. bislineata bislineata* with the exception of the costal groove count, which is 15 in *E. b. bislineata* and 14 in our species. In this respect our specimens agree with the account of *E. b. cirrigera*, and *E. b. Wilderae* Dunn, which, however, have southern ranges entirely.

7. *Eurycea longicauda* (Green).

Measurements of typical specimens are:

Length	Head	Body	Tail	Costal Grooves	Body Weight	Remarks
134.3	10.9	44.0	79.4	13	3.4 gms.	Large specimen
132.5	11.5	46.0	75.0	13	3.2 gms.	Large specimen
124.6	11.3	42.3	71.0	13	2.6 gms.	Large specimen
110.6	11.07	43.7	61.9	13	3.0 gms.	Average of 7 specimens

These measurements reveal that this species approaches *P. glutinosus* in size. However, the animal is slender and elongated, with a depressed body and compressed tail. All of the specimens studied had 13 costal grooves except one, which had 12. The length of the tail greatly exceeds that of the head and back. The sides are heavily spotted with black. These spots thin out dorsally and leave a yellow band on the back almost free of black. On the tail the lateral black spots form bars vertically placed.

8. *Eurycea lucifuga* (Rafinesque).

Specimens of this form have been found in small numbers in the county during the past two years, and three were found during the present autumn. None of these, unfortunately, were kept long enough to make exact studies, and the measurements below are given for a single preserved specimen.

Length	Head	Body	Tail	Costal Grooves	Body Weight	Remarks
132.4	13.4	44.0	75.0	14	.....	.....

The salamander is yellow with a distinct reddish hue; it might be said to have an orange color. Small round or oval spots of black occur on the sides and dorsum in no particular pattern or arrangement. Dunn (1926, page 342) regards this independence of the typical pattern of

spotting (lateral dark band) as an indication of the advanced state of the species. The occurrence of the lateral dark stripe, leaving a dorsal light stripe free of black, is in a measure the retention of the larval pattern (Dunn, 1926, page 342; Noble, 1931, page 148). In the case of *E. lucifuga* this breaks down, and the irregular distribution of the spots bears no resemblence to such a larval pattern.

In conclusion, we wish to state that it is our intention to correlate the present paper with one in which the life histories of the preceding forms, and any others that further collecting may discover, will be discussed.

Literature Cited

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