Forest Sciences

Prince Rupert Forest Region

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Riparian Management and the Tailed Frog in Northern Coastal Forests

Research Issue Groups:

- Forest Biology
- Forest Growth
- Soils
- Wildlife Habitat
- Silviculture
- Ecosystem Inventory and Classification
- Biodiversity
- Ecosystem Management
- Hydrology
- Geomorphology
- Extension

Figure 1. Adult male tailed frog.

Introduction

The protection of aquatic environments and the appropriate management of adjacent forests are important objectives of forest management (Ministry of Forests 1995a; Ministry of Forests 1995b). Until recently most of our efforts have been aimed at fish habitat protection, but there is now a greater appreciation of the importance of headwater creeks for protecting downstream values, and as unique ecosystems in their own right.

The tailed frog (*Ascaphus truei* ; Figure 1) is an unusual amphibian that breeds in small, fast flowing coastal creeks and streams and has potential as a biological "indicator" for assessing the impact of management activities. This species is unique to the west coast of North America, and only recently has it's presence as far north as the Skeena River drainage been documented (Hazelwood 1993). In taxonomic terms the tailed frog is widely separated from other amphibian species, occupying a unique and ancient evolutionary branch. This taxonomic uniqueness is reflected in unusual physical and ecological characteristics. It is the only North American frog, for example, that uses internal fertilization (thus the purpose of the "tail", the male reproductive appendage). The eggs are laid in streams, and require about 4 years to develop through the tadpole stage before emerging as a fully formed frog (Figure 2). This long developmental period means a high rate of tadpole mortality and potential sensitivity to degradation of the stream environment.

This note summarizes two years of work examining tailed frog distribution in parts of the Coastal Western Hemlock (CWH) biogeoclimatic zone of the Prince Rupert Forest Region, and the relationship of tadpole density to creek characteristics and timber harvesting. More detailed reports on this work will be available later in 1996.

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Distribution of the Tailed Frog in the North Coast and Kalum Districts

The distribution of the tailed frog appears closely tied to the CWH zone and associated subalpine Mountain Hemlock (MH) zone. It is possible the species occurs in adjacent areas of the neighbouring Interior Cedar-Hemlock (ICH) or Sub-Boreal Spruce (SBS) zones, although no confirmed sightings have been made.

Although the species is wide-spread, occurrence and abundance in creeks is not uniform throughout the CWH, possibly due to differences in geology and the resulting physical properties of creeks. The CWHws (Wet Sub-Maritime) subzone south and east of Terrace (Kitimat drainage, Skeena West area, Copper River drainage) has the greatest frequency of occurrence and abundance of areas sampled to-date (Figure 3).

Figure 2. Tadpoles in various stages of development.

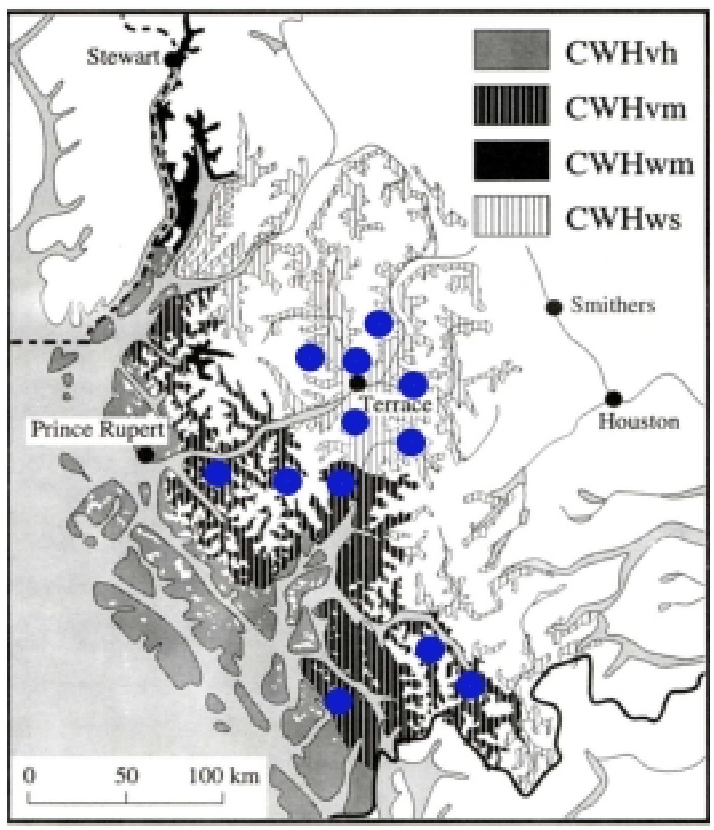

Figure 3. General areas of known tailed frog occurence in the Prince Rupert Forest Region. (Sources: This study; Hazelwood 1993; J. Kelson, personal communication; S. Liepins, personal communication.)

The CWHws in the Kitsumkalum Lake area north of Terrace, or the CWHvm (Very Wet Maritime) subzone in the vicinity of Prince Rupert (e.g. Scotia River) appear to have lower abundance of tailed frogs. So far only a few observations of tailed frogs have been made in the CWHvh (Very Wet Hypermaritime).

We suggest that areas with softer, erodible bedrock types (i.e. sedimentary types), or with surficial deposits prone to sediment production, results in creeks with characteristics less suitable for tailed frogs. Heavier rainfalls or more frequent storm events, resulting in less stable stream environments, may also play a role. In short, the best tailed frog streams seem to be relatively stable; have low levels of fine sediments; and have cobble/gravel/bedrock type substrates (Figure 4).

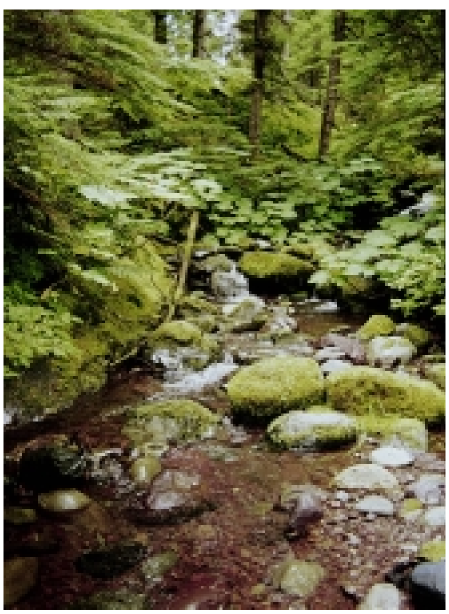

Figure 4. Typical tailed frog breeding creek.

Influence of Logging on Creek Characteristics and Tadpole Abundance

We sampled 54 creeks in the CWHws east of Terrace to examine logging effects on tadpole abundance. Creeks were sampled in 6 sub-drainages of the Skeena River, and in each sub-drainage we selected 3 undisturbed creeks, 3 creeks within recently logged areas, and 3 creeks in logged areas with some form of unlogged streamside buffer. These creeks were small, ranging from 0.5 to 6.4m wet width, and would mostly be classified as gullies (Ministry of Forests 1995a) or as class S5 or S6 for riparian management (Ministry of Forests 1995b). Due to the difficulty of finding suitable "buffer" creeks, the width of buffers was highly variable (5-60m), and in some cases on only one side of the creek.

Three 5 m stream segments (15 m total) on each creek were randomly selected for sampling, and intensively searched for tadpoles. On a sub-sample of 45 creeks additional stream physical parameters were measured, with values averaged for the 3 segments in each creek.

Tadpole abundance was significantly different between treatments, with logged creeks on average having much reduced populations compared to forested or buffered creeks (Figure 5). There was also a wide range of densities within the treatments. The mean values for basic creek parameters of elevation, slope, and width did not differ between logging treatments, thus we feel there was no bias between treatments for basic creek characteristics.

There were statistically significant differences between the treatments for the creek parameters of water temperature, % fines in the substrate, amount of small woody debris, and fine organic matter (Table 1). All these variables increased with the degree of logging disturbance from undisturbed - buffered - logged without buffers.

Although summer creek temperature increased with logging disturbance, the highest temperature we recorded (16° C) was still within the reported tolerance of tadpoles. This is in contrast to studies further south, where the increase in stream temperatures following logging can be more dramatic. We believe the primary impact on tadpoles in our study was from increased levels of fine sediment and organic debris, and reduced flow in smaller creeks.

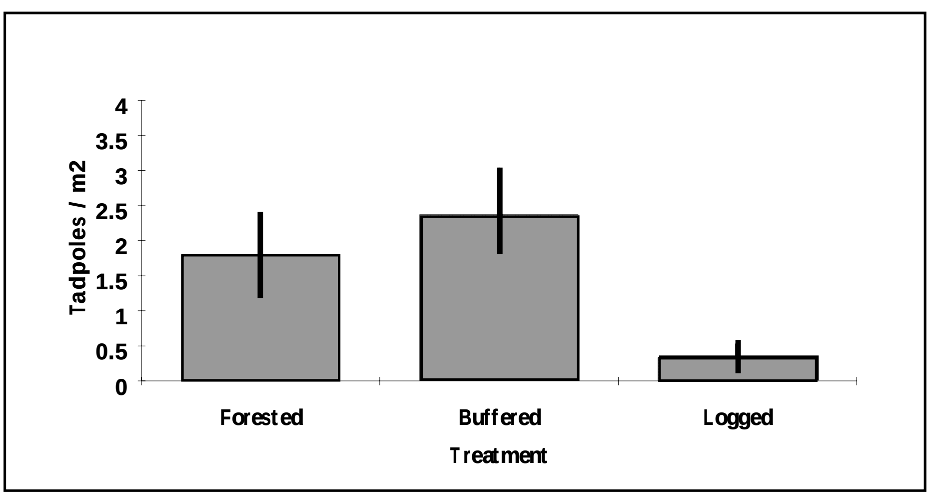

Figure 5. Mean number of tadpoles/m² (+/- SE)

Table 1. Mean (SE) values for creek variables significantly affected by logging treatment.

Parameter	Undisturbed	Buffered	Logged
Temperature (°C)	12.9 (0.5)	13.1 (0.3)	14.3 (0.3)
Fines (% cover)	34 (4.3)	39 (4.7)	52 (4.4)
Index of Fine Organics[a]	0.23 (0.11)	0.75 (0.19)	1.67 (0.38)
Index of Logging Debris[b]	0.35 (0.12)	0.75 (0.19)	2.08 (0.33)

[a] index (0 - 3) of depth of fine organic material in water column.
[b] index (0 - 4) of estimated % cover of logging debris.

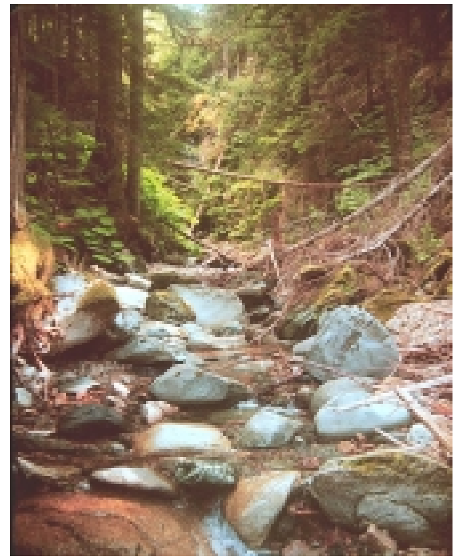

Figure 6. Buffered Creek with abundant tadpoles.

For the disturbed creeks, bank width and substrate stability play important roles. Wider, more stable creeks showed much less impact on substrate characteristics and tadpole abundance than smaller creeks. Smaller creeks were more likely to have elevated amounts of fine sediment, were often choked with logging debris, and sometimes had flows disrupted by road crossings.

Conclusions and Management Implications

At a landscape scale within the North Coast and Kalum districts, there are considerable differences in tailed frog abundance. The Skeena West and Kitimat areas in the Kalum District have the greatest abundance found to-date, although within each area there is an uneven distribution possibly based on bedrock geology.
Further extensive sampling would help better describe distribution and abundance in the more poorly sampled North Coast District.
Logging disturbance can greatly influence creek characteristics and abundance of tailed frog tadpoles. Stream side buffers appear to greatly reduce logging impact on creeks and tadpoles (Figure 6). We believe buffers reduce impact by: 1) preventing physical damage to creek banks and gully walls, thus reducing input of sediments, and; 2) by preventing deposition of logging debris into the creeks. These factors are likely of much greater long term importance then the temporary loss of forest cover itself, which will return with regrowth of the stand. Upstream road crossings are also potentially important both as sources of sediment or by disrupting water flow.
To maintain tailed frog tadpole habitat, minimizing disturbance and the resulting input of fine sediments and debris to small creeks is key. We should also be ensuring that examples of known high value breeding creeks are included in protected areas throughout the species range.

Contact:
Doug Steventon, Research Wildlife Habitat Ecologist
Prince Rupert Forest Region
Linda Dupuis, Herpetologist
Centre for Applied Conservation Biology, UBC
Pierre Friele, Geomorphologist
Centre for Applied Conservation Biology, UBC

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