Campbell River Watershed

Preliminary Amphibian Survey (2001)

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Abstract

Hydro-electric development and anthropogenic changes within the Campbell River watershed over the past 60 years have resulted in modification and loss of riparian habitat. These changes may have led to decreases of both terrestrial and pond-breeding amphibians. The overall objective of this project was to determine the distribution and abundance of amphibians in the watershed area and evaluate the effectiveness of habitat enhancement to mitigate the loss of suitable habitat. The initial phase of this project, in 2001, was to inventory the amphibian species within the area and establish habitat enhancements for future monitoring in 2003. From mid-April to mid-July, 2001 several sites and habitats throughout the Campbell River Watershed (Snowden Demonstration Forest, Strathcona Provincial Park, and Quinsam areas) were sampled using standardized Resources Information Standards Committee (RISC) protocols. Pitfall trapping, night and day surveys, area-constrained searches and time-constrained searches were employed. Twelve herptile species, including all six species of salamander present on Vancouver Island were detected in the study area. Intensive pitfall trapping at three locations caught 47 salamanders of six different species. A further 36 individuals were caught by other methods throughout the area. However, it was not possible to estimate species abundance or density for any of the species detected. Amphibians were also confirmed at several other locations based on detection of calls or larval stages. Western red-backed salamanders and rough-skinned newts were the most commonly encountered species accounting for 49% and 25% of the pitfall captures respectively. At each of the three locations where pitfall traps were used habitat enhancement was attempted by constructing 9 artificial cover objects (ACO's). In May 2003, these ACO's will be monitored and compared to pitfall trapping records for 2001.

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Introduction

Amphibians play an important role in energy flow in ecosystems. Both in terms of numbers and biomass, amphibians (and particularly salamanders) are the dominant vertebrate group in many forest ecosystems (Burton and Likens 1975; Hairston 1987; deMaynadier and Hunter 1995). Because amphibians are ectotherms with low maintenance requirements, their conversion of ingested energy to biomass and somatic growth is highly efficient (Lillywhite et al. 1973; Pough 1980). Furthermore, the high productivity and rapid growth of larval forms in aquatic habitats serves as an important energy pathway across the aquatic-terrestrial gradient when these forms metamorphose and undergo an ontogenetic shift in habitat use (Wilbur and Collins 1973; Wilbur 1980; Freeland and Kerin 1991). Amphibians with complex life-histories use a spatial and temporal mosaic for their life requisites which includes both aquatic and terrestrial habitat (Wilbur and Collins 1973). Their ecology is therefore potentially influenced by both natural and anthropogenic landscape disturbances in these two habitats (Elmberg 1993). Therefore hydro-electric developments and activities have the potential to impact amphibian populations and the aquatic and terrestrial habitat they use. Furthermore, mounting evidence of and concern about amphibian declines globally, underscores the importance of acquiring inventory data for this group and monitoring long-term population trends (Blaustein and Wake 1990).

Objectives:

Patrick Garcia and Leigh Anne Isaac for the British Columbia Conservation Foundation with the following objectives conducted the present study in the Campbell River Watershed between May 20 and July 14, 2001:

(1) Determine the distribution of amphibians (with a focus on plethodontid and pond-breeding salamanders) at selected sites in the Campbell River watershed.
(2) Estimate relative abundance of amphibians.
(3) Provide habitat enhancement for salamanders.
(4) Evaluate efficacy of enhancement (May 2003)
(5) Evaluate the impacts of hydro operations on amphibians within the footprint of John Hart Dam and recommend mitigation.

Study Areas:

The Campbell River watershed covers an area of over 1400 km^2 and lies within B.C. hydro's Bridge River / Coastal generation area. B.C. Hydro's BRC Compensation fund was established to help mitigate the impacts of several hydro-electric projects in the region, including the John Hart, Ladore and Strathcona Dams and associated diversions completed in the 1950's. Wildlife within the footprint of these structures may have been affected by habitat loss and modification (particularly loss of riparian habitat), changes to water flow patterns and fluctuating water levels (BCRP – Strategic Plan, 2000). To investigate the impacts of these projects on amphibians, inventory work was conducted in an area between the settlements of Campbell River to the east and Gold River to the west and encompassing Strathcona Provincial Park, the Quinsam area and the Snowden Demonstration Forest.

Methods

We sampled between mid-May and mid-July 2001 using Resources Information Standards Committee (RISC) protocols to assess the abundance and distribution of amphibians in the Campbell River Watershed. These methods included night and day surveys, pitfall trapping, area-constrained searches and time-constrained searches.

We surveyed at two spatial scales. Intensive sampling occurred at three sites in the Snowden Demonstration Forest on the north side of John Hart Lake, while more opportunistic sampling was conducted throughout the remainder of the watershed.

We chose the following three locations in the Snowden Demonstration Forest for intensive pitfall trapping and locations for habitat enhancement. The sites were chosen to give a representative but manageable cross section of available habitats in the area, which were also similar and close enough to give useful comparisons to one another and yet facilitate extrapolation across the region. Ease of access and freedom from disturbance / development over the three-year duration of the study were also considerations.

1. **RIley Lake:**
   UTM's: 329760 (Easting) 5548420 (Northing).

   Traps were located in second growth coastal western hemlock forest 25 metres west of a creek flowing into Riley Lake.

2. **Elmer Lake:**
   UTM's: 327280 (Easting) 5548380 (Northing).

   Traps were located in second growth coastal westerm hemlock forest 20-50 m upslope from the western edge of Elmer Lake.

3. **Rocky - Near thinned Stand on road to Elmer Lake:**
   UTM's: 327700 (Easting) 5547080 (Northing).

   Traps were located in second growth upslope habitat in an area with (dry) ephemeral ponds.

We established Pitfall trap – drift fence arrays at three sites. We used a triad design for each array with three 4m-long sections of drift fence (50 cm high plastic sheeting secured to wooden stakes) radiating out at 120° from a 4 - litre central trap. Each fence also ended in a 4 - litre trap. We placed three such arrays 50 m apart at each site. We checked traps a minimum of every two days for the duration of the study.

Once captured animals were identified, weighed (to nearest 0.1g) with a 50g Pesola spring balance and snout to vent length (SVL) was measured and recorded.

Pitfall arrays were dismantled after the sampling session and the site was restored to its original condition.

<u>Reptile Survey:</u>

While no efforts were made to systematically survey the reptile fauna in the study site, we opportunistically captured and identified snakes.

Habitat Enhancement:

The final part of phase one of the project involved the deployment of artificial cover objects (ACO's) to provide habitat enhancement. We constructed ACO's following the design of Ted Davis (1996) using a rough cut, untreated single western hemlock board (180 x 30 x 5 cm), two additional boards (180 x 15 x 2.5 cm) and strips of 1cm cedar lath, arranged as shown in figure 1. This design provides a number of different microhabitats and is therefore suitable habitat for a range of salamander species. We installed 27 (see above) cover boards at each of three sites (81 total). We removed vegetation along with the top layer of organic material / soil and boards and placed the boards flush with the ground, arranged in a 3 x 3 grid, with 4 m separating each board.

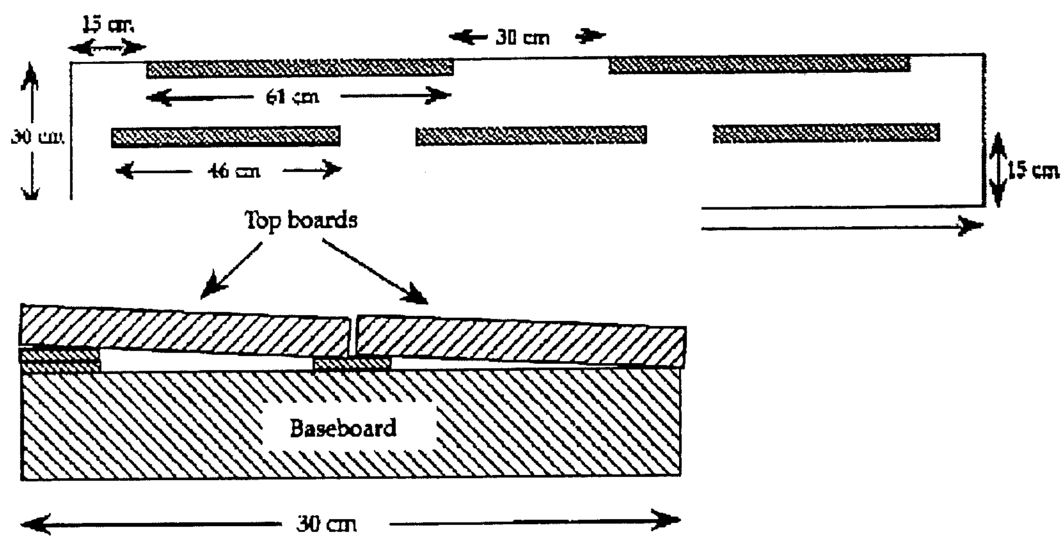

Figure 1. Artificial Cover Object boards (From Davis 1994).

Preliminary Results

We detected a total of 12 herptile species in the study area. This included three species of terrestrial salamander (Clouded Salamander, Ensatina, Western Redback Salamander), three species of pond breeding salamander (Northwestern Salamander, Long-toed Salamander, Rough-skinned Newt), three anuran species (Western Toad, Pacific Treefrog, Red-legged Frog) and three species of garter snake (Northwestern Garter Snake, Western Terrestrial Garter Snake, Common (Red Sided) Garter Snake) (Table 1).

We caught a total of adult 83 amphibians of 8 species, 47 in pitfalls (Table 2) and the remainder by hand. Additionally, we confirmed amphibians at several other locations based on detection of calls or larval stages. Western red-backed salamanders and rough-skinned newts were the most commonly encountered species accounting for 49% and 25% of the pitfall captures respectively.

Discussion

The initial phase of this study was successful in detecting the presence of all species expected within the study area. However, the relatively late start to sampling (i.e. after the breeding season), and low number of encounters and captures made an estimate of population densities impossible. It would therefore be improper to try and extrapolate the findings at specific locations to the entire watershed. However, some idea of the species diversity was determined and follow-up sampling in May 2003 should be able to directly compare the results of pitfall trapping and habitat enhancement and provide estimates of population density per unit area.

Although time-consuming to establish and monitor, pitfall trapping proved to be the most effective technique for capturing animals and sampling the amphibian diversity in the area and all expected salamander species were detected with this technique. However, it should be noted that pond-breeding salamanders (AMMA, AMGR, TAGR) would be under-represented in this study due to the timing of sampling and pitfall trapping is not a suitable method for sampling clouded salamanders (ANFE) (although one individual was caught this way).

Pitfall trapping indicated that western red back salamanders (PLVE) had the highest relative abundance in the area accounting for 49 percent of the total captures, followed by rough skin newts (TAGR) at 25 percent. However, this may reflect a sampling bias, rather than being an accurate reflection of the species abundancies relative to one another. The addition of cover board sampling in 2003 may be able to shed some light on this question.

Future Work

Phase 2 of the study shall commence in May 2003 and will consist of further inventory work in the Campbell River Watershed with the focus again being on the three sites in the Snowden Demonstration Forest. Using a combination of pitfall trapping, transect surveys and monitoring of the cover boards, attempts will be made to estimate species' densities. The effectiveness of cover boards as habitat enhancement shall be evaluated by comparing the species found with pitfall samples done in the same area in 2001 and 2003. If reasonable estimates of abundance and population density can be made, it may be possible to extrapolate the results to over areas of the watershed and estimate the impact hydroelectric development and activities have had on amphibian populations and habitats.

Extension and Development

- Interview and Article in Campbell River Mirror. – June 2001
- Interpretive Talks – Miracle Beach Provincial Park – June 2001
- Public Presentations in the Victoria area –2001/2002
- Seminar – Western College of Veterinary Medicine – October 2001

Table 1. Summary of amphibian species detected at different study sites in the Campbell River Watershed.

Species / Site:	AMMA[1]	AMGR	TAGR	PLVE	ANFE	ENES	BUBO	RAAU	PSRE	THIS	THOR	THEL
Snowden Demonstration Forest:												
Riley	X	X	X	X		X		X	X	X	X	
Elmer			X	X		X		X	X			
Rocky				X	X	X		X				
Lost Lake								X				
Elmer OG					X				X			
Reed Lake		X	X						X			
Quinsam Area:												
Gooseneck Lake		X						X			X	
$5 Log Lake		X	X					X				
Snakehead Lake			X					X				
Strathcona Provincial Park:												
East Buttle Lake		X	X					X	X			
Elk River									X	X	X	
Mud Lake			X									
Crest Creek				X								
Darkis Lake				X	X						X	
Toad Pond							X		X	X		X

[1] See appendix I for species codes

Table 2. Number of individuals captured in pitfall traps in the Snowden Demonstration Forest (See Appendix I for species codes).

Site	**Riley**	**Elmer**	**Rocky**	**Total**
Days Trapped	41	37	26	104
Species				
AMMA	2	0	0	2
AMGR	1	0	0	1
TAGR	5	7	0	12
ANFE	0	0	1	1
ENES	5	2	1	8
PLVE	13	8	2	23
Total	26	17	4	47

Literature Cited

Blaustein , A. R., and D. B. Wake. 1990. Declining amphibian populations: a global phenomenon? Trends in Ecology and Evolution 5:203-204

Bridge-Coastal Fish and Wildlife Restoration Program. 2000. Strategic Plan.

Burton, T. M., and G. E. Likens. 1975. Salamander populations and biomass in the Hubbard Brook Experimental Forest, New Hampshire. *Copeia* 1975:541-546

Davis, T.M. 1996. Distribution, abundance, microhabitat use and interspecific relationships among terrestrial salamanders on Vancouver Island, British Columbia. Ph.D. dissertation, University of Victoria, Victoria, BC.

deMaynadier, P. G., and M. L. Hunter, Jr. 1995. The relationship between forest management and amphibian ecology: a review of the North American literature. *Environmental Review* 3:230-261.

Elmberg, J. 1993. Threats to boreal frogs. Ambio 22(4): 254 - 255.

Freeland, W. J., and S. H. Kerin. 1991. Ontogenetic alteration of activity and habitat selection by *Bufo marinus. Wildlife Research* 18:431-443.

Hairston, N. G., Sr., 1987. Community Ecology and Salamander Guilds. Cambridge University Press, Cambridge.

Lillywhite, H. B., P. Licht, and P. Chelgren. 1972. The role of behavioural thermoregulation in the growth energetics of the toad, *Bufo boreas. Ecology* 54:375-383.

Pough, F. H. 1980. The advantages of ectothermy for tetrapods. *American Naturalist* 115:92-112.

Resources Information Standards Committee (RISC). 1999. Inventory Methods for Plethodontid Salamanders Standards for Components of British Columbia's Biodiversity No.36.

Resources Information Standards Committee (RISC). 1998. Inventory Methods for Pond-breeding Amphibians and Painted Turtle Standards for Components of British Columbia's Biodiversity No.37.

Wilbur, H. M. 1980. Complex life cycles. *Annual Review of Ecology and Systematics.* 11:67-93.

Wilbur, H. M., and J. P. Collins. 1973. Ecological aspects of amphibian metamorphosis. *Science* 182:1305-1314

Appendix I

Species Abbreviations

Plethodontid salamanders:

- Clouded Salamander - *Aneides ferreus* **(ANFE)**
- Ensatina - *Ensatina eschscholtzii* **(ENES)**
- Western Redback Salamander, *Plethodon vehiculum* **(PLVE)**

Pond-Breeding Amphibians:

- Northwestern Salamander - *Ambystoma gracile* **(AMGR)**
- Long-toed Salamander - *Ambystoma macrodactylum* **(AMMA)**
- Rough-skinned Newt - *Taricha granulosa* **(TAGR)**
- Western Toad - *Bufo boreas* **(BUBO)**
- Pacific Treefrog - *Pseudacris regilla* ***(PSRE)***
- Red-legged Frog - *Rana aurora* **(RAAU)**

Snakes:

- Northwestern Garter Snake – *Thamnophis ordinoides* **(THOR)**
- Western Terrestrial Garter Snake - *Thamnophis elegans* **(THEL)**
- Common (Red Sided) Garter Snake - *Thamnophis sirtalis* **(THSI)**

Appendix II

Morphometrics of captured amphibians:

Date	Species	Mass (g)	SVL (mm)	Location
29-May	ENES	6.6	60.9	Riley Lake site
29-May	AMMA	(4.0????)	35.5	Riley Lake site
29-May	AMGR	20.8	90.5	Riley Lake site
30-May	RAAU	17.6	57	Pond next to trail on way to Riley pitfall traps
31-May	TAGR	2.5	37.1	Elmer Lake site
31-May	RAAU			Pond next to trail on way to Riley pitfall traps
31-May	RAAU	5.8	32.3	Pond next to trail on way to Riley pitfall traps
31-May	RAAU	25.6	62	Pond next to trail on way to Riley pitfall traps
31-May	RAAU	18.2	59.9	Beaver pond next to Riley Trail- before crossing beaver dam
31-May	RAAU	14	42.6	Beaver pond next to Riley Trail- after crossing beaver dam
31-May	ENES	2	38.6	Riley Lake site
31-May	PLVE	2.4	47.9	Riley Lake site
31-May	TAGR	5.6	49.55	Riley Lake site
31-May	RAAU	10.1	47.05	Perimeter of Lost Lake
31-May	RAAU	14.7	52.2	Perimeter of Lost Lake
2-Jun	TAGR	5.4	54.6	Elmer Lake site
2-Jun	RAAU	15.9	50.65	Elmer Lake site
2-Jun	PLVE	2.3	49.7	Elmer Lake site
2-Jun	PLVE	2	46	Elmer Lake site
2-Jun	PLVE	1.4	40.1	Elmer Lake site
2-Jun	TAGR	3.2	44	Elmer Lake site
2-Jun	PLVE	2.1	50.35	Elmer Lake site
2-Jun	PSRE	1.4	26.15	Nr. Elmer Lake Site
2-Jun	PLVE	1.7	47.3	Riley Lake site
2-Jun	PLVE	2.3	48.35	Riley Lake site
4-Jun	TAGR	9.3	54.65	Riley Lake site
4-Jun	ENES	1.9	44.4	Riley Lake site
6-Jun	ENES	1.8	40.6	Elmer Lake site
6-Jun	TAGR	6.1	74.5	Elmer Lake site
8-Jun	TAGR	5.2	48.7	Elmer Lake site
8-Jun	TAGR	6.4	54	Riley Lake site
8-Jun	PLVE	1.8	52.65	Riley Lake site
10-Jun	PLVE	2.3	51.8	Elmer Lake site
10-Jun	PLVE	1.1	51.8	Elmer Lake site
10-Jun	TAGR	5.3	57.7	Elmer Lake site
10-Jun	PLVE	3	51.9	Rocky Marsh site
10-Jun	PLVE	2.5	40.95	Riley Lake site
10-Jun	PLVE	2.1	40.1	Riley Lake site
10-Jun	ENES	1	42.2	Riley Lake site

Date	Species	Mass (g)	SVL (mm)	Location
12-Jun	TAGR	6.5	50.5	Elmer Lake site
12-Jun	PLVE	1.2	40.15	Riley Lake site
12-Jun	PLVE	2	49	Riley Lake site
12-Jun	ENES	1.7	42.65	Riley Lake site
13-Jun	PLVE	2.5	35.85	Riley Creek Forest
13-Jun	PLVE	2.7	51.5	Riley Creek Forest
13-Jun	AMGR	10.9	60.65	Riley Creek Forest
13-Jun	PLVE	1.9	48.15	Riley Creek Forest
14-Jun	PLVE	1	46.25	Riley Creek Forest
14-Jun	PLVE	1.3	38.25	Riley Creek Forest
14-Jun	PLVE	3.3	49.1	Riley Creek Forest
14-Jun	RAAU			Riley Creek Forest
15-Jun	ANFE	2.4	49.2	Darkis Lake (Buttle Lake Camp Ground
15-Jun	PLVE	2	45.5	Crest Lake
16-Jun	ANFE	3.4	61.2	Rocky Marsh
20-Jun	PLVE	1.5	38.25	Elmer Old Growth
20-Jun	PLVE	2.1	46.7	Elmer Old Growth
20-Jun	ANFE	1.5	39.6	Elmer Old Growth
20-Jun	PLVE	2.1	41.75	Elmer Old Growth
20-Jun	ANFE	2.9	57.15	Elmer Old Growth
20-Jun	PSRE	2.4	30.5	Elmer Old Growth
22-Jun	ENES	5.3	54.05	Rocky Marsh
22-Jun	ENES	2.9	48	Elmer Lake site
22-Jun	PLVE	1.8	40.25	Elmer Lake site
24-Jun	AMMA	3.3	45.25	Riley Creek Forest
24-Jun	PLVE	2.1	45.55	Riley Creek Forest
24-Jun	TAGR	8.5	55.7	Riley Creek Forest
24-Jun	PLVE	1.9	40.2	Riley Creek Forest
24-Jun	PLVE	2.2	45.75	Riley Creek Forest
24-Jun	PLVE	1.9	44.5	Riley Creek Forest
24-Jun	AMGR	13	58.9	Riley Creek Forest
24-Jun	PLVE	1.7	40.05	Riley Creek Forest
24-Jun	PLVE	1.4	39.15	Riley Creek Forest
26-Jun	TAGR	7.35	56.6	Riley Creek Forest
26-Jun	PLVE	1.7	43.15	Riley Creek Forest
26-Jun	PLVE	1.8	45.25	Rocky Marsh
28-Jun	PLVE	1.6	43.2	Rocky Access Slope
28-Jun	PLVE	1.7	39.15	Riley Creek Forest
28-Jun	PLVE	1.7	45.5	Elmer Lake site
28-Jun	TAGR	5.9	52.3	Reed Lake
30-Jun	PLVE	0.8	30.05	Elmer Lake site
30-Jun	PSRE	4.2	44.45	Riley Creek Forest
4-Jul	TAGR	6.7	57.15	Elmer 1
4-Jul	PLVE			Elmer 2