Long-toed Salamander Conservation in the Alberta Foothills

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Abstract: This paper reports on the inventory and monitoring work being done on long-toed salamanders (*Ambystoma macrodactylum*) in the Alberta foothills; a summary of results from the 2002 field season is presented. A total of 149 ponds were surveyed, 50 of which showed evidence of breeding salamanders. Breeding ponds identified in 2002 were compared to those found in previous surveys to determine persistence of breeding populations. Evidence of breeding (primarily presence of eggs) was found in all but one known breeding pond (94% of all breeding ponds) in the Hinton area (Athabasca Valley; previously surveyed in 2000–2001), and in 78% of known breeding ponds in Jasper National Park (previously surveyed in 1995–1996). In the Kananaskis area (Bow Valley), only 56% of known salamander breeding ponds (previously surveyed in 1998–2001) continued to show evidence of breeding. Attempts to identify subpopulations in new survey areas were unsuccessful. Pitfall trapping results at two ponds (one in each of the Hinton and Kananaskis areas) provided data on reproductive success, and over the long term, will help track local population trends. The capture of a cohort of young-of-the-year salamanders suggested that there was good reproductive success at both ponds. In addition, mark-recapture was initiated at the pond in the Hinton area. It appears that long-toed salamander populations may be stable in protected areas, but are isolated and vulnerable to habitat destruction in other parts of their range within Alberta. Continued monitoring, education, and conservation actions are recommended.

Key Words: long-toed salamander, *Ambystoma macrodactylum*, surveys, inventory, monitoring, conservation, Alberta

Introduction

The long-toed salamander (*Ambystoma macrodactylum*) is found in the northwestern United States, and in British Columbia and Alberta. It is at the northern limit of its range in Alberta where it is restricted to river valleys in the Rocky Mountain foothills (Russell and Bauer 2000) except for a small population which was recently discovered in the Peace River Valley area (Walsh 1998). The long-toed salamander is listed as a species of Special Concern in Alberta because it has a limited distribution and is found in isolated and disjunct subpopulations (Alberta Sustainable Resource Development 2000). In addition, there is evidence that long-toed salamanders are sensitive to habitat alteration, fragmentation, and destruction (Fukumoto 1995; Graham and Powell 1999; Naughton et al. 2000). While some subpopulations occur in protected

areas, most are in areas that are experiencing increasing industrial activity and human-related development.

Long-toed salamanders are small, cryptic, nocturnal, forest-dwelling salamanders that are rarely seen and are difficult to study. Adults travel to ponds to breed in the spring and enter the ponds before they are completely ice-free. In late summer, young-of-the-year disperse from the ponds, although at high elevation sites, larvae may overwinter (Russell and Bauer 2000). If subpopulations are isolated and the number of breeding ponds is limited, alteration or destruction of an established breeding pond could have profound consequences for the overall population.

Alberta initiated a provincial amphibian monitoring program (RANA—Researching Amphibian Numbers in Alberta) in 1997. The program is designed to monitor long-term population data on amphibians by conducting annual pond surveys in established study areas, including operating pitfall traps at one pond per study area. Additional objectives of the program are to provide public education about amphibians and to promote wetland ecology and conservation. In 2001, a long-toed salamander monitoring project was introduced as part of the RANA program. Emphasis was placed on surveying known breeding ponds and new ponds for the presence of breeding long-toed salamanders.

In 2002, the long-toed salamander monitoring program was expanded in three ways. First, breeding sites identified during benchmark surveys in the Rocky Mountain corridor in 1995 and 1996 (Oseen et al. 1995; Hamilton et al. 1996) were revisited to investigate the persistence of breeding populations. Second, surveying was extended into new areas to identify range expansions and new subpopulations that may link known isolated populations. Finally, mark-recapture was initiated at one pond where pitfall trapping was conducted as a means of gathering more detailed population trend information.

Study Area

The general study area is located in southwestern Alberta and includes the Hinton (Athabasca Valley) and Kananaskis (Bow Valley) RANA study areas, Jasper National Park, and sites near Banff National Park (Fig. 1). The Hinton and Kananaskis RANA study areas are located in the Foothills Natural Region; Jasper and Banff National Parks are located in the Rocky Mountain Natural Region (Alberta Environmental Protection 1994).

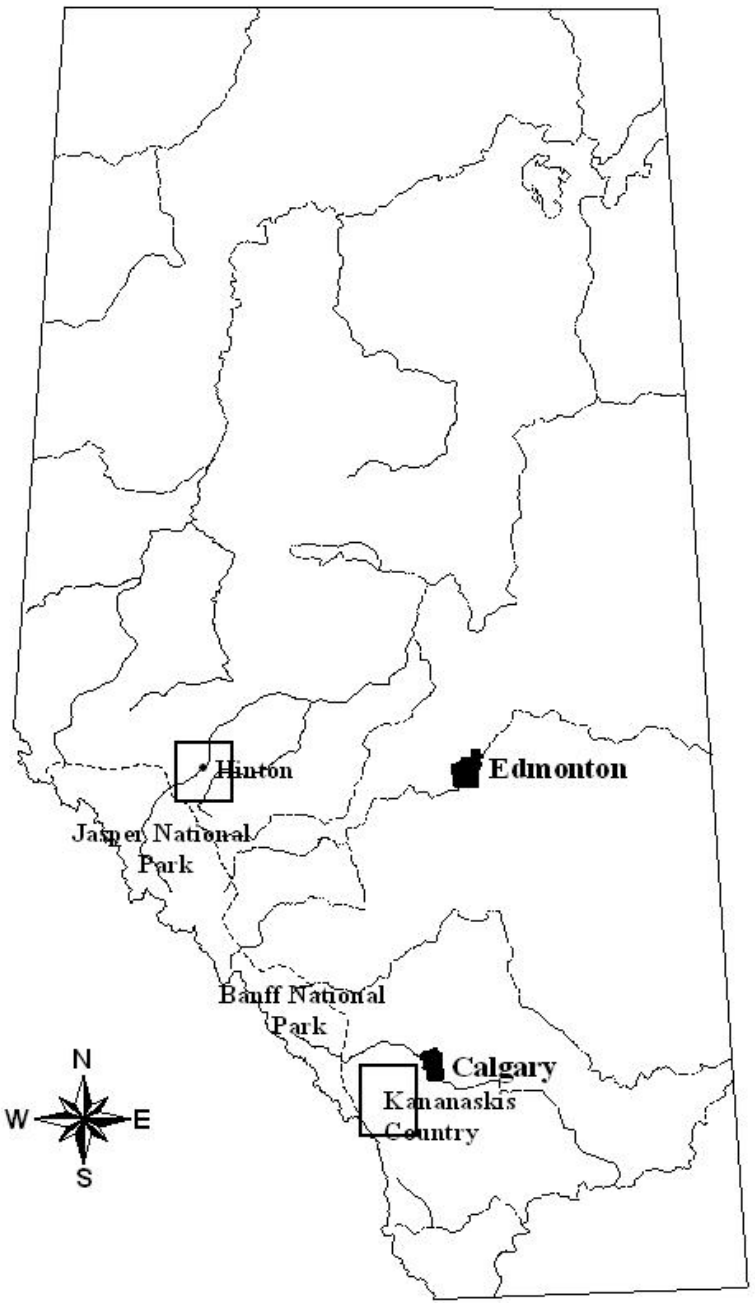

Figure 1. Location of long-toed salamander study areas in Alberta, 2002.

Methods

The methods used during the 2002 field season followed those outlined in the provincial long-toed salamander surveying and monitoring protocol (Pretzlaw et al. 2002). Surveys were designed primarily to identify and track the presence of breeding populations of long-toed salamanders over time.

Shoreline Surveys

The main method used to inventory long-toed salamanders involved searching pond shorelines for eggs. Long-toed salamander eggs are easy to distinguish from other amphibian eggs and are usually visible because they are laid in shallow water near the shoreline. In clear ponds, larvae may also be visible. Surveys were conducted in spring, beginning with ice thaw (1 May to 15 June 2002). A minimum of two surveys were conducted per pond to determine the maximum number of eggs laid and to track timing of reproduction.

Pitfall Trapping

Pitfall traps were operated at one pond in each of the Hinton (Wellsite pond) and Kananaskis (Kuhn's pond) RANA study areas. The traps were used for approximately six weeks in spring (1 May to 15 June 2002) and six to eight weeks in late summer (10 August to 30 September 2002). The number of trap nights at Wellsite pond and Kuhn's pond totaled 1646 and 13,360, respectively.

Each trap was constructed from two plastic flower pots and was approximately 30.5 cm deep and 15 cm in diameter. The traps were placed in the ground such that the rim of the pot was flush with the ground surface. Each trap contained a rock which acted as a perch, a wet sponge which maintained moisture, and a stick which allowed small mammals to escape. A coroplast cover was elevated on nails above each trap to provide shade and prevent rainfall from accumulating in the trap. The traps were placed 10 m apart on both sides of a silt fence that encircled the pond. The fence was constructed of durable plastic sheeting and was approximately 1 m high. The use of the silt fencing was based on the notion that amphibians traveling to or from the pond would be intercepted by the fence and would travel along its length until they fell into a trap.

The traps were checked every day or every other day. All captured amphibians were identified to species, and were weighed, measured (snout to vent length), and sexed. They were then released on the opposite side of the fence from which they were captured based on the assumption that they had been moving either towards or away from the pond when captured.

Mark-recapture was initiated at Wellsite pond as a means of gathering more detailed population trend information. Salamanders captured at the pond were marked with elastomer (Northwest Marine Technology 2000) at the base of the tail (refer to Pretzlaw et al. 2002 for details). Between trapping periods, traps were closed and sections of the fence were removed to allow passage to and from the pond.

Results

The following results summarize long-toed salamander data collected in 2002. Further study details, including information on other amphibian species observed in this study, can be found in Hanus (2002) and Rose (2002).

Shoreline Surveys

A total of 149 ponds were surveyed, 50 of which showed evidence of breeding long-toed salamanders (Table 1). Of these 50, 18 were newly discovered breeding ponds (Table 1).

Table 1. Summary of shoreline surveys and long-toed salamander observations in the Alberta foothills, 2002.

Location	*No. of ponds surveyed*	*No. of ponds with evidence of breeding long-toed salamanders*	*No. of new ponds with evidence of breeding long-toed salamanders*	*No. of known breeding ponds in which long-toed salamanders were observed*[a] */ No. of known breeding ponds surveyed*	*% of ponds with persistent populations of long-toed salamanders*[b]
Hinton	30	22	7	15/16	93.8
South of McLeod River	7	0	0	N/A	N/A
Grande Cache	4	0	0	N/A	N/A
Jasper National Park	26	14	7	7/9	77.8
Kananaskis	71	14	4	10/18	55.6
East of Banff	11	0	0	N/A	N/A
Total	149	50	18	32/43	74.4

[a]Ponds with previous observations of breeding long-toed salamanders
[b]Persistence refers to ponds in which evidence of breeding salamanders were observed in 2002 in addition to a previous year.

Although all salamander observations were recorded, only breeding observations were considered when calculating persistence of populations in ponds that had been previously identified as breeding ponds. The Hinton RANA study area was previously surveyed in 2000–2001. In 2002, evidence of breeding long-toed salamanders was recorded at all known breeding ponds except one, representing a population persistence of 94% (Table 1). New ponds north and south of Hinton (i.e., Grande Cache and south of McLeod River, respectively) were surveyed, but no salamanders were observed (Table 1).

In Jasper National Park in 2002, evidence of breeding long-toed salamanders was recorded at 78% of previously identified breeding ponds (Table 1). Also in Jasper, six additional ponds for

which anecdotal salamander records existed were surveyed. Two of these ponds showed evidence of breeding. Seven new breeding ponds were found in both Hinton and Jasper (Table 1).

The Kananaskis RANA study area was previously surveyed in 1998–2001. Although four new breeding ponds were found in 2002, only 56% of known breeding ponds showed evidence of breeding long-toed salamanders (Table 1). Park staff from Banff National Park periodically inventory ponds and have records of a number of persistent salamander breeding ponds, so Banff ponds were not included in this study. Surveys were expanded east of Banff (north of the Bow Valley), but no salamanders were found (Table 1).

Pitfall Trapping

At Wellsite pond in the Hinton area, a total of 130 adult long-toed salamanders and 88 young-of-the-year were captured (Table 2). The capture rate of adults in spring 2002 (0.15 individuals/trap night; Table 2) was similar to that in 2001 (0.19 individuals/trap night; Huynh 2001). The capture rate of young-of-the-year in 2002 (0.10 individuals/trap night; Table 2) was the same as that in 2001 (Huynh 2001).

Table 2. Numbers of long-toed salamanders captured at Wellsite pond, Hinton area, Alberta, 2002.

	Long-toed salamander captures			
	no. of adults	*no. of adults/trap night*	*no. of young-of-the year*	*no. of young-of-the year /trap night*
Spring	114	0.15	N/A	N/A
Late Summer	16	0.02	88	0.10
Total	130		88	

Kuhn's pond in the Kananaskis area was used as an amphibian trapping site for the first time in 2002. The previous trapping pond had dried up for three consecutive years and was deemed unsuitable; consequently, comparisons to previous capture data are not possible. A total of 120 adult long-toed salamanders and 345 young-of-the-year were captured in 2002 (Table 3). The capture rate of both adults and young-of-the-year was greater at Kuhn's pond than at Wellsite pond (Tables 2 and 3).

Table 3. Numbers of long-toed salamanders captured at Kuhn's pond, Kananaskis area, Alberta, 2002.

	Long-toed salamander captures			
	no. of adults	*no. of adults/trap night*	*no. of young-of-the year*	*no. of young-of-the year /trap night*
Spring	93	0.22	N/A	N/A
Late Summer	27	0.03	345	0.37
Total	120		345	

Discussion

Shoreline surveys are extremely important for monitoring the persistence of long-toed salamanders. Based on resurvey efforts in Jasper National Park, it appears that salamander populations within the park are persistent and likely stable. These populations were identified in 1995 and 1996 (Oseen et al. 1995; Hamilton et al. 1996). Breeding ponds and surrounding habitat are protected from alteration and destruction by industrial activities; however, park visitors can degrade shorelines and destroy amphibian eggs by trampling and by dogs walking and/or swimming in breeding ponds. For example, amphibian numbers have declined significantly in a Canmore pond (Bow Valley area) since the area was established as a dog off-leash site (S. Rose, pers. comm.). Tourism development and fish stocking can also impact salamander breeding ponds.

Most known breeding ponds in the Hinton area continue to show evidence of salamanders, although these ponds have been monitored for only one or two years. The discovery of additional breeding ponds is encouraging; however, the Athabasca Valley area is under increasing pressure from oil and gas exploration, forestry, and mining, all of which have the potential to alter and destroy critical wetland habitat.

The Kananaskis area ponds have been monitored for up to five years, and persistence of long-toed salamander populations is only 56%. While it is important to consider that evidence of salamanders may have been missed or that salamanders may be using different breeding ponds, the level of persistence could be indicative of an overall population decline. The Bow Valley corridor is under tremendous pressure from recreation and urban and industrial development, which may be negatively affecting pond availability and suitability for long-toed salamanders and other amphibians. Habitat protection and monitoring are critical to the effective conservation of long-toed salamander ponds.

An attempt was made to survey ponds beyond the current known range of the long-toed salamander in the Rocky Mountain foothills by expanding the survey area east and north. Unfortunately, poor weather conditions limited this component of the project. The small subpopulation found east of the foothills around the Peace River Valley (Walsh 1998) warrants further inventory work to determine its distribution and to identify potential habitat risks. While further survey efforts are recommended, results from this and other provincial studies indicate that the long-toed salamander's range is limited, and most breeding populations appear to exist in isolated and disconnected areas. This heightens the risk to the species within the northern Rocky Mountain foothills. It is unlikely that source populations can replenish breeding populations that are lost due to habitat destruction and increasing isolation.

While current monitoring efforts are beginning to define pond characteristics that are suitable for breeding long-toed salamanders (i.e., small, shallow, fishless, and permanent ponds), there is limited understanding of the species' forest habitat requirements beyond the need for cover and moisture (mature forests typically surround ponds in the Rocky Mountain foothills). Given that long-toed salamanders spend most of their lives in forests, management efforts need to be applied

to both terrestrial habitats and breeding ponds. A study in Montana showed that clear-cutting negatively affected local salamander populations (Naughton et al. 2000). Currently, buffer strips of 100–200 m have been established around known breeding ponds on Crown land to reduce industrial activity effects; however, these buffers may not protect the amount and type of forest habitat required during the nonbreeding season, including the hibernation period. Future research should determine how far salamanders travel to reach breeding ponds, and how far young-of-the-year disperse. Fidelity to pond sites should also be assessed. This information would help ensure that appropriate habitat conservation measures are implemented and would lead to increased understanding about the extent to which subpopulations are isolated. Additionally, improved policies regarding fish introductions and wetland draining and contamination are required. There also is no recourse to protect salamander ponds on private land.

Short-term pitfall trapping results suggest that local populations are reproducing successfully based on the capture of a cohort of young-of-the year at ponds in the Hinton and Kananaskis areas, and on the relatively stable capture rates between 2001 and 2002 in the Hinton area. Currently, there is little human activity around either trapping pond. While pond surveys are the most important amphibian population monitoring method because they provide data on a number of species from a variety of locations, pitfall trapping is useful for gathering data on local population size and trend, and on morphometrics, demographics, and general health (e.g., deformities). Introducing mark-recapture will improve our understanding of long-toed salamander population size and trends, and will provide data on dispersal and pond fidelity. These latter data are particularly relevant for management purposes as they can be used to determine the importance of existing ponds and surrounding habitat to salamander persistence.

Results of our study must be interpreted with caution because amphibian populations have inherent stochasticity and are strongly influenced by environmental conditions. This study represents the early stages of an annual, long-term monitoring program. In addition to the population monitoring, continuing education and communication with land managers and the public are essential components of this program. An important aspect of this program is that protection of long-toed salamander habitat will benefit a suite of wildlife species.

Acknowledgments

Funding for this project was provided by the Alberta Conservation Association (ACA), Alberta Sustainable Resource Development (ASRD), Human Resources Development Canada (Summer Career Placement Program), Weldwood of Canada Ltd. (Hinton Division), and Y2Y Conservation Initiative-Wilburforce Foundation. The project was administered by the ACA, with equipment provided by the ACA and SRD. Field work was conducted by Karen Graham, Stephen Hanus, and Selwyn Rose. Support and information were provided by Dr. A. Russell, Karen Graham, Troy Pretzlaw, Mai-Lynn Huynh, Kris Kendell, Lisa Takats Priestley, Charlie Pacas,

Brenda Dobson, and Ward Hughson. A number of volunteers provided invaluable assistance in the field.

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