

## Catalogue of American Amphibians and Reptiles.

VALENTINE, BARRY D. 1974. *Desmognathus quadramaculatus*.***Desmognathus quadramaculatus* (Holbrook)  
Black-bellied salamander**

*Salamandra quadramaculata* Holbrook, 1840:pl. 27 (sic, this plate is actually number 26 in the series). Type locality, "common in Georgia and Carolina, and is an inhabitant of Pennsylvania, from which state I have received living specimens." Restricted to "Great Smoky Mountains" by Schmidt, 1953:32; this should be construed as the North Carolina side only. (See Nomenclatural History).

*Salamandra maculo-quadrata* Holbrook, 1840:121 and table of contents between page viii and 9. Holbrook (1842), as first revisor, discards this inverted name.

*Salamandra quadrimaculata*: Holbrook, 1842:49. Emendation. *Salamandra quadramaculata*: Holbrook, 1842:pl. 13. Emendation.

*Triton niger* Holbrook, 1842:81, not *Salamandra nigra* Green, 1818:352. Type locality, "Atlantic states from lat. 43° to the Gulf of Mexico. Dr. Pickering found it near Salem, in Massachusetts; Professor Green observed it in Pennsylvania; I have seen it in Carolina and Georgia, and have received specimens from Louisiana... Professor Green was the first naturalist who observed and described the *Triton niger* under the specific name it here bears." (See Nomenclatural History).

*Triton nigra* Holbrook, 1842:pl. 27. Emendation.

*Desmognathus niger*: Baird, 1849 (1850):285. Transfer to *Desmognathus*.

*Desmognathus fuscus* Gray, 1850:40, not *Triturus fuscus* Rafinesque, 1820:4.

*Ambystoma quadrimaculatum*: Duméril, Bibron, and Duméril, 1854:109. Transfer to *Ambystoma*.

*Ambystoma nigrum*: Duméril, Bibron, and Duméril, 1854:105. Transfer to *Ambystoma*.

*Desmognathus nigra*: Cope, 1869:113. Emendation.

*Desmognathus quadrimaculata*: Stejneger, 1903:557. Transfer to *Desmognathus*.

*Desmognathus quadrimaculatus*: Brimley, 1908:154. Emendation.

*Desmognathus quadramaculata*: Dunn, 1917a:401. Emendation.

*Desmognathus quadramaculatus*: Stejneger and Barbour, 1917:23. Emendation.

*Desmognathus quadramaculata*: Breder and Breder, 1923:17. Emendation.

*Desmognathus quadramaculatus*: Pope, 1924:8. Emendation.

*Desmognathus quadramaculatus quadramaculatus*: by inference, Bishop, 1941:12; but not actually published until Bishop, 1943:210, and Stejneger and Barbour, 1943:15.

*Desmognathus quadramaculatus amphileucus* Bishop, 1941:12, pl. 1, fig. 3. Type locality, "Demorest, Habersham County, Georgia, April, 1926, M. E. Phillips, Collector." Holotype, female, UMMZ 89767. Synonymy by Pope, 1949:1.

*Desmognathus quadramaculatus*: Hilton, 1951:75. Lapsus.

• CONTENT. No subspecies are currently recognized, but see Neill (1948) for a contrary opinion.

• DEFINITION. A large *Desmognathus* with a dark or black venter. Maximum snout to posterior end of vent length (SV) is 107 mm, total length 208 mm; sexual maturity is at 44-62 mm SV, and the three smallest transformed individuals seen are 32-33 mm SV. Intercostal spaces between adpressed toes are 1½ to 4½ in specimens over 60 mm SV, the lower counts (longer legs) are more prevalent southward. The tail is shorter than the snout-vent length, and sharply keeled dorsally, the keel not or barely reaching the level of the hind leg insertion. Males retain prevomerine teeth, 60 individuals of both sexes from 19 localities throughout the range have 5-23 ( $\bar{x}$  12.6) prevomerine teeth (sample means range from 10.6 to 17.8). Males with the mental gland very small, apical, astride the dentary, and projecting into a faint emargination of the upper lip; jaws straight in lateral view; mandible toothed posteriorly; larger than females.

In preservative, dark specimens are largely slatey-black above and below merging into mottled brown on the apical half of the tail, limbs, limb insertions, mandible, and the entire dorsum of the head to just posterior to the eyes. The swollen area anterior to the gular fold is sometimes paler than

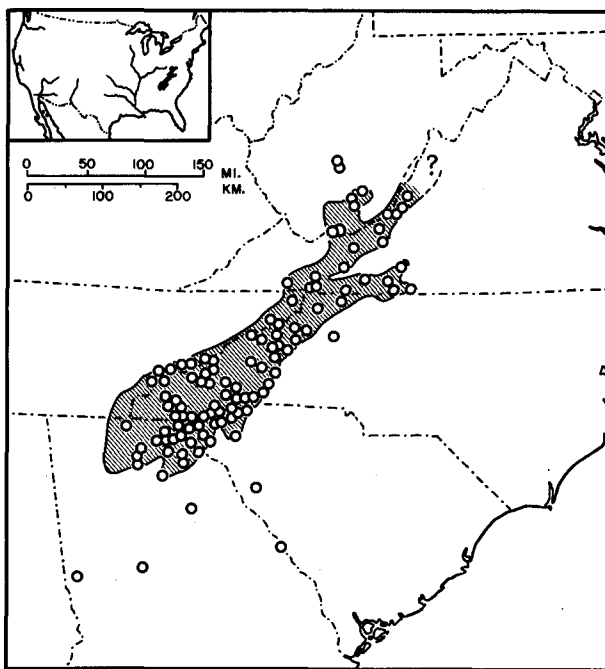
the belly, the throat often paler than the swollen area, and the mandible sometimes paler than the throat. The vent is white; the palms and soles vary from pale brown to almost white. In paler specimens, mottling is present on the lower sides and venter; and in the palest includes the entire dorsum; in such individuals the larval spot pattern often is visible. Counting those pale spots between but not above the limb insertions, this species has from 12 to 20 (mostly 14-17) spots in the two dorsal-most rows. The spots are paired or alternating with maximum crowding, irregularity, and asymmetry in the post-shoulder region. A few populations closely resemble *Leurognathus marmoratus*, and are best recognized by the more median internal nares.

Large larvae are about 41 mm SV; hatchlings with large yolk masses 11-14 mm SV. Fimbriae counts of 37 larvae from North Carolina are: dorsal gill 6-10 (mean about 8), middle gill 5-9 (8), ventral gill 4-6 (5), fimbriae are white and glistening with scattered basal melanophores, the rami have more melanophores. The venter of the trunk is not pigmented, the tail is variably darkened with melanophores, and the lower lip is rarely pigmented. The tail keel has a narrow median pale stripe and associated rows of spots which can be separate or fused with the median line.

• DESCRIPTIONS. The more useful descriptions of adults are by Bishop (1941, as *amphileucus*; 1943), Cope (1869, 1889, as *nigra*), Dunn (1917a, 1926), Huheey (1966), Neill (1948), and Pope (1949). Larvae are described by Bailey (1937), Bishop (1943), Eaton (1956), and Martof (1962). Eggs are described by Noble (1927b) and Pope (1924). The complete spermatophore has not been described.

• ILLUSTRATIONS. Photographs of moderate clarity of adults are in Bishop (1928, 1941, 1943), Conant (1958), Huheey (1966), Klingelhoffer (1956; not seen), and Martof (1962). A colored photograph appears in Cochran (1961). A stippled figure is given by Noble (1931b). Martof (1962) has a photograph in lateral view of a large larva, Noble (1927b) illustrates an encapsulated embryo, near hatching, and Pope (1924) has an excellent drawing in lateral view of a recent hatchling. Early eggs and spermatophores have not been illustrated. For other illustrations see PERTINENT LITERATURE.

• DISTRIBUTION. This species occurs in the southern Appalachian Mountains from Fayette County, West Virginia (Green, 1967), and Alleghany and Franklin Counties, Virginia (B. D.



MAP. Geographic distribution of *Desmognathus quadramaculatus*. The northeastern limit of its range is not clearly defined. Some of the scattered records in the south may be introductions by fishermen who use it for bait.

Valentine collection), to Banks County, Georgia (Martof, 1953) and Dawson County, Georgia (University of Georgia collection). It usually lives in or beside swift mountain streams, at elevations above 500 meters. Occasional specimens from lower elevations and the Piedmont (Martof, 1953, 1955) were probably sold as bait and released by fishermen.

• Fossil Record. None.

• PERTINENT LITERATURE. The most important references are Bishop (1943), Dunn (1926), Hairston (1949), Organ (1961), and Pope (1924). The first two are largely taxonomic, the last three primarily ecological. The skin is discussed and illustrated by Noble (1925). The lateral line system is mentioned by Fowler and Dunn (1917) and illustrated by Hilton (1947b). Myology is incompletely discussed, however the levator scapuli and the cularis are treated by Dunn (1941), the superficial muscles of the body and their motor areas are discussed and illustrated by Eaton (1957), the opercular apparatus is poorly sketched by Hilton (1949, 1950) and illustrated by Monath (1965), and the lateral superficial musculature of the head and neck is discussed and illustrated by Piatt (1935). The skull is illustrated in dorsal view by Hilton (1945), in cross-section by Moore (1899) and Dunn (1917a), in ventral view by Noble (1927a), the larval skull is described, discussed, and figured in dorsal view by Rubenstein (1971), and the larval vomers and palatopterygoids by Wake (1966); the otic apparatus is illustrated by Cope (1888), individual teeth by Noble (1927a), and the subocular calcareous nodules by Martof (1962) and Noble (1927a). The hyobranchial apparatus is illustrated by Hilton (1945, 1947a), and Wake (1966). Vertebrae are described and illustrated by Hilton (1948a), additional descriptions and comments are by Moore (1899, 1900), Soler (1950), and Wake (1963). Caudal anatomy and breakage is discussed and illustrated by Wake and Dresner (1967), internal pigmentation of the peritoneum by Wonderly (1963) and absence of testis pigment by Dunn (1917a) and Huheey (1966), lunglessness by Moore (1899), and the digestive system by Wonderly (1963). Capillaries of the muscle, skin and mouth are described by Czopek and Czopek (1967). The absence of a spiral valve in the truncus arteriosus and the nature of the digital blood sinuses are discussed by Noble (1925), while the size and number of erythrocytes is provided by Howell (1950) and Vernberg (1955). Starch gel electrophoresis of hemoglobin and liver lactate dehydrogenase is discussed by Schontz (1968). The choroid plexus is mentioned by Hilton (1953), the internal nares are illustrated by Martof (1962), the nasal gland is illustrated by Hilton (1951), the nasolabial grooves and their function are discussed by Brown and Martof (1966), testis lobing and sexual dimorphism by Organ (1961), a spermatophore decapped in September is mentioned by Organ and Lowenthal (1963), sperm are said to be similar to those of *D. fuscus* by Noble (1927a), discussed further by Noble and Weber (1929), and egg envelopes are described by Noble (1927b) and Salthe (1963).

Temperature tolerances and critical thermal maxima are provided by Bogert (1952), Hutchison (1961), and Zweifel (1957). Gas exchange and metabolic rate are discussed by Whitford and Hutchison (1965, 1967); evaporative water loss by Spight (1968). Altitudinal distribution is discussed by Huheey (1966) and McClure (1931), collection sites by many workers, especially Bogert (1952), Dunn (1928), Huheey (1964, 1966), Noble (1927a, 1927b), Tilley (1968), Wood (1947), while Brandon and Huheey (1971), King (1939), and McClure (1931) provide photographs of collection sites. Nests and egg deposition sites have been described especially by Hairston (1949), Organ (1961), Pope (1924), and Tilley (1968). Fecundity is discussed by the same authors and by Bishop (1924). Food is discussed by Bishop (1924), Hairston (1949), Huheey (1966), Huheey and Brandon (1961), Martof and Scott (1957), Netting (1932), and cannibalism is mentioned by Noble (1931b) and Noble and Evans (1932). Interaction and competition with *Desmognathus monticola* is described by Brandon and Huheey (1971). Population dynamics are discussed by Organ (1961), and supplemented and modified by Tilley (1968).

Courtship is reported by Noble and Brady (1930), and Noble (1931a).

Daily activity is discussed by Brandon and Huheey (1971), Hairston (1949), and mentioned briefly by Vial and Stewart (1971). Self-defense and biting are mentioned by Cope (1889), Dunn (1917a), Netting (1932), and Pope (1924, 1928). Dunn (1917a), King (1939), and McClure (1931) noted the habit of resting exposed, often in direct sunlight.

Parasites are discussed by Huheey (1966), Rankin (1937), and Walton (1964) who summarizes previous literature.

Geographic variation, although not carefully analyzed, is mentioned by Bishop (1941), King (1939), Neill (1947, 1948), Pope (1949), and Weller (1931). Relationships and evolution are discussed by Dunn (1926), Hairston (1949), Maslin (1952), Organ (1961), Rubenstein (1971), Tilley (1968), and Wake (1966). Partial albinism is mentioned by Brame (1962). The status of *D. q. amphileucus* is questioned by Neill (1948), Netting (1945), and Pope (1949).

Distribution records are as follows (due to space limits, works with an asterisk could not be cited but are in Bishop's (1943) excellent bibliography): General: Bishop (1943), Conant (1958), Cope (1869, 1889), Dunn (1926). WEST VIRGINIA: Green (1961, 1963, 1967), Hoffmann (1955), Richmond (1952). VIRGINIA: Bogert (1952), Dunn (1917a, 1918a\*, 1920, 1936), Fowler and Dunn (1917), Hoffman (1955), Hoffman and Kleinpeter (1948), Huheey and Brandon (1961), Hutchison (1956), King (1939), Martof and Rose (1962), Newman (1955), Organ (1961), Pope (1924, 1949), Richmond (1952). TENNESSEE: Bishop (1928, 1943), Blatchley (1901), Brimley (1918), Dunn (1917a), Fowler and Dunn (1917), Gentry (1955), Huheey (1964, 1966), Huheey and Stupka (1967), McClure (1931), Pope (1949), Rhoades (1895\*), Weller (1931), Windsor (1932\*), Wonderly (1963). NORTH CAROLINA: Bailey (1937), Bishop (1924, 1925\*, 1928, 1941), Brandon and Huheey (1971), Breder and Breder (1923), Brimley (1908, 1912\*, 1915\*, 1939-40), Dunn (1917a, 1917b, 1918b, 1920, 1924\*, 1927\*), Fowler and Dunn (1917), Hairston (1949), Harper (1935\*), Hilton (1948b), Huheey (1966), Huheey and Stupka (1967), Hutchison (1961), Pope (1928, 1949), Rubenstein (1971), Schontz (1968), Spight (1968), Stejneger (1903), Weller (1930\*, 1931). SOUTH CAROLINA: Bishop (1941), Bruce (1965), Chamberlain (1928\*), Dunn (1917a, 1918b), Pickens (1927\*), Schwartz (1957). GEORGIA: Bishop (1928 as *D. fuscus*, 1941, 1943), Dunn (1917a), Holbrook (1840, 1842), Humphries (1951), Martof and Scott (1957), Neill (1947, 1948), Pope (1949), Wood (1947). "CAROLINA": Holbrook (1840, 1842). Erroneous records are as follows: PENNSYLVANIA: Dunn (1917a), Fowler and Dunn (1917), Holbrook (1840, 1842). ILLINOIS: Dunn (1917a). Introductions are reported only in GEORGIA: Martof (1953, 1955).

• NOMENCLATURE HISTORY. Holbrook's descriptions of *S. quadramaculata* and *T. niger* appear to be composites of modern *D. fuscus*, *D. quadramaculatus*, and perhaps *D. auriculatus*. Two museum specimens "presented by Doctor Holbrook" are mentioned by Dunn (1926:72). They are M.C.Z. 183 from "Charleston, S.C.," and A.N.S.P. 14001 from "Penn.," both are listed as *quadramaculatus* by Dunn who nevertheless states that Holbrook's types of *Desmognathus* are not known to exist. A lectotype designation appears called for.

Green's name *Salamandra nigra* (1818) often has been used for the present species. The original description mentions "whitish" ventral surface, so the name probably applies to modern *D. fuscus*; but the names *nigra* and *niger* were widely used for the Black-bellied salamander prior to 1903. In that year Stejneger resurrected the name *quadramaculata* for twelve specimens (U.S.N.M. 30891-30902) from Grandfather Mountain, North Carolina. Stejneger recognized two large, montane, black-bellied species—*D. nigra* and *D. quadramaculata*, the former uniformly black above, the latter spotted above as in Holbrook's description and figure. These are now considered variants of *D. quadramaculatus*.

• REMARKS. This species is easily confused with *Leurognathus marmoratus*. The differences are described and illustrated by Pope (1924) and Martof (1962), described by Bailey (1937) and Eaton (1956), and summarized by Martof (1963).

Holbrook's 1840 publication is discussed and summarized by Schmidt (1942).

• ETYMOLOGY. The specific name *quadramaculatus* is from the Latin *quadratus*, four-sided, and *maculatus*, spotted.

COMMENT

Preserved specimens from the eastern end of the Great Smoky Mountains National Park, east to the area of Grandfather Mountain are paler and more mottled than those from farther south. Living specimens show considerable diversity in color and pattern, often with red, brown, or gray overlays which disappear rapidly after preservation. These paler overlays can cover the entire dorsum, or be variously restricted until only the larval spots are colored; the details of this variation are not

clear. Red spotted specimens resembling Holbrook's figure have been collected by B. D. Valentine in Virginia, Montgomery County, ½ mi. SW. Prices Forks.

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