A New Neotenic Plethodont Salamander, with Notes on Related Species

By SHERMAN C. BISHOP

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.


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2 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.

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 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

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.
groin; intercostal folds 6–7 between the toes of the appressed limbs (in spe-
laeus, 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 aver-
aging 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 pri-
mary importance of costal grooves and intercostal folds between the toes of
the appressed limbs in the separation of these forms. The number of speci-
mens 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 sep-
eration 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 Typhlo-
triton, 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.

![Graphs showing the distribution of costal grooves, intercostal folds between the toes of appressed limbs, vomerine and premaxillary teeth in the three species indicated.](image)

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.

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