

Pacific giant salamanders

(*Dicamptodontidae*)

Class Amphibia
Order Caudata
Suborder Salamandroidea
Family Dicamptodontidae

Thumbnail description

Large salamanders that have a multiyear aquatic larval stage and usually metamorphose into terrestrial adults with very large heads, short tails, stout bodies, and strong limbs

Size

6.7–13.8 in (17–35 cm)

Number of genera, species

1 genus; 4 species

Habitat

Wooded areas with clear, permanent streams for larvae

Conservation status

No species listed by the IUCN



Distribution

Northwestern North America

Evolution and systematics

These large salamanders occupy a somewhat enigmatic position phylogenetically. They long were thought to be allied with mole salamanders (Ambystomatidae) and torrent salamanders (Rhyacotritonidae) and were classified in a single family, Ambystomatidae, but there are no uniquely derived traits shared by these three groups. Despite the fact that each contains only a single genus, at present three families are typically recognized. Some molecular evidence suggests that dicamptodontids and ambystomatids are sister taxa. Some recent classifications place the dicamptodontids and rhyacotritontids in a single family, Dicamptodontidae, but there is no morphological or molecular evidence in support of a sister-group relationship of these two distinct lineages. Dicamptodontids differ from most ambystomatids in having a larval stage that lasts for more than one year, but there are species in both families that never metamorphose and breed as permanently gilled forms. Dicamptodontids also differ from ambystomatids in having relatively much larger and more heavily ossified skulls, with more skull bones; in the anatomy of the tongue skeleton; and in having trunk vertebrae that are not pierced by the spinal nerves. Members of both families have species that reach the largest size of any metamorphosed, terrestrial salamander (one plethodontid is as nearly as

large), but dicamptodontids are more massive. Dicamptodontids differ from rhyacotritontids in being much larger and in having less well developed skulls and limbs.

The single genus, *Dicamptodon*, includes four species (*D. aterrimus*, *D. copei*, *D. ensatus*, and *D. tenebrosus*). No subfamilies are recognized.

Physical characteristics

These large, robust salamanders have a massive head, well developed eyes, and large, well developed limbs. Fore and hind limbs fail to overlap when adpressed to the trunk in *D. copei* as well as in some individuals of the other species, but overlap slightly by as many as four costal folds in the other species. The tail is relatively short, always much shorter than head plus body length, and it is laterally compressed with a distinct keel. Metamorphosed adults are dark in coloration, often attractively mottled or marked with different shades of gray. Larvae are somewhat flattened dorsoventrally and are darkly pigmented. The relatively short, robust tail is somewhat flattened at the base but then becomes laterally compressed with a modest fin. The fin terminates at the base of



A coastal giant salamander (*Dicamptodon tenebrosus*) eats a large banana slug (*Ariolimax columbianus*) in northern California, USA. (Photo by Karl H. Switak/Photo Researchers, Inc. Reproduced by permission.)

the tail, well behind the pelvis. Gills of larvae are short and relatively inconspicuous in larvae living in small, rapidly flowing streams, but can become large and filamentous in larvae living in lakes and larger streams.

Distribution

The family is narrowly distributed and is restricted to the Pacific Northwest region of North America. An isolated group of populations of *D. ensatus* occurs on the central and southern San Francisco peninsula in California. The species are more or less continuously distributed in the coastal ranges from north of San Francisco to the northern end of the Olympic Peninsula in Washington, and from the southern Cascade Mountains of Oregon into the coastal mountains of southwestern British Columbia (but not on Vancouver and neighboring islands). One species, *D. aterrimus*, is disjunctly distributed and occurs in the mountains of northern Idaho and northwestern Montana, west of the Continental Divide.

Habitat

Dicamptodontids are restricted to wooded areas that have clear, permanent streams in which their larvae live. Typically they live in coniferous woodlands that are in relatively steep terrain. They do especially well in areas dominated by Douglas fir and coast redwood. Larvae do best in small, troutless streams, but larger larvae may live in rivers (such as the Willamette) and small lakes. Occasionally they are caught on hook and line by fishermen.

Behavior

Adults are frequently found walking by day in dark, moist forests, but more typically they are nocturnal. Large individuals can be aggressive and engage in head-butting and tail-lashing. They are capable of inflicting a dangerous bite

because they have strong jaws and small but numerous and well developed teeth. Nothing is known concerning courtship and mating, but fertilization is internal by means of a spermatophore, probably deposited in a terrestrial site, and eggs are deposited singly but in large groups of 80 or more under large rocks and logs in headwater streams. Adults are capable of vocalizing. They produce a sharp "bark," but the function of this behavior is unknown.

Feeding ecology and diet

The larvae are opportunistic feeders of benthic larvae of insects (those found at the bottom of the stream or river), but they also take other stream-dwelling organisms. Because the larvae grow to large size, they feed on larger prey as well, including larvae of ambystomatid salamanders and small fish. They are considered to be the most abundant vertebrate predators in headwater streams throughout their range. Adults display a wide range of sizes. As small adults they eat a wide array of terrestrial invertebrates, which they catch with their protrusible tongue. As they grow larger they prey on vertebrates, such as slender salamanders, lizards, shrews, mice, and even snakes, which they seize with their strong jaws. They forage widely and climb vegetation as high as 6.5 ft (2 m) on tree trunks.

Reproductive biology

Relatively little is known concerning the reproduction of dicamptodontids. Courtship has not been observed, but most likely it is aquatic because *D. copei* typically reproduces as a gilled form. Eggs are hard to find. The few discoveries have been under large rocks and logs in or at the edge of streams. Eggs develop slowly, and hatching does not occur for many weeks. Newly hatched larvae have large amounts of abdominal yolk and probably do not feed for several weeks. The larval stage is at least two years and may be as long as four years occasionally. Metamorphosis is rare in *D. copei*. Reproductive larvae have been reported in the other species, but courting and egg laying has not been observed, and the gravid larvae may metamorphose before reproducing.

Conservation status

Pacific giant salamanders are dependent on forests and clear, unpolluted streams. Areas in which they occur have been and are now undergoing great habitat modification as a result of forestry practices, road building and other construction, and urbanization. Salamanders are most abundant in old growth forests, but they survive following logging and even increase in density so long as streams remain relatively unsilted. Eventually their numbers decline, and as the forest regrows they appear not to recover, and their populations in second growth forests are much lower than in primary forests. These salamanders may spend most of their lives as stream-dwelling larvae, so stream quality is a major factor in their long-term survival. Different species are protected to some degree in various preserves, including national and state parks, and none of the species is at risk of extinction at present.

Significance to humans

Pacific giant salamanders are rarely seen by humans, but rare encounters are memorable because the animals are im-

pressively large and do not attempt to escape unless molested. Adults can be encountered during periods of light rain on the floors of dense coniferous forests.

Species accounts

Coastal giant salamander

Dicamptodon tenebrosus

TAXONOMY

Dicamptodon tenebrosus Baird and Girard, 1852, Oregon, United States.

OTHER COMMON NAMES

English: Pacific giant salamander; German: Pazifischer Riesen-Guerzahnmolch.

PHYSICAL CHARACTERISTICS

Adults of this species may be the largest terrestrial salamanders, with head plus body lengths of more than 7.5 in (19 cm) and total length of at least 13.5 in (34 cm). Projected mean adult sizes based on statistical analyses by Nussbaum (1976) are about 8 in (20 cm) total length. The largest recorded specimens, however, are larvae found in large rivers; these exceed 8 in (20 cm) in head plus body length and are nearly 14 in (36 cm) in overall length. While tiger salamanders (*Ambystoma tigrinum*) also reach this approximate size, they are differently proportioned, having longer tails and smaller heads, so giant salamanders are perceived as being larger and are certainly more massive. Pacific giant salamanders are geographically variable in proportions, with populations from California having longer legs. The species is highly variable in coloration of metamorphosed individuals. Coloration is variable, but the ground color is dark in larvae and in adults, and as metamorphosis approaches, light coloration appears over the dark base and produces a marbling effect of light (silvery to dull golden in color) on dark. The marbling varies from fine to coarse, and in extreme cases it is so coarse that the underlying ground color is obscured.



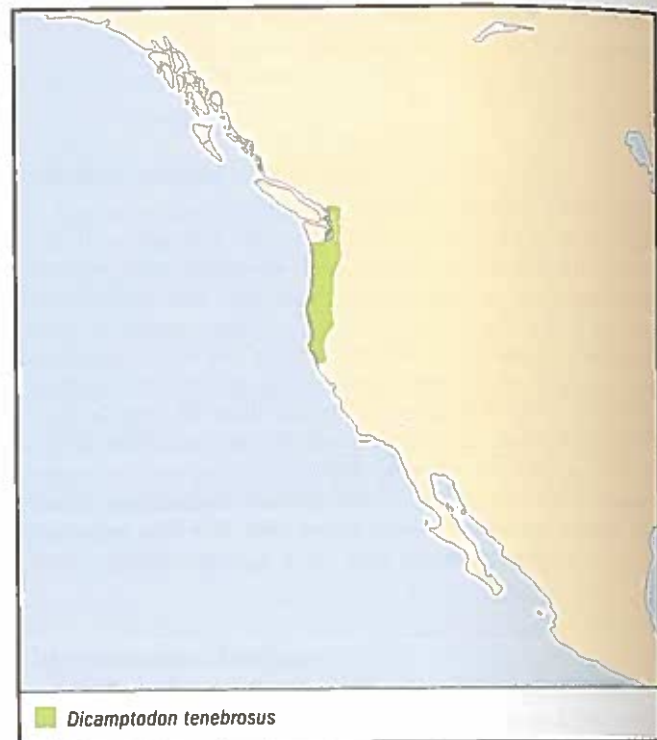
Dicamptodon tenebrosus

DISTRIBUTION

This species occurs in and near streams from southwestern British Columbia, Canada (south of the Fraser River), southward generally west of the crest of the Cascade Mountains to Mendocino and Sonoma counties in northern California, where it is abruptly replaced by the closely related and morphologically nearly identical California giant salamander, *D. ensatus*. In some streams hybridized populations occur, but there is apparently no gene flow between the two species. Some populations occur in isolated habitats in north central Oregon, east of the Cascade crest.

HABITAT

Coniferous woodlands.



Dicamptodon tenebrosus

BEHAVIOR

Adult salamanders are generally nocturnal and secretive, but they can be encountered on rainy days in densely forested regions walking through leaf litter. When approached they may issue a distinctive "bark," for they are one of the very few salamanders with a voice. They also can be found on rainy nights attempting to cross roads in areas near breeding sites.

FEEDING ECOLOGY AND DIET

These salamanders are voracious eaters and readily take frogs and small mammals, but they also eat worms and arthropods.

REPRODUCTIVE BIOLOGY

Very little is known concerning the breeding habits of Pacific giant salamanders. They have internal fertilization, so males are presumed to produce a spermatophore, but it has not been observed. Females typically lay large numbers of large, yolk eggs under large rocks that are at least partially submerged in streams. Eggs take several months to hatch, and they appear to be guarded by the female during this time.

CONSERVATION STATUS

Not threatened. The greatest danger to this species is destruction of forests and siltation of streams. Larvae require at least two full years in clear streams.

SIGNIFICANCE TO HUMANS

The species is rarely encountered and is little known to humans. ♦

Resources

Books

Petranka, James W. *Salamanders of the United States and Canada*. Washington, DC: Smithsonian Institution Press, 1998.

Periodicals

Nussbaum, Ronald A. "Geographic Variation and Systematics of Salamanders of the Genus *Dicamptodon* Strauch

(Ambystomatidae)." *Miscellaneous Publications of the Museum of Zoology of the University of Michigan* 149 (1976): 1-94.

Parker, M. S. "Feeding Ecology of Stream-dwelling Pacific Giant Salamander Larvae *Dicamptodon tenebrosus*." *Copeia* 1994 (1994): 705-718.

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