Terrestrial Pacific Giant Salamanders: Natural History and Response to Forest Practices

Barbara E. Johnston
Department of Zoology, University of British Columbia
Vancouver, BC, V6T 1Z4, Canada
johnston@fisheries.com

ABSTRACT

The Pacific giant salamander (*Dicamptodon tenebrosus*) is Red-listed in British Columbia because of its limited geographic distribution and loss of its habitat through logging and urban development. Aspects of larval giant salamander ecology have been studied, but virtually nothing is known about the terrestrial phase of this species. I used radiotelemetry to examine movements and habitat use of terrestrial Pacific giant salamanders in forested habitat. I also investigated the effects of clearcut logging and riparian buffer strips on their behaviour. Terrestrial Pacific giant salamanders were found to be relatively sedentary creatures that spent most of their time in refuges such as burrows, rotten logs, and streams. They were predominantly nocturnal and their activity level was strongly associated with rain. Although their response to forest practices was ambiguous, some results suggested that these animals may be adversely affected by clearcut logging and that riparian buffer strips could help conservation efforts.

Key words: *Dicamptodon tenebrosus*, habitat, logging, Pacific giant salamander, radiotelemetry.

The Pacific giant salamander is generally considered to be an obligate associate of old-growth forests, most commonly found along fast-flowing mountain streams. This semiaquatic species depends on streams for breeding and larval development. Although the ecology of aquatic Pacific giant salamanders has been studied, little is known about the terrestrial phase of this species.

In Canada, the Pacific giant salamander is found solely within the Chilliwack River valley. Because of its limited geographic distribution and the rapid rate at which its habitat is being lost to logging and residential development, the Pacific giant salamander is Red-listed (considered threatened or endangered) in British Columbia and is classified as "vulnerable" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). To better manage for the conservation of the Pacific giant salamander in British Columbia we must learn more about its basic natural history and the effects that habitat alteration have on this elusive creature. My objectives were to: (1) increase our understanding of terrestrial Pacific giant salamander natural history, specifically habitat use and activity pattern; (2) determine the effects of clearcut logging on movement patterns and habitat use of terrestrial giant salamanders; and (3) assess the efficacy of riparian buffer strips for their conservation.

METHODS

The study was conducted during the summer and fall of 1996 and 1997 in the Chilliwack and neighbouring Nooksack river valleys in southwestern British Columbia and northwestern Washington. I used 7 study sites: 2 old growth, 2 second growth, 1 clearcut to the stream margin, and 2 clearcut with forested riparian buffer strips (20–30 m wide) retained on each side of the stream.

Twenty salamanders with mass >25 g were captured during night searches and each was surgically implanted with a radio transmitter (Holohil model BD-2GH;Holohil Systems Ltd., Carp, Ont.). Salamanders were then released at their capture sites. Using a handheld directional antenna, I located each individual every second day for the remainder of the study (about 3 months). Telemetry locations were used to determine movement patterns and large-scale habitat use of the salamanders. I also conducted 24-hour monitoring sessions to determine daily activity patterns. I measured microhabitat features at 10 refuge sites per salamander and compared these data with information collected at paired "nonuse" sites used to represent habitat availability.

L. M. Darling, editor. 2000. Proceedings of a Conference on the Biology and Management of Species and Habitats at Risk, Kamloops, B.C., 15 - 19 Feb.,1999. Volume One.
B.C. Ministry of Environment, Lands and Parks, Victoria, B.C. and University College of the Cariboo, Kamloops, B.C. 490pp.

RESULTS

Natural History

Movements

The terrestrial Pacific giant salamanders were relatively sedentary creatures. They often went several days or even weeks without changing location. They were predominantly nocturnal and their activity level was strongly associated with precipitation. During periods without rain, activity was negatively associated with temperature. No evidence suggested seasonal migration in this species, as is characteristic of many closely related ambystomid salamanders.

Habitat Use

There was a great deal of individual variation in the way salamanders used their habitat. Some salamanders never ventured away from the stream while others were found primarily in upslope habitat. Refuge sites were associated with the availability of coarse woody debris, water, rocks, and leaf litter. Salamanders were also frequently found underground in small mammal burrows and root channels. When using coarse woody debris for cover, salamanders selected old wood in advanced stages of decay over newly fallen wood.

Effects of Clearcut Logging

Because these animals are fossorial and relatively sedentary, they are difficult to capture using the standard amphibian techniques (pitfall traps, time and area constrained searches). Therefore, I could not compare population densities or relative abundance in logged and control areas. I used 2 alternate approaches to assess the effects of clearcut logging on terrestrial Pacific giant salamanders. First, I examined the response of salamanders when they encountered the forest-clearcut interface. At sites with riparian buffer strips I released radio-tagged salamanders right at the boundary between forest and clearcut habitat. These salamanders did not move in random directions, but avoided entering clearcut habitat.

Second, I compared the behaviour of giant salamanders in different habitat types. For this analysis I measured total area covered, mean movement length, mean refuge duration, seasonal activity level, diel activity pattern, mean distance from stream, and proportional use of near-stream versus upslope habitat. While some measures showed no effect of habitat type, trends in other measures suggested that salamanders in clearcut habitat might have adjusted their behaviour to reduce their risk of desiccation. For example, compared with salamanders in forested areas, individuals in clearcut habitat covered less area, stayed in refuges longer, reduced their activity level in the dry summer season, and stayed closer to the stream. Salamander activity was also more dependent on precipitation in clearcuts than in other habitat types.

Efficacy of Riparian Buffer Strips

Riparian buffer strips appeared to be a promising management strategy for the conservation of terrestrial Pacific giant salamanders. A hypothetical buffer 40 m on each side of the stream contained 88% of the telemetry locations recorded for salamanders at forested sites. A buffer half this width (20 m on each side of the stream) still contained 80% of salamander locations. In addition, the behaviour of salamanders at sites with riparian buffer strips was indistinguishable from that of salamanders found in continuous forest.

DISCUSSION

Although terrestrial Pacific giant salamanders occur in clearcuts, individuals in this habitat appear to alter their behaviour in ways expected of amphibians under moisture or temperature stress. Without information about giant salamander survival or reproductive rates, effects of clearcut logging on salamander fitness and long-term population persistence remain to be determined.

ACKNOWLEDGEMENTS

This research was funded by Forest Renewal BC, the BC Habitat Conservation Trust Fund, and World Wildlife Fund Canada. I thank my supervisor W. Neill and my field assistants L. Frid, M. Krause, and D. Casimir.

REFERENCES

Johnston, B. In Review. Movements and habitat use of terrestrial Pacific giant salamanders. J. Herpetol.

_____, and L. Frid. In Review. Impact of clearcut logging on movements by terrestrial Pacific giant salamanders (*Dicamptodon tenebrosus*). For. Ecol. Manage.