

MITTLEMAN, M. B. 1966. *Eurycea bislineata*. Catalogue of American Amphibians and Reptiles, p. 45.

***Eurycea bislineata* (Green)  
Two-lined salamander**

*Salamandra bislineata* Green, 1818:352. Neither type nor type-locality designated by Green. According to Dunn (1926:297), "Cope claims that U.S.N.M. [U.S. Natl. Mus.] No. 3738 from western Pennsylvania, collected by Green, are the types. Fowler and Dunn . . . state that A.N.S. [Acad. Nat. Sci. Philadelphia] No. 695-8, no locality, collected by Dr. Bache, are the types. Probably there are none in existence and never were any. Cope states on another page that Green's types were from New Jersey." Type-locality designated as "New Jersey [probably Princeton?]," by Fowler (1906:65).

*Eurycea bislineata*: Stejneger & Barbour, 1917:18. Transfer of *S. bislineata* to *Eurycea*. Additional synonymic details are present in Dunn, 1926.

• **CONTENT.** Four annectant subspecies are recognized—*bislineata*, *cirrigera*, *rivicola*, and *wilderiae*. For a key to these forms see Mittleman (1949).

• **DEFINITION.** This species of *Eurycea* has well-developed eyes; dorsal body color of yellow or yellow orange; a brown or black stripe on each side extending from the eye to at least the midpoint of the tail; costal grooves numbering 13-16 (rarely 17); a compressed tail, oval in section and dorsally keeled; and nasolabial swelling or cirri, plus enlarged, monocuspid, premaxillary and mandibular teeth in sexually active males (Noble, 1931:fig. 45).

• **DESCRIPTIONS.** Adults and larvae of *E. b. bislineata*, *E. b. cirrigera*, and *E. b. wilderae* are described by Dunn (1926) and by Bishop (1943). Adults of *E. b. rivicola* are described by Mittleman (1949) and by P. W. Smith (1961), and a detailed study of the development and growth of this subspecies is given by Duellman & Wood (1954).

• **ILLUSTRATIONS.** Photographs of adults of the subspecies *bislineata*, *cirrigera*, and *wilderiae* are shown in Bishop (1943), and of *rivicola* in P. W. Smith (1961). Rossman (1965) also has a photograph of adult *E. b. wilderae*. Delineation of the individual egg (fig. 4n) and photographs of the characteristic egg clusters of *E. b. bislineata* (fig. 54) are given in Bishop (1941), as are also line drawings of the teeth and mouthparts (fig. 3), and of the larvae, spermatophore, and characteristic courtship positions (fig. 55, a-g). Hilton (1945) figures several skeletal elements.

• **DISTRIBUTION.** The species is known from southeastern Canada to Florida, and west to the Mississippi and into eastern Illinois. Doubtfully it is recorded from southern Michigan (see REMARKS under *E. b. rivicola*). *E. b. bislineata* occurs from Canada (Logier & Toner, 1961; Cook and Bleakney, 1960) through Virginia, and west throughout Pennsylvania and West Virginia exclusive of the Ohio River Valley. *E. b. cirrigera* is present from southern Virginia to northern Florida, thence west to the Mississippi River. *E. b. wilderae* occurs in the Blue Ridge Province, from southern Virginia, south to northern Georgia and Alabama. *E. b. rivicola* is found from the Ohio River Valley south through Tennessee and west to eastern Illinois.

• **FOSSIL RECORD.** None.

• **PERTINENT LITERATURE.** Because of its abundance and the ease with which it may be collected, *Eurycea bislineata* has been a popular experimental animal and a rather large literature has resulted. The best general account is by Bishop (1941). The following references cover much but by no means all of the literature. Soft anatomy: Hilton, 1956a, 1956b; Koehring, 1925; Wonderly, 1963. Skeleton: Hilton, 1945; Martof and Rose, 1962. Teeth: Hilton, 1951; Stewart, 1958. Size: Bell, 1960; Wood, 1949. Lateral line: Hilton, 1947. Albinism: Rubin, 1963. Thermal relationships: Bogert, 1952; Brattstrom, 1963; Brooks and Sassaman, 1965; Hutchison, 1961; Zweifel, 1957. Oxygen consumption: Vernberg, 1952. Water loss: Littleford *et al.*, 1947. Hematology: Vernberg, 1955. Chromosomes: Fankhouser and Dluhy, 1958. Repro-

ductive biology: Noble, 1929; Noble and Richards, 1930; Weichert, 1945; Wilder and Peabody, 1924; Richmond, 1945; Wood, 1953. Spermatophores: Noble and Weber, 1929; Organ and Lowenthal, 1963. Eggs and embryos: Goodale, 1911; Salthe, 1963; Wood, 1949, 1950; Wood and Duellman, 1951; Wood and McCutcheon, 1954. Larvae: Eaton, 1956; Hudson, 1955; Trapido and Clausen, 1940; Wood, 1951. Sound production: Geyer, 1927. Food: Smallwood, 1928. Growth and metamorphosis: Wilder, 1924b. Hibernation: Vernberg, 1953. Territoriality: Grant, 1955. Zoogeography: Bleakney, 1958. Numerous notes and short papers contain ecological or distributional information, for example: A. Allen, 1963; M. Allen, 1932; Barbour, 1953; Brandon, 1966; Eaton, 1953; Gordon *et al.*, 1962; Holman, 1960; Hutchison, 1956; Martof, 1955; Wilder, 1924a.

• **ETYMOLOGY.** The name *bislineata* is from the Latin *bis*, "two" and *lineatus* "streaked" or "lined." The name *cirrigera* derives from the Latin *cirrus*, a "lock," "curl," or "ringlet," as of hair, and *gero*, "to bear," in allusion to the pendant nasolabial process which occurs in the sexually active male. The name *rivicola* is also from the Latin *rivus*, a "stream"; plus *colo*, "to inhabit," with reference to its streamside proclivities. The subspecies *wilderiae* is named for Inez Whipple Wilder, pioneer in plethodontid biology and Smith College teacher.

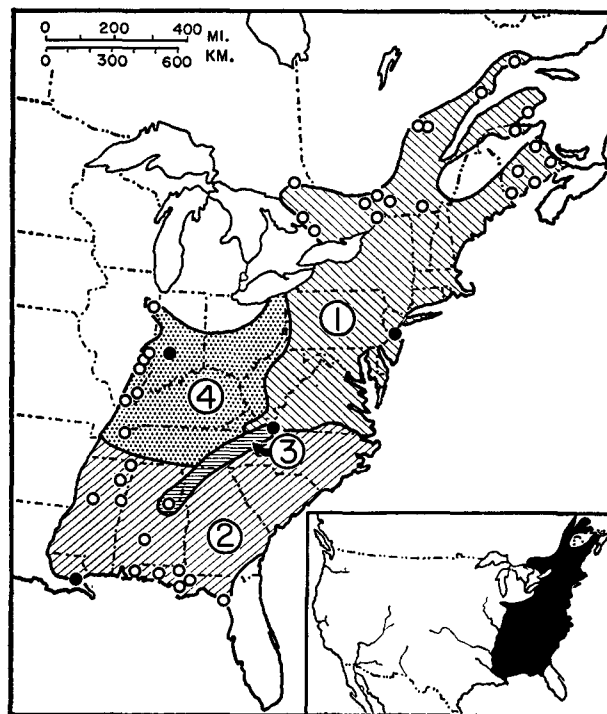
**1. *Eurycea bislineata bislineata* (Green)  
Northern two-lined salamander**

*Salamandra bislineata* Green. See species account.

*Eurycea bislineata bislineata*: Dunn, 1920:134. New Combination.

*Eurycea bislineata major* Trapido & Clausen, 1938:118. Type-locality, "under limestone slabs along Ouaiatchouan River, Val Jalbert, Lake St. John Co[unty], Quebec." Holotype, U.S. Natl. Mus. 104239, collected by R. T. Clausen and H. Trapido, 17 September 1937.

*Salamandra flavissima* Harlan, 1826:286. Type-locality, "Pennsylvania." Holotype, "a specimen in the cabinet of the Acad. of Nat. Sc. of Phil." (Harlan, 1826). The type is not now extant in the Academy of Natural Sciences of Philadelphia, nor is there any evidence other than Har-



MAP. Solid symbols show type-localities. Hollow symbols mark other selected localities.

lan's statement that it ever was (E. V. Malnate, *in litt.*, 10 November 1963).

*Salamandra haldemani* Holbrook, 1840:125. Type-locality, "from the borders of the Susquehanna River, [Pennsylvania]." Holotype unknown; may be fixed as Holbrook's (1840) plate 28.

*Salamandra dorsata* Valenciennes in Duméril, Bibron, & Duméril, 1854:93. Neither type nor type-locality designated. Type may be fixed as Figure 1, Vélín 88 du Muséum d'Histoire Naturelle de Paris (Duméril, Bibron, & Duméril, 1854:93).

*Salamandra bitaeniata* Valenciennes in Duméril, Bibron, & Duméril, 1854:93. Neither type nor type-locality designated. Type may be fixed as Figure 5, Vélín 88 du Muséum d'Histoire Naturelle de Paris (Duméril, Bibron, & Duméril, 1854:93).

*Spelerpes bilineatus borealis* Baird in Cope, 1889:165. Type-locality, "Kenebago Lake, Oquassa, Me." (= Kennebago Lake, near Oquossoc, Franklin County, Maine). Lake Oquassoc (Cochran, 1961:25) is a *lapsus*. Syntypes, U.S. Natl. Mus. 4735a, collected by Charles Girard, 1852. Cope (1889:165) states that there are 9 "cotypes"; Cochran (1961) lists 12, and more recently states that there are 11, consisting of 9 adults and 2 larvae (*in litt.*, 8 November 1963).

• **DEFINITION.** Costal grooves number 15 (53%) or 16 (47%); there are 8-21 vomerine teeth (average 12.2); dorsolateral stripes rarely extend beyond the midpoint of the tail; sexually active males are without cirri; maximum total length is 115 mm (snout-vent, 52 mm); and minimum total length at transformation is 43 mm (snout-vent, 21 mm).

• **REMARKS.** Proportionate tail length in this form varies ontogenetically, as it does in all the subspecies of *E. bislineata*, with small specimens having relatively shorter tails than large individuals. Occasional specimens show an anomalous branching of the first or last costal groove, to produce what may be considered a 17th groove; it is not systematically significant. The range boundary of this subspecies and *E. b. rivicola* in western Pennsylvania and northeastern Ohio remains to be determined.

## 2. *Eurycea bislineata cirrigera* (Green) Southern two-lined salamander

*Salamandra cirrigera* Green, 1830:253. Type-locality, "Louisiana, near New Orleans." Type not known to exist (Dunn, 1926:307). Cope states (1889:165, 168) that U.S. Natl. Mus. 4734 (2 specimens) from "Southern States (La.?)", collected by Dr. F. Bache, are Green's types. D. M. Cochran advises (*in litt.*, 8 November 1963) that opposite the entry in the catalogue for No. 4734 is the notation in Dr. Stejneger's script, "type of Green's *cirrigera*," but with no indication that he had ever seen the specimens. Dr. Cochran has not been able to locate these specimens and presumes them to be lost.

*Spelerpes cirrigera*: Baird, 1850:287. Transfer of *Salamandra cirrigera* to *Spelerpes*.

*Spelerpes bilineatus cirrigera*: Smith, 1882:727. New Combination.

*Eurycea bislineata cirrigera*: Dunn, 1920:135. New Combination.

• **DEFINITION.** Costal grooves number 13 or 14; there are 0-2 between the adpressed toes (average in adults 1.5); combined vomerine teeth number 10-24 (average 15.8); dorsolateral stripes usually extend to the distal fourth or tip of the tail; a well-developed series of lateral light or white spots is present; prominent cirri occur in sexually active males; maximum total length is 96 mm (snout-vent, 41 mm); and minimum total length at transformation is 48 mm (snout-vent, 27 mm).

• **REMARKS.** This subspecies intergrades with *E. b. bislineata* in Buckingham, Charlotte, Prince Edward, and Gloucester Counties, Virginia. It intergrades with *E. b. wilderae* in parts of the Piedmont in northern Georgia, although according to Neill (1957:44) in this area the two subspecies maintain interdigitated, ecologically separate ranges. Individuals of *E. b. wilderae* reported by Rossman (1965) from parts of southern Alabama are probably intergrades with *E. b. cirrigera*; see also Brandon, 1966.

## 3. *Eurycea bislineata wilderae* Dunn Blue Ridge two-lined salamander

*Eurycea bislineata wilderae* Dunn, 1920:134. Type-locality, "White Top Mt., Va. [White Top Mountain, Grayson County, Virginia], 4000 feet." Holotype, Mus. Comp. Zool. 5848, collected by E. R. Dunn, July 1919.

• **DEFINITION.** Costal grooves number 13 or 14 (rarely 15); combined vomerine teeth number 4-17 (average 11.4); dorsolateral stripes are black (rather than brownish), sharply demarcated from the ground color, and usually extend no further than the midpoint of the tail; prominent cirri usually are present in sexually active males; maximum total length is 93 mm (snout-vent, 39 mm); and minimum total length at transformation is 36 mm (snout-vent, 20.5 mm).

• **REMARKS.** This subspecies extends as far west as Sevier County, Tennessee and as far as Cheaha Mountain, Cleburne County, Alabama (Chermock, 1952). Intergradation with *E. b. bislineata* may occur at Abingdon, Washington County, Virginia (Dunn, 1926:303). Intergradation occurs with *E. b. cirrigera* at Duluth, Gwinnette County, Georgia; Tray Mountain, Habersham County, Georgia; and probably also in southern Alabama (Rossman, 1965).

## 4. *Eurycea bislineata rivicola* Mittleman Midwest two-lined salamander

*Eurycea bislineata rivicola* Mittleman, 1949:93. Type-locality, "Echo Canyon, McCormick's Creek State Park, Owen County, Indiana." Holotype, U.S. Natl. Mus. 129397, collected by M. E. and M. B. Mittleman, August 1942. An allotype (U.S. Natl. Mus. 129398) with the same data as the holotype was designated; it is not U.S. Natl. Mus. 8832, Cincinnati, Ohio, as listed by Cochran (1961:14).

• **DEFINITION.** Costal grooves usually number 14 (81%), occasionally 15 or 16 (19%); there are 1.5-5 between adpressed toes (average in adults 3); vomerine teeth number 8-27 (average 15); dorsolateral stripes extend beyond the midpoint of the tail, usually to the distal fourth; sexually active males are without cirri; maximum total length is 107 mm (snout-vent, 48 mm); and minimum total length at transformation is 33 mm (snout-vent, 17 mm).

• **REMARKS.** P. W. Smith (1961:43) reports costal grooves usually number 13 or 14 (96%), rarely 15 (4%), in Illinois specimens. Intergradation between this subspecies and *E. b. cirrigera* is known from Walls, Desoto County, Mississippi. Extension of the range to include Warren Dunes, Berrien County, in southern Michigan (Maldonado-Koerdell & Firschein, 1947) is doubtful. W. E. Duellman advises (*in litt.*, 1 February 1963) that the specimens on which this record is based were poorly preserved and hence discarded in April 1960. Duellman states further that the Warren Dunes habitat is not suitable for *Eurycea*, although a favorable situation might exist in nearby Warren Woods. The distributional limits of *E. b. rivicola* at the periphery of its range require elucidation.

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- M. B. MITTLEMAN, FANTON HILL, WESTON, CONNECTICUT 06880.
- Published 11 August 1967 by the American Society of Ichthyologists and Herpetologists. Publication is supported by National Science Foundation grant G24231.
- Primary editor for this account, Richard G. Zweifel.