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RESOURCE DATA AND
SPECIES AT RISK SECTION

**Magrath Northern Leopard Frog
Reintroduction Project:
Final Report**

Alberta Species at Risk Report No. 104

Magrath Northern Leopard Frog Reintroduction Project: Final Report

Kathryn A. Romanchuk and Richard W. Quinlan

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Information Centre - Publications

Alberta Environment/ Alberta Sustainable Resource Development

Main Floor, Great West Life Building

9920- 108 Street

Edmonton, Alberta, Canada T5K 2M4

Telephone: (780) 422-2079

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TABLE OF CONTENTS

ACKNOWLEDGEMENTS	VI
EXECUTIVE SUMMARY	VII
1.0 INTRODUCTION.....	1
2.0 STUDY AREA.....	1
2.1 Egg Mass Collection Sites	1
2.2 Reintroduction Area.....	3
3.0 METHODS	4
3.1 Criteria for Selection of Source Ponds.....	4
3.2 Rearing and Release Site Assessments	4
3.3 Egg Mass Searches, Collection and Transportation	4
3.4 Egg Mass Rearing	5
3.5 Tadpole Release	5
3.6 Post-Release Dispersal Monitoring in 2003	6
3.7 Monitoring of Over-wintered Frogs and Post-Release Dispersal in 2004.....	6
3.8 Monitoring of Over-wintered Frogs and Post-Release Dispersal in 2005.....	7
3.9 Public Information/Education	7
4.0 RESULTS	7
4.1 Water Quality and Temperature.....	7
4.2 Egg Mass Collection	8
4.2.1 Strathcona Island Park (2003).....	8
4.2.2 Bull Springs (2004).....	9
4.2.3 Red Creek (2005).....	9
4.3 Egg Mass Rearing.....	10
4.4 Tadpole Releases	11
4.5 Post-Release Monitoring.....	12
4.5.1 Year 1 Monitoring.....	12
4.5.2 Year 2 Monitoring.....	13
4.5.3 Year 3 Monitoring of Over-wintered Frogs.....	14
4.5.4 Year 3 Post Release Monitoring	15
4.6 Observations of Unhealthy Frogs	15
4.7 Public Information/Education	16
5.0 DISCUSSION	16
5.1 Source Pond Selection Criteria	16
5.2 Egg Mass/Tadpole Development	17
5.2.1 Food Availability	17
5.3 Predation on Frogs and Tadpoles.....	17
5.4 Young-of-the-Year Dispersal.....	17
5.5 Evidence of Natural Reproduction.....	18
5.6 Project Evaluation	18
6.0 MANAGEMENT RECOMMENDATIONS	18
7.0 LITERATURE CITED	20
8.0 PERSONAL COMMUNICATIONS.....	20
APPENDIX A: MAGRATH NORTHERN LEOPARD FROG	
REINTRODUCTION - PROJECT AREA.....	22

APPENDIX B – PHOTOS TAKEN DURING 2003 FIELD SEASON.....	24
APPENDIX C – NUMBERS AND LOCATIONS OF FROGS OBSERVED DURING THE 2003 FIELD SEASON.....	27
LIST OF TITLES IN THIS SERIES.....	28

LIST OF TABLES

Table 1. Water temperatures recorded at rearing sites during 2003.....	8
Table 2. Significant dates related to hatching and development of egg masses.	10
Table 3. Numbers of tadpoles counted from Magrath egg masses.....	11

LIST OF FIGURES

Figure 1. Map of Alberta (south of 55° latitude) showing locations of the egg mass collection sites and rearing and release sites for the Magrath northern leopard frog reintroduction project.....	2
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2. STUDY AREA

2.1 Egg Mass Collection Sites

A pond in Strathcona Island Park became a primary egg mass collection site in 2003 after egg mass searches in other areas were unsuccessful. It was well known by local residents that northern leopard frogs inhabited this pond (Nicholson, pers. comm.). Awareness that the frog population could be threatened by pond dewatering and reconstruction planned for later that summer contributed to the decision to use Strathcona Island Pond as a source pond (Lupyczuk, pers. comm.). Strathcona Island Park is located on the South

EXECUTIVE SUMMARY

Prior to the late 1970's, the northern leopard frog (*Rana pipiens*) was a common and widely distributed amphibian throughout central and southern Alberta. The northern leopard frog has vanished from much of its former range in the province. The species was designated as *Threatened* under Alberta's *Wildlife Act* in 1996. Because the small number of remaining populations of leopard frogs are separated by large areas of unsuitable habitat, their re-establishment into previously occupied habitat may rely on transplanting individuals or egg masses from existing major breeding populations in southern Alberta.

A reintroduction project was initiated in Magrath in spring 2002 with the primary objective of re-establishing a breeding population of northern leopard frogs in its formerly occupied native habitat in the area. After water quality testing and dissolved oxygen testing of potential receiving ponds, egg masses were collected from three different source populations in 2003, 2004 and 2005. The egg masses were transferred to the Pothole Creek area in Magrath, and reared in floating predator exclosures. Once the eggs had hatched and developed into mobile tadpoles they were released directly into suitable habitat. A total of 8502 tadpoles were released over the three years, in a pond known as Dudley's Pond, which had also served as the primary rearing site. Dispersal of frogs into surrounding habitat was observed and documented.

Preliminary success of the reintroduction project was achieved in spring 2004 when yearling northern leopard frogs were observed after over-wintering successfully in Dudley's Pond. Another level of success was reached in spring 2005 with an additional year of successful over-wintering of both yearling and young-of-the-year frogs, and with breeding behaviour being observed. Dispersal of the frogs has also resulted in establishment of northern leopard frogs for several kilometres upstream and up to 10 kilometres downstream in the Pothole Creek drainage.

The Magrath Northern Leopard Frog Reintroduction Project was established as a pilot project to test the effectiveness of local transplants using on-site rearing. It has successfully demonstrated that the technique is feasible, and provides a template for future northern leopard frog reintroduction projects.

1.0 INTRODUCTION

The northern leopard frog (*Rana pipiens*) was once abundant and widespread throughout Alberta, and they were a common sight in the Magrath natural areas along Pothole Creek (Dahl, pers. comm.). The northern leopard frog was placed in the general status category “At Risk” in Alberta in 1991 due to populations having vanished from much of the historic range, and the species was legislated as *Threatened* in Alberta’s *Wildlife Act* in 1996. The few remaining breeding populations of northern leopard frogs are separated by large distances, making them vulnerable to habitat changes and limiting their capability to disperse into formerly occupied habitat.

In 1998 the Alberta Fish and Wildlife Division initiated a northern leopard frog reintroduction program, and in 1999 the first pilot reintroduction project was started at the Raven Brood Trout Station near Caroline, Alberta (Kendell 2001). The goal of that project was to re-establish leopard frogs in historically occupied habitats of the upper Red Deer and North Saskatchewan River drainage basins. The project has been ongoing and has shown positive results (Kendell 2002a).

The Magrath northern leopard frog reintroduction project started with a request made by two local residents to staff of Alberta Fish and Wildlife Division (AFWD) and the Alberta Conservation Association (ACA). The wish of Magrath residents DeVar Dahl and Buck Cunningham was that they would see northern leopard frogs, once a common species in Magrath, reintroduced into historic native habitat in the area. Northern leopard frogs were last observed there in the late 1970’s (Dahl and Cunningham, pers. comm.). This request was reviewed by Alberta Fish and Wildlife Division, and in 2001 a feasibility assessment was initiated, which included discussions with local residents, discussions with Kris Kendell (a northern leopard frog specialist), site inspections, and testing of the water quality, late winter water depths and oxygen levels. Alberta Fish and Wildlife Division initiated the Magrath project in spring 2002, as a pilot project to evaluate the effectiveness of local transplants using on-site rearing of eggs and release of tadpoles. If successful, it was felt that this approach could be applied in other historic northern leopard frog habitats to speed the recovery of the species in Alberta.

The goal of this project was to re-establish a breeding population of northern leopard frogs in formerly occupied habitat in the Magrath area of southern Alberta.

2.0 STUDY AREA

2.1 Egg Mass Collection Sites

A pond in Strathcona Island Park became a priority egg mass collection site in 2003 after egg mass searches in other areas were unsuccessful. It was well known by local residents that northern leopard frogs inhabited this pond (Nicholson, pers. comm.). Awareness that the frog population could be threatened by pond dewatering and reconstruction planned for later that summer contributed to the decision to use Strathcona Island Pond as a source pond (Lupyczuk, pers. comm.). Strathcona Island Park is located on the South

Saskatchewan River floodplain in the city of Medicine Hat, AB. The pond runs parallel to Ross Creek and is an old oxbow that was modified by the City in 1983/1984 (Mudry, pers. comm.). It is narrow and contains small amounts of downed woody debris and submergent vegetation, plus sparse amounts of emergent vegetation. Much of the shoreline is muddy and lightly vegetated, providing good cover and basking opportunities for the frogs. The upper banks are well vegetated, primarily with grasses, shrubs, and some trees.

The 2004 egg mass collection site was at Bull Springs, an old channel of the South Saskatchewan River that is now a separate spring fed oxbow pond. The pond has shallow clear water, with a bottom substrate comprised of a thick layer of river silt, and scattered rocks and woody debris. Bull Springs Pond is located north of Medicine Hat in an area of riparian shrubs and grasses where a large coulee enters the South Saskatchewan River.

The 2005 egg mass collection site was a portion of Red Creek (a tributary of Milk River) on a grazing lease west of Coutts. This is a meandering portion of the creek, with adjacent spring fed depressions, in a reach that extends from the United States of America border fence approximately 700 metres downstream into Alberta. The area is surrounded by native prairie.

Figure 1. Map of Alberta (south of 55° latitude) showing locations of the egg mass collection sites and rearing and release sites for the Magrath northern leopard frog reintroduction project.

2.2 Reintroduction Area

Magrath is located approximately 32 km south of Lethbridge, AB in the mixed-grass natural subregion (Fig. 1). The Pothole Creek area, a natural area at the southwest edge of the town, was chosen as the reintroduction site for this project. The Pothole Creek floodplain includes sedge, cattail, shrub, and willow communities as well as cottonwood groves and areas of grassland. There are several small ponds along the floodplain; some are natural, and some are old reverted channels and impoundments of the historic Galt Canal system of the late 1800s and early 1900s. The Magrath Golf Club borders the southwest end of the project, and the project area extends into the town of Magrath. Pothole Creek originates on the Milk River ridge and runs north through Magrath, eventually flowing into the St. Mary's River, which joins the Oldman River in Lethbridge.

A site situated approximately 0.6 km upstream of Dudley's Pond was selected for rearing of one of the egg masses in 2003. It was an inlet of an impounded area approximately 0.5 km upstream of an old spillgate. Water depth in the inlet during the rearing period was about 0.6m and there was an abundance of filamentous green algae in the area. Cattails dominated the north end of the channel while the shoreline was comprised of sedges, grasses, and shrubs. Pike inhabit the creek and impoundment. This site served as a rearing site in 2003 only, and the reared tadpoles were released in Dudley's Pond.

The primary rearing site was Dudley's Pond, a water body of approximately 1 ha in size, situated on private property at the southwest edge of Magrath on the Pothole Creek floodplain. It is a permanent, kidney-shaped pond with several small springs and seeps running into it. The pond offers a variety of water depths, with the deepest area measuring approximately 1.5m. Cattails dominate the shoreline along with sedges, shrubs, and mixed grasses. There is adequate aquatic vegetation in Dudley's Pond to provide cover for all age classes of leopard frogs. The deep area of the pond does not freeze to the bottom, and provides suitable over-wintering habitat for leopard frogs. The area immediately surrounding the pond provides an abundance of invertebrates, as well as cover and basking locations for frogs. The surrounding habitat also appeared suitable for dispersal of young-of-the-year frogs, with vegetation high enough to provide cover but not too dense for them to travel through. Minnows, sticklebacks, and suckers occupy Dudley's Pond. Pike were not in the pond during the project, but they have appeared in the past following flood events (Cunningham, pers. comm.). Dudley's Pond served as a rearing site in 2003, 2004, and 2005 and was also the release site for all tadpoles reared for this project.

3.0 METHODS

3.1 Criteria for Selection of Source Ponds

Searches for egg masses were carried out each year in several areas of the southern Alberta prairie and foothill landscape. Although the initial plan was to use source ponds as close as possible to Magrath, several of those areas were eliminated from consideration due to there being no egg masses found, or low numbers of egg masses found (*e.g.* Pine Coulee, Michel Reservoir, Taber). An important consideration in selecting a source area was to ensure that the frog population at the source pond would be robust enough to be able to sustain removal of one or two egg masses. Also, it was decided that there needed to be three consecutive years of transplants in order to buffer against the chance of year class failures, and that these transplants should come from different populations each year. This decision was made to reduce the potential for impact on recruitment in any one source population, and to increase genetic diversity in the new Magrath population.

3.2 Rearing and Release Site Assessments

The Pothole Creek area had been identified as suitable northern leopard frog habitat following an initial site survey in 2001. In March 2002 seven locations in the Pothole Creek area were investigated to determine their potential suitability as rearing and release sites. Water depths, winter dissolved oxygen levels, and substrate types were recorded. Water samples were collected and analyzed for a suite of water quality parameters including pH, alkalinity, salinity, nitrites, nitrates, phosphates, and water hardness. The project was ready to be initiated in spring of 2002, but very cold temperatures resulted in low availability of egg masses in potential source ponds. Although the search for egg masses was still underway in late May/early June, the project was finally postponed to 2003 when, after heavy rains on June 8, Pothole Creek flooded the floodplain and part of the town of Magrath.

When the project resumed in the spring of 2003, two of the locations investigated previously were selected as being the most favourable for northern leopard frog reintroduction. Due to the flooding experience in 2002 the site selection process evaluated susceptibility to flooding, in addition to assessing suitable vegetation cover, water depth, and an adequate food source. Water samples were collected once again from the two selected sites and tested for the same water quality parameters tested for in 2002.

3.3 Egg Mass Searches, Collection and Transportation

Searches for northern leopard frog egg masses were done by one or two observers walking the perimeter of ponds or along banks of creeks, focusing on areas of suitable breeding habitat. The survey protocol was based upon that described by Kendell (2002).

Once egg masses were located they were collected and placed inside clean containers which had been flushed and filled with water from the source pond. In 2003 a 45 litre camping cooler was used, whereas in 2004 and 2005 four litre insulated water jugs were used. In one instance, where the egg mass was loose and breaking apart, it was contained within one of the predator enclosure nets inside the container.

Egg masses were transported by truck from the source pond to the rearing ponds at Magrath, a trip which varied from 45 minutes to 3 hours. Upon arrival at the rearing pond, half the water in the container was drained and replaced with water from the rearing pond. This facilitated acclimation of the eggs to the new water temperature and water chemistry. After 15 to 25 minutes the egg masses were transferred from the transport container into predator – proof enclosure nets, which had been previously anchored in water of a depth varying from 0.6 to 1.5 metres. The predator enclosure nets were constructed according to a design described by Kendell (2001), and they served to contain the egg masses and tadpoles and to protect them from fish and avian predators.

Temperatures were taken at source ponds and rearing ponds and a GPS unit was used to record locations. Direct handling of egg masses was minimized through measures such as submerging the transport container into the pond and gently directing the egg mass towards it. Clean latex gloves were worn during all procedures that could result in touching the egg masses.

3.4 Egg Mass Rearing

Throughout the 2003 rearing period, the development of both egg masses was monitored every two days. Air and water temperatures were recorded at each visit along with observations of the egg masses and any other general observations made at the rearing sites (*e.g.* presence of fish, changes in water level/flow, wildlife occurrences). After the egg masses hatched, monitoring of the tadpoles continued in the same fashion until they were released. Procedures for monitoring of egg masses in 2004 and 2005 were similar to those followed in 2003, but less frequent. In 2004 egg masses were monitored every 3-4 days, while the 2005 monitoring was weekly.

3.5 Tadpole Release

All tadpoles were counted prior to being released into Dudley's Pond (Appendix B, Photo 4). The predator enclosure containing the tadpoles was placed in a round dishwashing pan filled with water from the rearing site and brought onto level ground for ease of handling. The top of the enclosure was carefully removed and any tadpoles stuck on the sides or in the folds of the "no-see-um" mesh were washed down into the enclosure using pond water poured from a bottle. A clean bucket, which had been flushed and partially filled with pond water, was placed next to the dishpan. Using a small plastic strainer, the tadpoles were scooped, counted, and transferred to the bucket of water (Appendix B, Photo 5). The strainer was kept under water as much as possible during the counting process to minimize the impact on the tadpoles and protect them from sun exposure. One person counted the tadpoles and called out numbers, while a second person recorded.

Once several hundred tadpoles had been transferred into the bucket, they were released directly into habitat with good water depth (at least 10cm) and some emergent vegetation and filamentous algae for food and cover. Water in the dishpan was replaced with fresh pond water approximately halfway through the counting process. This process was repeated until all tadpoles were counted. The entire procedure took from 45 minutes to 2.5 hours.

3.6 Post-Release Dispersal Monitoring in 2003

Post-release monitoring of leopard frogs commenced on 15 July 2003. Dudley's Pond was the focal point for finding the first young-of-the-year frogs, so both a canoe and a foot search were used on the first day of monitoring in order to get the most complete coverage of the area. Most subsequent surveys were done by foot, but a canoe was used on one other occasion (31 July), since some areas were too difficult to access on foot or were too deep. The initial surveys focused on the shoreline of Dudley's Pond, but the search area was expanded as the frogs dispersed. Later in the season the Pothole Creek area became the primary focus for northern leopard frog surveys in order to document dispersal distances (Appendix A).

Surveys generally started at 1130 hrs and were completed by 1600 hrs. Walking transects were established around Dudley's Pond, as well as upstream from Dudley's Pond along both sides of Pothole Creek to an old Galt Canal spill gate and downstream to the Highway 62 bridge crossing. As the season progressed and frogs dispersed further, additional searches were carried out upstream of the spill gate along the southwest edge of the creek to the golf course, and along the east side of the old Galt Canal. Searches were also done of the west side of the creek upstream of the spill gate for several hundred metres.

Walking transects were conducted within the study area every 2-3 days from late July into early September 2003 to monitor the dispersal of the frogs. After mid-September the surveys were carried out approximately once a week until the last week of October when weather conditions became suitable for winter submergence.

3.7 Monitoring of Over-wintered Frogs and Post-Release Dispersal in 2004

The 2004 monitoring began in late April, and was comprised mainly of Buck Cunningham noting daily emergence numbers of over-wintered frogs. Post-release monitoring in 2004 was limited because of the project not being funded. Lethbridge Fish and Wildlife Division staff conducted intermittent foot searches, primarily around Dudley's Pond, throughout the spring. The number of frogs observed was recorded along with any other notable observations. The project technician also completed a few voluntary searches of the project area during the summer and fall of 2004.

3.8 Monitoring of Over-wintered Frogs and Post-Release Dispersal in 2005

Monitoring in 2005 commenced on 25 April. Dudley's Pond was the first main focus, in order to count the number of successfully over-wintered frogs and to document the different age classes observed. Foot searches were also conducted upstream and downstream along Pothole Creek, following transects established in 2003. Initial monitoring was every 2-3 days, then weekly by mid-May and throughout most of the spring and summer. Monitoring of the tadpoles released on 01 June 2005 commenced on 22 June. This was accomplished by foot searches around the pond to visually locate developing tadpoles as well as any other frogs that were still in the area. In mid-July daily inspections for young-of-the-year frogs were done. A canoe was used on 27 July to survey the pond as completely as possible in order to obtain a count prior to the frogs dispersing. Egg mass searches were conducted at Dudley's Pond and along Pothole Creek between late April and mid-June, 2005.

3.9 Public Information/Education

Prior to and during the project, local news articles appeared in the Lethbridge Herald and the Magrath News. Residents were also informed of the project through occasional personal contact with the project technician during the field seasons. Ongoing communication and involvement was maintained with the two Magrath residents (DeVar Dahl and Buck Cunningham) who had requested the initiation of this project. A Species at Risk Series Report was completed for year 1 of the project (Romanchuk, 2003).

4.0 RESULTS

4.1 Water Quality and Temperature

Water quality tests conducted in 2003 on samples collected from the Medicine Hat source pond and two rearing sites in Magrath included levels of dissolved oxygen, pH, alkalinity, salinity, nitrites, nitrates, phosphates, water hardness, and water temperature. Results of the water quality tests showed little difference between the three sites and did not reveal any concerns. On the day the egg masses were collected and transferred, there was only a slight difference in water temperatures between the draw site (12°C) and the two rearing sites (13°C at the Pothole Creek site and 14°C at Dudley's Pond).

In 2003, water temperatures fluctuated significantly during the first week of the rearing period. At Dudley's Pond the temperature dropped from 14°C on 02 May to 7°C on 06 May, and by 11 May it had risen back up to 15.5°C. The water temperature changed even more drastically at the Pothole Creek site, dropping from 13°C on 02 May to 4.2°C on 06 May and then rising up to 15.5°C on 11 May. After 11 May, water temperatures at both rearing sites remained above 14°C. The water temperature of the rearing site at Dudley's Pond was consistently warmer than the Pothole Creek site (Table 1).

Table 1. Water temperatures recorded at rearing sites during 2003.

Date	Water Temperature (°C)	
	Dudley's Pond	Pothole Creek
2-May	14	13
6-May	7	4.2
8-May	8	4.2
11-May	15.5	15.5
14-May	17	17
15-May	n/a	17
16-May	15	n/a
19-May	15	14
21-May	17	15
23-May	20	17
24-May*	23	n/a
26-May	n/a	19
28-May	n/a	19.8
3-Jun*	16	15

n/a: water temperature not taken

*24-May: tadpoles reared at Dudley's Pond released

*3-Jun: tadpoles reared at Pothole Creek released

4.2 Egg Mass Collection

4.2.1 Strathcona Island Park (2003)

A preliminary search for northern leopard frog egg masses was carried out at Strathcona Island Pond in the late afternoon of 01 May 2003. Two observers searched the perimeter of the pond, focusing on areas of suitable breeding habitat, and found two large egg masses, less than a metre apart, approximately 2.5 m from shore, and close to the water's surface attached to a branch of submerged woody debris. The following morning two observers carried out a more intensive survey of the pond, but did not find any additional egg masses. The egg masses found the previous day were collected. The first egg mass collected was very compact and firmly attached to a branch. The branch and attached egg mass were cut away from the rest of the submerged tree and carefully transferred to a clean water-filled pail and then into the cooler. A small piece of styrofoam was attached to the top end of the branch to keep the egg mass suspended and prevent it from banging against the bottom of the cooler during transport. The second egg mass collected was also attached to a branch of a submerged broken tree limb, however, it exhibited the first signs of hatching and therefore was much less condensed. A predator enclosure net was placed in the cooler and the egg mass was then placed inside it to keep it contained and separate from the other egg mass during transportation. The egg masses were then transported by truck for two hours to the two rearing sites in Magrath. A supplemental search for additional egg masses on 13 May resulted in no egg masses being found.

The eggs were delivered to the Magrath rearing ponds at 1430 hrs on 2 May 2003. The egg mass being reared at Dudley's Pond was anchored into position along the edge of open water and emergent cattails at 1515 hrs. Water depth at the rearing site was 0.75 m (Appendix B, Photo 2).

The second egg mass was transported inside the predator enclosure in the cooler to a Pothole Creek rearing site. The egg mass was anchored into position at 1700 hrs in an inlet with water depth of approximately 0.6 m (Appendix B, Photo 3).

4.2.2 Bull Springs (2004)

On 14 May 2004, two observers carried out a perimeter search of the Bull Springs pond. Three adult leopard frogs were recorded at the site, one of which was just emerging from the mud, still in a state of torpor. One egg mass was found attached to a dead Russian thistle (*Salsola kali*) that had blown into the pond.. The egg mass was collected at 1430 hrs. The water temperature in the source pond was 8°C. The egg mass was transported by truck for the 3 hour drive to Lethbridge, then to the rearing site in Magrath. It was transferred into a predator enclosure and anchored into position at 2000 hrs. in water depth of approximately 0.6 m.

4.2.3 Red Creek (2005)

A foot search to locate northern leopard frog egg masses in Red Creek was initiated by three observers on the morning of 24 May 2005, accompanied by the grazing lessees and a grade 7 Science class from Earl Rivers High School in Milk River. The area surveyed ran 700 metres north (downstream) from the 49th parallel. A total of 12 northern leopard frogs were observed at the site (5 yearlings and 7 adults). Earlier surveys of the same area by MULTISAR project staff had resulted in finding one egg mass on 27 April and eight egg masses on 04 May. On 24 May only one egg mass was located during the search. It was situated along the edge of the creek just beneath the water's surface attached to submerged vegetation in 0.2 m of water. The water temperature was 10°C. The egg mass was no longer compact and spherical, but fairly loose and somewhat elongated. As it was being placed inside the container, a few fragmented bits of egg mass were spotted floating nearby and these were also guided into the container. The egg mass was collected at 1100 hrs from Red Creek and transported by truck for the 45 minute drive to the rearing site in Magrath. At the rearing site the egg mass was placed into a predator enclosure anchored in 1 m deep water, approximately 3 m from the southwest shore. The transplant was complete at 1400hrs on 24 May 2005. Water temperature in the rearing pond was 13°C.

4.3 Egg Mass Rearing

The predator enclosure nets proved to be effective in safeguarding the egg masses and developing tadpoles from aquatic, avian, and terrestrial predators. Their design also allowed the egg masses to be submerged just below the water surface, which buffered them from air temperature changes and kept the eggs suspended in the warmest part of the water, thereby promoting egg development.

Significant dates relevant to the hatching and development process were recorded for the egg masses (Table 2). A notable difference in hatching times was observed. The 2003 egg mass in Dudley's Pond had already shown the first signs of hatching when it was collected on 02 May 2003. By 08 May the egg mass had almost completely hatched, and by 11 May hatching was complete. The hatchlings were confined to the predator enclosure for an additional 12 days so they could continue feeding and to allow them to develop into larger, more mobile tadpoles prior to being released.

The 2003 egg mass being reared at Pothole Creek site did not begin hatching until 19 May. This was seventeen days after being transferred from Medicine Hat to the rearing site in Magrath. Although it took a considerable amount of time before the egg mass began to hatch, the hatching process was complete within one week. The hatchlings were confined to the predator enclosure for an additional 7 days after complete hatch to continue feeding and to develop into larger tadpoles prior to their release. By 03 June the tadpoles had developed substantially, were swimming freely, and were released. Both the 2004 and 2005 egg masses were collected later in the spring when the eggs were near hatching. Consequently, the rearing period was much shorter (11 days in 2004, 8 days in 2005), than in 2003 (22 to 30 days).

Table 2. Significant dates related to hatching and development of egg masses.

Collection Site	Collection Date	Rearing Site	Start of Hatching	Completion of Hatching	Release Site	Release Date
Strathcona Pond	02 May 2003	Dudley's Pond	02 May 2003	11 May 2003	Dudley's Pond	24 May 2003
Strathcona Pond	02 May 2003	Pothole Creek	19 May 2003	26 May 2003	Dudley's Pond	03 June 2003
Bull Springs	14 May 2004	Dudley's Pond	18 May 2004	21 May 2004	Dudley's Pond	25 May 2004
Red Creek	24 May 2005	Dudley's Pond	25 May 2005	Incomplete	Dudley's Pond	01 June 2005

4.4 Tadpole Releases

The first tadpole release took place on 24 May 2003. Weather conditions were sunny and hot with a light breeze. Air temperature was 25°C at the start, rising to 30°C, and the water temperature in Dudley's Pond was 23°C at noon, reaching 25°C by late afternoon. A total of 3,103 tadpoles were counted from the egg mass that developed in Dudley's Pond (Table 3). One hundred sixty-six of those tadpoles were dead, resulting in 2,937 live tadpoles being released.

The second release took place on 03 June 2003. Weather conditions were sunny and warm with a very light breeze; air temperature was 17°C. A total of 2,732 tadpoles were counted, with 48 dead, resulting in 2,684 tadpoles being released. Due to concerns about the slower development of the second egg mass at the Pothole Creek site, observations of northern pike, and the efficiency of monitoring the dispersal from one rather than two release sites, a decision was made to release the Pothole Creek tadpoles into Dudley's Pond. This resulted in a total of 5,621 tadpoles being released at various locations along the east side of Dudley's Pond in 2003.

Table 3. Numbers of tadpoles counted from Magrath egg masses.

Egg Mass	Release Date	Living Tadpoles Counted	Unhatched Eggs Released	Dead Tadpoles Counted	Total Tadpoles/Eggs	Survival Rate (%) to Release
2003 in Dudley's Pond	24 May 2003	2,937	0	166	3,103	94.7
2003 in Pothole Creek	03 Jun 2003	2,684	0	48	2,732	98.2
2004	25 May 2004	714	0	85	799	89.4
2005	01 June 2005	1,712	455 (approx)	236	2,403	90.2
TOTAL		8,047	455	535	9,037	94.1

In 2004, the tadpoles were released on 25 May under sunny skies. Water temperature in the pond was 13°C. A total of 799 tadpoles were counted, with 85 dead, resulting in 714 tadpoles being released (Table 3).

The final release of tadpoles for this reintroduction project took place on 01 June 2005. Weather conditions were somewhat cool and cloudy with a light drizzle. Both the air and water temperatures were 13°C. Unlike the two previous years, there were some unhatched eggs detected during the counting process. The eggs appeared viable, so a decision was

made to release the unhatched eggs along with the tadpoles. The eggs were counted and recorded separately from the tadpoles; but because of difficulty in accurately counting the small clusters of eggs, the number recorded is considered an approximation. There were 1712 tadpoles and approximately 455 eggs released in spring 2005 (Table 3).

During each release the number of dead tadpoles was also recorded, which allowed for determination of a survival rate for the reared eggs. The survival rate to release varied from 89.4% in 2004 to 98.2% in one of the 2003 egg masses, with an overall survival rate average of 94.1% (Table 3).

4.5 Post-Release Monitoring

4.5.1 Year 1 Monitoring

The first young-of-the-year frogs were observed in Dudley's Pond on 15 July 2003. This observation was of six small frogs along the west side of the pond, almost directly across from their rearing site. None of the frogs were completely out of the water and they all had tails as long as their bodies.

The next inspection was one week later, on 22 July. Twenty-four frogs were observed at that time. All frogs were observed along the east side of the pond and in the very shallow water at the far south end of the pond. Most frogs were smaller than those seen a week earlier, and their tails were barely noticeable. Four frogs were on land just along the shoreline and hopped into the water as they were passed by.

The greatest number of frogs counted in 2003 was on 28 July, when 197 frogs were observed in and immediately surrounding Dudley's Pond. The size and development of the frogs varied greatly; some still had tails of varying lengths, while others appeared to be fully metamorphosed. Several frogs were completely in the water, some were partially in the water, and others were on land in the shoreline vegetation or in mud depressions very close to the water's edge.

On 29 July 2003 a Magrath resident reported finding a lone frog on his lawn under the sprinkler. The distance traveled would have been at least 500 m north from Dudley's Pond. The frog was returned to Pothole Creek by AFDW staff and released into suitable habitat. On the same day, two Magrath residents reported seeing 3 leopard frogs approximately 320 m downstream of Dudley's Pond on the banks of Pothole Creek. These frogs would have traveled downstream to reach this point or perhaps used the extensive cattail complex situated east of the northern tip of Dudley's Pond as an aquatic corridor to the edge of the creek.

On 31 July a canoe survey was done of Dudley's Pond. A total of 108 frogs were observed. Most of the frogs were in the water, although a few were noted along the shoreline very close to the water's edge.

By the first week of August it became apparent that many frogs had begun to disperse from the release site. On 07 Aug 2003 a search of the habitat along Pothole Creek was carried out with the assistance of two Magrath residents. The survey covered approximately 1.2 km of ground from the closest point of Dudley's Pond to Pothole Creek, extending upstream approximately 540 m to the old spill gate and downstream 640 m. The search located 25 frogs, most being found approximately 145 m upstream on the east side of Pothole Creek in a cattail/sedge community near an old beaver pond. A search for frogs along the east side of Dudley's Pond was also completed that afternoon that resulted in 81 frogs of various sizes being observed. By 14 August several frogs had dispersed approximately 500 m upstream to within 40 m of the old spill gate.

On 26 Aug 2003 the first leopard frogs were observed along the east side of the old Galt Canal approximately 465 m northeast of the release site. Three frogs were in the sedges and mixed grasses within an open cattail complex along the shoreline (Appendix B, Photo 6). During a survey of the canal on 05 Sept following the same route, five frogs were seen. The frogs observed along the canal throughout the study were consistently found along the shoreline in habitat comprised of cattails with a mixture of sedges, rushes, native and non-native grasses, and willows.

In 2003 the furthest upstream dispersal distance of 1.2 km was recorded on 02 Oct. The frogs were along the shoreline of Pothole Creek among cattails, sedges, and grasses, just downstream of the Magrath Golf Club. The furthest downstream dispersal distance recorded during that field season was 400 m, noted on 07 Aug 2003. Those frogs were found in and around a very small, shallow semi-permanent pond along the Pothole Creek floodplain.

In 2003, frogs were last observed above water on 24 October 2003. Five of them were spotted east of the old spill gate along the west side of Pothole Creek. The water temperature in Pothole Creek on 24 October was 7°C, and it was 10.5°C in Dudley's Pond. A summary of northern leopard frog observations during the 2003 field season is provided in Appendix C.

4.5.2 Year 2 Monitoring

On 23 April, Buck Cunningham observed the first over-wintered northern leopard frog in Dudley's Pond. It was very dark, almost black in colour and appeared to be in a state of torpor. This frog, and most others seen in the ensuing days were located along a section of the shoreline with noticeable spring seepages. On the following day five northern leopard frogs were observed, and on 25 April seven were seen. The weather had been continually warming over that period, reaching 20°C by 25 April. On 27 April the weather changed to be much colder, with some snow falling, and only two northern leopard frogs were observed that day. On 29 April, when the air temperature was 11°C, three frogs were observed in the pond. On 07 May 2004, thirty over-wintered frogs were observed, the majority of them being seen at the north end of the pond and along the west side (near the seepages). There were no frogs observed at the shallower south end of the pond. Three plains garter snakes (*Thamnophis radix*), potential frog predators, were

also noted in the water or at the water's edge. On 21 May approximately forty over-wintered frogs were observed at the north end of the pond. A group of at least 32 pelicans (*Pelecanus erythrorhynchos*) was also observed and it was reported that they had been on the pond for the last two or three days (B. Cunningham, pers. comm.). The highest number of northern leopard frogs counted at Dudley's Pond in 2004 was 64, recorded on 25 May along the pond perimeter walking transect.

The egg mass that was placed into Dudley's Pond on 14 May 2004 had completely hatched by 21 May. The tadpoles were released four days later, on 25 May. Post-release monitoring of the tadpoles and frogs was infrequent due to there being no funding of project staff. These searches, and intermittent voluntary searches carried out by the primary author throughout the summer and fall of 2004 confirmed the continued dispersal of the frogs, primarily upstream from the rearing pond.

4.5.3 Year 3 Monitoring of Over-wintered Frogs

In 2005, the first over-wintered northern leopard frogs to appear in Dudley's Pond were recorded on 07 April, three weeks earlier than the previous year (B. Cunningham, pers. comm.). Two adults were observed on that date when the air temperature was 23°C and the water temperature 15°C. The number of over-wintered northern leopard frogs observed at the pond continued to increase as the month progressed, to a high of 33 on 21 April. Weather on that day was sunny and warm, with a temperature of 18°C. Approximately half of the frogs that were seen that day were at the north end of the pond. Two pairs of frogs were observed clasping at 1300 hrs and another four pairs were observed clasping one hour later. Two males were heard calling from the pond in bright sunshine at 1400 hrs. Frogs were noted clasping on two other occasions, both on 24 April. Despite the breeding behaviour that was witnessed, there were no egg masses detected in Dudley's Pond during searches conducted between 29 April and mid-June.

On 13 May an intensive foot search was conducted with the assistance of two Waterton Park employees, who were visiting to learn about the project. It extended along Pothole Creek, upstream from the campground footbridge to the old spill gate (approximately 640 m) and approximately 500 m downstream from the campground footbridge to the Hwy 62 bridge. A total of 24 yearling frogs were observed, 21 in the upstream portion, and 3 downstream in a small semi-permanent pond along the floodplain of Pothole Creek.

On 27 May 2005 a total of 58 over-wintered frogs were observed, located throughout Dudley's Pond. The ratio of adult to yearling frogs was fairly even. One plains garter snake was observed.

The furthest spring dispersal distance recorded in 2005 was on 16 May. It was an observation of two adult northern leopard frogs along the edge of Pothole Creek adjacent to Magrath Golf Course, approximately 1 km upstream from the release site. Three other adult frogs were observed, 2 of them in a pond area just west of the old spill gate and 1 between the pond area and the golf course.

4.5.4 Year 3 Post Release Monitoring

The first monitoring of the tadpoles released on 01 June took place on 22 June. The weather that day was hot and sunny with an air temperature of 25°C and the water in the pond was 22°C. The Dudley's Pond transect was surveyed by foot revealing that the pond was teeming with tadpoles of various sizes and at varying stages of development. Some of the tadpoles were developing legs. Three plains garter snakes were observed.

The next inspection, on 08 July, showed that there were still countless large tadpoles in the pond, but there were no newly metamorphosed frogs observed. Eight adult frogs were counted along the shoreline. Water temperature in the pond was 24°C.

On the afternoon of 14 July the Dudley's Pond transect was completed again. Several hundred large tadpoles were observed, along with hundreds of young-of-the-year frogs that had fully metamorphosed. Five adult frogs were recorded. Two very large plains garter snakes were observed in the water, each of them with a frog in their mouth, and a great blue heron (*Ardea herodias*) was seen flying over the pond.

A survey was done by canoe on 27 July 2005. The search resulted in observation of 2,148 healthy looking young-of-the-year frogs, 71 unhealthy looking young-of-the-year frogs (including 2 frogs with missing limbs), 32 adult frogs, and 3 dead frogs for a total of 2,254 northern leopard frogs observed that day. The actual number of frogs present would have been higher than this, because of frogs being missed in vegetative cover. It is also possible that some frogs may have already dispersed from the pond.

Dispersal of young-of-the-year northern leopard frogs became evident during the second week of August. On 09 Aug 2005, four young-of-the-year frogs were observed crossing a shale trail located between Dudley's Pond and Pothole Creek (B. Cunningham, pers. comm.). That same day there were also 10 young-of-the-year frogs observed up to 200 m. downstream along Pothole Creek. At that time it was also noted that there was still a very high number of frogs in Dudley's Pond (B. Cunningham, pers. comm.).

On 13 September 2005 a location approximately 10 km downstream was investigated for the presence of northern leopard frogs. The landowner had never sighted northern leopard frogs at this frequently-visited pond in the past, but in August 2005 noted that they were very numerous (D. Dahl, pers. comm.). The pond is located within 100 m. of Pothole Creek, and is supplied with water from a permanent stream originating from springs further up the coulee. Three frogs were observed in the pond and associated spring. This new northern leopard frog site likely originated from frogs dispersing downstream from the Magrath reintroduction site.

4.6 Observations of Unhealthy Frogs

In mid September 2004 two "bloated" northern leopard frogs were observed in Dudley's Pond. One was collected on 9 Sept 2004 and observed to determine any change in the frog's condition. After four days of observation the frog died. It was refrigerated and then

shipped to the Canadian Cooperative Wildlife Health Centre (CCWHC) in Saskatoon, SK, but no diagnosis of the condition was determined due to poor condition of the specimen. On 14 July 2005, approximately a dozen young-of-the-year northern leopard frogs that were observed along the west side were recorded as looking partially “bloated”, but the condition was not as extreme as in 2004. Four days later, on 18 July, a partial search halfway around the west side of the pond revealed 31 “bloated” frogs. A water sample was collected from the pond on that date and taken to a laboratory to be analyzed. On a 27 July search, 69 “bloated” young-of-the-year frogs were observed.

The AFDW Disease Specialist and the CCWHC Wildlife Veterinarian were consulted regarding this situation, and upon their advice, seven live “bloated” frogs and 2 live healthy frogs were collected from Dudley’s Pond on 21 July, contained in a large styrofoam cooler with pond water and aquatic vegetation, and transported the same day by truck to Saskatoon, SK for analysis at the CCWHC. Preliminary communication with the wildlife veterinarian suggests that a heavy larval parasite burden was impairing lymphatic drainage. The resulting inflammation interfered with fluid movement from muscle and subcutaneous tissue causing accumulation. One frog also tested positive for *Ranovirus infection pcr – frog virus 3*, which can also cause the edema observed, but generally in a milder form than was observed (T. Bollinger, pers. comm.).

4.7 Public Information/Education

There has been a continued high level of local support for this project. Public awareness was heightened in 2003 through a presentation given by the project biologist to local Scout troops in late June and via a newspaper article in the Magrath News in July. In 2005 a reporter from the Lethbridge Herald visited the reintroduction site in Magrath and subsequently wrote an article about the project as part of a species at risk series. Project volunteer DeVar Dahl also submitted an update on the project to the Magrath News. Personal encounters with Magrath residents suggest a high level of support for this project.

5.0 DISCUSSION

5.1 Source Pond Selection Criteria

During the course of the 3-year project, egg masses were collected from three different source ponds. These source ponds were chosen because they supported large populations of northern leopard frogs, which could likely sustain the removal of one or two egg masses without negatively impacting the population. The rationale for selection of the 2003 source pond, Strathcona Island Park Pond in Medicine Hat, was also supported by the possibility of detriment to that source population due to an upcoming pond reconstruction project. Different source ponds were chosen each year in order to reduce the likelihood of negative impacts on source pond populations. This selection of three different sources will also effectively increase the genetic diversity at the Magrath reintroduction site, which may increase the chances of long-term survival of this population. However, this protocol may have caused integration of individual, as yet

unrecognized, “races” of the species at the Magrath reintroduction site. The fact that this was to be a reintroduction to a historic area where the local population had been extirpated, resulted in the decision that there was little risk associated with the decision to use northern leopard frogs from different source populations.

5.2 Egg Mass/Tadpole Development

Egg mass hatching times and tadpole development rates vary with water temperature (Russell and Bauer 1993, cited in Wagner 1997). Previous studies have shown that under cooler temperatures, hatching times are extended and tadpole development rates are reduced (Kendell 2001). The difference in hatching times and tadpole development rates between years in this project supported this.

5.2.1 Food Availability

The availability of food did not appear to be a limiting factor for the tadpoles during the growth and development stages in 2003 and 2004. Aquatic vegetation and algae was abundant at both rearing sites, in addition to a wide variety of invertebrates.

The variety of sizes and varying rates of metamorphosis suggests that availability of food may have been a limiting factor for the developing frogs in 2005. This may have been related to the high density of young-of-the-year frogs in addition to adult frogs in 2005 compared to the previous years, possibly in combination with fluctuating environmental conditions affecting the presence of important invertebrate prey species.

5.3 Predation on Frogs and Tadpoles

There was no predation on tadpoles observed during the three field seasons. During the 2005 field season predation by plains garter snakes on young-of-the-year and adult frogs was observed. Several plains garter snakes were observed around Dudley’s Pond throughout the study period. Fish did not appear to be a major threat in Dudley’s Pond as it is likely there were only minnow, sucker, and stickleback species present, although pike are nearby in Pothole Creek. Pelicans were noted at the release site on several occasions, however in the first year it was during the time when the tadpoles were very small so it is unlikely they would have been targeted. The tadpoles would have been taken inadvertently when the pelicans were feeding on fish. In 2004 and 2005, however, pelicans may have been targeting and feeding on the frogs since they were quite abundant. Muskrats (*Ondatra zibethicus*) were observed in Dudley’s Pond on a couple of occasions and great blue herons were noted in the pond area in 2005.

5.4 Young-of-the-Year Dispersal

Since the frogs were not fitted with any type of tracking device it was impossible to record exact travel distances and dispersal routes. As a result, an assumption was made that the frogs took the easiest route possible. Dispersal distances were approximated using the closest point of the release site (Dudley’s Pond) to Pothole Creek and then the

direct distance from that point along Pothole Creek to the observation points. This assumed that the frogs would make their way to the creek to facilitate their dispersal. Seburn *et al.* (1993) found that young-of-the-year leopard frogs used streams for dispersal, and suggested that dispersal routes and the distances young frogs successfully disperse are influenced by the presence of aquatic corridors. The field observations of young-of-the-year frogs along the old Galt Canal in 2003 and along Pothole Creek throughout the project all three years, supports this assumption.

5.5 Evidence of Natural Reproduction

With the large number of young-of-the-year frogs observed in July 2005 it is reasonable to assume that natural reproduction took place in Dudley's Pond or adjacent habitats along Pothole Creek in spring 2005, despite no egg masses being found. Given the high expectant mortality rates of tadpoles and young-of-the-year frogs, and lack of adjacent populations, there does not appear to be any other feasible explanation for the extremely high density of young-of-the-year frogs that were present in the pond in 2005.

5.6 Project Evaluation

Some of the preliminary successes of this project included finding egg masses at the selected source site in Medicine Hat in spring 2003, transferring them to and rearing them successfully at the reintroduction site in Magrath, and finally observing the young frogs' dispersal into surrounding habitat. Additional success was achieved in spring 2004 and spring 2005 when frogs were detected and confirmed to have overwintered successfully. A Further milestone was achieved when breeding behaviour was observed, and with the likely production of egg masses in 2005. Success is also represented by dispersal of young of the year and adult frogs to surrounding habitats including colonization of suitable Pothole Creek habitat as much as 10 km downstream of the reintroduction pond. Overall success will be measured by maintenance of a long-term self-sustaining population of northern leopard frogs at the site and throughout Pothole Creek habitats, and potential habitats downstream along the St. Mary's and Oldman Rivers. The successes of the Magrath reintroduction project demonstrate that small-scale reintroductions using on-site rearing is a feasible approach to contribute to provincial recovery of northern leopard frogs.

An encumbrance was presented by the appearance in both 2004 and 2005 of unhealthy frogs in Dudley's Pond. The diagnosis by a CCWHC wildlife veterinarian suggests that the condition is due to naturally occurring parasites (T. Bollinger, pers. comm.). The reasons for the high numbers of frogs in 2005 with this condition are unknown, but it may have resulted from the high densities of frogs in Dudley's Pond at that time.

6.0 MANAGEMENT RECOMMENDATIONS

The three consecutive years of northern leopard frog reintroductions provided through this project should have provided enough of a population burst to re-establish a self-sustaining population in Magrath. There are no further Magrath reintroductions planned,

but there does need to be monitoring to document continued over-wintering, breeding, and dispersal to surrounding habitats. Specific recommendations are as follows:

- Encourage Magrath residents to continue observing and recording emergence dates and numbers of over-wintered northern leopard frogs.
- Conduct egg mass searches in spring 2006.
- Search suitable habitats throughout the Pothole Creek Basin to further document dispersal and colonization by the reintroduced northern leopard frogs.
- Continue to document any occurrences of “bloated” frogs in the project area, and attempt to quantify the proportion of the population affected.
- In other areas of Alberta where northern leopard frogs have been extirpated, use the methods tested through this project to recover local populations in historic habitats.

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8.0 PERSONAL COMMUNICATIONS

- Bollinger, Trent. Western and Northern Regional Coordinator, Canadian Cooperative Wildlife Health Centre, Saskatoon, Sk.
- Cunningham, Buck. Retired biologist and resident of Magrath, AB.
- Dahl, DeVar. Teacher, town councilor, and resident of Magrath, AB.
- Kendell, Kris. Biologist. Alberta Conservation Association, Edmonton, AB.

Lupyczuk, Len. Conservation Officer. Alberta Sustainable Resource Development, Fish and Wildlife Division, Medicine Hat, AB.

Mudry, Maureen. City of Medicine Hat, Parks and Outdoor Recreation Division, Medicine Hat, AB.

Nicholson, Joel. Non-Game Biologist. Alberta Sustainable Resource Development, Fish and Wildlife Division, Medicine Hat, AB.

**APPENDIX A: MAGRATH NORTHERN LEOPARD FROG
REINTRODUCTION - PROJECT AREA**

Appendix A

Magrath Northern Leopard Frog Reintroduction - Project Area

Appendix B – PHOTOS TAKEN DURING 2003 FIELD SEASON

Photo 1. Predator exclusion net held by B.Downey

Photo 2. Predator exclusion net containing egg mass anchored at the Dudley's Pond rearing site

APPENDIX B – continued

Photo 3. Pothole Creek rearing site – the predator exclosure net containing the egg mass was anchored in the top left corner of the photo

Photo 4. Tadpoles prior to release, June 3/03

APPENDIX B – continued

Photo 5. K. Romanchuk counting tadpoles prior to their release, 24 May 2003

Photo 6. Northern leopard frog observed along the Galt Canal, 26 August 2003

**Appendix C – NUMBERS AND LOCATIONS OF FROGS OBSERVED DURING
THE 2003 FIELD SEASON.**

Date	# Frogs Observed	Location	# Search Hrs. (Person Hrs.)
15-Jul	6	Dudley's Pond	5
22-Jul	24	Dudley's Pond	4
28-Jul	197	Dudley's Pond	4
31-Jul	108	Dudley's Pond	5
4-Aug	93	Dudley's Pond	4
7-Aug	106	25 along W side of Pothole Creek, 81 at Dudley's Pond	8
12-Aug	42	39 in Dudley's Pond, 3 in surrounding habitat	4
26-Aug	4	3 on E side of canal, 1 just E of northern tip of pond among vegetation	4.5
29-Aug	2	1 on E side of canal, 1 d/s on E side of Pothole Creek	3.5
3-Sep	10	W side of Dudley's Pond among veg. on the shoreline	4.5
5-Sep	12	5 along E side of canal, 7 near spillgate along Pothole Creek	4.5
12-Sep	10	5 on E side of Dudley's Pond, 2 by spillgate along Pothole Creek, 3 west of spillgate on SW side of Pothole Creek	4
19-Sep	17	Dudley's Pond	4
26-Sep	2	Along SW side of Pothole Creek (W of spillgate)	4.25
2-Oct	5	4 on E side of canal, 1 along SW side of Pothole Creek just downstream of golf club (furthest upstream dispersal)	4
6-Oct	6	NW side of Pothole Creek (W of spillgate)	4.25
17-Oct	8	1 near Pothole Creek rearing site, 1 on NW side of Pothole Creek (W of spillgate), 5 on SW side of creek (W of spillgate)	4.25
24-Oct	5	Along W side of Pothole Creek (E of spillgate), across from S end of Dudley's Pond	4.5

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(as of December 2005)

- No. 1 Alberta species at risk program and projects 2000-2001, by Alberta Sustainable Resource Development, Fish and Wildlife Division. (2001)
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- No. 3 Distribution and relative abundance of the shortjaw cisco (*Coregonus zenithicus*) in Alberta, by M. Steinhilber and L. Rhude. (2001)
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