Catalogue of American Amphibians and Reptiles.

ANDERSON, JAMES D. 1969. *Dicamptodon* and *D. ensatus.*

Dicamptodon Strauch
Giant salamander

Dicamptodon Strauch, 1870:68. Type-species *Triton ensatus* Eschscholtz 1833, by monotypy.
Chondrotus Cope 1887:88. Type-species *Amblystoma tenebrosus* Baird and Girard 1852 = *T. ensatus* Eschscholtz 1833.

• CONTENT. One species, *Dicamptodon ensatus.*

• DEFINITION. A large ambystomatid with well-developed lungs and ypsiloid cartilage, an independent lacrimal, exoccipital, prootic and columella. The skull is more solid and rigid than in any other ambystomatid. The premaxillary spines are short and broad with the fontanelle almost or completely obliterated. The teeth are compressed, blade-like structures. Three phalanges are present in the fourth toe. The color pattern consists of a dark mottling on a brown background. The larvae are of the stream type with reduced gills and dorsal fin.

• DESCRIPTIONS, ILLUSTRATIONS, DISTRIBUTION. See species account.

• FOSSIL RECORD. Peabody (1959) attributes trackways from the lower Pliocene of California to *Dicamptodon* sp.

• PERTINENT LITERATURE. Tihen (1958) and Regal (1966) discussed in detail structure and relationships and Dunn (1920) and Eaton (1934) gave more limited accounts.

• REMARKS. Tihen (1958) placed *Dicamptodon* in the monotypic subfamily Dicamptodontinae and considered it the most primitive member of the family. Regal (1966) included both *Rhyacotriton* and *Dicamptodon* in the same subfamily and considered the latter a more advanced genus.

Peabody (1954) suggested a close relationship between *Dicamptodon* and *Ambystomichnus*, a form known only from trackways of the Paleocene, and Tihen (1958) placed both genera in the Dicamptodontinae.

• ETYMOLOGY. *Dicamptodon*, of masculine gender, is from the Greek (*di* + *kamptos* + *odon*), and means having doubly curved teeth.

Dicamptodon ensatus (Eschscholtz)
Pacific giant salamander

Triton ensatus Eschscholtz, 1833:6. Type-locality, vicinity of the Bay of San Francisco. The type specimen, not known to exist, was collected in November by Eschscholtz.
Amblystoma tenebrosum Baird and Girard, 1852:174. Type locality, "Oregon." Holotype, U. S. Natl. Mus. 4710.
Xiphonura tenebrosa: Girard, 1858:14. New combination.
Amblystoma aterrimum Cope, 1867:201. Type locality, "North Rocky Mtns." Holotype, U.S. Natl. Mus. 5242: collector, Lt. Mullen.
Dicamptodon ensatus: Strauch, 1870:68. Transfer to new genus.
Chondrotus tenebrosus: Cope, 1887:88. See generic account.
Ambystoma ensatum: Grinnell and Camp, 1917:139.
Ambystoma tenebrosum: Stejneger and Barbour, 1917:11.

• CONTENT. No subspecies have been described.

• DEFINITION. Same as for the genus.

• DESCRIPTIONS. Cope (1867, 1889), Storer (1925), Bishop (1943) and Stebbins (1951, 1966) described general features, especially color and proportions. Cope (1867) described the hyoid apparatus; Tihen (1958), osteology and teeth; Regal (1966), tooth pattern and replacement; Eaton (1933, 1934), jaw suspension. Eschscholtz (1833) included descriptions of internal and external morphology, skeleton and teeth that were probably added by Rathke. Stokely and Holle (1953) gave vertebral counts and Hilton (1946, 1951, 1952, 1953, 1956, 1957), brief anatomical descriptions. The urogenital system was described by De Marco (1952). Czopek (1962) described respiratory capillary beds. Maslin (1950) and Bogert (1960) described the vocal apparatus and voice. Dethlefsen (1948) described eggs and nests; Bishop (1943), Myers (1943) and Stebbins (1951) described larvae.

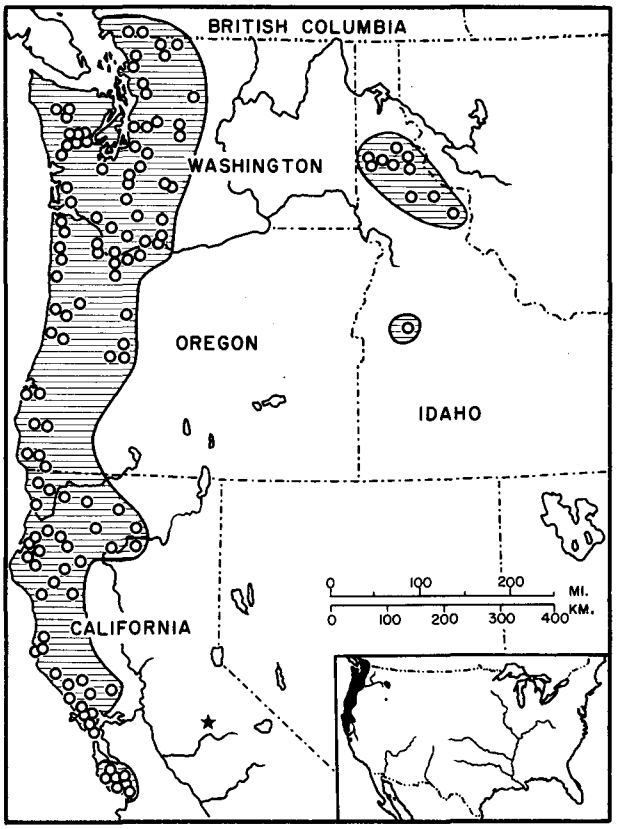
• ILLUSTRATIONS. Storer (1925), Bishop (1943) and Stebbins (1951, 1954, 1966) illustrated adults; Bishop (1943), and Stebbins (1951) illustrated larvae. Cope (1889) provided drawings of head, mouth and feet. Gordon (1939), Stebbins (1951) and Regal (1966) illustrated tooth arrangement and Regal (1966) diagrammed tooth replacement. The hyoid was illustrated by Eschscholtz (1833) and Cope (1887); throat musculature by Eschscholtz (1833); larynx and trachea by Hilton (1952) and Maslin (1950); capillaries of the palate by Czopek (1962). Tihen (1958) illustrated the teeth and the skull and Eschscholtz (1833) the skull, limbs, girdles, and vertebrae. Monath (1965) illustrated the opercular apparatus. Dethlefsen (1948) gave photographs of eggs and nest site. Bogert (1960) provided a sound spectrogram of the voice. Peabody (1959) illustrated tracks and trackways of living and possible fossil *Dicamptodon* and the related fossil *Ambystomichnus.*

• DISTRIBUTION. Southwestern British Columbia to Santa Cruz County, California, primarily in humid coastal forests, and in the Rocky Mountains of Idaho and Montana.

Savage (1952) discussed distribution east of the Cascade Mountains; Gordon (1939), Logier and Toner (1961), and Slater (1955) gave regional locality records.

• FOSSIL RECORD. See generic account.

• PERTINENT LITERATURE. Cope (1887), Eaton (1934), Tihen (1958) and Regal (1966) discussed relationships and phylogeny. Salthe (1965) and Salthe and Kaplan (1966) used the lactic dehydrogenase enzyme of *Dicamptodon* in studies on amphibian enzyme activity and evolution. Brattstrom (1963) gave body temperatures of adults and larvae. Bishop (1943) and Stebbins (1951) provided summaries on natural history. Two clutches



MAP. Distribution of *Dicamptodon ensatus.* Circles indicate locality records; the type-locality is not definite enough to be plotted. The star marks the Pliocene fossil (trackway).

of eggs have been described by Dethlefsen (1948) and by Henry and Twitty (1940). Kessel and Kessel (1943a, 1943b, 1944) studied growth and metamorphosis of larvae. Fitch (1936), Schonberger (1944) and Metter (1963) gave food habits of larvae.

Reed (1949), De Marco (1952), and Schuierer (1958) discussed neoteny. Stebbins (1955) indicated habitat segregation between larvae of *Rhyacotriton* and *Dicamptodon*. Dearolf (1956) and Rodgers (1962) reported the occurrence of larvae in caves.

• REMARKS. Eggs described and illustrated by Storer (1925) are of *Ambystoma gracile* and not *Dicamptodon* (Henry and Twitty, 1940; Stebbins, 1951).

• ETYMOLOGY. The specific name *ensatus* (Latin *ensis*, meaning sword) apparently refers to the pointed teeth.

LITERATURE CITED

Baird, Spencer F., and Charles Girard. 1852. Characteristics of some new reptiles in the Museum of the Smithsonian Institution. Proc. Acad. Nat. Sci. Philadelphia 6:68–70, 174.

Bishop, Sherman C. 1943. Handbook of salamanders: The salamanders of the United States, of Canada, and of Lower California. Comstock Publ. Co., Ithaca, New York. xiv + 555 pp.

Bogert, C. M. 1960. The influence of sound on behavior of amphibians and reptiles, pp. 137–320. *In* W. E. Lanyon and W. N. Tavolga (ed.), Animal sounds and communication. Amer. Institute Biol. Sci. Publ. (7) xiii + 443 pp.

Brattstrom, Bayard H. 1963. A preliminary review of the thermal requirements of amphibians. Ecology 44 (2): 238–255.

Cope, E. D. 1867. A review of the species of the Amblystomidae. Proc. Acad. Nat. Sci. Philadelphia (2nd series) 19:166–211.

— 1887. The hyoid structure in the Amblystomid salamanders. American Nat. 21 (1): 87–88.

— 1889. The Batrachia of North America. Bull. U. S. Nat. Mus. (34) :1–525.

Czopek, Juliusz. 1962. Vascularization of respiratory surfaces in some Caudata. Copeia 1962 (3):576–587.

Dearolf, K. 1956. Survey of North American cave vertebrates. Proc. Pennsylvania Acad. Sci. 30:201–210.

Dethlefsen, Edwin S. 1948. A subterranean nest of the Pacific giant salamander, *Dicamptodon ensatus* (Eschscholtz). Wasmann Collector 7 (3):81–84.

Dunn, E. R. 1920. Notes on two Pacific coast Ambystomidae. Proc. New England Zool. Club 7:55–59.

De Marco, M. N. 1952. Neoteny and the urogenital system in the salamander *Dicamptodon ensatus*. Copeia 1962 (3): 192–193.

Eaton, T. H., Jr. 1933. The occurrence of streptostyly in the Ambystomidae. Univ. California Publ. Zool. 37 (17): 521–526.

— 1934. The affinities of *Dicamptodon* and *Rhyacotriton*. Copeia 1934 (4) :182.

Eschscholtz, Friedr. 1833. Zoologischer Atlas. Part V. Berlin. viii + 28 pp.

Fitch, Henry S. 1936. Amphibians and reptiles of the Rogue River Basin, Oregon. Amer. Midland Nat. 17 (3):634–652.

Girard, C. 1858. United States exploring expedition, during the years 1838, 1839, 1840, 1841, 1842 under the command of Charles Wilkes, U. S. N. 20. Herpetology. Philadelphia, J. B. Lippincott & Co. xvii + 496 pp.

Gordon, Kenneth. 1939. The Amphibia and Reptilia of Oregon. Oregon State Monogr. Studies in Zool. (1) :1–82.

Grinnell, J., and C. L. Camp. 1917. A distributional list of the amphibians and reptiles of California. Univ. California Publ. Zool. 17 (10) :127–208.

Henry, W. V., and V. C. Twitty. 1940. Contributions to the life histories of *Dicamptodon ensatus* and *Ambystoma gracile*. Copeia 1940 (4) :247–250.

Hilton, W. A.. 1946. A preliminary study of skeletons of Amblystomidae. J. Entomol. Zool. 38 (2) :29–36.

— 1951. Teeth of salamanders. Herpetologica 7 (3) :133–136.

— 1952. The pulmonary respiratory system of salamanders. *Ibid.*, 8(3) :87–92.

— 1953. The choroid plexus of the lateral and third ventricles of tailed Amphibia. J. Comp. Neurol. 99:545–559.

— 1956. Eye muscles of salamanders. Herpetologica 12 (4): 273–276.

— 1957. Head muscles of salamanders. Bull. So. California Acad. Sci. 56 (1) :1–13.

Kessel, E. L., and B. B. Kessel. 1943a. The rate of growth of the young larvae of the Pacific giant salamander, *Dicamptodon ensatus*. Wassmann Coll. 5(3) :108–111.

— 1943b. Rate of growth of the older larvae of the Pacific giant salamander, *Dicamptodon ensatus*. *Ibid.*, 5 (4) :141–142.

— 1944. Metamorphosis of the Pacific giant salamander, *Dicamptodon ensatus* (Eschscholtz). *Ibid.*, 6 (2) :38–48.

Logier, E. B. S., and G. C. Toner. 1961. Check-list of the amphibians and reptiles of Canada and Alaska, a revision of contribution No. 41. Royal Ontario Mus., Contrib. No. 53, viii + 92 pp.

Maslin, T. P. 1950. The production of sound in caudate Amphibia. Univ. Colorado Studies Biol. (1) :29–45.

Metter, Dean. 1963. Stomach contents of Idaho larval *Dicamptodon*. Copeia 1963 (2):435–436.

Monath, Thomas. 1965. The opercular apparatus of salamanders. J. Morphol. 115 (2) :149–170.

Myers, G. S. 1943. Notes on *Rhyacotriton olympicus* and *Ascaphus truei* in Humboldt County, California. Copeia 1943 (2):125–126.

Peabody, F. E. 1954. Trackways of an ambystomid salamander from the Paleocene of Montana. J. Paleontol. 28:79–83.

— 1959. Trackways of living and fossil salamanders. Univ. California Publ. Zool. 63 (1) :1–72.

Reed, Charles A. 1949. The problem of metamorphosis in the western marbled salamander, *Dicamptodon ensatus*. Copeia 1949 (1):81.

Regal, Philip J. 1966. Feeding specializations and the classification of terrestrial salamanders. Evolution 20 (3) :392–407.

Rodgers, Thomas L. 1962. Report of giant salamander in California. Copeia 1962 (3) :646–647.

Salthe, S. N. 1965. Comparative catalytic studies of lactic dehydrogenases in the Amphibia: environmental and physiological correlations. Comp. Biochem. Physiol. 16: 393–408.

—, and N. O. Kaplan. 1966. Immunology and rates of enzyme evolution in the Amphibia in relation to the origins of certain taxa. Evolution 20 (4) :603–616.

Savage, J. M. 1952. The distribution of the Pacific giant salamander, *Dicamptodon ensatus*, east of the Cascade Mountains. Copeia 1952 (3) :183.

Schonberger, C. F. 1944. Food of salamanders in the northwestern United States. Copeia 1944 (4) :257.

Schuierer, F. W. 1958. Factors affecting neoteny in the salamander, *Dicamptodon ensatus* (Eschscholtz). Bull. So. California Acad. Sci. 57:119–121.

Slater, J. R. 1955. Distribution of Washington amphibians. Occ. Papers Dept. Biol. Coll. Puget Sound 16:122–154.

Stebbins, Robert C. 1951. Amphibians of western North America. Univ. California Press, Berkeley. ix + 539 pp.

— 1954. Amphibians and reptiles of western North America. McGraw-Hill Book Co., New York. xxiv + 528 pp.

— 1955. Southern occurrence of the Olympic salamander *Rhyacotriton olympicus*. Herpetologica 11 (4) :238–239.

— 1966. A field guide to western reptiles and amphibians. Houghton Mifflin Co., Boston xiv + 279 pp.

Stejneger, Leonhard, and Thomas Barbour. 1917. A checklist of North American amphibians and reptiles. Harvard Univ. Press, Cambridge, Massachusetts. iv + 125 pp.

Stokely, Paul S., and Paul A. Holle. 1953. Variation in the vertebral axis of the Ambystomidae. Herpetologica 9 (2): 133–138.

Storer, Tracy I. 1925. A synopsis of the Amphibia of California. Univ. California Publ. Zool. 27:1–342.

Strauch, Alexander. 1870. Revision der Salamandriden-Gattungen nebst beschreibung einiger neuen oder weniger bekannten arten dieser familie. Mem. Acad. Imperiale Sci. St. Petersbourg 16 (4) :1–109.

Tihen, J. A. 1958. Comments on the osteology and phylogeny of ambystomatid salamanders. Bull. Florida State Mus. 3 (1):1–50

J. D. ANDERSON, RUTGERS UNIVERSITY, NEWARK, NEW JERSEY 07102.

Published 20 June 1969 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.