

## A New Neotenic Plethodont Salamander, with Notes on Related Species

By SHERMAN C. BISHOP<sup>1</sup>

RECENT studies indicate that neoteny among salamanders of the family Plethodontidae occurs more frequently than has been suspected, known examples of this phenomenon having been limited to *Typhlomolge rathbuni*, and to occasional individuals of other species, until 1937, when *Eurycea neotenes* was described from Texas. Since 1937 the unique *Haideotriton wallacei* has been described from Georgia and two additional neotenic species of *Eurycea* have been recognized, *nana* from Texas and *tynerensis* from Oklahoma. The purpose of the present paper is to call attention to additional examples of neoteny in the family and to describe a new species hitherto confused with larval *Typhlotriton spelaeus*.

In several collections of supposed *Typhlotriton spelaeus*, three species were found to be represented, typical *T. spelaeus*, neotenic *Eurycea multiplicata* and a neotenic plethodontid tentatively regarded as a distinct species of *Typhlotriton*. The new species was first detected when a series of specimens from Cherokee County, Kansas, was made available for study by Dr. Hobart M. Smith and Dr. Edward H. Taylor.

The adults of *T. spelaeus* are commonly found in caves, the larvae often in streams in the open. *Eurycea multiplicata* also enters caves, apparently as a larva, and may continue as a neotenic individual, becoming very pale and resembling *Typhlotriton*. The new *Typhlotriton* is often found in open streams where caves are not available and may be quite highly pigmented, but enters caves readily and fades until it is nearly as pale as typical *T. spelaeus*.

### *Typhlotriton nereus*, nov. sp.

TYPE.—Collection of Sherman C. Bishop No. 926; a female, total length 96 mm.; from York Spring, Imboden, Lawrence Co., Arkansas.

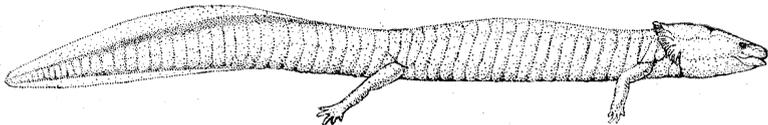


Fig. 1. *Typhlotriton nereus*, n. sp. Sexually mature female; actual length 88 mm. Camden County, Missouri. Drawn by H. P. Chrisp.

PARATYPES.—*Missouri*: USNM<sup>2</sup> Nos. 19778–79, 19781, 19784–85, 19787, Rockhouse Cave, Barry Co.; MCZ Nos. 2269–70, 4607–4608, Wilson's Cave, Jasper Co.; UMMZ No. 77052 (2), Downer's Cave, Sarcoxie, Jasper Co.; SCB (2), Sarcoxie, Jasper Co. *Arkansas*: MCZ Nos. 24061–64, Monte Né, Benton Co.; UMMZ No. 77053 (2), Lawrence Co.; AMNH Nos. 34246–48, 34250, Imboden, Lawrence Co., No. 34152, Carroll Co., Nos. 50040–44, Mammoth Springs, Fulton Co.; KU No. 16199, Lawrence Co.; UAM (2), Sharp Co. *Kansas*: KU Nos. 16036–38, 16043–45, 16350, 16352–54, 16357–60,

<sup>1</sup> Department of Zoology, University of Rochester.

<sup>2</sup> Abbreviations used in this paper are: USNM, United States National Museum; MCZ, Museum of Comparative Zoology, Harvard University; UMMZ, Museum of Zoology, University of Michigan; AMNH, American Museum of Natural History; KU, University of Kansas Museum; UAM, University of Arkansas Museum; EHT, Edward H. Taylor; CU, Cornell University; SCB, Sherman C. Bishop.

near Galena, Cherokee Co., March 26, 1932; EHT No. A 1204 (15), near Galena, March 26, 1932. *Oklahoma*: UMMZ No. 81481, 8 miles south of Kansas, Adair Co.; CU No. 434 (8), Adair Co.; SCB (3), Adair Co.

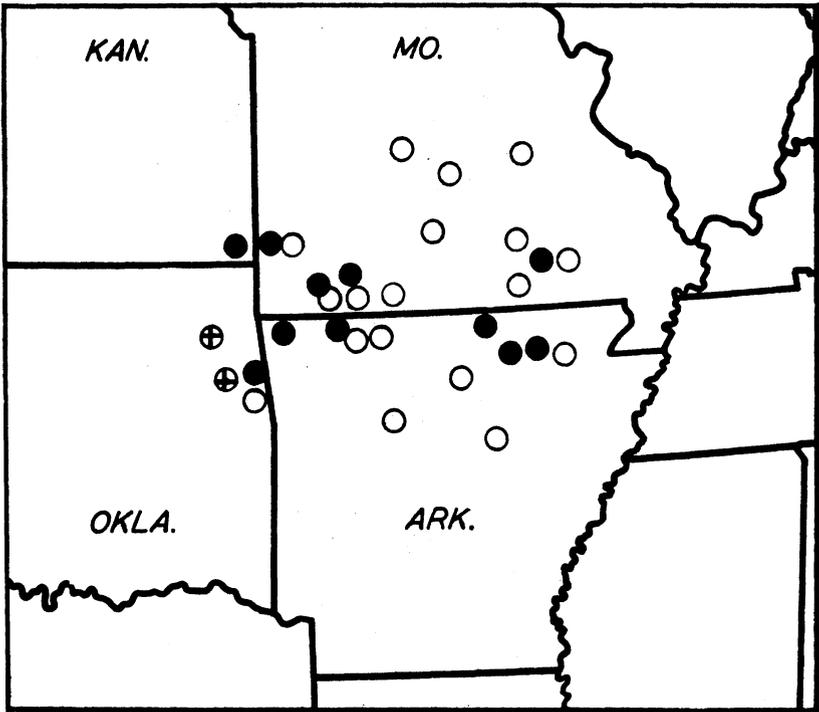


Fig. 2. Map showing the distribution of *Typhlotriton spelaeus* (open circle) and *T. nereus* (solid circles), the latter apparently limited to the Ozark Plateau. The circles enclosing crosses in Oklahoma represent literature records of specimens I have not been able to examine.

**RANGE.**—*Typhlotriton nereus* is apparently limited to the Ozark Plateau. The map (Fig. 2) shows the distribution of *T. spelaeus* and *T. nereus* by counties but does not indicate the specific localities where these species and *Eurycea multiplicata* have been found together. In the USNM collections from Rock House Cave, Barry County, Missouri, *T. spelaeus* is represented by about a dozen specimens, *T. nereus* by six, and *Eurycea multiplicata* by five. The three species are also present in various collections from Imboden, Lawrence County, Arkansas, but whether from the same streams or caves is not apparent from locality data given on labels. *T. nereus* and *E. multiplicata* occur together in springs in Carroll County, and *T. spelaeus* and *E. multiplicata* together at Eureka Springs, Arkansas.

**DIAGNOSIS.**—A neotenic species, pigmented when living in the open, pale when found in caves; 18 or 19 costal grooves and 6 to 7 intercostal folds between the toes of the appressed limbs; pterygoid teeth usually in patches, rarely in a single series.

**DESCRIPTION OF TYPE SERIES.**—The head is somewhat depressed, the sides

behind the angle of the jaws nearly parallel, in front tapering slightly to the bluntly rounded snout; eyes normal in young larvae, their long diameter about twice in the snout, somewhat reduced in the sexually mature individuals and

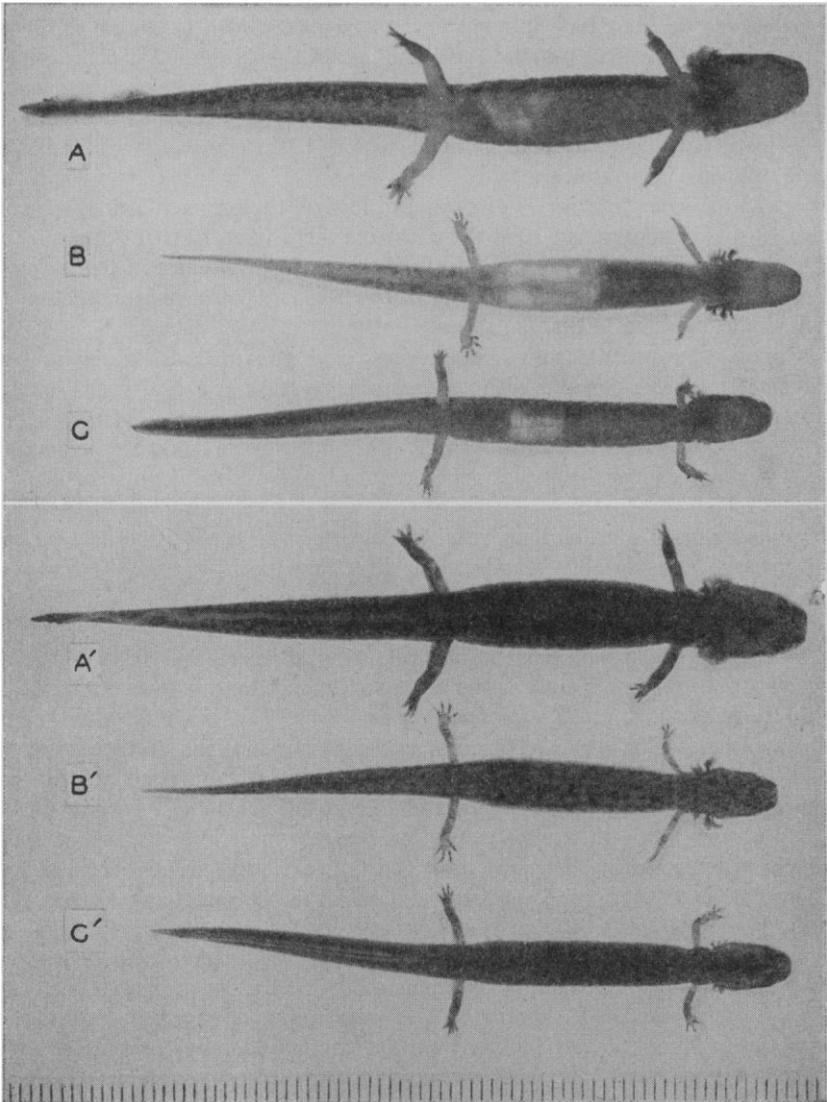


Fig. 3. Ventral and dorsal views of larvae of A, A', *Typhlotriton spelaeus*; B, B', *T. nereus*; C, C', *Eurycea multiplicata*. Rule subdivisions in mm. Photos from life by Arthur J. Smith, through the courtesy of Dr. Robert B. Barden, Cornell University.

contained about three times in the snout; gills lightly pigmented with many long, slender, flattened filaments in immature individuals but greatly reduced in the sexually mature; trunk somewhat compressed, with a mid-dorsal impressed line and 18 or 19 costal grooves, counting one each in the axilla and

groin; intercostal folds 6-7 between the toes of the appressed limbs (in *spelaeus*, costal grooves 16-17 and 2 to 4 intercostal folds); toes 5-4, 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; tail compressed and with a dorsal keel that arises above the insertion of the hind legs and reaches its greatest width at about the distal third; ventral tail keel narrow and confined to the distal half; premaxillary teeth 12 to 20, average 15.8 in seventeen individuals; vomerine teeth in two sinuous lines that converge anteriorly and narrowly separated at the midline; these teeth varying in number from 11 to 15 (17 in one instance) and averaging 13.2 in 20 examples.

In *T. spelaeus*, in a series of comparable size, the premaxillary teeth vary from 18 to 25 and average 20.6, the vomerine teeth from 12 to 17 and average 13.8. In larval *Typhlotriton* the pterygoid teeth form patches in the majority of specimens, in this respect differing from *E. multiplicata*, in which the teeth form single, or at most double, series.

COLOR.—Specimens from open springs and streams are lightly mottled above and on the sides and with at least a suggestion of larval spots forming faintly developed lines on sides. Individuals from caves are often very pale but may be lightly pigmented above, fading out on the sides at the level of the legs and having the larval spots reduced and inconspicuous or lacking (Fig. 3).

Sexually mature individuals reach a length of at least 102 mm. (4 inches) but average considerably smaller. In direct comparison with *T. spelaeus*, this species appears stouter and slightly more pigmented both as larvae in open streams and sexually mature individuals in caves. *T. nereus* is regarded as a distinct species because it occupies the same general territory as *T. spelaeus*, and in some instances the same streams and caves, without evidence of intergradation.

REMARKS.—For the three species under discussion, the graphs presented below (Fig. 4) summarize several structural features and indicate the primary importance of costal grooves and intercostal folds between the toes of the appressed limbs in the separation of these forms. The number of specimens studied is indicated by the italicized figures at the points of the curves. It may be noted that for *T. spelaeus* and *T. nereus*, complete separation may be made on the basis of both costal groove counts and the number of folds between the toes of the appressed limbs; and approximately 72 per cent separation on the basis of counts of premaxillary teeth. Approximately 90 per cent of specimens of *T. nereus* and *E. multiplicata* may be separated on costal groove counts and 93 per cent on the number of intercostal folds. Counts of premaxillary teeth of *spelaeus* and *multiplicata* show no significant differences and the vomerine teeth are essentially the same in all three species.

As indicated above, *nereus* is tentatively regarded as belonging to *Typhlotriton*, mainly because of its great superficial similarity to *T. spelaeus*. The structure of generic significance, and practically the only constant one that separates *Typhlotriton* and *Eurycea*, is the anteriorly attached tongue of the former and the boletoid type of the latter. The tongue is attached anteriorly in the larvae of both and the proper allocation of *nereus* may have to await experimental transformation by means of pituitary stimulation. Another

character that seems to indicate relationship of *T. spelaeus* and *T. nereus* is the presence of patches of pterygoid teeth. In most specimens of *Eurycea* larvae examined, these teeth are in single or, at most, in double series.

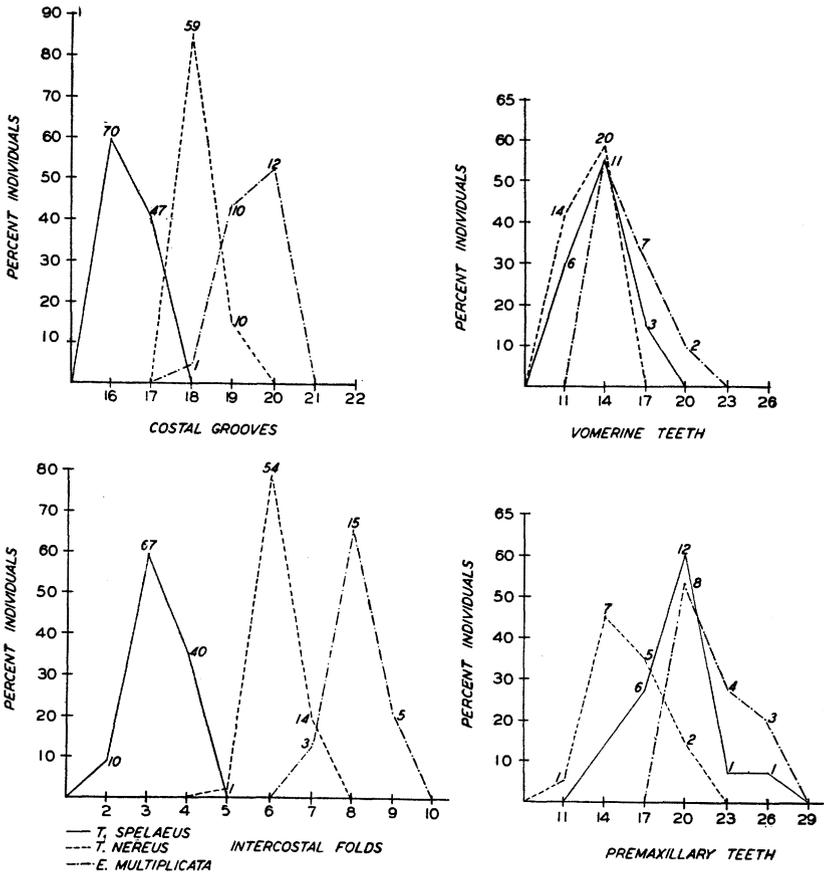


Fig. 4. Graphs showing the distribution of costal grooves, intercostal folds between the toes of appressed limbs, vomerine and premaxillary teeth in the three species indicated.

The clearing and staining of a number of specimens of both *Typhlotriton* and *Eurycea* have brought out certain internal structural features that are not evident in untreated material. *Typhlotriton nereus* and *Eurycea neotenes* possess gland-like structures in the parotoid region lacking in all specimens of *Typhlotriton spelaeus*, *Eurycea multiplicata*, and *E. nana* I have examined. The presence of these structures suggests a possible relationship to be explored more fully when specimens are available for treatment by the pituitary technique.

The cleared specimens also reveal the number of rib-bearing vertebrae between the skull and pelvis and these seem to be constant for a given species. In descending order they are as follows: *Eurycea multiplicata*, 21; *Typhlotriton nereus*, 20; *T. spelaeus*, 19; *Eurycea neotenes* and *nana*, 18.