ALBERTA PIPING PLOVER PREDATOR EXCLOSURE AND POPULATION MONITORING PROGRAM

2010 Field Season Report

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In cooperation with:

Alberta Conservation Association
Conserving Alberta's Wild Side

Canada

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TD Friends of the Environment Foundation

EXECUTIVE SUMMARY

Nest predation continues to be a significant limiting factor for the Great Plains piping plover *(Charadrius melodus)* population. Previous studies conducted in east-central Alberta and in the United States have shown that the use of predator exclosures can significantly reduce piping plover nest predation. Since 2002, predator exclosures have been applied to as many nests as possible in Alberta with the goal of increasing nest success and ultimately enhancing fledging success.

As a part of this program, annual surveys are conducted on core breeding lakes in order to better gauge population numbers and movement. These surveys complement the international census conducted every five years across North America and are designed to monitor changes in populations and distribution. Surveys also provide researchers with an opportunity to re-sight piping plovers banded in Alberta in previous years, as well as those banded in other jurisdictions. The information collected from band recoveries assists wildlife biologists in determining dispersal patterns, adult and juvenile survival, and complements the banding program being undertaken in Saskatchewan.

We carried out population inventories on 26 waterbodies in Alberta and one in Saskatchewan in 2010. In Alberta, 233 adults were located on 21 different waterbodies, and an additional 23 adults were seen in adjacent Saskatchewan. In total, 121 nests were found, of which 117 had exclosures applied to them. Exclosures were 60 cm in diameter and were made of a single length of 5 cm x 5 cm stucco wire 40 cm high. Overall, Mayfield nest success was calculated to be 80.3%, fledging success was calculated to be 45.4%, and we calculated that 1.61 chicks per pair were fledged in 2010. We banded four young plovers and recorded 23 piping plovers banded in previous years.

All activities carried out during the course of this project were done in support of the *Alberta Piping Plover Recovery Plan, 2010 - 2020* (Alberta Piping Plover Recovery Team 2010). In particular, these activities were conducted to address Section 8.2 (Productivity Enhancement), Section 8.3 (Information and Outreach) and Section 8.4 (Population Monitoring and Research) of the recovery plan.

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Finally, we want to say thank-you to those individuals who granted us access through their land to plover habitat. Our sincere apologies to anyone we have missed.

Please note that the results and recommendations presented in this report do not necessarily represent official positions of our funding agencies or their sponsors.

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1.0 INTRODUCTION

The piping plover *(Charadrius melodus)* is designated as *Endangered* in Canada (COSEWIC 2010), *Threatened* in the United States (United States Fish and Wildlife Service 2010), *Near Threatened* by the International Union for Conservation of Nature (IUCN 2010), and is listed as *Endangered* under Alberta's *Wildlife Act* (Government of Alberta 2010). Low productivity, primarily resulting from nest predation, has been identified as a significant limiting factor to piping plover populations in the Great Plains (Whyte 1985, Haig 1992, Heckbert 1994, Richardson 1999). Results from studies carried out in east-central Alberta from 1995 to 1998 showed that, through the use of predator exclosures, piping plover nest predation can be significantly reduced, thus increasing productivity (Heckbert and Cantelon 1996, Richardson 1999). Results from other jurisdictions have been similar (Rimmer and Deblinger 1990, Melvin et al. 1992, Larson et al. 2002, Murphy et al. 2003). The Alberta Piping Plover Recovery Team has endorsed the use and continued refinement of predator exclosures as a management technique in the *Alberta Piping Plover Recovery Plan 2010-2020 (*Alberta Piping Plover Recovery Team 2010). This program has been ongoing since 2002 (Engley and Schmelzeisen 2002, Schmelzeisen and Engley 2003, Engley et al. 2004, Schmelzeisen et al. 2005, Rezansoff et al. 2006, van Huystee et al. 2007, Rezansoff et al. 2008, Rezansoff et al. 2009) and in addition to exclosure application, this program includes inventories on at least 25 lakes with the potential to support plover populations. These annual surveys assist wildlife biologists in determining the population trends and distribution of Alberta's piping plovers.

2.0 STUDY AREA

The majority of this program was carried out on water bodies in east-central and southeastern Alberta. One lake occurring in extreme west-central Saskatchewan was also included in the study because of its proximity to the Alberta lakes in the program. This lake was South Freshwater Lake (hereafter referred to as Freshwater Lake).

3.0 MATERIALS AND METHODS

Two researchers in one field crew carried out the majority of the work. Fieldwork began on 12 May 2010 and was completed by 31 July 2010. The field crew split their time between two field camps. One field camp was located in Dillberry Lake Provincial Park, where they monitored lakes near Dillberry and in the Provost area. The second camp was located in Hanna, where

they monitored lakes in the surrounding area. Additional staff from Alberta Conservation Association, Alberta Sustainable Resource Development and the federal government's Department of National Defence assisted in project activities on lakes outside of the core program area. Field crews contacted landowners whenever it was necessary to cross private land to gain access to a lake.

3.1 Population inventories

We surveyed lakes with known or potential piping plover habitat, prioritizing lakes with larger and more recent populations of piping plovers. Following guidelines outlined by Goossen (1990), we surveyed lakes for adults during the peak breeding period, May 25 – June 7, by walking approximately 60% - 70% of the way from the water's edge to the vegetation line and stopping periodically to scan for plovers. Location of the adult plovers and breeding activity were recorded and mapped, and all adults were checked closely for leg bands. We conducted lake surveys again in July to assess habitat conditions and look for broods.

3.2 Exclosure application and monitoring

Nest locations were georeferenced using a handheld Global Positioning System (GPS) and recorded in Universal Transverse Mercator (UTM) coordinates and North American Datum 1983. To avoid disturbance to incubating adults, we monitored nests from 50 m - 100 m away using binoculars or spotting scopes. Nests were only approached to apply exclosures, to check maximum clutch size, or if nest abandonment or predation was suspected. The majority of nests were monitored every 5 - 15 days throughout the incubation period. We considered nests to be "successful" if at least one egg hatched, as described in Murphy et al. (1999).

Exclosure application and monitoring techniques followed the procedures outlined by Richardson (1997). Once located, we applied exclosures to the majority of nests within one day of discovery, regardless of stage of laying or incubation. One researcher would carry the exclosure to the nest and secure it to the substrate. After application of an exclosure, each nest was monitored to ensure the adults resumed incubation. Following guidelines outlined by the United States Fish and Wildlife Service (1996), we removed exclosures if adults did not resume incubation within 60 minutes of application (sooner if the weather turned inclement).

Predator exclosures used during the 2010 field season followed the same basic design that has been used since 2002 (Engley and Schmelzeisen 2002), and included the modification of a stucco wire top used in 2006 (Rezansoff et al. 2006). Exclosures were circular in shape, and made of a single length of 5 cm x 5 cm stucco wire approximately 2 m long and 40 cm high. The two ends of the stucco wire were overlapped by three sections and attached using 10 cm nylon cable ties, forming a circular exclosure 60 cm in diameter. To prevent predatory birds from perching on the exclosures, the horizontal wire along the top of the exclosure was removed to expose the vertical wires, thus creating 5 cm spikes around the top of the exclosure. Exclosures were anchored with 25 cm nails (bent 90^0 at the top). The number of anchors used on an exclosure varied between four and twelve anchors (depending on the firmness of the substrate) with most exclosures having eight anchors.

In five cases, exclosures were topped with 2 cm x 2 cm plastic mesh as they were readily available and the stucco wire tops were not (Figure 1, Appendix 1).

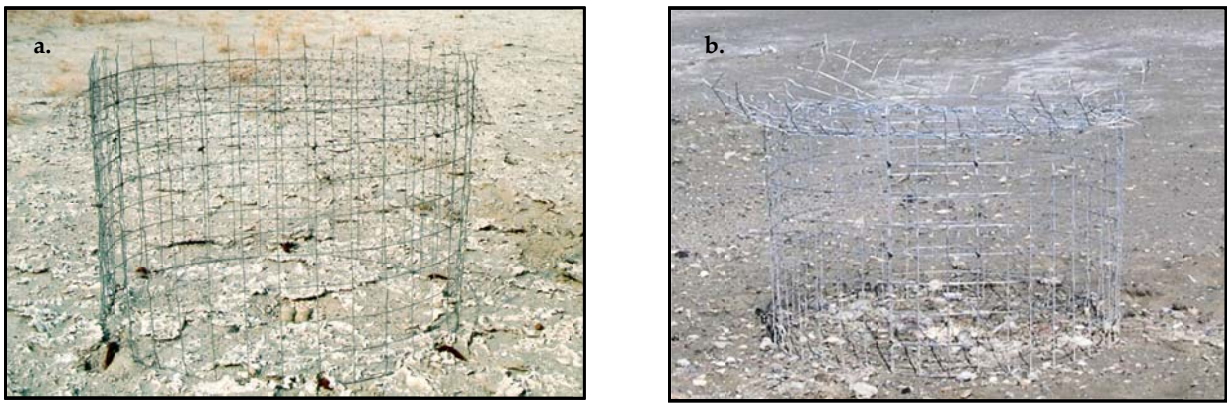

Figure 1. (a) An exclosure with a 2 cm x 2 cm plastic mesh top and (b) an exclosure with a 5 cm x 5 cm stucco wire top.

We tested the utility of the RECONYX PC85 RapidFire™ Professional camera to document exclosure effectiveness, nest threats and nest activity (Figure 2). Five separate cameras were placed between 5 m - 10 m from exclosed nests on Akasu, Cipher, Dowling, Horseshoe and McLaren lakes. Each of the five cameras, were pre-programmed with factory default settings except trigger sensitivity was changed from high to very high, the number of successive images after the camera was triggered by a motion event was changed from three images to five images, and image interval was changed from one second to RapidFire or continuous trigger interval. 4GB compact flash cards were used to store the images. Images were downloaded from all five cameras once every two weeks.

Figure 2. RECONYX RapidFire™ Professional camera.

3.3 Band application and tracking

We opportunistically captured young plovers using hand nets and marked them with a combination of one metal, and two black-and-white striped plastic bands. Bands were applied in combinations that allow banded birds to be traced back to the lake and year of banding. We weighed and photographed captured young to build a reference dataset linking age with weight and development.

3.4 Productivity analyses

We used Mayfield nest success (Mayfield 1961, 1975; Johnson 1979) with a 35 day laying and incubation period (Murphy et al. 1999). We calculated Mayfield nest success separately for exclosed and unexclosed nests and for all nests combined. In cases where a nest was monitored both with and without an exclosure applied, exposure days were added to the appropriate nest calculations.

We calculated fledging success using a modified Mayfield approach (Flint et al. 1995). This method, which has been employed for a variety of species including piping plovers (Elias et al. 2000), determines daily survival rates (DSR) of chicks (1-[#chicks lost/total exposure days (Exp)]) based on periods of time when broods are actually under observation. Several different ages have been used to consider a young plover fledged; Haig (1992) used 25 days, Larson et al. (2002) used 16 days and Murphy et al. (1999) recommended using 18 - 20 days. For the purposes of this study, any young seen that were 20 days or older were considered to have

fledged, and fledging success was therefore calculated as DSR^{20} (Engley et al. 2004). This method yields a conservative value, as calculations are based only on chicks that are actually observed, and some chicks are undoubtedly missed during visits. Overall production per nesting attempt (OPN) in the province during 2009 was calculated as:

OPN = (Mayfield nesting success) x (mean # eggs laid) x (% eggs hatching in successful nests) x (Mayfield fledging success).

Because productivity goals established in the provincial and national recovery plans (Goossen et al. 2002, Alberta Piping Plover Recovery Team 2006, Environment Canada 2006) are expressed as chicks/pair, rather than chicks/nesting attempt, we multiplied OPN by 1.20, based on the observation that the number of nests on well-surveyed Alberta lakes is typically 20% higher than the number of pairs known to occur on those lakes in the same year (unpublished data), as some pairs will re-nest if their first nest fails. This method has been shown to be very accurate when compared to observed fledging rates for piping plovers (Engley et al. 2004).

4.0 RESULTS

4.1 Population inventories

We conducted piping plover population inventories on 26 waterbodies in Alberta and one waterbody in Saskatchewan (Table 1, Figure 2), as part of the annual monitoring program in Alberta. In total, 233 adults were located on 21 lakes in Alberta during the course of these surveys. An additional 23 adults were located in Saskatchewan (1 on Freshwater Lake and 22 on the Saskatchewan side of Reflex Lake).

Table 1. Alberta piping plover population inventories for 2010.

Lake	# Adults
Akasu	13
Baxter	5
Birch	13
Border	0
Chain #4	13
Cipher	2
Clark	22
Dowling	27
Foster	2
Frog	7
Gooseberry	0
Handhills	14
Horseshoe	9
Junction	13
Killarney	14
Little Fish	0
McLaren	6
Mott	2
Muriel	13
NW Killarney	4
Piper	9
Red Deer	15
Rider	0
Rockeling Bay	0
Reflex[1]	20
Sunken	10
Total	**233**

[1] *An additional 23 adults were located in Saskatchewan (22 on the Saskatchewan side of Reflex Lake and one on Freshwater Lake).*

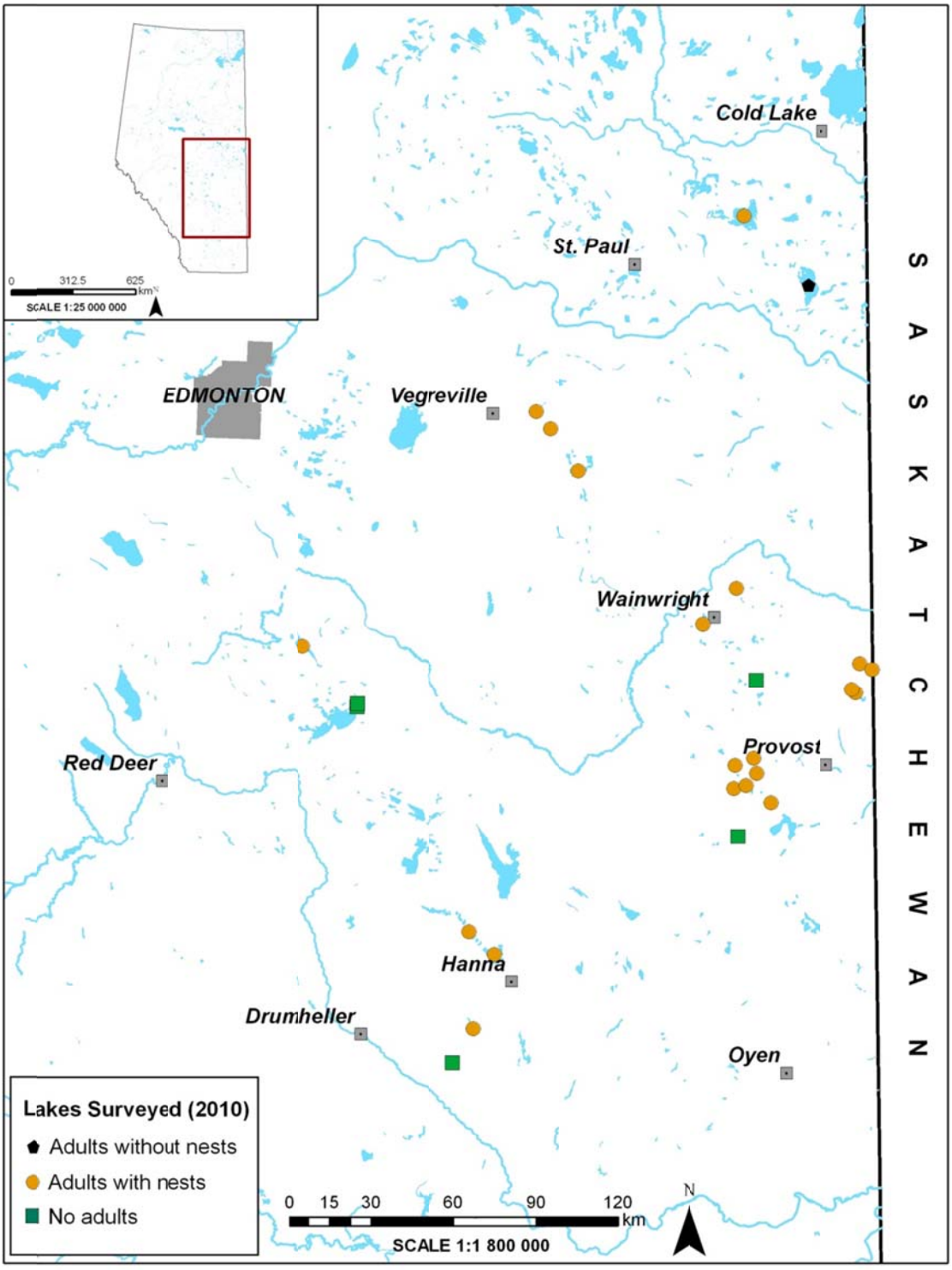

Figure 3. Location of lakes surveyed for piping plovers in Alberta in 2010.

4.2 Nest summaries

In total, we found 121 nests on 20 waterbodies in Alberta and on adjacent lakes in Saskatchewan (Figure 2, Table 2). The lakes with the highest number of recorded nests were Dowling (n = 16) and Reflex (n = 16) lakes. For all nests with a documented full clutch size, mean clutch size was 3.96 $\pm$ 0.0328 (n = 96). Nest fate was unknown for a total of 14 nests (eleven exclosed and three unexclosed). Mayfield nest success was calculated to be 80.1% for exclosed nests (DSR = 0.9937 $\pm$ 0.0016, Exp = 2378) and 100.0% (DSR = 1.00, Exp = 19) for unexclosed nests. A test of significance was not conducted because of the small number of nests and exposure days for unexclosed nests. Overall, Mayfield nest success for all nests found in 2010 was 80.3% (DSR = 0.9937 $\pm$ 0.0016, Exp = 2397).

A total of 15 exclosed nests failed (Table 3). The majority of nest failures (n = 10) resulted from abandonment for unknown reasons. Other causes of nest failure included infertile eggs (n=3), all-terrain vehicle (ATV) (n=1), and nest predation by a coyote digging up anchors and exclosure (n =1).

We observed signs of coyote activity at 9.4% (n = 11/117) of all exclosed nests, and it is likely more nests were approached by coyotes.

Cattle activity was observed in the vicinity of 8.5% (n = 10/117) of exclosed nests on Dowling, Horseshoe, Reflex and Sunken lakes. One exclosure on Dowling Lake was crushed and pulled off the nest by cattle; however, the eggs hatched prior to the damage occurring. Another nest on Dowling Lake failed as a result of abandonment. One nest on Horseshoe Lake failed because of abandonment and one nest on Sunken Lake failed because of infertile eggs. The remaining nests with cattle activity were successful.

We observed evidence of ATV disturbance at 26% (n =31/117) of all exclosed nests. Many of these ATV tracks were seen within the vicinity of exclosed nests on Muriel Lake, including nests that were in the Muriel Lake Waterbird Sanctuary, where public access is prohibited during the breeding season. Two exclosures on Muriel Lake outside of the sanctuary were hit by an ATV; both exclosures were repaired but both nests had an unknown fate. Another exclosure on Muriel Lake outside of the sanctuary was hit by an ATV; however, the eggs hatched prior to the damage occurring. In addition, one exclosure on Reflex Lake was hit by an ATV and the nest failed as a result.

Three separate RECONYX RapidFire™ Professional cameras were placed on three exclosed nests each at Akasu, Cipher and Dowling lakes. All three cameras recorded a coyote approaching the nest and on each occasion the coyote was unsuccessful in preying upon the eggs. In addition to coyote observations, cameras also captured several images of crows, gulls, jackrabbits and deer mice placed on the same exclosed nest at Akasu, Cipher, Dowling lakes and also on an exclosed nest at McLaren Lake. All nests eventually hatched except the nest on McLaren Lake, which failed as a result of an unexplained abandonment.

Table 2. Piping plover nest summaries for Alberta and adjacent Saskatchewan lakes in 2010.

Lake	Total # of Nests	# of Nests Exclosed	# of Nests not Exclosed	Successful Nests	Failed Nests	Nests with Unknown Fate	Exposure Days[1]	
							Exclosed	Unexclosed
Akasu	4	4	0	2	1	1	94	0
Baxter	3	1	2	0	0	3	25	2
Birch	5	5	0	5	0	0	90	0
Chain #4	4	4	0	3	1	0	84	0
Cipher	1	1	0	1	0	0	17	0
Clark	12	11	1	11	0	1	213	10
Dowling	16	16	0	15	1	0	305	6
Foster	1	0	1	0	0	1	0	1
Handhills	3	3	0	3	0	0	69	0
Horseshoe	4	4	0	3	1	0	75	0
Junction	8	8	0	7	1	0	199	0
Killarney	11	11	0	8	2	1	197	0
McLaren	5	5	0	1	1	3	115	0
Mott	1	1	0	1	0	0	10	0
Muriel	11	11	0	7	2	2	225	0
NW Killarney	1	1	0	1	0	0	13	0
Piper	6	6	0	4	2	0	153	0
Red Deer	5	5	0	5	0	0	111	0
Reflex (AB)	9	9	0	5	2	2	146	0
Reflex (SK)	7	7	0	7	0	0	146	0
Sunken	4	4	0	3	1	0	91	0
Totals	**121**	**117**	**4**	**92**	**15**	**14**	**2378**	**19**

[1] *Exclosed exposure days are the number of days a nest is observed while an exclosure is applied.*
Unexclosed exposure days are the number of days a nest with no exclosure is observed.

Table 3. Nest fate in 2010.

Nest Fate	Exclosed	Unexclosed
Successful	91	1
Unknown	11	3
Unexplained Abandonment	10	0
Infertile Eggs	3	0
ATV	1	0
Nest Predation	1	0
Totals	**117**	**4**

4.3 Band application and tracking

We banded four young plovers in 2010 (Table 4). This brings the total number of young banded to 755 since recovery efforts in Alberta began in the summer of 1998. We identified 23 birds banded in previous years from Alberta, Saskatchewan or on their wintering grounds. We were able to determine banding year and lake of origin for 11 birds (Appendix 2).

Table 4. Summary of young banded in 2010.

Lake	Band Combination[1]	Number of Young Banded
Clark	(W/B,B/W:m,-)	1
Sunken	(-,W/Bm:B/W,-)	3
Total		**4**

[1] *Band combinations read as follows: (upper left, lower left: upper right, lower right). Dashes (--) mean no bands were located on that part of the leg. Consecutive letters mean bands were stacked, where the first letter refers to the band used highest on the leg. Band types include the following: B/W = black-and- white striped plastic band, W/B = white-and-black stripped band and m = silver metal band with serial number.*

4.4 Fledging success

We calculated Mayfield fledging success for all nests to be 45.4% (DSR = 0.9613 $\pm$ 0.0031, Exp = 3798.5). Based on the mean clutch size (3.96 eggs), percent of eggs hatching (93.1%), Mayfield nest success (80.3%) and Mayfield fledging success at 20 days (45.4%), overall production per nesting attempt for 2010 was estimated to be 1.34 chicks/nest. Using 1.20 nests/pair, the overall fledging rate was 1.61 chicks/pair.

5.0 DISCUSSION

This project was undertaken in support of the *Alberta Piping Plover Recovery Plan 2010-2020* (Alberta Piping Plover Recovery Team 2010). Exclosure applications and landowner liaisons addressed sections 8.2 and 8.3 (Productivity Enhancement and Information and Outreach) of the recovery plan. Population inventories and banding of young addressed recovery actions under section 8.4 (Population Monitoring and Research).

5.1 Population inventories

We recorded 233 adult piping plovers in Alberta in 2010, which was 18 more than we recorded in 2009 (n=215). While our count of piping plovers was slightly higher in 2010 compared to 2009, we surveyed the same number of lakes with approximately the same amount of survey effort (Rezansoff et al. 2009). This slight population increase in 2010 was despite the fact that for many parts of Alberta it was a very wet spring. In years where there are high water levels, such as in 2010, beach width is restricted and the availability of nesting habitat is limited. However, eventual recession of high water levels exposes unvegetated shorelines which provide nesting habitat for several years thereafter. Whereas in years where there are prolonged periods of low water, vegetation is able to encroach onto nesting beaches, which reduces habitat suitability until high water returns (Prescott 1997). Populations of piping plovers were also higher along areas of the South Saskatchewan River between Saskatchewan Landing and Gardiner Dam (Davies 2010). However, populations in the US alkali lake core area and on the Missouri River system (Aron 2010) were slighter lower in 2010 than 2009.

5.2 Nest success

Since the 2007 field season, we have made a concerted effort to cover exclosures with stucco wire tops and, as a result, only five of 117 exclosed nests had plastic mesh tops. The use of stucco wire tops has proven to be effective in increasing overall stability of the exclosures and making them less conspicuous. The stucco wire tops are also less susceptible to damage by coyotes.

Mayfield nest success for unexclosed nests in 2010 was unusually high (100%). However, this value is not particularly meaningful, given the small sample size of unexclosed nests with known fate (n=1). From 1998 - 2010, Mayfield nest success for unexclosed nests in Alberta was calculated to be 30.0%. This is likely higher than the actual nest success since we typically monitor unexclosed nests much less frequently than exclosed nests. As a result, in many cases the only way to determine the fate for infrequently monitored unexclosed nests is by finding young from the nest. Ultimately, this means that all such nests with found broods are recorded as “successful”, but many nests that likely failed are recorded as “unknown fate”. This creates an artificially high nest success rate for unexclosed nests.

5.3 Fledging success

In 2010, the fledging rate for piping plovers was 45.4% (1.61 chicks per pair per nest). Historically, fledging rates in Alberta have been approximately 35%. The increase in fledging success in 2010 allowed us to surpass the recovery team goal of 1.25 chicks per pair per nest.

6.0 RECOMMENDATIONS

Participants at the 2003 Northern Great Plains Piping Plover Science Workshop ranked the use of predator exclosures as the most important and the most feasible management technique available to aid in recruitment (Westworth et al. 2004). However, there is recognition that agencies involved with piping plover recovery efforts in Alberta cannot continue to place exclosures over the majority of piping plover nests in Alberta in perpetuity. Annual funding challenges have made it increasingly difficult to carry on delivering a large-scale exclosure program. At some point we will have to see if the population has recovered enough to persist without direct intervention. Our hope is that with the 60% increase in piping plover populations in Alberta over the past decade that the population will remain stable without the need for continuous productivity enhancements through the use of predator exclosures.

We make the following recommendations to those involved with piping plover recovery efforts in Alberta:

- Alberta should participate as fully as funding allows in the 2011 International Piping Plover Census.
- The application of predator exclosures should continue on as large a scale as funding will allow.
- Continue to work with landowners and record habitat information. This information should continue to be passed on to the coordinator of the Alberta Piping Plover Habitat Enhancement Program, where efforts can be made to reduce the impacts of livestock and human disturbance.
- Ensure all actions carried out through this program are supported by the Alberta Piping Plover Recovery Team. Alberta Conservation Association is a member of the recovery team and will seek approval for all program actions prior to implementation in 2011.

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APPENDIX 1. Original nest data from 2010 field season.

Nest Number	Treatment[1]	Eggs Laid	Eggs Hatched	Fate	Comments
AKLA-10-01	Stucco	4	0	Infertile Eggs	
AKLA-10-02	Stucco	4	4	Successful	
AKLA-10-03	Stucco	4	4	Successful	
AKLA-10-04	Stucco	4	Unknown	Unknown	No YOY seen.
BALA-10-01	Not Exclosed	2+	Unknown	Unknown	No YOY seen.
BALA-10-02	Stucco	4+	Unknown	Unknown	No YOY seen.
BALA-10-03	Not Exclosed	4	Unknown	Unknown	No YOY seen.
BILA-10-01	Stucco	4	3	Successful	
BILA-10-02	Stucco	4+	2+	Successful	
BILA-10-03	Stucco	4	2+	Successful	
BILA-10-04	Stucco	3	3	Successful	
BILA-10-05	Stucco	4	4	Successful	
CHL4-10-01	Stucco	4	4	Successful	
CHL4-10-02	Stucco	4	4	Successful	
CHL4-10-03	Stucco	4	0	Predated	Coyote predation on nest.
CHL4-10-04	Stucco	4	4	Successful	
CILA-10-01	Stucco	4	4	Successful	
CLLA-10-01	Stucco	4	3	Successful	
CLLA-10-02	Stucco	4	3	Successful	
CLLA-10-03	Stucco	4	Unknown	Unknown	No YOY seen.
CLLA-10-04	Stucco	4	4	Successful	
CLLA-10-05	Stucco	4	4	Successful	
CLLA-10-06	Stucco	4	4	Successful	
CLLA-10-07	Stucco	4+	4+	Successful	
CLLA-10-08	Stucco	4	4	Successful	
CLLA-10-09	Stucco	3+	1+	Successful	
CLLA-10-10	Not Exclosed	4+	4+	Successful	
CLLA-10-11	Stucco	4+	3+	Successful	
CLLA-10-12	Stucco	4	3	Successful	
DOLA-10-01	Stucco	4	4	Successful	
DOLA-10-02	Stucco	4	4	Successful	
DOLA-10-03	Stucco	4	0	Abandonment	Unknown cause.
DOLA-10-04	Stucco	4+	4+	Successful	
DOLA-10-05	Stucco	4	4	Successful	
DOLA-10-06	Stucco	4	3	Successful	
DOLA-10-07	Stucco	4	4	Successful	
DOLA-10-08	Stucco	4	3	Successful	
DOLA-10-09	Stucco	4	4	Successful	
DOLA-10-10	Stucco	4+	2+	Successful	
DOLA-10-11	Stucco	4	2	Successful	
DOLA-10-12	Stucco	4	3	Successful	
DOLA-10-13	Stucco	4	4	Successful	
DOLA-10-14	Stucco	4+	2+	Successful	
DOLA-10-15	Stucco	4	4	Successful	
DOLA-10-16	Stucco	4+	4+	Successful	
FOLA-10-01	Not Exclosed	1+	Unknown	Unknown	Adult was incubating when the nest was last visited.
HALA-10-01	Stucco	4	4	Successful	
HALA-10-02	Stucco	4	1	Successful	

APPENDIX 1. Continued

Nest Number	Treatment[1]	Eggs Laid	Eggs Hatched	Fate	Comments
HALA-10-03	Stucco	4	4	Successful	
HOLA-10-01	Stucco	1	0	Abandonment	Unknown cause.
HOLA-10-02	Stucco	4	4	Successful	
HOLA-10-03	Stucco	4	4	Successful	
HOLA-10-04	Stucco	4	4	Successful	
JUNC-10-01	Stucco	4	4	Successful	
JUNC-10-02	Stucco	4	0	Abandonment	Unknown cause.
JUNC-10-03	Stucco	4	4	Successful	
JUNC-10-04	Stucco	4	4	Successful	
JUNC-10-05	Stucco	4	4	Successful	
JUNC-10-06	Stucco	4	4	Successful	
JUNC-10-07	Stucco	4	4	Successful	
JUNC-10-08	Stucco	4	4	Successful	
KILA-10-01	Stucco	4	0	Abandonment	Unknown cause.
KILA-10-02	Stucco	4	0	Abandonment	Unknown cause.
KILA-10-03	Stucco	4+	4+	Successful	
KILA-10-04	Stucco	4+	4+	Successful	
KILA-10-05	Stucco	4+	4+	Successful	
KILA-10-06	Stucco	4+	4+	Successful	
KILA-10-07	Stucco	4	3	Successful	
KILA-10-08	Stucco	4	3	Successful	
KILA-10-09	Stucco	4	4	Successful	
KILA-10-10	Stucco	4	Unknown	Unknown	No YOY seen.
KILA-10-11	Stucco	3	3	Successful	
MCLA-10-01	Stucco	3	Unknown	Unknown	No YOY seen.
MCLA-10-02	Stucco	4	Unknown	Unknown	No YOY seen.
MCLA-10-03	Stucco	5	Unknown	Unknown	No YOY seen.
MCLA-10-04	Stucco	4	0	Abandonment	Unknown cause.
MCLA-10-05	Stucco	4	4	Successful	
MOLA-10-01	Stucco	3+	3+	Successful	
MULA-10-01	Stucco	4	4	Successful	
MULA-10-02	Stucco	4	0	Abandonment	Unknown cause.
MULA-10-03	Stucco	4	4	Successful	
MULA-10-04	Stucco	4	Unknown	Unknown	No YOY seen.
MULA-10-05	Stucco	4	4	Successful	
MULA-10-06	Stucco	4	Unknown	Unknown	No YOY seen.
MULA-10-07	Stucco	4	0	Abandonment	Unknown cause.
MULA-10-08	Stucco	4	4	Successful	
MULA-10-09	Stucco	3	3	Successful	
MULA-10-10	Stucco	4	4	Successful	
MULA-10-11	Stucco	4	3	Successful	
NWKI-10-01	Stucco	4+	3+	Successful	
PILA-10-01	Stucco	4	0	Abandonment	Unknown cause.
PILA-10-02	Stucco	4	4	Successful	
PILA-10-03	Stucco	4	0	Infertile Eggs	
PILA-10-04	Stucco	4	4	Successful	
PILA-10-05	Stucco	4	3	Successful	
PILA-10-06	Stucco	4	4	Successful	
RDLA-10-01	2 cm^2 Plastic	4	4	Successful	
RDLA-10-02	2 cm^2 Plastic	4	4	Successful	

APPENDIX 1. Continued

Nest Number[1]	Treatment[2]	Eggs Laid	Eggs Hatched	Fate	Comments
RDLA-10-03	2 cm^2 Plastic	4+	4+	Successful	
RDLA-10-04	2 cm^2 Plastic	4	4	Successful	
RDLA-10-05	2 cm^2 Plastic	4	3	Successful	
RELA-10-01	Stucco	4	4	Successful	
RELA-10-02	Stucco	5	0	Abandonment	Unknown cause.
RELA-10-03	Stucco	4	4	Successful	
RELA-10-04	Stucco	4	4	Successful	
RELA-10-05	Stucco	4+	Unknown	Unknown	No YOY seen.
RELA-10-06	Stucco	1	0	ATV	
RELA-10-07	Stucco	4	4	Successful	
RELA-10-08	Stucco	4+	4+	Successful	
RELA-10-09	Stucco	4	4	Successful	
RELA-10-10	Stucco	4+	4+	Successful	
RELA-10-11	Stucco	4	4	Successful	
RELA-10-12	Stucco	2	Unknown	Unknown	No YOY seen.
RELA-10-13	Stucco	4	4	Successful	
RELA-10-14	Stucco	4	4	Successful	
RELA-10-15	Stucco	4	3	Successful	
RELA-10-16	Stucco	4	4	Successful	
SULA-10-01	Stucco	4+	4+	Successful	
SULA-10-02	Stucco	4	4	Successful	
SULA-10-03	Stucco	4	0	Infertile Eggs	
SULA-10-04	Stucco	4	4	Successful	

[1]*Nest numbers read as follows: AKLA = Akasu Lake, BALA = Baxter Lake, BILA = Birch Lake, CHL4 = Chain #4 Lake, CILA = Cipher Lake, CLLA = Clark Lake, DOLA = Dowling Lake, FOLA = Foster Lake, HALA= Handhills Lake, HOLA = Horseshoe Lake, JUNC = Junction Lake, KILA = Killarney Lake, MCLA = McLaren Lake, MOLA = Mott Lake, MULA = Muriel Lake, NWKI = NW Killarney Lake, PILA = Piper Lake, RDLA = Red Deer Lake, RELA= Reflex Lake and SULA = Sunken Lake.*

[2]*Treatments consisted of enclosing, or not enclosing the nest. Predator exclosures were made of 5 cm x 5 cm stucco wire with either a 2 cm x 2 cm plastic mesh cover, or a cover made of the same 5 cm x 5 cm stucco material.*

APPENDIX 2. Adult plover band recoveries in 2010**.**

Band combinations read as follows: (upper left, lower left: upper right, lower right). Dashes (--) mean no bands were located on that part of the leg. Consecutive letters mean bands were stacked, where the first letter refers to the band used highest on the leg. Letters divided by a slash ("/") indicate a striped band of two colours (e.g., B/W = a black-and-white striped band and BI/R = a blue-and-red strip band). Uncoloured metal bands are indicated by a lower case "m". Bands with flags are abbreviated with a lower case "f" after the colour (e.g., Bf = black band with a flag). The following abbreviations are used for plastic band colors: W = white, Y = yellow, O = orange, LG = light green, LB = light blue, DB = dark blue.

Example: (--,LGB/W:--,m) reads nothing on the upper left leg, a light green band over a black-and-white striped band on the lower left leg, nothing on the upper right leg, and a metal band on the lower right leg.

Lake	Band Combination	Apparent Sex	Dates Observed	Original Banding Location
Clark	(--,LGB/W:--,m)	M	May 17	Birch Lake, AB 2005
Clark*	(B/W,--:m,W)	F	May 17 – June 20	Freshwater Lake, SK 2007
Clark*	(--,B/Wm:-,LG)	M	June 20 – July 8	Horseshoe Lake, AB 2005
Clark*	(m,O:Bf,OO)	U	June 20 – June 28	Lake Diefenbaker, SK 2006
Clark	(--,--:B/W,?m)	U	July 8	Killarney Lake, AB 2005-2007
Dowling	(--,m:--,B/W)	M	June 2- June 22	AB
Freshwater	(--,--:B/W,LGm)	M	June 16	Killarney Lake, AB 2005
Handhills	(--,--:B/W,m)	M	May 26	Freshwater Lake, SK 2005 or Killarney Lake, AB 2005-2007
Handhills	(BI/R,B/W:m,--)	F	May 26	Clark Lake, AB 2006
Killarney	(m,-:B/W,--)	M	July 6	AB
Killarney	(--,--:B/W,LGm)	U	July 24	Killarney Lake, AB 2005
Muriel*	(--,m:--,--)	M	May 14	?
Muriel*	(--,m:--,--)	F	May 14	?
Muriel	(m,--:--,Y)	M	May 14	?
Muriel	(--,--:,--,m)	F	May 23 – August 3	?
Red Deer*	(O,--:--,m)	M	May 25 – June 15	?
Red Deer*	(LB,m:--,--)	M	May 27 – June 15	?
Reflex	(m,LG:Bf,DBO)	M	June 3	Shoe Lake, SK 2006
Reflex	(B/W,--:m,W)	M	July 6	Freshwater Lake, SK 2007
Reflex	(--,--:B/W,LGm)	F	July 6	Killarney Lake, AB 2005
Reflex*	(--,--:m,--)	F	July 6	?
Sunken*	(m,--:B/W,--)	M	July 15	Muriel Lake, AB 2004-2006, Reflex Lake, AB 2004-2008 or Freshwater Lake, SK 2004
Sunken	(--,W/Bm:B/W,--)	U	July 23	Sunken Lake, AB 2010

* *These birds were confirmed to have nested in Alberta in 2010.*