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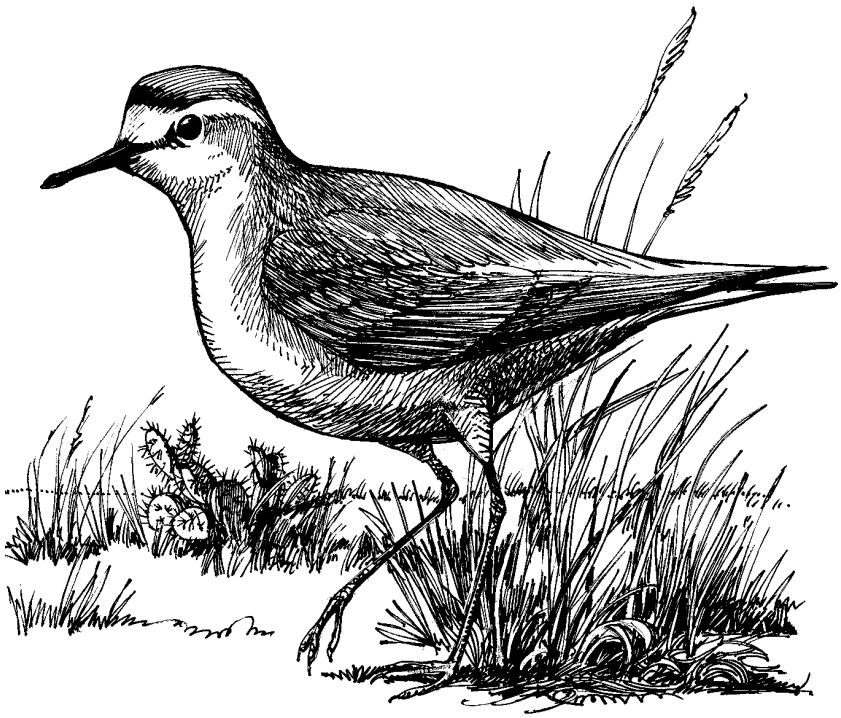
Status of the Mountain Plover (*Charadrius montanus*) in Alberta



Alberta Wildlife Status Report No. 50

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

Alberta Conservation Association

Status of the Mountain Plover (*Charadrius montanus*) in Alberta

Prepared for:
Alberta Sustainable Resource Development (SRD)
Alberta Conservation Association (ACA)

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PREFACE

Every five years, the Fish and Wildlife Division of Alberta Sustainable Resource Development reviews the status of wildlife species in Alberta. These overviews, which have been conducted in 1991, 1996 and 2000, assign individual species "ranks" that reflect the perceived level of risk to populations that occur in the province. Such designations are determined from extensive consultations with professional and amateur biologists, and from a variety of readily available sources of population data. A primary objective of these reviews is to identify species that may be considered for more detailed status determinations.

The Alberta Wildlife Status Report Series is an extension of the general statusing exercises (1996 *Status of Alberta Wildlife, The General Status of Alberta Wild Species* 2000*)*, and provides comprehensive current summaries of the biological status of selected wildlife species in Alberta. Priority is given to species that are potentially at risk in the province ("At Risk," "May Be At Risk"), that are of uncertain status ("Undetermined"), or those considered to be at risk at a national level by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Reports in this series are published and distributed by the Alberta Conservation Association and the Fish and Wildlife Division of Alberta Sustainable Resource Development. They are intended to provide detailed and up-to-date information which will be useful to resource professionals for managing populations of species and their habitats in the province. The reports are also designed to provide current information which will assist the Alberta Endangered Species Conservation Committee to identify species that may be formally designated as "Endangered" or "Threatened" under Alberta's *Wildlife Act*. To achieve these goals, the reports have been authored and/or reviewed by individuals with unique local expertise in the biology and management of each species.

EXECUTIVE SUMMARY

The mountain plover (*Charadrius montanus*) is a habitat specialist, relying on burned or intensively grazed, shortgrass prairie for breeding. Contrary to its name, the mountain plover does not inhabit montane areas, nor does it frequent shorelines like most other shorebirds. An endemic species of the dry tablelands of the Great Plains of North America, the species occurs regularly in the province of Alberta as a transient, and occasionally as a breeding species. The only known breeding sites, referred to as Lost River and Wildhorse, are located in the extreme southeastern portion of the province. The mountain plover is listed as a "Sensitive" species within the province, in recognition of its small population size (zero to six pairs) and narrow habitat preferences. Given its rarity in Canada, the species is listed as "Endangered" nationally.

The mountain plover has two core breeding populations in North America, one in Colorado and another in Montana. These two states are thought to support the majority of the global breeding population. Outside of these areas, the abundance and distribution of smaller, isolated populations may be strongly influenced by range management and variation in annual precipitation. In years of unusually high or low precipitation, habitat is often less suitable and food scarce. In Alberta, the presence and abundance of this species is highly variable, occurring with much greater frequency in years when conditions are more favourable.

With the removal of native grazers, the suppression of wildfires, and conversion of native North American grasslands to agriculture, breeding habitat for the mountain plover has declined dramatically. Correspondingly, the population has declined anywhere from 50% to 89% in the U.S., though data from Breeding Bird Surveys indicate a 1.5% (not statistically significant) annual decline in the population between 1966 and 2001. The entire mountain plover population in Canada has been estimated at 10 birds or less.

ACKNOWLEDGEMENTS

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INTRODUCTION

Unlike most shorebird species, the mountain plover (*Charadrius montanus*) tends to avoid shorelines, and contrary to its name, avoids montane areas as well. An endemic breeder of the mixed-grass prairie in the Northern Great Plains Steppe, including Alberta, Montana, and Wyoming, and short-grass prairie in Colorado, the species is considered a habitat specialist. Historically, the species relied on natural forms of habitat disturbance by large herbivores, such as bison (*Bison bison*), prairie dogs (*Cynomys* spp.), and pronghorn (*Antilocapra americana*), and from periodic grass fires. With the removal of some of these herbivores from North American grasslands, the conversion of native prairie to cropland, and the suppression of natural fire regimes, this species has experienced significant range-wide declines in recent decades.

The mountain plover is one of eight species in the genus *Charadrius* known to have bred in North America (American Ornithologists' Union 1998). The mountain plover of North America, the Oriental plover (*Charadrius veredus*) of eastern Asia, and Caspian plover (*Charadrius asiaticus*) of central and western Asia, are thought to be closely related and may constitute a superspecies (American Ornithologists' Union 1998).

Considered a peripheral species in the province of Alberta, the species was listed as "Yellow B" or "not currently at risk" in the 1985, 1991 and 1996 provincial wildlife status reviews (Alberta Fish and Wildlife 1985, 1991, Alberta Wildlife Management Division 1996). In 2000, using a new general status evaluation process, the species was listed as "Sensitive*" in the province of Alberta (Alberta Sustainable Resource Development 2001). In Canada, the mountain plover is listed as "Endangered" (COSEWIC 2002), and is listed as a "proposed threatened" species in the United States (U. S. Fish and Wildlife Service 1999).

This report summarizes historical and recent information on the mountain plover in Alberta, in an effort to update its status in the province.

HABITAT

1. General – Many of the world's grassland ecosystems have been altered dramatically by human activity over the last two centuries, resulting in land conversion, habitat fragmentation, and ultimately, reduced ecosystem function (Vickery et al. 2000). North America is no exception, with grasslands rapidly becoming one of the most endangered ecosystems on the continent (Vickery et al. 2000). Evolving largely in response to grazing by large herbivores, such as bison, and periodic fires, grassland bird communities in North America are adapted to a particular suite of habitat features (Vickery et al. 2000). Populations of grassland birds are temporally variable, with considerable annual variation in both their distribution and abundance, largely as a result of periodic climatic extremes, and ultimately, variation in habitat quality (Wiens 1974, Wiens and Dyer 1975). With the removal of native herbivores, the suppression of fire, and periodic drought, grassland birds have suffered some of the largest declines of all North American avifauna (Dobkin 1992, Knopf 1994, Knopf 1996a, Houston and Schmutz 1999).

The mountain plover is a habitat specialist, preferring areas of open, flat tableland, interspersed with patches of bare ground and short vegetation (Parrish et al. 1993, Knopf and Miller 1994, Knopf 1996b). The species seeks out areas of local aridity, disturbance, and intensively grazed grass (Knopf and Miller 1994). Areas disturbed by fire or prairie dog towns are also highly suited (Knowles and Knowles 1984, Olson 1984, Wershler and Wallis

* See Appendix 1 for definitions of selected status designations.

1986). Mountain plovers are also known to use sparsely vegetated areas with cacti, low shrubs, and open understory in semi-desert habitats both within and west of the short-grass prairie region (Tolle 1976, Parrish 1988, Day 1994).

2. Nesting – In Alberta, the mountain plover inhabits a sandy phase of the Dry Mixedgrass Subregion of the Grassland Natural Region (ANHIC 2002a, Wershler 1987). Habitat where breeding has been documented consists of heavily grazed or recently burned habitat in flat, upland areas (Wershler and Wallis 1986). Preferred habitat at the start of the breeding season is thought to be areas of extensive grassland (0.5-1 km diameter) with very short (< 10 cm; typically < 8 cm in Colorado, < 6 cm in Montana) native grass (Knopf and Rupert 1996, Knowles and Knowles 1998, Wershler 2000). In Alberta, documented breeding habitats are of two basic types: 1) extensive, open (mainly shrub-free or with a few widely scattered sagebrush) grassland on sandy loam formed over outwash materials in the Lost River area, and 2) concentrations of discontinuous, open grassland within grassland-sagebrush/lower-lying solonetzic blow-out vegetation in the Wildhorse area (Wallis 1976, Wershler 2000). Dominant plant species described at nine nest sites in the Lost River area included sedge (*Carex filifolia*), sandberg bluegrass (*Poa sandbergii or P. secunda)*, and June grass (*Koeleria macrantha*), and on burned sites, blue grama (*Bouteloua gracilis*) (Wershler and Wallis 1986). Forb cover at nest sites was generally sparse, but prairie spike-moss (*Selaginella densa*) was the dominant ground cover on unburned sites, with bare ground ranging from 15%-25% on unburned sites to 45%-50% on burned sites (Wershler and Wallis 1986).

Nesting areas are also characterised by significant areas of bare ground (>30% is an apparent threshold), and flat to gently rolling topography (<5% slopes) (Olson-Edge and Edge 1987, Parrish et al. 1993, Knopf and Miller 1994). In many areas, a strong association between the presence of black-tailed prairie dogs (*Cynomys ludovicianus*) and the presence or abundance of mountain plovers has been observed (Knowles et al. 1982, Knowles and Knowles 1984). Recent observations of mountain plover in Saskatchewan, during the breeding season, were in close association with prairie-dog colonies near Val Marie (Gollop 1987a, Gollop 1987b, Peart and Woods 1980). Native grasslands that have experienced recent wildfires or prescribed burns are also preferred habitat (Wershler 1990, Svingen and Giesen 1999).

Characteristics of mountain plover breeding habitat across the entire range of the species have been summarized by Dechant et al. (1998). Although results from numerous studies are described, the coarse-scale habitat characteristics across the species' breeding range are quite similar, reflecting those in Alberta, as described above.

Recent evidence from the east-central portion of the species' range, primarily eastern Colorado, suggests that cultivated fields may also make suitable habitat during the breeding season. Of a total of 52 nests, 26 (50%) were located in bare or fallow fields, 13 (25%) were in growing wheat or wheat stubble, 7 (13.5%) were in milo, 4 (7.7%) were in fields with forbs or forb stubble, and 2 (3.8%) were in fields of sprouting corn (Shackford et al. 1999). Between 1986 and 1995, an extensive inventory of cultivated fields within the breeding range of the mountain plover confirmed nesting in Colorado, Kansas, Oklahoma, and southeastern Wyoming, with 97% of all documented records coming from these states (Shackford et al. 1999). However, extensive surveys conducted in cultivated fields in Montana failed to confirm a nesting record (Knowles and Knowles 1998). Because of a combination of less cropland acreage, shorter growing period, and different farming practices on cultivated fields in more northern latitudes, there is probably little risk posed to mountain plovers by cultivation and farming practices

(Shackford et al. 1999). There is one record in Alberta of a mountain plover using a field that had been cultivated in the 1960s, containing a mixture of exotic Russian wild rye and native plant species, although this site adjoined more typical nesting habitat (Wershler 2000).

Following hatching, adult plovers in Colorado moved broods to areas of disturbed prairie, often as far as 2 km in the first 2-3 days, and then remained in those general areas (Knopf and Rupert 1996). In contemporary prairie landscapes, disturbed habitats are generally those near cattle watering or loafing areas or agricultural fields (Knopf and Rupert 1996). In Colorado, brood-rearing habitat is also described as areas with forbs, or objects such as fenceposts, where birds can find shade or protection from predators (Graul 1973). In Utah, broods primarily used moderately dense, low-growing (< 30 cm) shrubby areas with open understory (Day 1994). Broods have also been known to use oil well pads and dirt roads for foraging (Ptacek and Schwilling 1983, Day 1994), though the post-hatching movement to man-made structures has not been documented in Alberta (C. Wershler, pers. obs.). Following hatching, birds in Montana often stay in or adjacent to prairie dog colonies (Dinsmore 2001).

3. Foraging – During the breeding season, mountain plovers forage most often within the boundaries of their territory, but will occasionally forage in other suitable areas away from the territory (Graul 1973). Foraging habitat consists of extensive areas of disturbed ground with interspersed short vegetation (< 2 cm) and patches of bare ground (Knopf 1996b). Disturbed ground may consist of prairie dog towns, kangaroo rat precincts, sites that have been heavily grazed by cattle or sheep, areas of trampled ground (such as near livestock watering areas), unpaved roads, and recently ploughed or fallow fields (Knopf 1996b). Preference for these foraging habitats may be a function of increased prey abundance and availability at these sites relative to other areas (Olson 1985).

4. Wintering – In California, mountain plovers spend about 75% of their time on ploughed fields in winter (Knopf and Rupert 1995). Despite this, they seem to prefer sink scrub, and heavily grazed native grasslands or burned fields, a habitat type that is increasingly less common on the wintering grounds (Knopf and Rupert 1995). For instance, in the San Joaquin Valley, California, preferred mountain plover habitat has been reduced to < 4% of historical abundance (Knopf and Rupert 1995). As on the breeding grounds, the species appears to associate with habitat created by burrowing animals, namely colonies of ground squirrels or kangaroo rats (U. S. Fish and Wildlife Service 1999). In Orange and Ventura counties of coastal California, they occur on Bermuda grass (*Cynodon dactylon*), and in Imperial County, they occur on grazed or burned agricultural fields (Knopf 1996b).

CONSERVATION BIOLOGY

1. Species Description - Mountain plovers are medium-size shorebirds, but are relatively large members of the plover (*Charadriidae*) family, averaging about 20% larger than the piping plover (*Charadrius melodus*) and only slightly smaller than the killdeer (*C. vociferous*). Male and female mountain plovers are virtually identical in length (21.0 – 23.5 cm), weight (90 –110 g), and plumage (Hayman et al. 1986, Howell and Webb 1995, Knopf 1996b). The mountain plover is an overall pale, sandy brown colour with white underparts, and the sides of the upper breast and neck are washed a buff-brown (Hayman et al. 1986). A brilliant white forehead and eyebrow, contrasting sharply with a narrow black line extending between the eyes and base of the bill and a black frontal bar on the crown are other distinguishing characteristics for this species (Hayman et al. 1986). Unlike most other North American members of the family *Charadriidae*, mountain plovers have no black markings on the breast (Hayman et al. 1986, Knopf 1996b).

Generally, the mountain plover is silent (Knopf 1996b). The few described vocalisations consist of a rolling whistled "*wee-wee*" call repeated 5-15 times during advertising and courtship, and a single "*kip*" call given during agonistic encounters or potentially as a contact call when flocking (Knopf 1996b). Male plovers also give a low "*moo*" call when displaying at the nest scrape, and a soft, repeated "*chert*" call during pre-copulatory displays (Knopf 1996b). The most often heard vocalisation in Alberta is a low, guttural alarm call given by adults near young (C. Wershler, pers. obs.).

2. Foraging - The mountain plover is an opportunistic feeder, employing a flush-pursuit method of foraging (Remsen and Robinson 1990, Jablonski 2002). Typical foraging behaviour involves a short run of approximately 1 m, followed by a pause to survey for moving insects (Knopf 1996b). Foraging efficiency appears to be greatest during the early morning when temperatures are cool and prey are sluggish (Knopf 1996b). An analysis of dry-weight biomass of stomach contents of birds in Colorado revealed a diet consisting almost exclusively of invertebrates (99.7%), with occasional seeds (0.3%) (Baldwin 1971). The composition of invertebrate prey represented 90 different taxa, with beetles (*Coleoptera*; 60%), grasshoppers and crickets (*Orthoptera*; 24.5%), and ants (*Hymenoptera*; 6.6%), being the most important prey items. In Utah, insects collected from nest sites represented 12 orders, with 31% of individuals from the order *Hymenoptera* and 23% *Orthoptera* (Ellison-Manning and White 2001). The range in size of prey selected is between 1-33 mm (Baldwin 1971), but grasshoppers up to 50-60 mm long are taken regularly (Knopf 1996b). Although the species appears to show a dietary preference for beetles and grasshoppers, foraging studies have generally been of limited geographic scale. Recent evidence, however, would suggest that the mountain plover is a highly opportunistic forager, with a high degree of dietary flexibility across its range (Skagen and Oman 1996, Knopf 1998).

3. Breeding - Mountain plovers are thought to breed in the year following hatching and each subsequent year thereafter (Graul 1973). In Alberta, birds arrive on the breeding grounds in April, with breeding probably commencing in early to mid-May (Wershler and Wallis 1986). Pairing generally begins immediately after arrival on the breeding grounds, with some birds already being paired upon arrival (Knopf 1996b). The period between courtship and nest initiation is believed to be 7 days (Leachman and Osmundson 1990, Day 1994). Several nest scrapes are created by a territorial male soon after arrival on the breeding grounds; however, which member of the pair makes the final selection of nest site is unclear (Knopf 1996b). Nests are often located next to cow manure or other conspicuous objects (Wallis and Wershler 1981, Leachman and Osmundson 1990). The nest scrape is roughly 9-10 cm in diameter and approximately 2.5 cm deep (Knopf 1996b). Nest material is continually added to the scrape throughout early incubation until the eggs are partially or fully covered (Graul 1973, Knopf 1996b). Nesting material usually consists of bits of lichen, dried chips of cow manure, or grass roots and leaves (Graul 1975). In Alberta, forb stems and seeds, spike-moss (*Selaginella* sp.) cuttings, and lagomorph droppings were also used to line a nest (Wallis and Wershler 1981).

Typical clutch size is 3 eggs (2.9 eggs ± 0.4 SD, range 1-4, n = 152) (adapted by Knopf 1996b from Graul 1975) (2.9 ± 0.3 SD, n = 108) (Knopf 1996b), although clutches with as many as 6 eggs have been documented (Dinsmore and Knopf 1999). Following the laying of the first egg, subsequent eggs are laid 34-48 hours apart (Day 1994, Knopf 1996b), with incubation not commencing until the laying of the last egg (Graul 1975). Nest attentiveness is greatest in inclement or hot, sunny weather, increasing as incubation progresses (Knopf 1996b). Incubation lasts an average of 29 days (range 28-31, n=13; Graul 1973). On occasion, female mountain plovers will lay a second clutch, which was thought to be incubated and tended by her

mate (Graul 1976). Although thought to be uncommon, this behaviour may occur more frequently in years of abundant food and stable weather (Graul 1976, Knopf 1996b). Recent evidence suggests that this multiple-clutch breeding system may occur in most pairings (Knopf and Rupert 1996). In this system, the first clutch is incubated by the male, with the second clutch incubated by the female (Knopf and Rupert 1996). In Montana, 55% of nests (n=432) were tended by the male, suggesting the species practised sequential polyandry, rather than strict monogamy (Dinsmore 2001). Nests that were tended by males had higher daily survival than those tended by females (49% and 35%, respectively), with precipitation negatively affecting nest survival (Dinsmore 2001).

Nest spacing ranged from 240 m to 370 m in Utah (Ellison-Manning and White 2001), with a minimum spacing of 100 m recorded in Wyoming (Parrish et al. 1993). In Colorado, the estimated minimum area in which a brood can be raised was 28 ha (Knopf and Rupert 1996), although density ranged from 2.0 birds/km^2 (± 0.46(SD)) to 4.7 (± 1.20) and 6.8 birds/km^2 (± 1.61 birds/km^2) to 5.83 (± 1.39) at core sites in Colorado and Montana, respectively (Knopf 1996b). In Utah, nests were located an average of 68.6 m from some type of surface disturbance, including roads and oil well pads (Ellison-Manning and White 2001).

Annual reproductive success has been studied intensively on shortgrass prairie of Pawnee National Grassland, Colorado. Success shows high annual variation; nests with ≥ 1 egg hatching varied from 26% (Knopf and Rupert 1996) to 65% (Graul 1975). In Montana, annual nest success ranged from 42-72% (mean 58%, *n*=600) (Dinsmore 2001). Average numbers of eggs hatching from successful nests varied from 2.1/nest (McCaffery et al. 1984) to 2.7/nest (Graul 1975). Reported fledging rates of 0.26 chicks/nesting attempt are low relative to other, similar species, and probably reflect reduced food availability and increased predation during drought conditions (Knopf and Rupert 1996). Fledgling survival to migration varied from 0.17 to 0.74 chicks/nesting attempt, with variation because of losses from predation (Miller and Knopf 1993, Knopf and Rupert 1996).

Following hatching, precocial chicks receive uniparental care and can move long distances, often upwards of several kilometres, to brood rearing areas (Graul 1975) (see Habitat section above). Given the relative openness of the preferred habitat of this species, mountain plover chicks show a number of adaptations to avoid predation. These include cryptic coloration of plumage (Sordahl 1991), multiple clutches (Graul 1973), shell removal from the nest site at hatching, rapid movement of chicks away from the nest at hatching (Graul 1975), predator distraction displays by adults (McCaffery et al. 1984), and the ability of chicks to fly at only 70% of adult body weight (Miller and Knopf 1993).

4. Longevity and Population Dynamics - In a 6-year study in southern Phillips County, Montana, the estimated mean life span for adult mountain plovers was 1.92 years (n=620), a number that is relatively low for shorebirds (Dinsmore 2001). The longevity record for the species is 8 years (Dinsmore 2001). Adults had an estimated annual survival rate of 68%. As a result of low annual survival and low mean life expectancy, local populations are maintained by high annual productivity, greater than that for many other ground-nesting species (Dinsmore 2001). Site fidelity of adults to breeding sites appeared to be high, with no evidence of permanent emigration by adults, whereas some juveniles permanently emigrated from the area (Dinsmore 2001). Immigration from surrounding areas was probably partly responsible for rapid population recovery following a major decline (Dinsmore 2001). Overwinter survival rates are high, with close to a 95% (n=44) survival for birds wintering in California from 1 November to 15 March (Knopf and Rupert 1995).

Several aspects of mountain plover natural history and ecology suggest that density regulation in this species may be driven by processes functioning at several spatial scales. In particular, the species has several obvious population core areas where habitat quality is probably optimal, such as South Park, Park County, Colorado (U.S. Fish and Wildlife Service 2002), along with numerous peripheral sites where habitat quality is more variable, depending on weather and range condition. These peripheral sites are usually separated from the population core by areas of unsuitable habitat (crops, rangelands, etc.) making them spatially distinct. High quality core areas may serve as population "sources," where annual productivity and survival more than compensate for mortality (Pulliam 1988). Conversely, peripheral sites may serve as population "sinks," where annual mortality exceeds productivity and survival. Competition at core areas may force young birds to disperse to peripheral sites in their first year of breeding in an attempt to maximise their individual fitness. However, in any given year, if habitat quality declines at a peripheral site, or mortality exceeds productivity, local extinction may result. Population dynamics at core sites may also influence peripheral sites, because if fewer birds disperse, the probability of extinction at a peripheral site may also increase.

Populations adhering to this dynamic sequence of dispersal, colonisation, mortality, and extinction are generally referred to as metapopulations (Levin 1970). For conservation considerations, a metapopulation may be defined as an assemblage of spatially distinct, but interconnected populations, among which at least some are susceptible to extinction and recolonisation (McCullough 1996). The term "mainland-island" metapopulation describes situations where dispersal from one or more extinction-resistant subpopulations (core areas) maintains smaller, more extinction-prone subpopulations nearby (peripheral sites) (Harrison 1991). Given the highly specific habitat requirements of the mountain plover, and the high degree of variability in both its distribution and abundance in any given year, this species may be adhering to the "mainland-island" metapopulation model.

If this is the case, then variation in Alberta's peripheral population of the mountain plover may be influenced as much by conditions near the core population (i.e., Montana) as those at peripheral sites within the province. In years when breeding has been recorded in Alberta, habitat quality and productivity may be high at both core and peripheral sites, resulting in an asynchronous flow of individuals from core areas (sources) to peripheral sites (sinks). When habitat quality declines, or mortality exceeds productivity or survival at either core or peripheral sites, this flow may halt, and local extinction may again occur at a peripheral site.

5. Predation/Parasitism - The eggs and chicks of mountain plovers are susceptible to predation from thirteen-lined ground squirrels (*Spermophilis tridecemlineatus*), swift fox (*Vulpes velox*), badger (*Taxidea taxus*), and coyote (*Canis latrans*) (Knopf 1996b, Dinsmore 2001). Predation of chicks is usually by avian predators such as Swainson's hawk (*Buteo swainsonii*), prairie falcon (*Falco mexicanus*), loggerhead shrike (*Lanius ludovicianus*), ring-billed gull (*Larus delawarensis*), and black-billed magpie (*Pica pica*) (Miller and Knopf 1993, Knopf and Rupert 1996, Dinsmore 2001). Bullsnakes (*Pituophis melanoleucus*) are also suspected nest predators (Knopf 1996b, Svingen 1999). Although no records of nest parasitism by brown-headed cowbirds (*Molothrus ater*) exist (Knopf 1996b), there is one documented report of parasitism by a killdeer (Jojola-Elverum and Giesen 2000).

DISTRIBUTION

1. Alberta – The breeding range of the mountain plover in Alberta, based on both historic and recent records, is limited to two main areas

(Wershler and Wallis 2002). These two areas, referred to as Lost River and Wildhorse, are roughly 19 km apart and are located in extreme southeastern Alberta, in the Dry Mixedgrass Natural Subregion (ANHIC 2002a) (Figure 1). Since the mountain plover was first documented nesting in Alberta in 1979, the species has nested erratically, and no stable breeding population has been established (Wershler 2000, C. Wershler, pers. comm.). These two populations are separated from the closest, stable breeding populations in northern Montana by at least 140 km (Prellwitz 1993). There are a few records outside of these two main breeding areas, two of which likely represent nonbreeding transients (see records in Cypress Hills Provincial Park and south of CFB Suffield, Figure 1).

In the Lost River region of extreme southeastern Alberta, Wershler and Wallis (1986) estimated the extent of potential breeding habitat at approximately 5180 hectares. In Montana, Knowles and Knowles (1984) suggested that approximately 2500 hectares of suitable habitat is the minimum area required to maintain a population of mountain plovers. Even though there appears to be adequate habitat, mountain plovers have occurred only sporadically in Alberta and a stable population has never become established. It is estimated that approximately 73% of survey sites with high potential for breeding mountain plovers in Canada occur within the province of Alberta (Wershler and Wallis 2002). This Alberta range probably represents less than 1% of the entire North American breeding range of the species.

2. Other Areas – In Canada, the only other province in which the species has been recorded is Saskatchewan, where breeding has been confirmed (Wershler 2000) (Figure 2), although a questionable record from British Columbia in the nonbreeding season has been reported (Campbell et al. 1997). Throughout North America, the species has experienced a range contraction in recent decades, existing in small breeding populations primarily in Colorado, Wyoming, and Montana (Knopf 1996b). The Pawnee National Grassland in Colorado was believed to contain the largest single population of mountain plovers, and probably represented the centre of the species' breeding distribution (Graul and Webster 1976). Currently, there may be larger populations outside of Pawnee National Grassland, in other areas of Colorado (Dinsmore 2001). Combined with Phillips and Blaine Counties in Montana, these two states probably contain the majority of breeding mountain plovers (Knopf and Miller 1994, Knowles and Knowles 1998).

Remaining birds are patchily distributed from northern Montana, south to central New Mexico, western Oklahoma, western Kansas, and eastern Utah (Thompson and Ely 1989, Day 1994, Knopf 1996b). Isolated populations probably exist in south-central and southeastern Colorado, west-central New Mexico, and the Texas panhandle. A recently documented breeding record from Arizona is one of the most westerly breeding records for the species (McCarthey and Corman 1996). An isolated breeding population exists in the Davis Mountains of western Texas; however, the population has received little attention and the extent of its distribution is poorly known (Knopf 1996b). Mountain plover breeding was recently confirmed on a prairie dog town in Nuevo Leon, Mexico (F, Knopf, in litt. 1999, U.S. Fish and Wildlife Service 2002).

The majority of records of wintering mountain plovers are from California, with birds occurring in the north-central portion of the state, south to the Mexican border (Knopf and Rupert 1995). Some birds overwinter on the Pacific slope in several southern counties. Occurring somewhat sporadically, the location and abundance of wintering birds outside California is poorly known, but probably represents a minor proportion of the wintering population as compared to California (U.S. Fish and Wildlife Service 1999). Many birds are known to winter in Mexico, with records from Baja California (Wilbur 1987), northwestern Mexico, south to

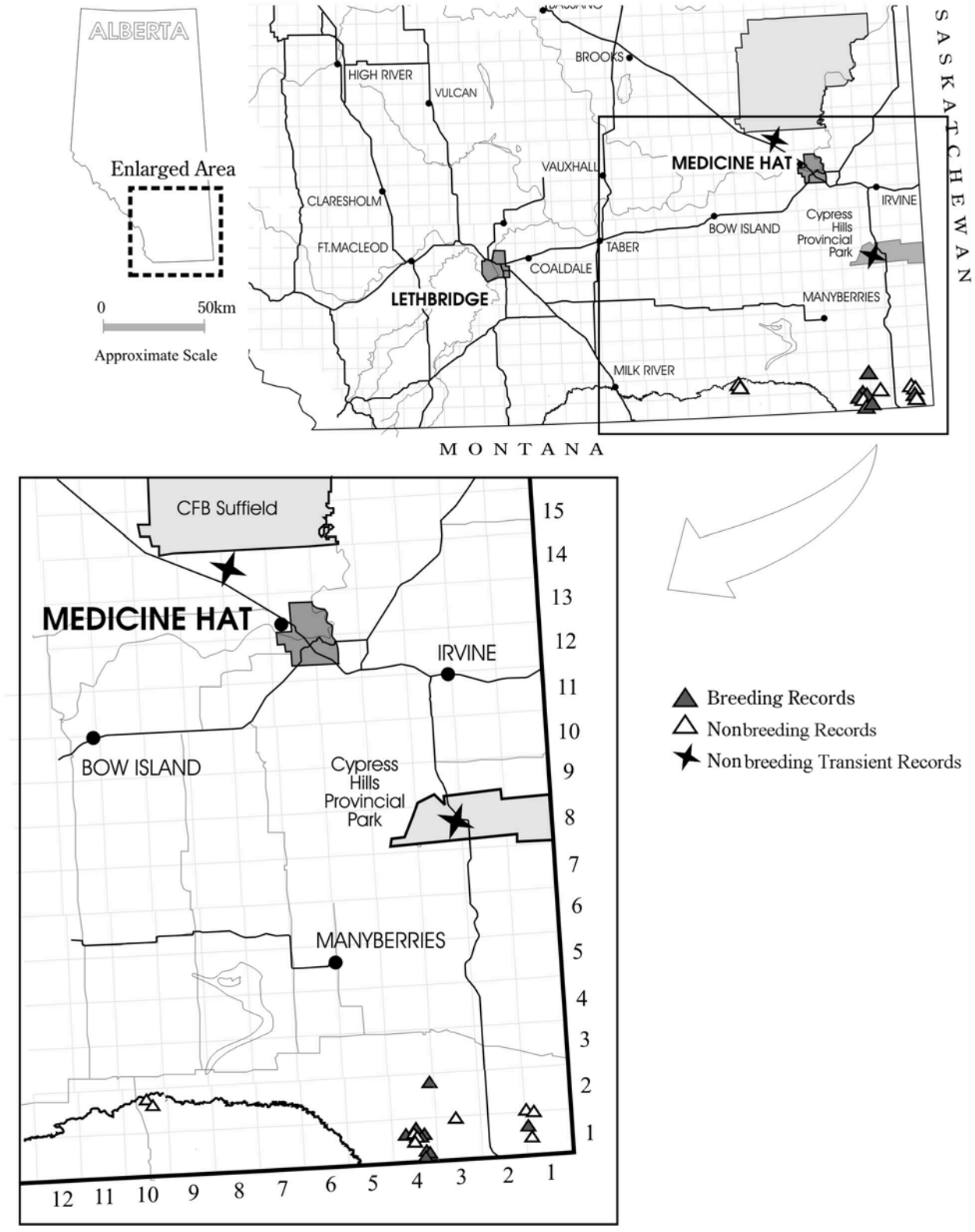

Figure 1: Mountain plover (*Charadrius montanus*) observations in Alberta. Breeding records are observations of confirmed breeding activity, whereas nonbreeding records are those for which no evidence, or only possible evidence, of breeding was available. Details of these records can be found in the Biodiversity/Species Observation Database (BSOD) maintained by Alberta Sustainable Resource Development. See Appendix 2 for details of each record, including the date and number of birds seen.

Figure 2: Distribution of the mountain plover (*Charadrius montanus*) in North America, including wintering and breeding ranges.

Sonora (Russell and Lamm 1978), Tamaulipas in the east, and Zacatecas and San Luis Potosi in the interior (Oberholser 1974, Howell and Webb 1995, Gomez de Silva et al. 1996). Occasional winter records also exist for Florida (Robertson and Woolfenden 1992) and Oregon (Gilligan et al. 1994).

POPULATION SIZE AND TRENDS

1. Alberta – It is difficult to ascertain whether the mountain plover has ever been common within the province of Alberta. Despite an historical account by Coues (1878), who describes the species in an area along the 49th parallel as common and occurring in considerable numbers, there is some dispute as to whether this location was actually near the Canadian border. According to Bent (1962), Dr. Coues found mountain plover on Frenchman Creek and obtained a specimen reported as being labelled forty-ninth parallel, but the point of collection was probably well within the present state of Montana. Regardless of the actual location of Coues' historical observations, it seems likely that the species probably did occur up to, and possibly into the province of Alberta, though it remains difficult to ascertain the population size and distribution of the species prior to human settlement. Other accounts of mountain plovers in the province provide little additional evidence of the historical abundance and distribution of the species in the province. In his cross-Canada journey, Raine (1892) makes no mention of the species, but probably did not travel south of Cypress Hills. Taverner (1926) states that the species was too rare in Canada to warrant inclusion in his book based on site records alone. He suggests, however, that occasional birds may possibly be noted in southern Saskatchewan and Alberta.

The first confirmed record of the species in Alberta is from 1941, when four birds were observed near Onefour, Alberta, and nesting was suspected (Soper 1941; see Appendix 2). Despite these sightings, Salt and Wilk (1966) suggested that the mountain plover was a scarce summer visitor in the province, and only four additional sightings of the species were reported in Alberta until 1977 (Wershler and Wallis 1986). Breeding was first confirmed in both Canada and Alberta in 1979, when two nests were located in the Lost River area (Wallis and Loewen 1980, Wallis and Wershler 1981).

In recent decades, counts of mountain plovers in Alberta in any one year have not exceeded the maximum count of 11 adults and six nests recorded during localized surveys of high potential habitat in 1981 (Wershler and Wallis 1986). However, survey effort has been inconsistent (see Table 1). In years when surveys have been conducted, the presence and abundance of the species has been erratic, but never more than 11 individuals, and sometimes zero. According to Wershler and Wallis (1986), this variability may be because of a lack of conditions (e.g., grazing intensity) necessary to create sufficient suitable habitat, as well as fluctuating levels of precipitation during the early part of the breeding season, with birds being scarce in drought years and more common years with above average May precipitation.

No specific population size estimates exist for the province of Alberta, but survey information suggests zero to six pairs. Given the ephemeral nature, both spatially and temporally, of optimal mountain plover habitat in Alberta, previous surveys may have underestimated population size. However, a comprehensive survey of habitats with high and limited suitability for mountain plovers conducted in 2001 failed to detect any birds. Consistent annual surveys have not been conducted in the province as a means of estimating population trends, though inconsistent survey results suggest no discernible trend in recent years.

2. Other Areas - In Canada, estimates for mountain plover suggest a current population of 10 birds (Morrison et al. 2001), and Wershler

Table 1: Summary of mountain plover survey effort in Alberta from 1979 to present (based on C. Wershler, C. Wallis, W. Smith and R. Wershler, unpubl. data.).

Year	Extent of Survey
1979	following discovery, by chance, of the first documented nest, there was localized, intensive effort (late May-mid July) throughout the nesting season in a portion of Lost River area (S½ Tp 1, Rge 4) on Onefour Experimental Range Sub-station; limited reconnaissance surveys in surrounding areas
1980	single, 2-day survey (mid June) in Lost River area (Tp 1, Rge 4)
1981	localized, intensive effort (mid May-mid June) in Lost River area; extensive reconnaissance surveys in the Milk River-Lost River-Sage Creek area
1982	single, short survey (late April) in Lost River nesting habitat (Tp. 1, Rge 4)
1983	single, short spring survey in Lost River nesting habitat
1984	single, short spring survey in Lost River nesting habitat
1985	several visits (spring, summer, fall) in Lost River nesting habitat
1986	extensive survey and habitat assessment across potential Alberta range, excluding habitat NE of Wildhorse (mainly in Tp. 1, Rge. 3-5; Tp. 2, Rge 4-5); localized intensive surveys in vicinity of previous observations
1987	3 short surveys in Lost River nesting habitat (early May, early June, early July)
1988	3 short surveys in Lost River nesting habitat (late June-late August)
1989	1 short survey (early July) in Lost River nesting habitat
1990	1 short survey (late June) in Lost River nesting habitat; reconnaissance surveys and habitat assessment (early July) of known and potential habitats (including sage grouse leks) in the Lost River-Sage Creek-Wildhorse area, including more intensive surveys in Lost River nesting habitats and habitats NE of Wildhorse where mountain plovers had recently nested and been observed
1991	1 short spring survey (late May) in a portion of Lost River high potential habitat
1992	1 short spring survey (late May) in Lost River nesting habitat
1993	no survey
1994	short summer (July) surveys in Lost River nesting habitat and Wildhorse nesting habitat
1995	mid May survey in Wildhorse nesting habitat
1996	no survey
1997	no survey
1998	no survey
1999	short, late May survey in Lost River nesting habitat
2000	no survey
2001	intensive and extensive survey, from May to July, of known and potential habitats in the Milk River-Lost River-Sage Creek-Wildhorse areas of Alberta
2002	short spring (early June) survey of a portion of Lost River nesting habitat

(2000) suggests that since 1979, the population has probably never exceeded 50 individuals. Estimates of the continental population of mountain plover range from 8000 to 10 000 birds (Knopf 1996b), so the Canadian population is not currently, and possibly never has been, a significant part of the global/North American population.

The mountain plover has experienced range-wide declines of anywhere from 50% to 89% in the U.S. (Knopf 1996a), though Breeding Bird Survey (BBS) data suggest a 1.5% annual survey-wide decline ($P = 0.39$, 95% confidence intervals –5.0, 1.9, $n = 40$) between 1966 and 2001 (Sauer et al. 2002).

LIMITING FACTORS

Knopf and Rupert (1995) suggest that the species is limited by changes occurring on the breeding grounds or along migration routes, since overwinter survival rates in the bulk of the species wintering range in California are high. However, the loss and degradation of preferred, uncultivated habitat, and extensive use of pesticides in the California wintering range, may become significant limiting factors to the population in the future (U.S. Fish and Wildlife Service 1999). For the persistence of a mountain plover population in Alberta, it is doubtful that impacts on the wintering grounds would be limiting. For the purposes of this report, factors limiting mountain plover populations on the breeding grounds are of greatest relevance. The following are thought to be the most significant factors limiting mountain plovers on the breeding grounds and remain relevant in Alberta only if a breeding population exists.

1. Habitat Alteration - Native temperate grasslands in North America have experienced dramatic and widespread change, largely through the loss of habitat from agriculture and urban development (Vickery et al. 2000). The largest single source of habitat loss in native grasslands comes from the conversion of native habitat to cropland and other agricultural land use (Graul and Webster 1976, Wershler 2000). For instance, many fields are now planted with crops such as sunflower and millet, the majority of which are seeded in May (Knopf 1996b). Mountain plover nests located in fallow fields in early May are destroyed by farm equipment during planting. Individuals that subsequently re-nest on the planted fields typically abandon their nests when young crops begin to grow and habitat becomes unsuitable. Although mountain plovers are known to nest in cultivated fields, success is dependent upon both the type of crop and timing of planting/harvest. Mountain plovers are attracted to cultivated habitats that mimic their natural habitat; however, because of low productivity within this habitat, cultivated fields are apparently functioning as a reproductive "sink" in many parts of the species' breeding range (U.S. Fish and Wildlife Service 1999). Since plovers are unable to perceive the future quality of these cultivated habitats, especially those that are tilled during the breeding season, they may represent an "ecological trap" to this species (Gates and Giffen 1991).

Although much of the conversion of grassland to cropland in the province of Alberta took place early in the last century (Wershler 2000), the continued loss of native grassland has resulted in other potential problems. The small remaining blocks of native grassland may become more fragmented and degraded, ultimately decreasing habitat quality. Since 1986, suitable breeding habitat at Lost River has deteriorated, and the extent of heavily grazed grassland has become more restricted (Wershler 2000).

2. Range Management - The flora and fauna of the shortgrass prairie of North America evolved largely as a result of the grazing activities of herbivores such as bison, pronghorn, and numerous burrowing mammals. As a result, species such as the mountain plover adapted to

a particular suite of habitat features, such as areas of intensively grazed grass and bare soil. Unfortunately, current range management practices favour homogeneous grazing of grasslands by cattle and other domestic stock, instead of the erratic, largely heterogeneous grazing of native grazers (Wershler 2000). Landowners with an interest in the long-term production of their land are reluctant to allow grazing to levels that would create suitable habitat for mountain plovers.

The planting of exotic grasses, which are typically taller and denser than native species and are not well adapted to tolerate intense grazing, reduces suitable mountain plover habitat. The expansion of irrigation systems has allowed crops to grow on previously marginal lands, further reducing the amount of suitable mountain plover habitat (Knopf 1996b).

According to Wershler (2000), existing range management appears to be the major limiting factor to the mountain plover breeding population in Canada. Moderate grazing may create a mosaic of different habitats, but heavily grazed patches are generally too small for productive mountain plover habitat (Wershler 2000). In rangelands in Oklahoma, reduced stocking rates are believed to have been partly responsible for declines in mountain plovers (U.S. Fish and Wildlife Service 1999).

3. Natural Disturbance **-** Declines in North American grassland bird species have largely been a result of the elimination of natural forms of habitat disturbance to which they are adapted. This disturbance came largely from the grazing and burrowing activity of numerous herbivores, and periodic natural wildfire. Bison, the largest terrestrial mammal in North America, once numbering between 40 and 60 million (Forsyth 1985), were largely gone from the prairie landscape by the end of the nineteenth century (MacEwan 1995). Being adapted to native grasslands, both in the efficiency of their digestive systems and cold tolerance, they are much better adapted to grassland systems than cattle (Forsyth 1985). In many areas, a lack of sufficient grazing has led to the invasion of grasslands by shrubs and forbs, again reducing suitable habitat for the mountain plover (Houston and Schmutz 1999, Vickery et al. 2000).

Treated largely as vermin, black-tailed prairie dogs have been persecuted intensively throughout North America, declining by as much as 98% (Marsh 1984, Whicker and Detling 1993, Miller et al. 1994, Wershler 2000). Considered important for the maintenance of suitable mountain plover habitat, declines in black-tailed prairie dogs have probably directly led to declines in this species. Although black-tailed prairie dogs are not present in the province of Alberta, the Richardson's ground squirrel (*Spermophilus richardsonii*) may serve a similar ecological role. Even though the burrowing activity of ground squirrels may create more areas of bare soil (Wershler 2000), their ability to maintain and expand habitat suitable for nesting mountain plovers has not been demonstrated. Furthermore, Richardson's ground squirrels are also known to depredate the nests of other grassland bird species (Davis and Sealy 1998), potentially limiting any beneficial role of this species.

Known to benefit from, and potentially select for, recently burned native grassland, the suppression of fire has likely had negative impacts on mountain plovers (Wallis and Wershler 1981, Wershler and Wallis 1986, Knowles and Knowles 1984, 1998, Knopf 1996b). The use of prescribed burning in areas where grazing disturbance has been largely removed may maintain or increase suitable breeding habitat (Svingen and Giesen 1999).

4. Human Disturbance **-** Given the small, ephemeral mountain plover population in Alberta, and the relative isolation of suitable habitat within the province, threats from human disturbance are probably minor. One of the

greatest forms of human disturbance in the grasslands region of southern Alberta is the increasing footprint from oil and gas exploration and extraction activity. Typical forms of disturbance related to this type of activity include habitat loss through the creation of trails, roads, well sites, pump jacks, and compressor stations. The associated disturbance of industrial noise and increased vehicular traffic are also potential forms of disturbance. Although some studies suggest that the potential breeding habitat created by this activity (bare soil, sparse vegetation) may actually benefit mountain plovers (Parrish 1988, Day 1994), evidence is limited to anecdotal reports from the U.S. portion of the species' range. Continual disturbance from machinery and vehicles may cause adults to abandon nests entirely, or make chicks or eggs more susceptible to overheating (Knopf 1996b). Birds using trails or roads to forage may be struck and killed by vehicles, or may be forced out of cover, thereby exposing them to increased predation.

5. Pesticides/Contaminants **-** Given that the mountain plover often preys on grasshoppers, which are often controlled with pesticides, they may be exposed to pesticide residue. Organochlorine residues were detected in the bodies of 40 mountain plovers collected on the wintering grounds in California (Knopf 1996b). Residue concentrations ranged from 1.0 to 10.0 parts per million (ppm) for DDE (considered high for an upland species) and from 0 to 0.36 ppm for DDT. Despite these concentrations, no behavioural abnormalities or decreases in eggshell thickness were observed in the following breeding seasons.

6. Weather/Climate **-** Weather may be a significant limiting factor for this species in Canada. In years of above average precipitation, breeding habitat may become unsuitable when grass cover gets too high. During drought years, birds may experience low productivity if the food supply is diminished. Adding to this pressure, food shortages during drought years may also impact the predator community, potentially leading to increased predation pressure (Knopf 1996b, Wershler 2000). Under these conditions, birds may elect to forgo breeding; early departure from a breeding site in Wyoming was attributed to extreme drought conditions (Leachman and Osmundson 1990).

This species exhibits relatively high nest site fidelity (Graul 1973, Knopf 1996b); several years of suboptimal weather and poor quality habitat may prevent the establishment of a population. In Alberta, if mortality and dispersal consistently exceeds productivity and survival, the species may never establish a population within the province. Requiring several years of optimal habitat, relatively high breeding success, and high overwinter survivorship, the likelihood that a self-sustaining population could ever exist in Alberta seems low.

Potential scenarios of climate change and global warming may prove detrimental to this species if weather conditions become more extreme, or if drought severity worsens on the prairies.

STATUS DESIGNATIONS*

1. Alberta **-** The mountain plover is considered a peripheral species in the province of Alberta, and was listed as "Yellow B" or "not currently at risk" in the 1985, 1991 and 1996 provincial wildlife status reviews (Alberta Fish and Wildlife 1985, 1991, Alberta Wildlife Management Division 1996). In 2000, using a new general status evaluation process, the species was listed as "Sensitive" in the province of Alberta (Alberta Sustainable Resource Development 2001). The Alberta Natural Heritage Information Centre ranks the species as S1 (ANHIC 2002b).

* See Appendix 1 for definitions of the status designations used in this section.

2. Other Areas - In states and provinces where the mountain plover occurs currently, or has formerly occurred, as a breeding species, it is ranked as S1 (Arizona, Kansas, Nebraska, Utah, and Saskatchewan), S2 (Colorado, Montana, New Mexico, Oklahoma, Texas, and Wyoming), or SX (North Dakota and South Dakota), using Natural Heritage Element Rarity Ranks (NatureServe Explorer 2002).

In the nonbreeding season, the species is ranked as S2 (Arizona and California) or S4 (New Mexico). In several states, the species is considered a "migratory transient" during the nonbreeding season (Colorado, Montana, Nevada, Utah, and Wyoming) (NatureServe Explorer 2002).

Nationally, the mountain plover is listed as "Endangered" in Canada (COSEWIC 2002), and is a "proposed threatened" species in the United States (U.S. Fish and Wildlife Service 1999). The World Conservation Union (IUCN) has listed the mountain plover as "Vulnerable" on its Red List of threatened species, because the species faces a high risk of extinction in the wild in the medium-term future (IUCN 2002). A recent review of North American shorebirds identified the mountain plover as "highly imperilled" (Brown et al. 2001).

RECENT MANAGEMENT IN ALBERTA

Apart from management plans and irregular surveys (Table 1), this species has received relatively little attention to date in Alberta (Wershler 1989, Wershler 2000). In 2001, the largest comprehensive survey for mountain plovers was conducted in the province of Alberta (Wershler and Wallis 2002). A combination of aerial and ground surveys was used to identify and ground-truth sites thought to represent potential high quality breeding habitat. Subsequent visits were made to sites deemed to have suitable mountain plover habitat in an attempt to survey for nesting birds. Although no mountain plovers were found during this intensive survey, three sightings representing a total of four birds were made by independent observers within a similar timeframe and location of the survey; these likely represented transients, rather than potential breeders. This species is known to be difficult to monitor, largely because adult birds in the breeding season stay very close to nests and are very inconspicuous (Dechant et al. 1998). Extreme drought conditions have probably reduced the quality of breeding habitat in Alberta, and may explain the lack of observations of this species in recent years (Wershler and Wallis 2002).

Despite drafting two provincial mountain plover management strategies in Alberta (Wershler 1989, 1990) and a national recovery plan (Edwards et al. 1993), there has been no direct management of this species in Alberta. Apart from affording some protection to maintain highly suitable habitat in the Lost River/Milk River and Wildhorse regions, specific management for this species does not seem warranted. Although there does appear to be a sufficient amount of highly suitable habitat available for this species in the province, there does not seem to be an established breeding population in Alberta at present. Again, based on historical accounts, it is difficult to ascertain the historical size and distribution of the population in Alberta, though populations were probably always small. The province of Alberta represents the northern periphery of the species' range and probably does not constitute, nor has it ever represented, a large population "source" for this species.

SYNTHESIS

The mountain plover is considered a peripheral species in the province of Alberta. It is a habitat specialist whose presence and abundance are strongly associated with both local and regional variation in precipitation and range quality. Throughout its range, many aspects of its general

ecology, population dynamics, and wintering ecology remain unknown. Although the current status within the province is uncertain, the species has undergone a dramatic range-wide decline in recent decades.

The historical abundance and distribution of the mountain plover in Alberta remain unknown, though it has probably never been a common breeding species. Recent surveys within the province suggest that there may not be a breeding population of the mountain plover, although habitat conditions have been poor in recent years. Recent records of single birds probably represent nonbreeding transients from breeding sites located further south. Considering the global population may only number as few as 8000 individuals, maintaining all potential populations, regardless of how small, may be necessary. Repeating intensive surveys in the province when range conditions are more favourable is recommended to more accurately assess the status of the Alberta population. Further, some protection should be afforded to historical breeding sites, namely high quality habitat in the Lost River/Milk River and Wildhorse areas, until the status of the species in the province can be better assessed. If it can be demonstrated that the species no longer breeds at these sites, resources should be focused on other grassland species for which Alberta represents a more significant portion of both the current and/or former breeding range. If an established breeding population is detected within the province, then a management strategy that maintains or expands areas of high quality breeding habitat should be pursued.

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Appendix 1. Definitions of selected legal and protective designations.

A. The General Status of Alberta Wild Species 2000 (after Alberta Sustainable Resource Development 2001)

2000 Rank	1996 Rank	Definitions
At Risk	Red	Any species known to be "At Risk" after formal detailed status assessment and designation as "Endangered" or "Threatened" in Alberta.
May Be At Risk	Blue	Any species that may be at risk of extinction or extirpation, and is therefore a candidate for detailed risk assessment.
Sensitive	Yellow	Any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk.
Secure	Green	Any species that is not "At Risk", "May Be At Risk", or "Sensitive".
Undetermined	Status Undetermined	Any species for which insufficient information, knowledge or data is available to reliably evaluate its general status.
Not Assessed	n/a	Any species known or believed to be present but which has not yet been evaluated.
Exotic/Alien	n/a	Any species that has been introduced as a result of human activities.
Extirpated/Extinct	n/a	Any species no longer thought to be present in Alberta ("Extirpated") or no longer believed to be present anywhere in the world ("Extinct").
Accidental/Vagrant	n/a	Any species occurring infrequently and unpredictably in Alberta, i.e., outside their usual range.

B. Alberta Wildlife Act/Regulation

Species designated as "Endangered" under Alberta's *Wildlife Act* include those listed as "Endangered" or "Threatened" in the Wildlife Regulation.

Endangered	A species facing imminent extirpation or extinction.
Threatened	A species that is likely to become endangered if limiting factors are not reversed.

C. Committee on the Status of Endangered Wildlife in Canada (after COSEWIC 2002)

Extinct	A species that no longer exists.
Extirpated	A species that no longer exists in the wild in Canada, but occurs elsewhere.
Endangered	A species facing imminent extirpation or extinction.
Threatened	A species that is likely to become endangered if limiting factors are not reversed.
Special Concern	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
Not at Risk	A species that has been evaluated and found to be not at risk.
Data Deficient	A species for which there is insufficient scientific information to support status designation.

APPENDIX 1 continued.

D. Heritage Status Ranks: Global (G), National (N), Sub-National (S) (after Alberta Natural Heritage Information Centre [ANHIC] 2002c)

G1/N1/S1	5 or fewer occurrences or only a few remaining individuals. May be especially vulnerable to extirpation because of some factor of its biology.
G2/N2/S2	6-20 or fewer occurrences or with many individuals in fewer locations. May be especially vulnerable to extirpation because of some factor of its biology.
G3/N3/S3	21-100 occurrences, may be rare and local throughout its range, or in a restricted range (may be abundant in some locations). May be susceptible to extirpation because of large-scale disturbances.
G4/N4/S4	Typically >100 occurrences. Apparently secure.
G5/N5/S5	Typically >100 occurrences. Demonstrably secure.
GX/NX/SX	Believed to be extinct or extirpated, historical records only.
GH/NH/SH	Historically known, may be relocated in future.
GR/NR/SR	Reported, but lacking in documentation

E. United States Endangered Species Act (after National Research Council 1995)

Endangered	Any species which is in danger of extinction throughout all or a significant portion of its range.
Threatened	Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Appendix 2. Mountain plover records held in the Biodiversity/Species Observation Database (BSOD).

General Location	Date	Activity[1]	Comments	Total Count[2]	ID reliability[3]
E. of Lost River	June 1941	Nonbreeding	Suspected nesting	4	High
Cypress Hills Provincial Park	June 1966	Nonbreeding (transient)	Observed in flight (nonmigratory) over Elkwater, following a half day of heavy rain. Not thought to be breeding in the area	2	Confirmed
Lost River	July 1971	Nonbreeding	Unspecified activity	2	High
N. of Lost River	September 1977	Breeding	Pair with brood observed; area of level grassland within shallow badlands and solonetzic soil	5	Confirmed
Lost River	May-July 1979	Breeding	Occupied nest - adult seen attending nest or incubating; 3 family groups of 1 adult and 3 young each, newly hatched; nest site dominated by *Bouteloua gracilis* (25%-30%), *Carex filifolia* (10%-15%), and bare sandy loam soil (45%-55%)	12	Confirmed
Lost River	May-July 1979	Breeding	Occupied nest - adult seen attending nest or incubating; unfledged young observed July 11	9	Confirmed
Lost River	May-July 1979	Breeding	Occupied nest - adult seen attending nest or incubating; nest site dominated by *Bouteloua gracilis* (25%-30%) *Carex filifolia* (10%-15%), and bare sandy loam soil (45%-55%); nests situated in localized burned area from previous fall	2	Confirmed
Lost River	June 1980	Breeding	Occupied nest - adult seen attending nest or incubating; appeared to be at least 3 broods, but all young were probably not observed	6	Confirmed
Lost River	May 1981	Breeding	Occupied nest - adult seen attending nest or incubating; habitat was heavily grazed sandy mixed grassland on level topography, used as winter pasture; 6 nests	11	Confirmed
Lost River	June 1981	Breeding	Occupied nest - adult seen attending nest or incubating; appeared to be at least 2 broods	4	Confirmed
Lost River	April 1982	Nonbreeding	Courtship behavior observed; breeding probable	6	Confirmed
Lost River	January-Dec. 1983	Nonbreeding	Unspecified activity; at least 2 adults observed	2	Unknown
Lost River	May 1985	Breeding	Occupied nest - adult seen attending nest or incubating	2	Confirmed
Wildhorse	May 1986	Nonbreeding	Unspecified activity	1	Unknown
Lost River	June 1988	Breeding	Occupied nest - adult seen attending nest or incubating; 1 adult on nest of 3 eggs; S of Onefour	6	Confirmed
Lost River	July 1988	Breeding	Downy or recently fledged young observed	4	Unknown
Lost River	August 1988	Breeding	1 adult and 1 fledged young observed	2	Confirmed
Wildhorse	June 1990	Breeding	Bird on nest with eggs seen in area of sagebrush flats	5	Confirmed
Wildhorse	May 2001	Nonbreeding	Unspecified activity	2	Confirmed
Lost River	May 2001	Nonbreeding	Breeding possible; single bird observed near known nesting site	1	Confirmed
Wildhorse	June 2001	Nonbreeding	Unspecified activity; heavily grazed grassland within scattered patches of high sagebrush	1	Confirmed
South of CFB Suffield	April 2002	Nonbreeding (transient)	Single bird observed in slightly rolling prairie with grass 1-5 cm as ground cover; considered transient	1	Speculative
Milk River	May 2002	Nonbreeding	2 adults seen	2	High
Milk River	May 2002	Nonbreeding	1 adult seen	1	Speculative

[1] Records are considered "breeding" (and mapped as such in Figure 1) only if this was confirmed (e.g., nest seen); possible breeding records are noted in the comments, but are considered "nonbreeding" in Figure 1.

[2] Total count includes adults and young.

[3] Identification reliability scale: confirmed, high, moderate, low, speculative, unknown.

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