Northern Leopard Frog Recovery Program

Year 6 (2004)

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In cooperation with:

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

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North American Waterfowl Management Plan

Northern Leopard Frog Recovery Program

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Please note that the views and opinions expressed are those of the author and do not necessarily represent the policies or positions of the Alberta Conservation Association or our funding agencies.

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EXECUTIVE SUMMARY

The northern leopard frog (*Rana pipiens*) was once a common amphibian found throughout central and southern Alberta. During the late 1970s, the leopard frog experienced a dramatic decline in distribution and numbers over much of its historic range in Alberta. Today, the leopard frog is designated as *Threatened* under Alberta's *Wildlife Act* and is currently extirpated from the upper Red Deer River and the North Saskatchewan River drainage (Wagner 1997, Kendell 2002b, Alberta Sustainable Resource Development 2003).

The leopard frog has demonstrated little ability to naturally disperse back into historic parts of its range. As a result, in 1998, the Alberta Fish and Wildlife Division began to explore the feasibility of reintroducing leopard frogs into formerly occupied habitats in the upper Red Deer River and North Saskatchewan River drainage basins. With the information gathered, the Alberta Conservation Association initiated a pilot reintroduction project in 1999 at the Raven Brood Trout Station near Caroline, Alberta. The project involves the captive rearing of leopard frogs from egg stage of development to metamorphosed frog, in two man-made outdoor ponds at the station.

The primary objective of the project is to re-establish leopard frogs in the upper Red Deer River and North Saskatchewan River drainage. Through the efforts of the northern leopard frog reintroduction program, over 13,000 leopard frogs have been captive-reared at the Raven Brood Trout Station and released into habitats within the historical range of the species. Of these 13,000 leopard frogs, approximately 9,000 frogs have been released into the upper headwaters of the Red Deer River near Caroline, since the projects inception in 1999. Over a three-year period beginning in 2001, 2845 frogs have been released at a site along the North Saskatchewan River near Rocky Mountain House and over a two-year period beginning in 2002, 1310 frogs have been released at a Ducks Unlimited property, near Red Deer.

All captive reared leopard frogs were marked with a Visual Implant Elastomer (VIE) tag, providing an externally visible internal identification mark. This tagging system allowed researchers to better assess the survival success at each release site and to monitor the dispersal of released frogs.

Confirmed frog observations each year between 2001 and 2004, as well as evidence of breeding activity in 2002, show some evidence of the preliminary success of the project at the Caroline release site. With the exception of two unconfirmed leopard frog observations in 2002 at the North Saskatchewan River release site, no other observations have been documented from that site or the Ducks Unlimited property despite monitoring efforts.

1.0 INTRODUCTION

Once a common and widespread species throughout much of Canada, the northern leopard frog has declined or vanished from much of the western portion of its range. The northern leopard frog is designated as a *Threatened Species* under the Alberta Wildlife Act, and the prairie population (including Alberta) is listed by COSEWIC and under the federal *Species at Risk Act* as *Special Concern*.

In Alberta, the decline resulted in a significant range contraction and reduction in population numbers leaving the northern leopard frog absent from much of its northern range limit. Remnant viable breeding populations of leopard frogs remain vulnerable to disturbance, disease and natural disasters and occur primarily in southern portions of the province. With minimal prospect of natural recolonization of its former range, the re-establishment of leopard frogs may be dependent on transplanting individuals from existing major breeding populations in southern Alberta (Cottonwood Consultants 1986, Roberts 1987, Wershler 1991, Wagner 1997). A management decision was made in 1998 to initiate a reintroduction project involving the leopard frog.

Project Objectives

Project Goal:

The goal of the reintroduction project is to re-establish breeding populations of northern leopard frogs in formerly occupied habitats in the headwaters of the upper Red Deer River and North Saskatchewan River drainage.

Primary Objectives:

- develop, refine and implement techniques of captive propagation, marking, and release of captive reared leopard frogs that are needed to implement a reintroduction program;

- promote the reintroduction project, conservation issues surrounding the northern leopard frog and Alberta's herpetile species in general;

- increase partnerships with a variety of organizations through co-operative work and shared research, knowledge and initiative;

2.0 GENERAL METHODS

Captive Rearing

As in previous years, two large outdoor ponds (formerly used as trout raceways) at the Raven Brood Trout Station were used to rear leopard frogs from egg stage of development to fully metamorphosed frogs.

In 2004, four leopard frog egg masses were collected from three different ponds in southern Alberta. All ponds were in the vicinity of Bow City. More specifically, eggs were collected from a pond located at Circle E Ranch (DU managed property) and ponds associated with the Bow City recreation area near Bow City. The four egg masses were placed separately into a floating egg mass predator exclosures. Once the eggs hatched, the hatchling tadpoles were confined to the exclosures until they were free swimming. They were then released between the two ponds disproportionably.

During the captive rearing process the water levels and potential predator threats were carefully monitored and managed when possible. Shortly after complete metamorphosis, volunteers and project field personnel captured the young frogs by net and funnel traps from the rearing ponds. In 2004, 196 captive reared leopard frogs were measured and weighed prior to release and all frogs released into the wild were marked using a Visible Implant Elastomer (VIE) tagging system producing a unique color and foot combination. In 2004, all frogs were marked with pink elastomer on the right hind foot, in the webbing between the 4^{th} and 5^{th} toe.

Release sites

Three sites were designated as release sites. They are located in central parkland region (Ducks Unlimited property), upper headwaters of the Red Deer River near Caroline and along the North Saskatchewan River near Rocky Mountain House. In 2004, frogs were only released at the Caroline site due to the small number of captive reared frogs available for release.

Frog surveys

At the Caroline release site, leopard frog surveys began in May 2004 for potential surviving leopard frogs. Early spring surveys focused on favourable leopard frog breeding habitat and for evidence of breeding (i.e. egg masses, calling). Surveys continued through June, July and August on a formal and informal basis at the Caroline site.

Surveys conducted at the Ducks Unlimited property and the Rocky Mountain House release site also occurred in May, and as well as in June. Additional formal surveys were undertaken in August at all release sites. North American Amphibian Monitoring Protocol (NAAMP) and the northern leopard frog survey protocol (Kendell 2002a) were followed during the surveys.

3.0 RESULTS

As in previous years, public involvement and education were important components of the summer captive-rearing program at the Raven Brood Trout Station. Approximately, 40 volunteers were involved with the project, helping with the frog surveys and the collection, marking and releasing of captive reared frogs in August. Many of the volunteers were given formal and informal presentations regarding the project and Alberta's reptiles and amphibians.

Volunteers included members of the general public and individuals from the following organisations: Red Deer River Naturalists, The Calgary Zoo, ACA and SRD.

In total, 16,128 tadpoles were counted from the four egg masses collected in 2004. The overall productivity (percent of tadpoles that survived to metamorphosis) in the two rearing ponds in 2004 was lower then in any previous year (Table 1). Of the 16,128 tadpoles introduced into the two ponds, 1,270 metamorphs were captured, marked and released, representing a survival rate of 8%.

Table 1. Percent of tadpoles that survived to metamorphosis during each field season from 1999 to 2004.

Year	No. of egg masses	No. of tadpoles hatched	No. of metamorphs	% Survival through metamorphosis
1999	3	8,292	1,430	17 %
2000	4	6,692	1,477	22 %
2001	6	21,036	2,983	14 %
2002	4	12,676	4,191	33 %
2003	4	7,380	2,491	34%
2004	4	16,128	1,270	8%

The release of frogs commenced on 9 August with frogs collected shortly after complete metamorphosis and mass emergence of young-of-the-year frogs. The majority (approximately 97%) of the captive reared frogs were collected from the rearing ponds by 16 August. The remaining captive reared frogs were collected and released by 27 August. All 1,270 frogs reared in 2004 were released at the Caroline release site.

Frog surveys

Several call surveys, following the North American Amphibian Monitoring Protocol (NAAMP), were conducted after sunset between 12 May and 8 June at the Caroline, Rocky Mountain House and Hummer Property. During these surveys wood frogs and boreal chorus frogs were detected at the Hummer Property and wood frogs, boreal chorus frogs and boreal toads were detected at the Caroline and Rocky Mountain House site. No leopard frogs were detected during these surveys.

Formal surveys for older age classes of frogs and YOY were conducted at the Hummer Property and at the Rocky Mountain House site on 10 and 11 August, respectively and the Caroline site was surveyed on 12 August. Three additional surveys were undertaken at the Hummer Property on 23 April, 15 June and 1 October. All surveys followed the survey protocol for the northern

leopard frog. These surveys failed to detect leopard frogs. A number of informal surveys for leopard frogs were undertaken at the Caroline site and were more successful in detecting leopard frogs. On three occasions leopard frogs were detected at Caroline release site as a result of survey efforts (see Table 3).

Table 3. Leopard frog observations in 2004 at Caroline release site.

Frog (sex)	Date	Activity	Tag information	Year of release	Release site
1 (unknown)	16 June	Not-Captured	NA	Unknown (Adult frog)	Unknown
2 (unknown)	9 August	Not-Captured	NA	Unknown (Adult frog)	Unknown
3 (female)	13 August	Captured	Green / left foot	Released in 2000	Raven River (oxbows along Raven River)

4.0 DISCUSSION

The 2004 captive rearing effort will be remembered as the least productive in terms of the number of captive reared frogs for release, to date. In 2004, only 8% of the hatchling tadpoles survived through metamorphosis. However, despite these low numbers of frogs reared, survivorship through metamorphosis was still higher than what is generally thought to occur in nature. For example, Merrell (1977) estimated that 600 000 leopard frog eggs yielded 20 000 young-of-the-year (YOY) (a survival rate of 3%) and Hine *et al*. (1981) estimated that the survival rate of leopard frogs (egg to YOY) at a number of study ponds was 1-6% using an average of 3500 eggs per egg mass.

It is believed that predation on the hatchling tadpoles, and tadpoles at later stages of development, (see discussion below), was the main cause for the low productivity in the rearing ponds in 2004. However, with that said, disease could not be ruled out as a factor in the low number of metamorphosed individuals. Also, it was believed that any mass mortality of the tadpoles likely occurred at a very early stage of development (i.e., shortly after they were release into the rearing ponds). The reason for this belief was because no tadpole corpses were observed at any time during the rearing period and if any mass die-off had occurred at later stages of development (i.e., in late July or early August), dead tadpoles would have been easily observed because of their large size.

The suspected high level of depredation of tadpoles may have been advantageous for the remaining population of tadpoles as it reduced competition for food and other resources in the rearing ponds, thus increasing the body size and survival rate of the tadpoles that did survive to metamorphosis. Under conditions with low tadpole density and high resource availability most tadpoles will grow at greater than average rate and will not metamorphose until they reach maximum size (McDiarmid and Altig 1999). In contrast, at higher tadpole densities and lower resource availability, tadpoles grow slowly and metamorphose at or near minimum size. Therefore, the presence of predators may provide some benefits to those tadpoles that escape depredation (Babbitt and Tanner 1998). In 2004, the average snout-to-vent length (SVL) and weight of recently metamorphosed leopard frogs was approximately 34 mm and 4.6 g, respectively. Hine *et al*. (1981) found that the average weight and SVL of leopard frogs at metamorphosis over a 2 year study in Wisconsin was 2.1 g / 39 mm SVL. In 1991, Seburn

(1993) calculated the average SVL of young of the year at several breeding sites in Alberta at 35-40 mm.

Litch (1974) suggested that most tadpole mortality (for the red-legged frog (*Rana aurora)* and the spotted frog (*Rana pretiosa*)) was caused by predation and that the cumulative survival from egg to young frog was less than 1% and 5% at a pond site and river site, respectively. Calef (1973) found that *Rana aurora* tadpoles were depredated at a relatively constant rate and that only about 5% survived to metamorphosis from a number of egg masses deposited in Marion Lake, British Columbia over two years. Conversely, when predation is limited or absent, survival rates through metamorphosis can increase (McDiarimid and Altig 1999). Results in 2004 show that survival rates in the rearing ponds closely were similar to what was observed in nature by the above researchers in terms of tadpole survival.

It is well known that the growth, development and ultimately survival rates of tadpoles depend on a number of physical and environmental conditions during their development. Such conditions include food availability and quality, water temperature, larval density, depredation (as discussed above), competition and water quality. A number of measures such as ensuring optimum water levels were maintained in the rearing ponds, and monitoring of terrestrial (i.e., mink) and avian predators (great blue heron), were undertaken in this project to reduce the loss of tadpoles and young frogs during the rearing process. Of all the factors affecting survival of tadpoles, the least controllable is depredation by aquatic invertebrates. In 2004, a high number of predacious diving beetle larvae (*Dytiscidae sp.*) were observed in the rearing ponds.

Field data on survival rates of tadpoles suggest that depredation is a major source of mortality through metamorphosis (Arnold and Wassersug 1978, Wassersug and Sperry 1977) and indeed it has generally been accepted that the bulk of predation on anurans appears to during the various stages of metamorphosis when high numbers of tadpoles may be eaten by a variety of invertebrate and vertebrate predators.

Predation levels can be influenced by the relative size of the predator and the prey (Eklov and Diehl 1994, Wilbur 1988) and in systems with size-limited predators, large body size can provide protection from predation (Persson *et al*., 1996). For example, larger tadpoles swim faster and may be more capable of escaping predators. Predators may also be gape limited (i.e. have jaws or mouths that are too small or weak to harm tadpoles at a given size) and therefore larger tadpoles may be safe from predators. Although no data loggers were used to monitor water temperatures in 2004, several cool weeks during the spring may have reduced the growth rate of the developing tadpoles resulting in a prolonged exposure to a high number of aquatic predators. Studies examining the growth and survival rate of tadpoles have suggested that tadpole mortality rates decreased as tadpoles grew (McDiarmid and Altig 1999).

Although the competition between tadpoles of the same, or different species may have influenced the growth rate, development and survival of the leopard frog tadpoles in the rearing ponds, it was not believed that this was the case in 2004. Both adult and sub adult wood frogs and boreal toads were observed in each of the two rearing ponds on several occasions in 2004 and a small number of boreal toad and wood frog YOY were observed in the rearing ponds in late summer, indicating that some successful reproduction of those species occurred in the rearing ponds.

Tadpoles are specialized feeders that may ingest planktonic material from the water column, obtain organic materials from pond sediments, or scrape material from various substrates (McDiarmid and Altig 1999). Leopard frog tadpoles are primarily herbivores, however under certain circumstances may extend their diet and tend to be omnivorous as they grow. As in previous years, the availability and quality of food sources in the rearing ponds was not believed to be limiting.

It has been noted that over-crowding of tadpoles under laboratory conditions will produce stunted growth (Adolph 1931). Lynn and Edelman (1936) suggested that physical encounters between individual tadpoles under crowded conditions could cause stress resulting in decreased growth rates. Based on previous years' results, the number of tadpoles introduced to the rearing ponds in 2004 was within the acceptable density supported by the rearing ponds.

In summary, the poor productivity of the rearing ponds was likely the result of depredation of the tadpoles, a disease outbreak and/or a combination of a number of factors, including environmental conditions that affected ambient water temperatures.

Update on the Leopard Frog Recovery Team:

The Alberta Northern Leopard Frog Recovery Team has been recently formed, and the team held its first official meeting on 8 December 2004 to continue the development of the leopard frog recovery plan. The draft recovery plan will be further developed and finalized in 2005 by the recovery team.

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