

A STUDY ON THE INCIDENCE OF AMPHIBIAN ROAD MORTALITY BETWEEN UCLUELET AND TOFINO, BRITISH COLUMBIA

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Abstract

Surveys along Highway 4 between Ucluelet and Tofino, British Columbia indicate that hundreds of amphibians are killed each year during peak migration periods in the spring and autumn. The Red-legged Frog (*Rana aurora*) comprised 33% of 978 roadkills (N=26 surveys) found between 2001 and 2006. The next most frequently killed species were Pacific Chorus Frog (*Pseudacris regilla*) (32%) and Northwestern Salamander (*Ambystoma gracile*) (26%), followed by Roughskin Newt (*Taricha granulosa*) (6%), Western Redback Salamander (*Plethodon vehiculum*) (2%), and Wandering Salamander (*Aneides vagrans*) (1%). The potential impacts of highway mortality on these species' populations and options for mitigation are discussed.

Introduction

Aquatic-breeding species of amphibians migrate en masse between wetland breeding sites and forested habitats during late winter to spring, and late summer to autumn. Individuals move over distances of 30 m to 7 km, depending on the species and other factors. Migration routes often intersect roads, and as a result, being run over by vehicles is one of the major causes of mortality of amphibians throughout the world (Ashley and Robinson 1996, Fahrig et al. 1995,

Langton 1989). On Vancouver Island and the Gulf Islands, highway mortality of amphibians has been reported at several locations along the New Island Highway north of Courtenay (Blood 2000, Bernard 2000), Hamilton Marsh near Coombs, Gabriola and Salt Spring Island roadways (K. Dunster, pers. comm.), and Nanaimo (E. Wind, pers. comm.). Undoubtedly, numerous other locations are unreported.

Preliminary surveys conducted in the autumn of 2000 showed that many amphibians were being killed on Highway 4 through Pacific Rim National Park Reserve (Long Beach Unit) between Ucluelet and Tofino. This study was initiated to find out what species were being killed, how many, and where. Information from the study is being used to focus efforts to mitigate highway mortality in places with the highest densities of roadkills.

Study Site

On the west coast of Vancouver Island, Highway 4 joins Ucluelet and Tofino by crossing the Kennedy Lake flats, approximately 1400 ha of gently undulating and flat land south and southwest of Kennedy Lake extending to the Pacific Ocean (Figure 1). This area is located within the Southern Very Wet Hypermaritime variant of the Coastal Western Hemlock Biogeoclimatic Zone (CWHvh1). High rainfall, common summer fogs and proximity to the Pacific Ocean contribute to high humidity year round. Vegetation is dominated by western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), and amabilis fir (*Abies amabilis*). Lodgepole pine (*Pinus contorta*) is especially prevalent on poorly drained



Figure 1. Highway 4 near Long Beach, British Columbia. 14 August 1968 (R. Wayne Campbell).

soils and sitka spruce (*Picea sitchensis*) dominates coastal strips. Dominant understory species are salal (*Gaultheria shallon*), blueberries and huckleberries (*Vaccinium* sp.), deer fern (*Blechnum spicant*), sphagnum mosses (*Sphagnum* sp.) and waxy-leaved cotton moss (*Plagiothecium undulatum*). Numerous bogs and other types of wetlands are scattered throughout the Kennedy Lake flats on both sides of the highway.

Methods

Surveys began in the autumn (September to November) of 2000 and continued seasonally until the spring (February to May) of 2004, and then resumed again in the autumn of 2005 and spring of 2006. On rainy nights, I drove with a trained volunteer to search for amphibians crossing the 40 km stretch of highway. We traveled at approximately 30 km/hr, starting at least one hour after sunset. When an amphibian, alive or dead, was encountered on the road, we pulled over and searched on foot with a flashlight to find the individual. If it was alive, we gently moved it to the ditch on the side of the road where it was headed. We also removed carcasses from the road to avoid double-counting animals on consecutive nights. We recorded the species, condition (alive or dead), direction of movement, and location of each animal. The location was identified as the distance, in km, from a standardized starting point using the odometer. We also recorded the time at the beginning and end of each survey, date, and weather conditions.

There were 66 surveys in total, however, 30

surveys were conducted on nights with less than five sightings. Analyses include results only from surveys with greater than five amphibian sightings per night.

Results

I counted a total of 1,259 individual amphibians during 36 surveys. Of these, 281 (22%) were alive and moved across the highway safely. The other 978 (78%) were dead. Northwestern Salamander (Figure 2), Red-legged Frog and Pacific Chorus Frog were seen most often, followed by Roughskin Newt, Western Redback Salamander and Wandering Salamander (Table 1). A higher proportion of the Red-legged Frogs (Figure 3), Roughskin Newts and



Figure 2. The Northwestern Salamander was the most frequently observed amphibian, but compared to other species, had a relatively low mortality rate of 65%. Highway 4 near the junction to Tofino and Ucluelet. 30 March 2006 (Barbara Beasley).

Table 1. Number of individuals of each amphibian species observed during 36 night-surveys along Highway 4 between Ucluelet and Tofino in spring and autumn between 2001 and 2006.

Species	Total No. Observed	No. Dead
Northwestern Salamander	397	258 (65%)
Pacific Chorus Frog	384	315 (82%)
Red-legged Frog	367	330 (90%)
Roughskin Newt	71	65 (92%)
Western Redback Salamander	51	26 (51%)
Wandering Salamander	13	8 (62%)
All Species	1,259	978 (78%)



Figure 3. The Red-legged Frog was one of the most frequently counted species on Highway 4 and suffered one of the highest percentage mortality rates. Highway 4 near Swan Lake, BC. 8 November 2002 (Tanya Dowdall).

Pacific Chorus Frogs were dead compared to the other species.

We found an average of 27 (\pm 39 SD) dead amphibians on each survey. The maximum number on a single survey was 224, counted on the night of the first major rainstorm in the autumn of 2005. Many of the animals were juveniles.

Amphibians crossed the highway along its entire length, however, the greatest concentration occurred within a 2-km stretch close to Swan Lake, the largest wetland with open water on the Kennedy Lake flats (Figure 4). Swan Lake is approximately 33 km from Tofino and just outside the southern border of Pacific Rim National Park Reserve. It has been known as a breeding site for Red-legged Frogs since 2000 but no quantitative breeding surveys had been done until April 2006 when I counted 51 egg

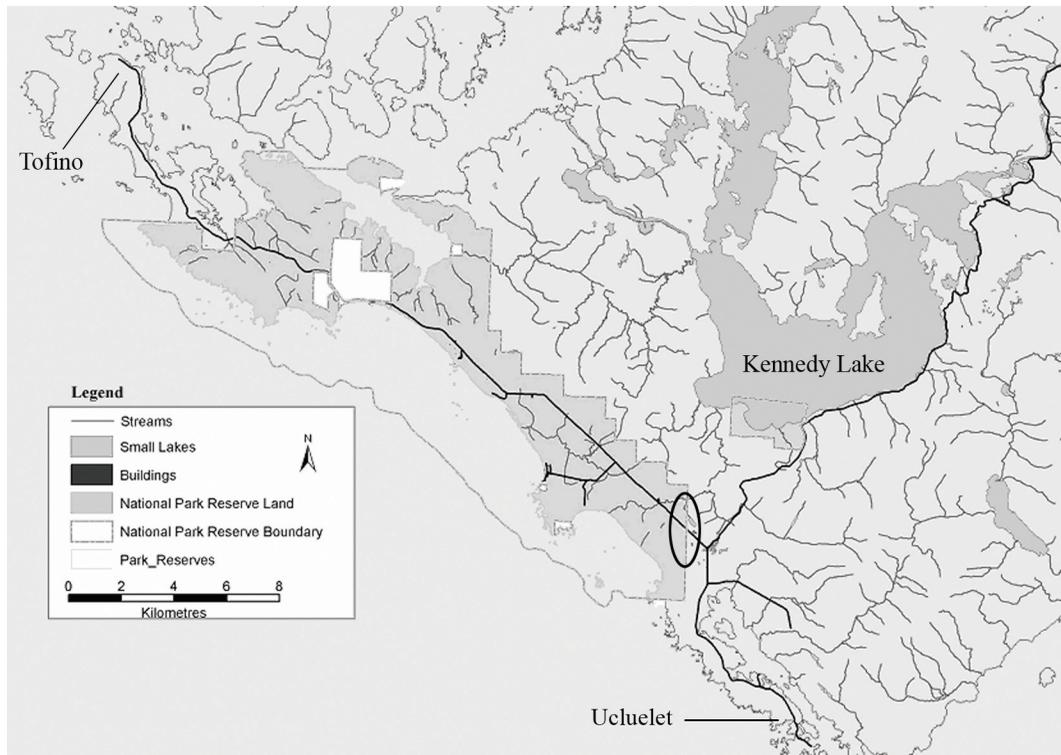


Figure 4. Map of Highway 4 between Ucluelet and Tofino, BC. The ellipse indicates the area with the highest density of mortality adjacent to Swan Lake, a wetland just southeast of Pacific Rim National Park Reserve.

masses of Northwestern Salamander, 48 egg masses of Red-legged Frog, and 34 egg masses of Pacific Chorus Frog. These numbers are underestimates of the breeding populations at Swan Lake because approximately only 30% of the wetland was searched.

Discussion

It is difficult to judge the effect of road mortality on the populations of amphibians living on the Kennedy Lake flats. Although hundreds are killed each year, there is currently little information about how many survive. Between 10 and 50 % of the animals seen on the road during surveys were alive but this is only a sub-sample of the number that move across safely.

The ratio of live to dead does provide a relative estimate of the likelihood of different species being killed, at least during the period of time sampled. The results indicate that vehicles are more likely to run over Red-legged Frogs, Roughskin Newts and Pacific Chorus Frogs than the other species.

People have tried a number of solutions for reducing road mortality of migrating amphibians (Langton 1989, Ovaska et al. 2003). Installing relatively simple “amphibian crossing” traffic signs, and speed reduction zones, is generally ineffective, although signs do serve to educate the public about the problem (Ryser and Grossenbacher 1989). Temporary road closures during the migration period have been successful only where alternative travel routes exist (Podloucky 1989). This is not an option for Highway 4. Trapping and transport of animals from one side to the other is widely used (Feldmanpon and Geiger 1989, Meinig 1989, Zuiderwijk 1989, Linck 2000) and works well, at least in the short term, provided the animals are trapped with drift fences at crossing points and volunteer support is available.

Tunnel systems that are specially constructed for amphibians consist of drift fencing or walls to prevent animals entering the road, a guiding system to direct them to the underpasses, and the tunnels themselves, which are placed at intervals across a critical section of the road that interrupts an amphibian migration route (Langton 1989 and papers within, Ovaska et al. 2003). One of the early systems deployed near Lausanne, Switzerland in 1969, has been monitored for many years and is successful. In North America,

an amphibian tunnel system was constructed in 1988 for the Spotted Salamander (*Ambystoma maculatum*) in Amherst, Massachusetts; this system was also successful with a crossing efficiency of about 70% for animals that encountered the drift fences (Jackson and Tynning 1989). Other amphibian tunnel systems exist in Texas and California, and still others are under consideration in Oregon and Florida (Ovaska et al. 2003). In British Columbia, amphibian tunnel systems are present at two locations along a new section of the Inland Island Highway on Vancouver Island. One is in the vicinity of Keddy Swamp, a 5-ha wetland that intersects the highway near Courtenay and serves as a breeding ground for Western Toads (*Bufo boreas*; Figure 5). The second is near Coombs, where it intercepts a migration route to Hamilton Marsh and other smaller, breeding ponds (D. Blood, pers. comm., Fitzgibbon 2001). Although there has been little follow-up monitoring on either system, toads and Roughskin Newts are known to use these tunnels to a certain extent (Bernard 2000, Blood 2000).



Figure 5. For species like Western Toad, tunnel systems are used in high-density areas to facilitate safe passage across roads. Amor de Cosmos Creek, Vancouver Island, BC. 7 June 2004 (Michael I. Preston).

Existing culverts along the Pacific Rim Highway may provide suitable tunnels for migrating amphibians during low water periods. In big storm events, however, many of these culverts flood and amphibians may be unable to move against the direction of flow. This would be a problem given that the night surveys indicated that individuals crossed

in both directions in each season.

Trapping and transporting of animals from one side to the other is currently being done along the stretch of highway with concentrated mortality near Swan Lake. As an interim measure, it serves as a way of assessing the proportion of amphibians killed versus those that cross safely. It will also provide information about movements at a finer scale than I could acquire from night surveys. I am setting traps in existing culverts in the fenced areas to find out whether amphibians move through them. The results will be used to decide whether permanent mitigation would be worthwhile, and, if so, to learn the exact location and types of permanent structures to install.

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About the Author

Barb completed her Ph.D. on Violet-green Swallows in the Creston valley and is presently a freelance biologist doing research, education and conservation projects on the west coast of Vancouver Island. She enjoys teaching summer field courses at the Bamfield Marine Sciences Centre and being a Director for the Raincoast Education Society in Tofino.