

AMPHIBIA: CAUDATA: PLETHODONTIDAE

Catalogue of American Amphibians and Reptiles.

BRANDON, RONALD A. 1970. *Typhlotriton* and *T. spelaeus* [Revised].

***Typhlotriton* Stejneger**
Grotto salamander

Typhlotriton Stejneger, 1893:115. Type-species *Typhlotriton spelaeus* Stejneger, 1893, by monotypy.

• **CONTENT.** One species is recognized, *T. spelaeus*; see COMMENT under *T. spelaeus*.

• **DEFINITION.** The genus contains the only known blind, troglobitic salamander that transforms fully. The tongue is attached in front by a fine membrane only. A lingual cartilage is present, and there is no genioglossus muscle. The premaxilla is single; (a median fissure may form in large, old adults); frontal processes (= nasal processes) are separate in larvae and in most adults, but occasionally they are partially fused in large adults. Vomerine (= prevomerine) and paravomerine (= parasphenoid) tooth series are continuous in 90 per cent of specimens. A slender, spinelike process projects posteriorly from the body of the vomer and forms the lateral margin of the internal naris. The optic foramina are very small. Eyes of metamorphosed individuals are reduced in diameter and structure from the larval condition; they are covered by eyelids in various stages of fusion, and are functionless. The eyes of larvae are functional but are small in diameter when compared with those of *Eurycea* larvae from the same area.

• **DESCRIPTIONS AND ILLUSTRATIONS.** Stejneger (1893), Dunn (1926), and Wake (1966) describe the diagnostic characteristics of the genus. See also the account of *T. spelaeus* that follows.

• **DISTRIBUTION.** This salamander is restricted to caves and springs on the Salem and Springfield plateaus of the Ozark region of Arkansas, Kansas, Missouri and Oklahoma. Adults have not been reported outside of caves, but larvae are sometimes abundant in springs runs as well as in caves.

• **FOSSIL RECORD.** None.

• **PERTINENT LITERATURE.** Brandon (1965) consolidated information in a previous account. Wake (1966) indicated the similarity between *Typhlotriton* and *Eurycea* and included both in the plethodontid tribe Hemidactyliini. See also the account of *T. spelaeus*.

• **ETYMOLOGY.** The name *Typhlotriton* derives from the Greek *typhlos* meaning "blind", and *triton* meaning "salamander." The name is of masculine gender.

***Typhlotriton spelaeus* Stejneger**
Grotto salamander

Typhlotriton spelaeus Stejneger, 1893:116. Type-locality, "Rock House Cave [Barry County], Missouri." Holotype, U.S. Nat. Mus. 17903, collected 24 July 1891, by F. A. Sampson (examined by author).

Typhlotriton nereus Bishop, 1944:1. Type-locality, "York Spring, Imboden, Lawrence Co[unty], Arkansas." Holotype, Field Mus. Nat. Hist. 93143, collected by Byron C. Marshall, 15 February 1927 (examined by author). Considered a junior synonym of *T. spelaeus* by Brandon (1966).

Typhlotriton braggi Smith, 1968:156. Type-locality, Cushman Cave, 3½ miles SE. of Cushman, Independence County, Arkansas." Holotype, U.S. Nat. Mus. 167146, collected by C. C. Smith, on 29 April 1959 (examined by author). Tentatively considered a junior synonym of *T. spelaeus*. See COMMENT.

• **CONTENT.** No subspecies are described.

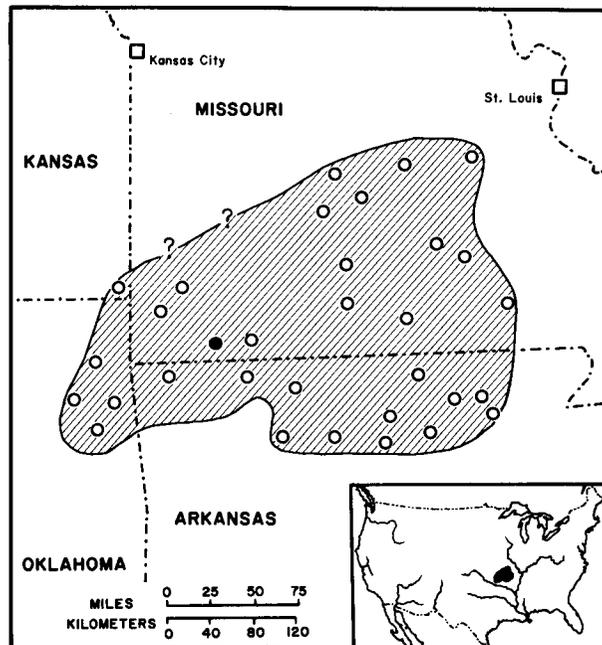
• **DIAGNOSIS.** *T. spelaeus* is the only troglobitic salamander that occurs in the Ozark region. Adults are distinct from other troglobitic salamanders, all of which retain external gills throughout their lives. Larval *T. spelaeus* may be confused with larval *E. multiplicata*, and possibly with larvae of *E. lucifuga* and *E. longicauda*. The last two species have only 14-15 costal grooves (15-16 trunk vertebrae) compared with 16-19 (17-20) in *T. spelaeus*. At all sizes, larval *Eurycea* have relatively larger eyes. Larvae of *E. multiplicata* are more slender than *T. spelaeus*, have a narrower head, lower tail fin, and generally have more trunk vertebrae (20-21).

• **DESCRIPTIONS.** Nothing is known of breeding activities or of eggs laid in nature. Eggs obtained by pituitary implants and preserved in formalin (Barden and Kezer, 1944) have an unpigmented vitellus 2.0-2.2 mm in diameter, a vitelline membrane, and three envelopes. Yolkeg ovarian eggs as large as 2.7 mm in diameter are known from preserved specimens (Brandon, 1966).

The eggs presumably are laid in or near the water, attached to rocks (Barden and Kezer, 1944). Larvae have a dark dorsum and sides, but usually no distinct pattern. Pigmentation may be uniform, occasionally mottled or streaked, and usually is more intense on larvae found in above-ground situations. Although the eyes of larvae are smaller than those of sympatric species of *Eurycea*, they are structurally complete and functional. Loss of vision may begin in large larvae, and continues through metamorphosis. Degeneration of the retina and fusion of the eyelids was described by Stone (1964c).

The smallest larvae known are 17 mm in total length (13 mm S-V). Size distribution suggests that larvae transform 2-3 years after hatching (Hendricks and Kezer, 1958). Transformation occurs between 36-56 mm snout-vent length (Brandon, 1966). The larger larvae probably occur in caves having a richer aquatic food supply.

Transformed individuals are slender and range from 36-70 mm snout-vent; the usual size is 45-55 mm, but varies from locality to locality. The tail accounts for 42-47 per cent of the total length, is slightly compressed, and weakly keeled or rounded dorsally. The number of trunk vertebrae ranges from 17-20 (16-19 costal grooves), varying by 2-3 in all populations. Geographic variation in vertebral number is slight; the modal number is 18 in easternmost populations and 19 in the westernmost (Brandon, 1966). The degenerate eyes appear as small black spots recessed into the broad, flattened head, and are covered by eyelids in various stages of fusion. The degree of fusion is probably related to postmetamorphic age (Stone, 1964c). At the end of the nasolabial groove the lip is swollen, and in sexually active males is extended into a small cirrus. Additional secondary sexual characters in males include a circular mental gland and an internally papillose vent. Uniformly scattered melanophores on the dorsum produce a light flesh to brownish-purple color. The venter is lighter. Regenerated tail tips tend to have increased pigmentation. The tongue is oval in outline and attached to the floor of the mouth by a small pedicel. The only other attachment is by a fine membrane just anterior to the pedicel.



MAP. The solid circle marks the type locality. Open circles indicate other sites of collection. The presumed distributional range of the genus is based on known localities and the limits of the Salem and Springfield plateaus.

Major features of larval and metamorphosed individuals are described by Dunn (1926) and Bishop (1943). Variation was described by Brandon (1966) and some features of the osteology by Wake (1966).

• ILLUSTRATIONS. Barden and Kezer (1944) included a diagram and photographs of eggs. Bishop (1943) provided photographs of an adult and larvae and (1944) indistinct photographs of a larva. Mittleman (1950), Mohr and Poulson (1966) and Noble (1927) provided good photographs of the adult head. The adult and larvae are illustrated in color by Conant (1958). The hyobranchial apparatus was figured by Wake (1966).

• DISTRIBUTION. Same as for the genus.

• PERTINENT LITERATURE. The most complete accounts of the species are by Dunn (1926) and Bishop (1943). Brandon (1962, 1965) summarized some aspects of the recent literature. The structure of the "degenerate" eyes was discussed by Alt (1910), Eigenmann (1899, 1909), Eigenmann and Denny (1898, 1900), Noble and Pope (1928), and Stone (1964c). Two additional papers by Stone (1964 a, b) discussed experiments on lens regeneration and eye transplantation. A few other anatomical (Hilton, 1909, 1946, 1953, 1956; Moore, 1900), ecological (Hendricks and Kezer, 1958; C. Smith, 1960; P. Smith, 1948 a, b), and physiological (Barden and Kezer, 1944; Noble and Pope, 1928; Wells *et al.*, 1954) papers have appeared, as well as some distributional reports (Blair, 1951, 1952; Bragg and Hudson, 1951; Dowling, 1956, 1957). Noble (1931) provided remarks on sensory behavior. Brandon (1966) discussed variation in the number of trunk vertebrae, variation in number of larval teeth, reports of neoteny and the status of *T. nereus*, and provided additional locality records. Wake (1966) provided additional anatomical information and discussed relationships and evolution.

• ETYMOLOGY. The name *spelaeus* comes from the Greek *spelaton*, meaning "cave."

COMMENT

References to neotenic *Typhlotriton* appear in the literature under *T. nereus* (Bishop, 1944; Blair, 1957; Smith, H. M., 1956; Smith, C., 1960). The validity of *T. nereus* was long questioned; Dowling (1957) synonymized it with *T. spelaeus*. Brandon (1966), after examination of many of the presumably neotenic specimens, concluded that none was sexually mature.

C. Smith's (1960) impression that populations which he studied in the vicinity of Batesville, Arkansas, represented an undescribed species of *Typhlotriton* was recently formalized by the description of *T. braggi* Smith, 1968. Because the 1968 paper contains no information supplemental to the 1960 paper, and because Brandon's (1966) evaluation of the 1960 paper and specimens from southeastern Missouri and northeastern Arkansas suggested only one species, *T. braggi* is of necessity here considered a junior synonym of *T. spelaeus* pending further investigation.

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