

Stephen P. Flemming
(editor)

The 1991 International Piping Plover Census in Canada

**Occasional Paper
Number 82
Canadian Wildlife Service**



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Stephen P. Flemming¹
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Plover Census in Canada**

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New Brunswick E0A 1B0

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Cover photo: Piping Plover on nest, Prince Edward Island
(S.P. Flemming)

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Abstract

In 1991, the first simultaneous North America-wide census of the Piping Plover *Charadrius melodus* was conducted. The North American population was estimated to comprise 5484 adults, the largest estimate ever made. In Canada, 1948 adult plovers were counted—comprising 36% of the entire North American Piping Plover population—including at least 824 pairs. During the wintering area census, 3384 plovers were located, accounting for 62% of the population counted during the breeding season. The majority of wintering birds (55%, n = 1904) were found in Texas.

In eastern Canada, 511 adults (234 pairs) were counted. Seven birds were located in Newfoundland, 113 in Nova Scotia, 110 in Prince Edward Island, 203 in New Brunswick, and 76 in Quebec (Îles-de-la-Madeleine). Four other birds were located in the Atlantic region on St-Pierre-et-Miquelon (France). The 1991 counts appear similar to most previous estimates made in eastern Canada. However, the poor productivity reported for some provinces suggests that the region's plover population requires further consideration before its status can be assessed.

In Ontario and Prairie Canada, 1437 adults (590 pairs) were counted. Five birds were seen in Ontario, 80 in Manitoba, 1172 in Saskatchewan, and 180 in Alberta. Population estimates for these provinces have varied widely among years, making a status assessment difficult. Nevertheless, if a trend can be gleaned from the available productivity data, it is that the Prairie population may be at risk.

Throughout Canada, recovery efforts have been designed to mitigate the factors limiting plover productivity. Efforts have been devoted to public education; a reduction in human disturbance, predation, and disturbance by cattle; enhancement of productivity through intensive management; and influencing water level policy.

Résumé

En 1991, on a mené le premier recensement des Pluviers siffleurs *Charadrius melodus* couvrant toute l'Amérique du Nord. On a évalué la population nord-américaine de cet oiseau à 5484 adultes, ce qui constitue l'estimation la plus élevée jamais obtenue. Au Canada, on a dénombré 1948 pluviers adultes — dont au moins 824 couples — soit 36 % de la population nord-américaine totale. Au cours du recensement dans l'aire d'hivernage, 3384 pluviers ont été repérés, ce qui représente 62 % de la population dénombrée durant la saison de reproduction. La majorité des oiseaux hivernants (55 %, n = 1904) ont été observés au Texas.

Dans l'est du Canada, on a dénombré 511 adultes (234 couples), dont sept à Terre-Neuve, 113 en Nouvelle-Écosse, 110 à l'Île-du-Prince-Édouard, 203 au Nouveau-Brunswick et 76 au Québec (Îles-de-la-Madeleine); quatre autres pluviers ont été observés dans la région de l'Atlantique, à St-Pierre-et-Miquelon (France). Les effectifs observés en 1991 dans l'est du Canada semblent similaires à ceux de la plupart des estimations antérieures. Toutefois, vu la faible productivité signalée dans certaines provinces, il faudrait étudier plus à fond la population de pluviers de cette région pour que son statut puisse être évalué.

En Ontario et dans les Prairies canadiennes, on a dénombré 1437 adultes (590 couples) : cinq en Ontario, 80 au Manitoba, 1172 en Saskatchewan et 180 en Alberta. Les estimations de la population de ces provinces ont grandement varié au cours des ans, de sorte qu'il est difficile d'évaluer son statut. Néanmoins, une certaine tendance peut être dégagée des données de productivité existantes, tendance indiquant que la population des Prairies pourrait être exposée à devenir menacée de disparition.

Partout au Canada, on mène depuis un certain temps des activités de rétablissement de la population visant à atténuer les facteurs limitant la productivité des pluviers. Ces activités sont diverses : sensibilisation du public; réduction des perturbations anthropiques, de la prédation et des effets négatifs du bétail; gestion intensive visant l'accroissement de la productivité; et mesures visant à modifier les politiques relatives aux niveaux des eaux.

Acknowledgements

Literally hundreds of people, most of them volunteers, contributed to the information presented in this paper. The success of the 1991 International Piping Plover Census is a testament to the value of volunteers in the recovery of endangered species.

For facilitating the census and subsequent writing of this document, the following agencies are acknowledged: Newfoundland and Labrador Department of Tourism and Culture, Nova Scotia Department of Natural Resources, Natural History Society of Prince Edward Island Ltd., Ministère du Loisir, de la Chasse et de la Pêche du Québec, Parks Canada, Canadian Wildlife Service, Ontario Ministry of Natural Resources, Manitoba Wildlife Branch, Saskatchewan Natural History Society, Alberta Fish and Wildlife Division, U.S. Fish and Wildlife Service, Clemson University, and Université de Moncton.

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Introduction

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The number of Piping Plovers *Charadrius melodus* in North America has fluctuated over the last century. Nineteenth-century naturalists described the Piping Plover as a common summer resident. By the beginning of the 20th century, however, uncontrolled shooting of plovers for the millinery trade had greatly reduced the population, and the Piping Plover was close to extirpation in some areas (Bent 1929). Following passage of the Migratory Birds Convention Act in 1917, plover numbers recovered and the species was once again considered common (Bent 1929; Wilcox 1939). However, that recovery was short-lived, and the number of Piping Plovers has dwindled since the 1940s (Haig 1985).

Life history

The breeding range of the Piping Plover is the Northern Great Plains, Great Lakes, and Atlantic coast of North America. Most plovers overwinter along the coastline of the U.S. Gulf of Mexico and the shores of the southern Atlantic states from North Carolina south to Florida (Haig and Oring 1985).

Along the Atlantic coast, Piping Plovers nest on pebbly beaches, often in areas where vegetation is sparse (Burger 1987; Flemming et al. 1992). In the continental interior, nesting occurs in sandy, pebbly areas on the back shore of shallow alkaline lakes or along the shores of freshwater rivers and lakes (Whyte 1985; Haig 1987; Prindiville Gaines and Ryan 1988). The nest is a shallow depression, often lined with small pebbles. Four eggs are normally laid. Incubation is shared by both sexes, and the incubation period is 26–28 days (Haig 1991b). Birds frequently renest if the initial clutch is lost, although not necessarily with the same mate (Haig and Oring 1988c).

Chicks begin walking soon after they hatch (Cairns 1982). They are brooded frequently by both parents for the first two weeks but relatively little in the latter two weeks of the brood-rearing period (Cairns 1977; Flemming 1984). Chicks begin foraging almost immediately after drying off, and they improve their foraging efficiency as they grow older (Flemming 1984). Young plovers achieve sustained flight at 21–35 days of age (Wilcox 1959; Cairns 1982; Prindiville Gaines and Ryan 1988).

Johnson and Baldassarre (1988) found that plovers wintering on the Alabama coastline spent 76% of their time

foraging. Important habitat features for wintering plovers included the presence of large islets, passes, and mudflats on the Atlantic coast; and beach width, number of small islets, and beach area on the Gulf coast (Nicholls and Baldassarre 1990a).

Threats to the population

The reproductive success of the Piping Plover is often low owing to predation, human disturbance, and water control practices. Predation has been shown to significantly decrease productivity of Piping Plovers (MacIvor 1990; Patterson et al. 1991), as Piping Plover eggs and chicks may be taken by predators (Dyer et al. 1987). Several predatory species have recently increased in number as an indirect result of human activities (Dyer et al. 1987).

Flemming et al. (1988) and Strauss (1990) suggested that human activity in plover territories caused chicks to forage at a decreased rate of efficiency and to expend more energy to avoid humans. That increased human activity results in reduced chick survivorship is supported by several studies (Cairns 1982; Burger 1987; Flemming et al. 1988; Strauss 1990).

In the Canadian Prairies and U.S. Great Plains, Piping Plover nests are sometimes washed out by untimely discharges from dammed water bodies. At Lake Diefenbaker, Saskatchewan, the largest concentration of Piping Plovers in North America (276 pairs in 1991) is threatened by extreme and rapid increases in water levels during the breeding season (Skeel, this volume). Similarly, on the Missouri River system, losses of nests owing to rapidly rising water have been reported annually since 1978 (Sidle et al. 1991).

Brood survivorship is also reduced by an increase in water level because it decreases the size of the brood-rearing area and may decrease food availability (North 1986). Conversely, damming of streams or seepage that flows into a lake at which plovers nest will lower water levels and can cause negative changes in Piping Plover habitat by increasing the distance between nesting habitat and the water's edge and/or by concentrating the salinity of the water body and hence altering the invertebrate fauna on which the plovers depend for food (Wershler 1990).

Need for an international census

When the Canadian Piping Plover population was designated as "endangered" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1985, it was estimated to number between 1448 and 2047 adults. That same year, the entire North American population was estimated to be between 2881 and 3490 individuals (Haig 1985). Given these estimates, the U.S. Fish and Wildlife Service also took action. The United States listed the Piping Plover as "threatened" in the Northern Great Plains and on the Atlantic coast and as "endangered" on the Great Lakes, under the provisions of the U.S. Endangered Species Act (Sidle 1985).

Despite the status listings for the Piping Plover, it was widely agreed that a reliable population estimate was lacking. Further, without regularly timed censuses, the progress being made in recovery efforts would be difficult to judge. As population estimates varied widely even for areas thought to be well described, it was clear that a single range-wide census was required in a short time frame. It was hoped that this would eliminate the risk of double-counting birds that shifted breeding or wintering areas. Because of the widely dispersed distribution of the Piping Plover, a monumental effort would be required to document the number of birds occurring throughout North America. Hence, the four North American recovery teams planned a series of international censuses to be conducted once every five years, the first of which was scheduled for 1991.

Purpose of this Occasional Paper

The purpose of this account is to ensure documentation of the results of the 1991 International Piping Plover Census for each Canadian province; this will facilitate a fair appraisal of population trends when the next census is conducted. Representatives from each province prepared a chapter, detailing the census methods and results for their province. To round out the paper, a chapter is included that briefly describes the results of the breeding and winter census in the United States, Mexico, and the Caribbean. Hence, this paper reports on the results of the entire international effort but focuses on the Canadian initiative. Finally, this account seeks to provide a 1991 snapshot of the status of the species in Canada and the recovery efforts that are under way.

The 1991 Piping Plover census in Newfoundland and St-Pierre-et-Miquelon (France)

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Abstract

In 1991, potential nesting areas of Piping Plovers *Charadrius melodus* in Newfoundland (11 sites) and St-Pierre-et-Miquelon (France) (four sites) were surveyed by the Newfoundland and Labrador Wildlife Division (4–9 June and 21 July) and volunteers from St-Pierre-et-Miquelon (14–15 and 21 June, 2 and 6 July), as part of the 1991 International Piping Plover Census. Piping Plovers were found at only three sites: Big Barasway in Newfoundland (seven adults); and the Gully of Grand Barachois (two adults) and the southern part of the Isthmus on the island of Miquelon (two adults). Seven chicks were observed at Big Barasway, one chick at the Gully of Grand Barachois, and two chicks on the south part of the Isthmus, Miquelon. Plovers have been consistently observed at Big Barasway and Miquelon in recent years.

Résumé

En 1991, des relevés ont été effectués par la Newfoundland and Labrador Wildlife Division et des bénévoles de St-Pierre-et-Miquelon (14–15 et 21 juin; 2 et 6 juillet) à des sites où sont susceptibles de nicher les Pluviers siffleurs *Charadrius melodus* à Terre-Neuve (11 sites) et à St-Pierre-et-Miquelon (France) (quatre sites) dans le cadre du recensement international des Pluviers siffleurs de 1991. Des Pluviers siffleurs n'ont été observés qu'à trois de ces sites, soit à Big Barasway (sept adultes), à Terre-Neuve, et au goulet du Grand Barachois (deux adultes) et dans la partie sud de l'isthme de Langlade sur l'île de Miquelon (deux adultes). On a observé sept petits à Big Barasway, un au goulet du Grand Barachois et deux dans la partie sud de l'isthme de Langlade. Des pluviers ont été régulièrement observés à Big Barasway et sur l'île de Miquelon ces dernières années.

Introduction

Since 1983, the Newfoundland and Labrador Wildlife Division has conducted surveys for Piping Plovers *Charadrius melodus* in Newfoundland, and volunteers on Miquelon (France) have provided information on sightings. Historical evidence suggests that the Piping Plover was never numerous in Newfoundland. In the past, plovers were

observed at Stephenville Crossing, Codroy Valley, St. Paul's Inlet, and other areas (Peters and Burleigh 1951). This is in contrast to census results of the past several years, which indicate that these areas are no longer used by plovers. The 1991 survey concentrated on the same areas of suitable habitat as in recent years. Here, we document and discuss the results of the 1991 survey relative to past population estimates and threats to the species in Newfoundland and St-Pierre-et-Miquelon.

Methods

Within the province of Newfoundland, the Wildlife Division, Department of Tourism and Culture, undertook the responsibility of organizing and conducting Piping Plover surveys. Roger Etcheberry organized surveys on Miquelon. Wildlife and Fisheries Officers around Newfoundland were asked to advise us of the location of potential breeding habitat. Several of the recommended sites were checked prior to the census and omitted because they had unsuitable habitat. The Newfoundland census was conducted on 4–9 June 1991 in areas that had previously been used by nesting plovers as well as in potential nesting areas that contained suitable habitat. A second survey of Big Barasway was conducted on 21 July 1991. The St-Pierre-et-Miquelon survey was conducted on 14–15 June and 6 July 1991 at sites that were used in the past by plovers.

Survey times were generally mid-morning to mid-afternoon, with air temperatures averaging 10°C and wind conditions varying from calm to brisk. Eight of 15 sites were censused by two observers, one walking along the water's edge to census feeding birds and one walking along the dune area to census birds at nest sites. The other six sites were surveyed by one person. Where a body of water or barasway created a "back beach," this area was also surveyed.

Notes were kept on human disturbance, such as the presence of roads, off-road vehicles, and people and dog tracks. Natural disturbances such as heavy ice conditions and the presence of predators were also recorded.

Results

Eleven sites (36.9 km) on the west and northeast coasts of Newfoundland were censused (Fig. 1). Seven adult plovers were observed at Big Barasway on 6 June (Table 1). A subsequent survey on 21 July found six adults and seven chicks present. A set of all-terrain vehicle (ATV) tracks was observed on the outer edge of Big Barasway.

Four sites on the island of Miquelon were censused (Fig. 2). One adult was observed at a nest on the Gully of Grand Barachois on 14 June. On 21 June, one chick from a clutch of four eggs had hatched. It was subsequently found that the three remaining eggs did not hatch. One adult was observed on 2 July and two adults were observed on 6 July at this site. On the southern part of the Isthmus, two adults and two chicks were seen on 6 July. These observations indicate at least two nesting pairs of plovers on Miquelon in 1991. Both areas showed evidence of ATV and motorcycle activity. Colonies of Herring Gulls *Larus argentatus* and Greater Black-backed Gulls *L. marinus* were present less than 1.6 km away from the nesting area on Grand Barachois.

Discussion

It appears that the seven plovers observed at Big Barasway represent at least three nesting pairs and the four birds at Miquelon represent two nesting pairs. These five pairs may be the total breeding population for Newfoundland and the French island of Miquelon.

Cairns and McLaren (1980) estimated that the population of nesting Piping Plovers in Newfoundland was 10–15 pairs, all occurring in the southwest and northeast sections of the province. The only observations of plovers by Division staff on the northeast coast have been at Lumsden, where three adults and one chick were seen in 1983 (Brazil 1983), two adults in 1984 (Brazil 1984), and two adults in each of 1985 and 1987 (J. Brazil, pers. obs.) (Table 2). A single bird was observed at Cape Freels in 1984. The only sightings of Piping Plovers on the west coast of Newfoundland have been at Flat Island, where a single bird was seen in 1984–86 (Brazil 1984, and pers. obs.; Burger 1985), and at Stephenville Crossing, where a single bird was observed in 1984. There have been no sightings of Piping Plovers at Little Codroy or Grand Codroy by Division staff since the Wildlife Division began surveys in 1983. However, there is a historical record of nesting in these areas (Peters and Burleigh 1951).

The last sighting of plovers farther north on the west coast occurred at Western Brook in 1975, when a single adult was seen (M.H. Estabrooks, pers. commun.). Plovers have been consistently observed at Big Barasway on the south coast of the island.

Piping Plovers have in recent years been seen by local naturalists at other locations within Newfoundland. In each case, the time of year or behaviour of the bird suggested that it was not a nesting individual. There have also been several unconfirmed reports of possible nesting activity in the southwest corner of the province at Rocky Barachois near Port aux Basques.

It would appear that human encroachment and disturbance of nesting habitat owing to the increasing popularity of ATVs and greater recreational use of beaches over the past three decades may be a cause of the decline in

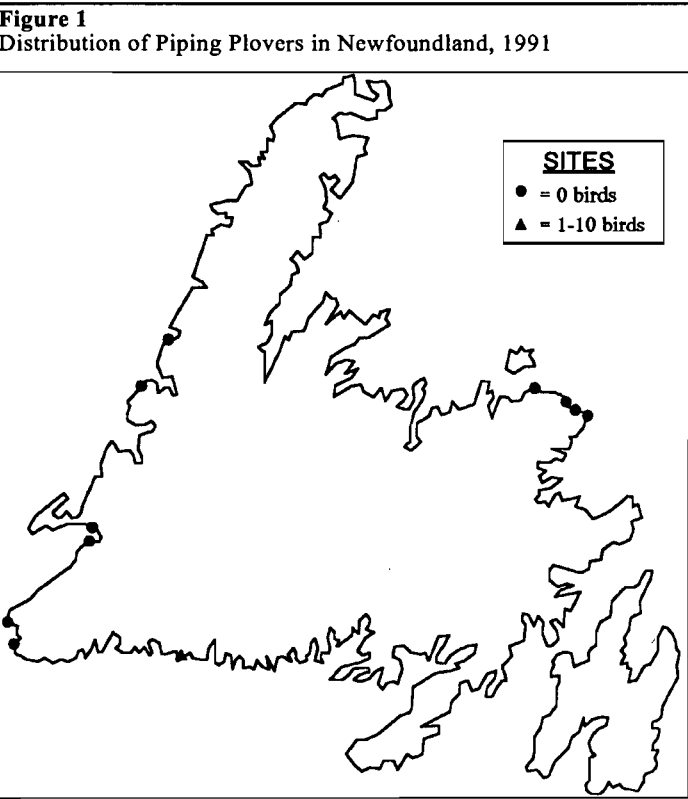


Table 1			Locations and numbers of Piping Plovers found in Newfoundland and St-Pierre-et-Miquelon (France), 1991		
Date	Map sheet	Site name	Distance searched (km)	No. of adults	No. of chicks
4 June 1991	11 O/14	Little Codroy	1.5	0	0
5 June 1991	11 O/14	Grand Codroy	2.0	0	0
5 June 1991	12 B/7	Sandy Point, Flat Island	4.0	0	0
5 June 1991	12 B/8	Stephenville Crossing	8.0	0	0
6 June 1991	11 P/12	Big Barasway	5.0	7	0
21 July 1991	11 P/12	Big Barasway	5.0	6	7
7 June 1991	12 H/13	Western Brook	1.7	0	0
7 June 1991	12 H/13	Shallow Bay	4.0	0	0
9 June 1991	2 F/5	Musgrave Harbour	3.6	0	0
9 June 1991	2 F/5	Deadman's Bay	3.4	0	0
9 June 1991	2 F/5	Lumsden	1.8	0	0
9 June 1991	2 F/5	Cape Freels	1.9	0	0
14 June 1991	11 P&I	Gully of Grand Barachois, Miquelon	—	2	0
21 June 1991	11 P&I	Gully of Grand Barachois, Miquelon	—	2	1
2 July 1991	11 P&I	Gully of Grand Barachois, Miquelon	—	1	—
6 July 1991	11 P&I	Gully of Grand Barachois, Miquelon	—	2	0
14 June 1991	11 P&I	Southeast Beach, Miquelon	—	0	0
15 June 1991	11 P&I	Northwest Beach, Miquelon	—	0	0
6 July 1991	11 P&I	South part of Isthmus, Miquelon	—	2	2

Piping Plover numbers in Newfoundland. The relative inaccessibility of the Big Barasway (accessible only by boat) and small human population on Miquelon may explain why these areas have remained viable as nesting sites for Piping Plovers.

Figure 2
Distribution of Piping Plovers in St-Pierre-et-Miquelon, 1991

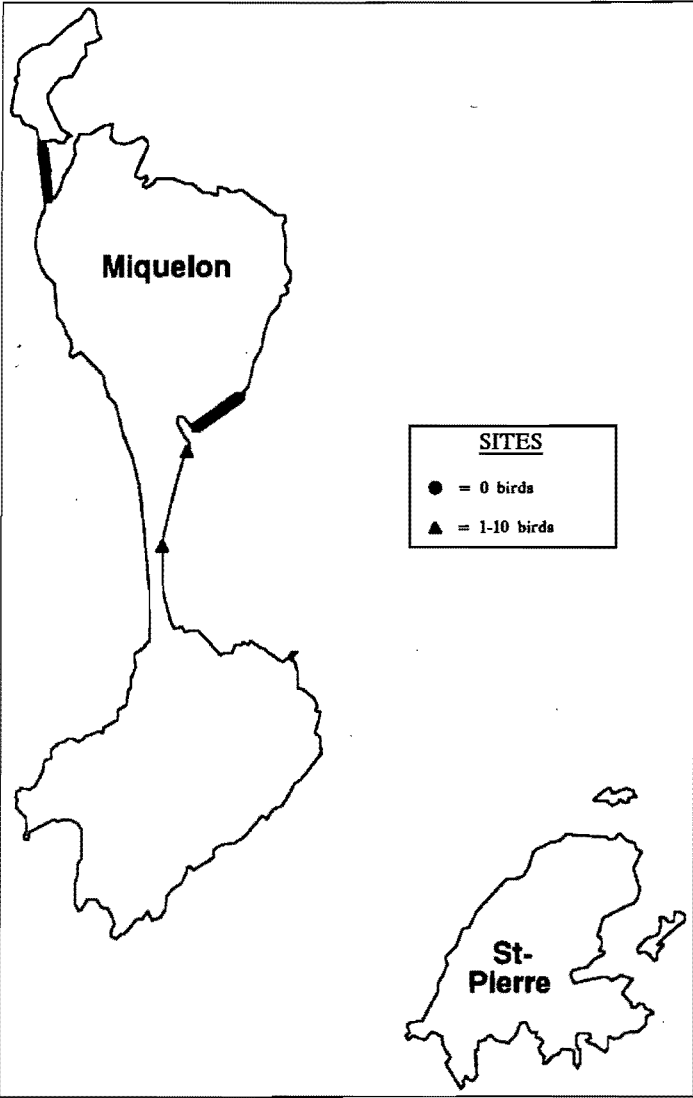


Table 2
Observations of Piping Plovers in Newfoundland and St-Pierre-et-Miquelon, 1983-91

Site	No. of individuals observed									
	1983	1984	1985	1986	1987	1988	1989	1990	1991	
Little Codroy	-	0	0	-	0	0	-	-	0	
Grand Codroy	-	0	0	-	0	0	-	-	0	
Big Barasway	-	-	6	-	6	8	8	5	7	
										7 Juv
Flat Island	-	1	1	1	-	0	-	-	0	
Stephenville	0	1	0	-	0	0	-	-	0	
Crossing										
Lumsden	3	2	2	-	2	0	-	-	0	
	1 Juv									
Cape Freels	0	1	-	-	-	-	-	-	0	
Miquelon	2 ^a	1 ^b	2 ^b	-	-	-	1 ^c	3 ^c	4	
		1 Juv						3 Juv	3 Juv	

Juv = juvenile(s)

^a R. Etcheberry (pers. commun.).

^b Desbrosse (1988).

^c A. Desbrosse (pers. commun.).

On almost all beaches surveyed there were signs of ATV activity (including Big Barasway, where ATVs are brought over in boats to access cabins), as well as pedestrian and dog tracks. Predators such as Greater Black-backed and Herring gulls were present, often in large numbers, in areas of good breeding habitat. As well, through June 1991, the entire northeast coast of the island of Newfoundland had heavy ice rafting onto shore, drastically reducing feeding habitat and almost certainly deterring plovers from attempting to nest until July.

Future plans for the Piping Plover include continued monitoring of currently known nesting sites, surveys of other potential nesting sites, and enhanced efforts devoted to protecting habitat. The Newfoundland and Labrador Wildlife Division conducts information sessions on endangered species in schools and to interest groups. The Piping Plover is one of the species regularly included in these sessions, and a brochure has recently been designed and printed discussing the plight of this bird in Newfoundland.

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The 1991 Piping Plover census in Nova Scotia

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Abstract

Counts of adult Piping Plovers *Charadrius melodus* totalling 113 birds were recorded from 35 of 87 beach sites censused in Nova Scotia during the 1991 breeding season. The Nova Scotia breeding population is estimated to be 51 pairs. Most plovers were located along the southern Atlantic shore of Nova Scotia in Queens and Shelburne counties. The fledging success rate of breeding pairs studied at 15 sites was calculated to be 0.7 young/pair. Habitat changes, predation, and human disturbances alone or in combination have altered plover distribution and reduced productivity in Nova Scotia. New recovery initiatives are being implemented to address these concerns.

Résumé

On a dénombré au total 113 Pluviers siffleurs *Charadrius melodus* adultes à 35 des 87 sites littoraux ayant fait l'objet de relevés en Nouvelle-Écosse en 1991 durant la saison de reproduction. On estime à 51 couples la population de reproducteurs de cette province. La plupart des pluviers ont été observés sur la côte atlantique sud de la province, dans les comtés de Queens et de Shelburne. On a observé que les couples de 15 des sites ont réussi à élever chacun en moyenne 0,7 jeune jusqu'à l'âge de l'envol. L'altération des habitats, la prédation et les perturbations anthropiques ont, isolément ou ensemble, modifié la répartition des pluviers et réduit leur productivité en Nouvelle-Écosse. De nouvelles initiatives de rétablissement de la population sont pour cette raison actuellement mises en oeuvre.

Introduction

In Nova Scotia, Piping Plovers *Charadrius melodus* have been the focus of studies involving nesting habitat (Flemming et al. 1992), breeding success (Cairns 1977, 1982; Flemming 1984; Flemming et al. 1988; Kenney 1991), and distribution (Flemming et al. 1988; Nova Scotia Department of Natural Resources files). The changing status of the Nova Scotia population has been reported in several

publications (Cairns and McLaren 1980; Haig 1985; Haig and Oring 1985; Flemming et al. 1988). This report details the findings of the census fieldwork in Nova Scotia and compares the 1991 status and productivity results with those obtained in previous years.

Methods

Beach sites (n = 87) were selected for censusing in four major coastal regions of the province. All but one of these sites—26 on the northern shore, nine on Cape Breton Island, 14 on the eastern shore, and 37 on the southern shore—had been previously categorized as either appropriate or potential plover habitat. Nest productivity data were obtained from 15 sites—three on the northern shore and 12 on the southern shore.

Volunteers and participating provincial government employees were sent census guidelines drafted by the Atlantic Canada Piping Plover Recovery Team, a list of assigned beaches marked on 1:50 000 maps, and census forms for recording field information. In addition to recording information on weather, tides, and any disturbances noted during the census, participants were encouraged to sketch a map noting the numbers and locations of plovers and highlighting significant features on or adjacent to the beaches.

At least 50 individuals participated in field surveys. Beaches were surveyed on foot, with access to island sites by boat. Forty-eight of the 87 censused beach sites were surveyed by two people, whereas the remaining 39 sites were each surveyed by a single observer. For sites where more than one census was conducted, we report the most reliable census result as the number of plovers present at the site.

The surveys were completed under acceptable weather conditions, with most counts (95% of reporting surveys) conducted under clear or partly cloudy skies but with moderate to brisk winds (64% of reporting surveys). Sixty percent of the beach sites were surveyed in the forenoon. All but six beach surveys were conducted between 1 and 19 June. One beach site on Cape Sable was visited on 16 May, and five sites in northern Cape Breton were censused on 26 June.

Breeding efforts by Piping Plovers at 15 beach sites were followed to record the number of young reaching at

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least 17 days of age (Flemming et al. 1988). Nests, located by observing birds or following tracks, were monitored until the young hatched or the eggs were destroyed or disappeared. Piping Plover chicks were counted on each visit by observing undisturbed broods. Reproductive success was based on the number of fledged young per nesting pair.

Results

Of the 87 beaches surveyed in 1991, 68 were considered to be suitable as Piping Plover breeding habitat. Thirty-five of these beaches had Piping Plovers—113 adult birds, including 51 pairs, in total (Table 1). Piping Plovers were most common on beaches along the southern Atlantic shore of Nova Scotia in Queens and Shelburne counties (Fig. 1).

Although some deviations from the standardized census techniques occurred as a result of logistical circumstances (second person unavailable for two-person census), beach physiography, and breeding phenology, these were not considered to be significant sources of error in the counts. However, one event that may pose an error was the desertion of St. Catherines River Beach by 12 birds as a consequence of nest losses a week previous to the census period. As some of these birds may not have reestablished territories by the census week, it is possible that we may have missed a few birds.

Habitat changes considered detrimental to Piping Plovers because of encroaching dune grasses (stabilization) or storm damage (erosion) were noted on six and four beaches, respectively, where the foreshores were reduced in area from former years. Habitat changes believed favourable to Piping Plovers were recorded at four beach sites.

Calculation of fledging success rates by region shows that 1.5 young (age 17 days) were produced per breeding pair on three northern shore beaches (Table 2). On 12 southern shore beaches, 23 breeding pairs produced a total of 14 young, for a fledging success rate of 0.6 young (age 17 days) per breeding pair. On a provincial scale, 20 young were produced by 27 breeding pairs, for a fledging success rate of 0.7 young/breeding pair.

Ten pairs of plovers laid 16 clutches on six Queens County beaches just outside Kejimikujik National Park Seaside Adjunct. Four nests successfully hatched young; two were lost to avian predators, one was washed away, two were abandoned, and seven failed for unknown reasons. Wire exclosures were placed around two nests, one of which was abandoned. The other nest successfully produced young. Area-specific beach closures were also used around three nests; one closure was successful at maintaining an undisturbed buffer zone. The 10 pairs of plovers reared eight chicks, for a fledging success rate of 0.8 young/breeding pair.

Nest success was also measured on the two plover nesting beaches in Kejimikujik National Park Seaside Adjunct. On St. Catherines River Beach, 10 breeding pairs (three pairs, eight birds during census) established nests, which were subsequently exclosed with wire. Seven nests were lost to predators, and two were abandoned within a few days. Two re-nest attempts on St. Catherines River Beach and one on Port Joli Beach were subsequently abandoned. No young were fledged in 1991 at the Seaside Adjunct.

Discussion

It is conceivable that some Piping Plover sites may have been inadvertently omitted from the 1991 census. We believe, however, that, with few exceptions, all potential Piping Plover breeding habitat was censused, because beach selection was based on previous field studies and on censuses of beach sites that recently formed appropriate habitat for the species. Furthermore, in Atlantic Canada, Piping Plovers prefer to breed on light-coloured, more often nearly white, sand beaches, particularly on overwash pebble-strewn areas (Flemming et al. 1992; Flemming 1992a). Beaches with these characteristics are most common along the Atlantic southeastern and southern coasts of the province. We are unaware of any beaches in this region that were not censused in 1991.

The numbers of Piping Plovers located on Nova Scotia beaches in 1987 and 1991 compare favourably, with 48–54 pairs counted in 1987 and 51 pairs counted in 1991 (Table 3). This suggests that the precipitous decline of these birds in the province, documented by Flemming et al. (1988), has slowed for unknown reasons. Whether this is temporary or signals a longer-term change in population status will require further monitoring.

The distribution of breeding pairs in the province has changed, as indicated by surveys conducted in 1983, 1987, and 1991 (Table 3). These changes may be due to many factors. Human disturbances are significant causes of nest desertion or failure (Flemming et al. 1988; Strauss 1990) and may act in concert with other factors such as avian predation. Avian as well as mammalian predators may be attracted by signs of human activity near nests. Human disturbances associated with recreational activities, beach cleanups, and the driving of motorized vehicles on beaches, which may pose a direct threat to eggs and unfledged plovers, are also of concern, because they tend to disrupt normal behavioural patterns, especially those of the young birds. Flemming et al. (1988), working in Nova Scotia, found that the presence of humans in plover territories altered the behaviour of chicks such that they spent more time in avoidance behaviours and less time foraging or being brooded. This may have made them more susceptible to human disturbance, as fledging success was significantly lower on beaches with high disturbance. Strauss (1990) made the same observation in Massachusetts.

Physical forces that shape the coastlines, sometimes influenced by both intentional and unintentional human activities, affect the numbers and annual distribution patterns of Piping Plovers in the province. Sandy shores are inherently unstable. Beach profiles may change abruptly, especially during winter storms. These changes may render them either habitable or uninhabitable by Piping Plovers. For example, sand washed from Sevim Beach over the past three to five years (prior to census) has exposed a cobble-stone shoreline there; however, the sand has deposited on the north side of Sandhills Beach, thereby creating additional plover habitat at that site. Likewise, a channel through the sandbar at Conrads Beach was filled during a recent winter storm, also creating additional nesting habitat. Conversely, we suspect that the intentional stabilization of beaches at some traditional breeding sites has led to decreased incidences of overwash and blowout, thus reducing favoured habitat for nesting plovers. Future plover management will require a thorough examination of the

Table 1
Locations and numbers of Piping Plovers found in Nova Scotia, 1991

Date	Map sheet	Site	UTM grid	No. of observers	No. of hours	No. of adult plovers
16 May 1991	20 P/5	Cape Sable (Inner Beach)	685 086	2	3	2
1 June 1991	11 F/12	Pomquet Beach	940 550	1	2.25	2
1 June 1991	11 D/15	Taylor's Head	347 615	2	2.5	0
1 June 1991	21 A/2	Cherry Hill Beach	790 884	2	1.5	6
2 June 1991	11 E/15	Caribou Island	225 674	2	0.5	0
2 June 1991	11 F/16	Kennington Cove	284 846	2	0.5	0
2 June 1991	11 F/6	Ragged Head Pond	260 306	1	1	0
2 June 1991	11 F/6	Clam Pond	240 305	1	1	0
2 June 1991	11 D/10	Clam Harbour	081 525	2	1.5	2
2 June 1991	11 D/10	West Marsh	040 524	2	1	0
2 June 1991	11 D/11	Cole Harbour	670 439	2	1	3
2 June 1991	11 D/11	Cow Bay	651 397	2	?	0
2 June 1991	21 A/1	Moshers Island (Sloop Cove)	921 987	1	?	0
2 June 1991	21 A/2	Beach Meadows Beach	687 795	1	1	4
2 June 1991	20 P/15	Gull Island	632 708	1	0.75	0
2 June 1991	20 P/15	Port Mouton Island	569 634	2	4	0
2 June 1991	20 P/14	Louis Head Beach	380 465	2	1.25	4
2 June 1991	20 P/11	Black Point Beach	345 405	2	1	3
2 June 1991	20 P/5	Clam Point	923 192	2	1.75	2
2 June 1991	20 P/5	Stoney Island	925 163	2	?	0
3 June 1991	21 A/1	Halibut Bay (Cape LaHave Island)	924 927	2	1.75	0
3 June 1991	21 A/1	Cap Bay Beach (Cape LaHave Island)	900 940	2	1.75	4
3 June 1991	21 A/1	The Creek (Cape LaHave Island)	894 964	2	1.75	0
3 June 1991	20 P/15	Summerville Beach	518 676	1	1.75	7
3 June 1991	20 P/15	Carters/Wobamkek Beach	540 629	1	0.75	4
4 June 1991	11 D/11	Conrad Beach (East and West)	814 496	2	1.25	2
4 June 1991	20 P/11	Fox Bar	120 310	2	0.75	4
5 June 1991	20 P/15	Johnstons Pond	431 488	2	0.75	2
5 June 1991	20 P/6	Baccaro (Crow Neck)	005 165	1	0.75	6
5 June 1991	20 P/5	Burks Point (Powells Beach)	973 168	2	0.75	2
5 June 1991	20 P/12	Sand Hills/Sevim	934 222	2	1	3
6 June 1991	11 E/14	Horton Beach	680 736	1	1	0
6 June 1991	11 E/14	Long Beach	800 725	1	1	0
6 June 1991	11 E/14	Malagash Mines	754 715	2	?	0
6 June 1991	21 A/8	Masons Beach	937 128	1	0.25	0
6 June 1991	21 A/8	Kingsburg	996 026	2	0.25	0
6 June 1991	21 A/8	Hirtles Beach	985 019	2	0.75	0
6 June 1991	20 P/15	Port Joli Harbour	490 588	1	1	4
6 June 1991	20 P/15	Sandy Bay Beach	480 538	1	1.25	2
6 June 1991	20 P/11	Roseway Beach/Round Bay	100 300	2	1	6
7 June 1991	11 E/13	West Pugwash	444 780	1	1	0
7 June 1991	11 E/13	Cameron Beach	435 796	1	1	0
7 June 1991	11 E/14	Oak Island	685 768	1	2	0
7 June 1991	11 E/14	Murray Beach (Rushton Park)	900 667	2	4	0
7 June 1991	20 P/15	St. Catherines River Beach	530 560	2	3	8
7 June 1991	20 P/12	Northeast Point	900 205	2	1	2
7 June 1991	20 P/15	Cranberry Pond Beach	555 614	1	?	2
8 June 1991	11 E/10	Sinclair's Island Beach	336 580	1	1	0
8 June 1991	20 P/15	Little Port Joli	545 580	2	1	2
8 June 1991	20 P/5	Daniels Head (Southside)	905 130	2	1.5	7
8 June 1991	20 P/5	The Hawk	882 096	2	1.25	1
8 June 1991	20 P/6	Blanche Point	060 180	2	?	0
9 June 1991	20 P/5	Goose Point	903 190	2	0.75	2
11 June 1991	11 E/10	Roaring Bull Point	332 583	1	0.75	0
12 June 1991	11 D/11	Conrads Beach	700 434	2	?	0
12 June 1991	11 D/11	Fishermans Beach	822 470	2	?	0
12 June 1991	11 D/11 (5)	Long Beach	840 476	2	?	0
16 June 1991	11 F/12	Dunn's Beach	865 600	1	1.25	0
16 June 1991	11 F/12	Captains Pond Beach	893 588	1	0.75	0
16 June 1991	11 F/12	Monks Head Beach	902 586	1	0.75	0
17 June 1991	11 E/10	Pictou Bar Spit	405 587	1	1	2
17 June 1991	11 E/10	Bowen Island	351 556	1	0.5	4
17 June 1991	11 E/10	Little Harbour Spit	347 561	1	0.5	1
17 June 1991	11 E/9 (10)	Melmerby Beach	390 555	1	0.75	0
17 June 1991	11 E/9	Kings Head Beach	405 546	1	0.25	0
17 June 1991	11 E/9	Savage Point	425 546	1	0.5	0
17 June 1991	11 E/9	Big Merigomish Island	480 579	1	0.25	0
17 June 1991	11 K/16	North Harbour Beach	935 990	2	3.25	0
17 June 1991	11 K/16	South Harbour Beach	955 950	2	0.5	0
17 June 1991	11 D/11	Stoney Beach	730 433	1	0.75	2
17 June 1991	21 A/9	Bayswater Beach	153 280	1	0.25	0
18 June 1991	11 F/12	Grahams Cove	947 549	2	0.5	0
18 June 1991	11 F/12	Bayfield	969 546	2	0.5	0
18 June 1991	11 F/12	Tracadie West Arm	025 543	2	?	0
18 June 1991	11 F/12	Tracadie Big Island	046 553	2	1.25	0

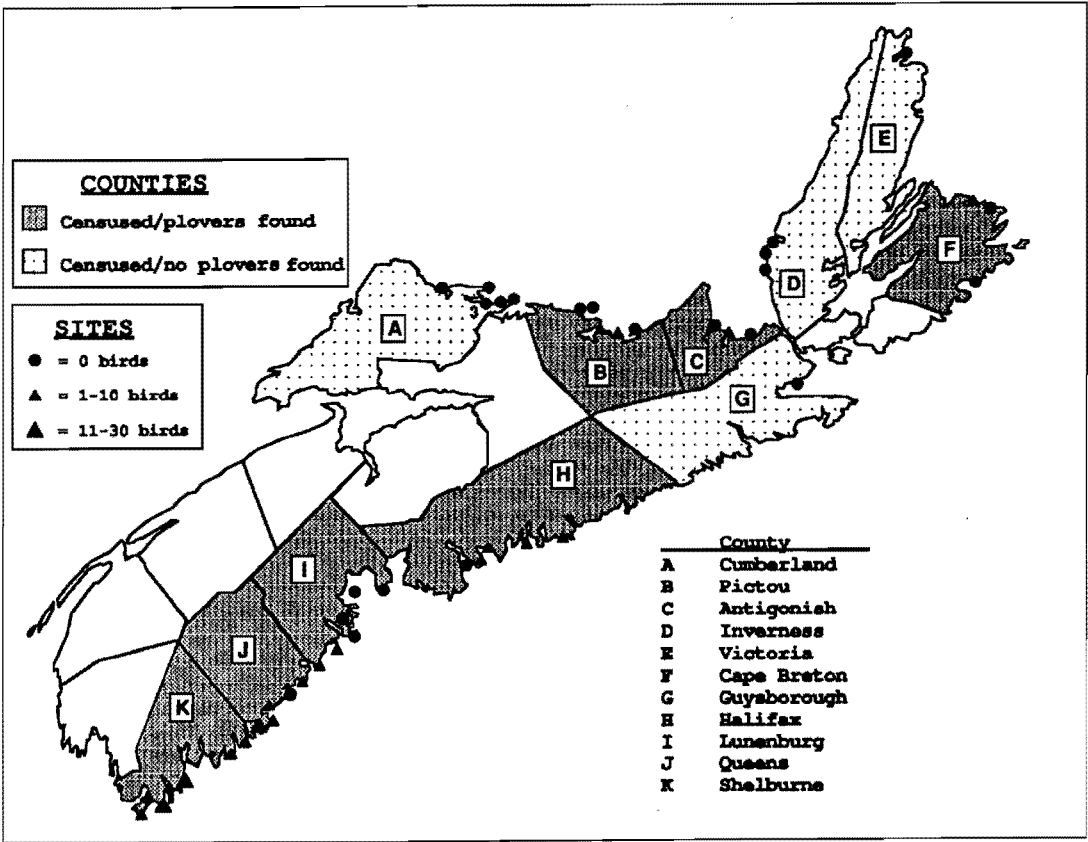
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Table 1 (continued)
Locations and numbers of Piping Plovers found in Nova Scotia, 1991

Date	Map sheet	Site	UTM grid	No. of observers	No. of hours	No. of adult plovers
18 June 1991	11 D/11	Martinique Beach	900 486	1	4	2
18 June 1991	11 D/12	Maugher Beach	583 390	2	0.5	0
19 June 1991	11 F/12	Mahoneys Beach	860 605	2	?	0
19 June 1991	11 K/1	Dominion Beach (Lingan)	284 225	2	?	2
19 June 1991	11 J/4	Glance Bay Bar	740 180	2	?	0
19 June 1991	21 A/8	Rafuse Island	011 229	1	0.25	0
19 June 1991	21 A/8	Mason Island	997 232	1	0.75	0
19 June 1991	20 P/11	Red Head	104 267	2	0.5	2
26 June 1991	11 K/4	Colindale	150 020	1	0.5	0
26 June 1991	11 K/4	Port Hood	137 955	1	1	0
26 June 1991	11 F/13	Big Rorys Point	145 868	1	1	0
26 June 1991	11 F/13	Little Judique Harbour	141 905	1	0.5	0
Total					84.75	113

UTM = Universal Transverse Mercator

Figure 1
Distribution of Piping Plovers in Nova Scotia, 1991



effects of current beach stabilization practices on the species' breeding habitats.

The 1991 productivity rate of 0.7 chicks/pair was lower than the previous estimate of productivity for the province. For the period 1979-83, Nova Scotia plovers produced 1.2 chicks/pair, on average ($n = 62$ pairs, age 17 days). It is unclear if the 1991 breeding season was an especially poor one or if it is representative of current productivity. However, data collected in Kejimikujik National Park Seaside Adjunct (St. Catherines River and Little Port Joli beaches) during the period between the two estimates might provide some insight. Kenney (1991) reported that plovers at St. Catherines River Beach produced 1.2 chicks/pair, on average ($n = 44$ pairs, age 17 days),

during the period 1986-90. Substantial increases in fledgling numbers—increases of 17 and 23 chicks in 1989 and 1990, for a productivity rate of 2.4 and 2.6 chicks/pair, respectively—indicate that productivity had improved at that site largely because of nest exclosures.

Based on long-term population data, the Nova Scotia population was calculated to be declining at a rate of 3.3-5.8 pairs per year (Flemming et al. 1988). The 1991 census results, however, indicate that the population consists of 51 pairs, essentially unchanged from the estimate of 48-54 breeding pairs in 1987.

Future plans for the management of the Piping Plover in Nova Scotia include the implementation of a Piping Plover Guardian Program, continued monitoring of the

Table 2
Fledging success of Piping Plover in Nova Scotia, 1991

Region/beach site	No. of pairs	No. of chicks (to 17 days)	Fledging success (young/pair)
Northern shore			
Pictou Bar Spit	1	0	0
Bowen Island	2	3	1.5
Pomquet	1	3	3.0
	4	6	1.5
Southern shore			
Beach Meadows	2	0	0
Carters/Wobamkek	2	3	1.5
Forbes Cove	1	0	0
Little Port Joli	1	0	0
St. Catherines River	4	0	0
Port Joli Harbour	1	0	0
Sandy Bay	1	2	2.0
Summerville	3	3	1.0
Johnstons Pond	1	0	0
Roseway/Round Bay	3	3	1
Baccaro	3	3	1
Sandhills/Sebim	1	0	0
	23	14	0.6
Total/average	27	20	0.7

provincial population, and alleviating the predator problem at Kejimikujik National Park Seaside Adjunct. The Piping Plover Guardian Program seeks to reduce human disturbance to Piping Plovers at breeding sites that cannot be closed to public access. These nesting areas will be posted with approximately 10 signs to form a breeding area boundary line. The signs will request that people stay out of the nesting area or walk along the water's edge if they must pass through the area. The "Do Not Disturb" request of the signs will be reinforced by trained volunteer guardians with identifying apparel who will make the same request in person.

Monitoring of the population outside of Kejimikujik National Park Seaside Adjunct is planned for selected sites on a continuing yearly basis. Also, nest exclosures will be placed around established nests on specific beaches where exclusion or buffer zones are feasible and can be regularly monitored.

The unprecedented loss of seven exclosed Piping Plover nests on St. Catherines River Beach of the Kejimikujik National Park Seaside Adjunct is of concern because it indicates that predators can identify exclosures with food and readily gain access to the nests. This learned behaviour could become more widespread, jeopardizing nest protection efforts throughout the region and reversing the trend to increased nest productivity since 1988 when exclosures were first used (Reive et al. 1988).

Acknowledgements

We wish to thank the Nova Scotia Bird Society and the many volunteers who participated in this census project. The assistance of Parks Canada staff, Nova Scotia Department of Natural Resources subdivision biologists, wildlife technicians, and other Department of Natural Resources district staff is appreciated. Gerald Dickie provided especially valuable assistance in the field and in compiling records. Bruce Johnson of the Canadian Wildlife Service provided guidance and support throughout every phase of this project.

Table 3
Changes in the number and distribution of breeding pairs of Piping Plovers in Nova Scotia, 1983, 1987, and 1991

Beach name	Pair estimate ^a		
	1983	1987	1991
Pictou Bar Spit	1	2	1
Bowen Island	1	1	2
Mahoneys	1	1	0
Dunn's	2	0	0
Pomquet	1	1	1
Dominion (Lingan)	0	1	1
Glance Bay Bar	3	2	0
Clam Harbour	1	0	1
Martinique	2	2	1
Stoney Island	1	2	1
Conrads (East and West)	7	2	1
Cole Harbour	1	0	1
Cape LaHave Island	3	3	2
Cherry Hill (Conrads)	5	2	3
Beach Meadows	1	1	2
Summerville	1	1	3
Carters/Wobamkek	0	1	2
Port Mouton Island	1	1	0
Cranberry Pond	0	1	1
Little Port Joli	1	2	1
St. Catherines River	11-14	7-9	3
Port Joli Harbour	1	1	2
Sandy Bay	2	1-2	1
Johnstons Pond	6-7	3-5	1
Louis Head	1	0	2
Fox Bar	1	1	2
Roseway/Round Bay	5-6	2-3	3
Red Head	0	0	1
Baccaro	2	2	3
Sandhills/Sebim	1	3	1
Stoney Island	1	0	0
Daniel Head (Southside)	0	0	3
The Hawk	1	0	0
Cape Sable Island (Inner)	1	2	1
Northeast Point	0	0	1
Clam Point	0	0	1
Burks/Powell Point	0	0	1
Indian Point/Goose Point	0	0	1
Total	66-71	48-54	51

^a 1983 and 1987 data from Flemming et al. (1988).

The 1991 Piping Plover census in Prince Edward Island

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Abstract

The Piping Plover *Charadrius melodus* census in Prince Edward Island was conducted on 1–9 June, using 51 people. During the census, approximately 152 km and 57 beaches with suitable nesting habitat were surveyed. The population estimate for Piping Plovers in Prince Edward Island during the census period was 110 adults, comprising 51 pairs and eight single birds, on 20 beaches. Areas identified as being particularly important for Piping Plovers were Conway Sand Hills/Hog Island chain, Cabot Provincial Park to Cousins Pond shoreline, Prince Edward Island National Park, and Savage Harbour to Greenwich Point shoreline. The provincial population appears relatively stable, as the 1991 estimate compares well with previous counts, and the mean productivity is at the theoretical level required for population maintenance.

Résumé

À l'Île-du-Prince-Édouard, le recensement des Pluviers siffleurs *Charadrius melodus* a été réalisé par 51 personnes du 1^{er} au 9 juin. Environ 152 km et 57 plages renfermant des habitats favorables à la nidification de cette espèce ont été couverts. Dans la période du recensement, on a estimé la population de la province à 110 adultes, soit 51 couples et huit solitaires, répartis sur 20 plages. Les endroits suivants se sont révélés particulièrement importants pour les Pluviers siffleurs : les collines de sable de Conway et le cordon littoral de l'île Hog, le trait de côte s'étendant du parc provincial Cabot à l'étang Cousins, le parc national de l'Île-du-Prince-Édouard, et le trait de côte s'étendant du havre Savage à la pointe Greenwich. La population de pluviers de la province semble être assez stable; en effet, l'estimation de 1991 est comparable aux dénombrements des années précédentes, et la productivité moyenne est théoriquement suffisante pour assurer le maintien de la population.

Introduction

Censuses of Piping Plovers *Charadrius melodus* on Prince Edward Island have been conducted since 1977 (Cairns 1978; Johnson and Feldstein 1983; MacLeod 1984; Northcott and Creamer 1987; Flemming 1992b). Most of

these censuses have sampled only a small portion of the provincial population in a given year. For Prince Edward Island National Park, good census and productivity data have been collected since 1977 (Corbett 1988b; Flemming 1992b). These data suggest a healthy population for the Park, which had implemented intensive recovery efforts. However, as little effort was implemented at sites outside of the Park, it seemed possible that productivity was lower in these areas, resulting in decreasing numbers overall. Hence, the 1991 census was an opportunity to fill informational gaps on the distribution and status of the species in Prince Edward Island.

Methods

Several calls for volunteers to assist with the census were made at monthly meetings of the Natural History Society of Prince Edward Island Ltd., in newsletters, and via press releases. A letter of invitation was also sent to known birders and other people interested in Piping Plover conservation on Prince Edward Island.

An education session was held on 16 May for those volunteering to census Piping Plovers. The session entailed a general overview of the project, reviewed identification of the Piping Plover and similar birds, and provided information on location of breeding areas. Nesting habitat, plover tracks, census techniques, and acceptable weather parameters for conducting the census were also discussed. Maps of beaches that previously had nesting Piping Plovers and of other potential nesting sites were compiled. Fifty-seven beaches in Prince Edward Island were selected as census sites.

Beach census kits included census instructions, an identification sheet on plover and predator tracks, a Prince Edward Island road map, a 1:50 000 topographical map, a 1:17 500 aerial photograph (photocopy), and an Atlantic Canada Piping Plover census form. The kits were prepared for each beach to be surveyed. These were distributed to the census volunteers, who were instructed to mark the locations of Piping Plovers, predator tracks, and disturbance factors directly on the aerial photograph and then to fill out the census report form.

Censuses were carried out by two people, one walking along the shoreline and the other walking close to the dunes. When a Piping Plover was spotted, the person

near the dunes moved quickly to join the second person near the water. The two then proceeded 100 m past the plover before resuming the shoreline and near-dune positions. Special attention was paid to washover areas, the ends of sandspits and islands, and beaches with Piping Plover tracks. Any deviation from this technique was noted on the census report forms.

Presurveys of some beaches were conducted by the organizers, and then volunteers or organizers surveyed these beaches during the census period. If Piping Plovers were originally found by the organizers and were not found by the volunteers during the census period, the beach was resurveyed. The purpose of this was to minimize errors in the results and to identify movement of Piping Plovers.

During the census, the volunteers were asked to record potential disturbance factors. The presence of people or vehicles on the beach and the tracks of people, dogs, or vehicles were recorded.

Results

The 1991 International Piping Plover Census was completed in Prince Edward Island during 1–9 June. Table 1 provides a list of the beaches that were surveyed and the census results. In total, 110 adult Piping Plovers were seen on 20 of the 57 beaches surveyed throughout Prince Edward Island.

Several areas were identified as being particularly important for Piping Plovers. These included the Conway Sand Hills/Hog Island chain (19 adults), the Cabot Provincial Park to Cousins Pond shoreline (nine adults), Prince Edward Island National Park (46 adults), and the Savage Harbour to Greenwich Point shoreline (21 adults). On these beaches was found 86.4% of the Prince Edward Island population of Piping Plovers (Fig. 1).

Several areas where Piping Plovers had been observed in the past—Cascumpec Sand Hills, Tignish Shore, Cedar Dunes Provincial Park, Indian Point Sand Hills, and Launching Point—did not have birds in 1991.

A severe storm accompanied by a 1.5-m tidal surge occurred on 14 June 1991. This storm destroyed all nests (17) in Prince Edward Island National Park except one whose clutch hatched just prior to the storm. In total, 13 pairs successfully re-nested in the Park after the storm. Resurveys of six beaches outside the Park that had contained 14 pairs and nine known nests prior to the storm indicated that all these nests with the possible exception of one were lost to the storm before the eggs hatched. Only nine pairs were located at these sites after the storm, although Piping Plover tracks were also present at two other previously occupied sites. The storm radically altered the habitat of many of the nesting beaches.

Thirty-four of 52 beaches had visible evidence of human disturbance. Piping Plovers attempted nesting on 10 of 34 (29.4%) beaches with human tracks and eight of 18 (44.4%) beaches without human tracks. Twenty-six beaches, 44.1% of those surveyed for disturbance, had vehicle tracks present. In 18 cases, the tire tracks were in the nesting habitat of Piping Plover.

Discussion

The census revealed a Prince Edward Island population of 110 Piping Plovers, comprising 51 pairs and eight singles. A comparison of the 1991 census data with those of previous censuses indicates that there has been little or no change in Prince Edward Island's Piping Plover population. Cairns (1978) estimated the Prince Edward Island population of Piping Plovers to be 50–60 pairs in 1977–78. MacLeod's (1984) surveys in 1984 combined with the counts from Prince Edward Island National Park in that year (Flemming 1992b) provide a population estimate of 90–105 adults, or 45–52 pairs.

The compression of the 1991 census into a 10-day period should have minimized Piping Plover movement between beaches. The census data for the period of 28 May – 9 June suggest that several pairs of Piping Plovers moved from the St. Peter's Harbour West area.

A number of beaches that appeared to have suitable nesting habitat and low amounts of disturbance (e.g., Spry Cove and Boughton Bay) were found to have no Piping Plovers. Others with relatively high levels of human disturbance had successful nests (e.g., Cousins Pond and one nest at Covehead Harbour). There appears to be a need for further beach-scale studies to clarify the impacts of human disturbance.

The 1991 fledging success rate in Prince Edward Island National Park was 1.7 young/pair compared with 0.6 young/pair outside the Park (Flemming 1992b). The Park has stringent monitoring of the nesting beaches, and each of the identified Piping Plover nesting areas is posted with signs and closed to the public. This program is supported by the installation of predator enclosures, an active Piping Plover interpretation and awareness program, and a viewing opportunity program to allow people to observe plovers at a distance, which minimizes disturbance.

The results of public awareness surveys conducted in Prince Edward Island in 1988 and 1991 suggested that these education and awareness programs require significant improvements (MacEachern and Barrett 1988; McAskill and Hoteling 1991). As human disturbance has been identified as a factor in the decline of Piping Plover, a higher priority must be assigned to increasing the level of public knowledge regarding the identification of the species and its habitat and appropriate human behaviour in Piping Plover nesting areas.

Prince Edward Island has legislation—the Environmental Protection Act—that is designed to control the use of vehicles on beaches in the province. However, in the past two years no charges have been laid under this act or its regulations (C. Murphy, P.E.I. Department of Environment, pers. commun.). Based on the number of tracks encountered during the census, there appears to be a need to enforce these regulations for the protection of the Piping Plover and its habitat.

The Piping Plover conservation programs in Prince Edward Island National Park are critical to the survival of the Piping Plover in the province. Every effort must be made to continue these efforts and to expand these types of programs to areas outside the Park. In addition, we believe there is a need for a beach guardian program for areas outside the Park; the enforcement of vehicle restrictions on Piping Plover beaches, and an awareness program on charges for violation of these regulations; an expanded

Table 1
Locations and numbers of Piping Plovers found in Prince Edward Island, 1991

Site name	Date	Distance searched (km)		No. of Piping Plovers		
		Outer	Inner	Adults	Pairs	Singles
Deroche Pond	3 June 1991	3.0	0	0	0	0
Savage Harbour West	2 and 4 June 1991	0.5	0.5	2	1	0
Canavoy	3 June 1991	2.0	0	11	5	1
Lake Run	2 and 4 June 1991	2.0	0	2	1	0
St. Peter's Harbour	1 June 1991	2.0	1.0	0	0	0
Greenwich Point	9 June 1991	3.8	2.4	6	3	0
Cable Head	2 June 1991	2.1	0.1	0	0	0
Cow River	2 June 1991	0.4	0	0	0	0
Naufage	2 June 1991	2.0	0	2	1	0
Cross River	2 June 1991	1.0	0	0	0	0
Priest Pond	2 June 1991	1.9	0	0	0	0
North Lake	2 June 1991	1.7	0	0	0	0
East Lake	2 June 1991	1.5	0	0	0	0
Diligent Pond	2 June 1991	1.0	0	1	0	1
South Lake	2 June 1991	4.9	0	2	1	0
Basin Head	4 June 1991	3.2	0	0	0	0
Souris Causeway	4 June 1991	1.0	0	0	0	0
Eglington Cove	4 June 1991	1.1	1.0	2	1	0
Howe Bay	2 June 1991	1.0	1.0	2	1	0
Spry Cove	2 June 1991	1.0	0	0	0	0
Boughton Bay	2 June 1991	1.5	0	0	0	0
Launching Point	4 June 1991	1.9	0	0	0	0
Boughton Island	2 June 1991	3.2	0	0	0	0
Panmure Island	3 June 1991	2.8	0	0	0	0
Poverty Beach	8 June 1991	3.9	2.9	0	0	0
Beach Point	4 June 1991	1.0	0	0	0	0
Wood Islands	3 June 1991	1.3	1.0	0	0	0
Bell Point	3 June 1991	2.0	0	0	0	0
Gascoine Cove East	3 June 1991	1.0	0.5	0	0	0
Gascoine Cove West	3 June 1991	1.4	0.4	0	0	0
Pond Point	3 June 1991	0.3	0.2	0	0	0
Hampton	8 June 1991	1.0	0	0	0	0
Victoria	8 June 1991	0.5	0	0	0	0
Cape Traverse	6 June 1991	0.9	0.2	0	0	0
Barachois Run	6 June 1991	4.8	0.1	0	0	0
Indian Point Sand Hills	6 and 7 June 1991	7.0	2.0	0	0	0
Cedar Dunes West Spit	6 June 1991	0.5	0	0	0	0
Cedar Dunes Provincial Park	6 June 1991	2.0	0	0	0	0
Miminegash Pond	7 June 1991	2.5	0	0	0	0
Nail Pond	7 June 1991	4.5	0	1	0	1
Tignish Shore	3 June 1991	4.0	0	0	0	0
Kildare Capes	6 June 1991	2.0	0	0	0	0
East of Jacques Cartier	6 June 1991	6.4	0	5	2	1
Cascompec Sand Hills	1 June 1991	5.9	7.0	0	0	0
Conway Sand Hills	1 June 1991	14.3	3.0	8	3	2
Rocky Point	8 June 1991	0.3	0	0	0	0
Hog Island	2 June 1991	15.0	3.0	11	5	1
Cabot Provincial Park	4 June 1991	1.2	0.3	4	2	0
Darnley Point	2 June 1991	0.8	0.5	3	1	1
Cousins Pond	3 June 1991	0.7	0	2	1	0
P.E.I. National Park sites						
Cavendish Sandspit	2 June 1991	5.0	5.0	20	10	0
Rustico Island Sandspit	1 June 1991	0.3	0	0	0	0
Rustico Island Causeway	2 June 1991	1.0	0	6	3	0
Covehead Harbour	2 June 1991	3.0	0	4	2	0
Brackley Main	2 June 1991	0.2	0	0	0	0
Tracadie Beach	18 June 1991	3.4	0	0	0	0
Blooming Point	3 June 1991	7.0	7.5	16	8	0
Total		151.6	39.6	110	51	8

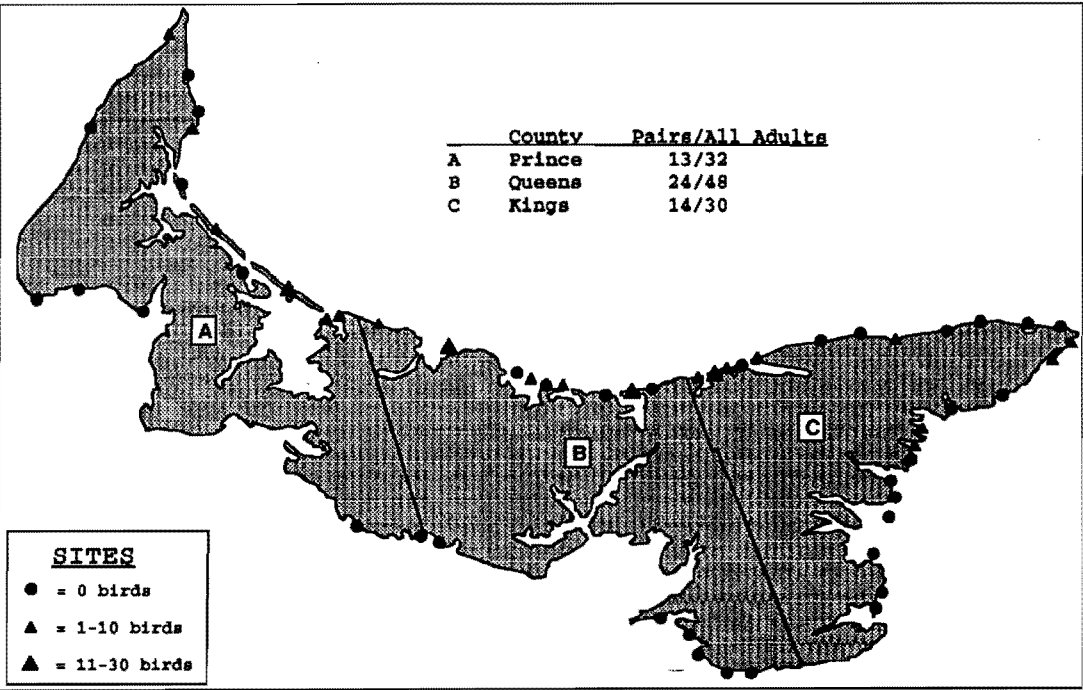
education program; and further work on food habits, nest site selection, and other innovative and proactive techniques.

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Figure 1
Distribution of Piping Plovers in Prince Edward Island, 1991



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The 1991 Piping Plover census in New Brunswick

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Abstract

In the 1991 Piping Plover *Charadrius melodus* census of New Brunswick, 203 adult plovers were counted at 24 sites. Forty-one sites were censused between 1 and 21 June 1991, primarily between 1 and 14 June. The fledging success rate for northeastern New Brunswick was 1.3 young/pair (n = 10 pairs) in 1991 and 1.5 young/pair (n = 24 pairs) in 1990. In Kouchibouguac National Park, the fledging success rate was 1.2 young/pair (n = 17 pairs) in 1991 and 1.9 young/pair in 1990. In northeastern New Brunswick (1990–91), the fledging success rate was 1.3 young/pair on disturbed sites and 1.6 young/pair on undisturbed sites. The New Brunswick population of Piping Plovers appears to be stable.

Résumé

Au cours du recensement de 1991 des Pluviers siffleurs *Charadrius melodus* réalisé au Nouveau-Brunswick, on a dénombré 203 adultes à 24 sites. Les relevés ont été réalisés à 41 sites du 1^{er} au 21 juin 1991, surtout du 1^{er} au 14 juin. Le nombre de jeunes ayant atteint l'âge de l'envol était de 1,3 par couple (n = 10 couples) dans le nord-est du Nouveau-Brunswick en 1991, et de 1,5 (n = 24 couples) en 1990. Dans le parc national Kouchibouguac, ce nombre était de 1,2 (n = 17 couples) en 1991 et de 1,9 en 1990. Par ailleurs, dans le nord-est de la province (1990–1991), il était de 1,3 aux sites non perturbés et de 1,6 aux sites perturbés. La population de Pluviers siffleurs du Nouveau-Brunswick semble stable.

Introduction

The Piping Plover *Charadrius melodus* has been censused for several years in most of its New Brunswick range. Plover censuses in Kouchibouguac National Park have been conducted for 10 years (1982–91; Tremblay et al. 1992), whereas censuses in northeastern New Brunswick have been conducted for six years (1986–91; Chiasson and Dietz 1991). Other sites in New Brunswick have been occasionally censused during 1983–91 by the Canadian Wildlife Service (B. Johnson, unpubl. data). The 1991 Piping Plover census in New Brunswick was part of the 1991 International Piping Plover Census and

the most complete Piping Plover census ever conducted in New Brunswick. Here, we report on the 1991 population assessment and on variation in fledging success over time and among different levels of human disturbance.

Methods

Site locations were determined by reviewing past census data, talking with local birders, and making visual inspections of potential breeding sites (as assessed from topographical maps). A list of 41 sites was compiled for the census, and all of these sites were visited. Volunteers were approached via presentations made at naturalist clubs and through public notices. An information workshop for volunteers, held one week prior to the census, reviewed the purpose of the census and emphasized standardizing methods and minimizing human disturbance to the birds during census activities. Censuses were conducted from 1 to 21 June between 09:00 and 17:00, with only four sites being censused after 14 June. Censuses were conducted only when visibility was good and winds were light. Most (85.4%) censuses were conducted by two or more people. If only one person conducted the census, it was an experienced individual. At least one member of each survey party had previously conducted a Piping Plover census. The two-person census technique consisted of one member walking along the edge of the dune while the other walked near the water's edge. If more than two people were involved, the others positioned themselves equidistant between the dune and water. In this way, an organized sweep was made of the beach. When Piping Plovers were spotted, the person(s) on the upper portion of the beach joined the person(s) at the water's edge. The census takers then counted the number of plovers while proceeding 100 m past the birds. They then resumed their previous spread-out census positions. Censuses were done in one direction when the number of people was sufficient to cover the entire width of the beach, eliminating any need to cover other parts of the beach on the way back. Each party had a photocopied topographical map of the beach and an Atlantic Canada Piping Plover census form. The form was completed in the field to ensure accuracy. In addition to the census, fledging success was determined for most areas by counting the number of young that survived to 20 or more days after hatching. This

Table 1
Locations and numbers of Piping Plovers found in New Brunswick, 1991

Site name	Date	Distance searched (km)	Time spent searching (h)	No. of pairs	No. of adults
Carron Point	14 June 1991	0.1	0.50	0	0
Maisonnette	8 June 1991	1.7	2.00	0	0
Ward Road South	5 June 1991	1.5	0.37	0	0
Ward Road North	5 June 1991	2.4	1.22	0	4
Lac Frye	5 June 1991	2.5	1.00	2	4
Miscou Beach	4 June 1991	3.5	1.17	1	3
Wilson Point	4 June 1991	1.7	1.08	1	3
Sandy Point	4 June 1991	1.8	0.50	1	3
Fox Dens	6 June 1991	3.2	1.17	0	0
Pigeon Hill	6 June 1991	0.3	0.63	2	5
Le Goulet	1 June 1991	2.8	1.00	3	6
Grand Passage	3 June 1991	4.5	4.20	10	20
Pokemouche South	8 June 1991	7.3	2.50	2	5
Green Point South	5 June 1991	5.3	5.00	5	10
Tracadie Dune	5 June 1991	5.5	2.00	6	12
Pointe à Bouleau	2 June 1991	3.5	3.00	6	13
Val-Comeau	1 June 1991	6.5	5.50	1	2
Cedar Road South	2 June 1991	8.0	4.08	8	16
Tabusintac Spit	6 June 1991	7.5	6.50	7	21
Neguac	4 June 1991	8.0	6.00	8	19
Portage Island NWA ^a	5 June 1991	5.8	5.00	1	2
Fox Island	6 June 1991	16.0	6.00	0	0
Huckleberry Island	6 June 1991	3.2	3.50	0	0
Egg Island	6 June 1991	0.2	1.00	0	0
Sheldrake Island	6 June 1991	1.0	1.33	0	0
Preston Beach	21 June 1991	1.6	0.63	0	1
Pointe-Sapin	21 June 1991	0.1	0.17	0	0
Kouchibouguac National Park	3–19 June 1991	25.0	35.00	15	30
South Richibucto Dune	5 June 1991	9.6	4.00	2	4
Buctouche Bar	17 June 1991	11.6	4.67	7	14
Bar de Cocagne	7 June 1991	1.3	0.75	0	0
Pointe Grande-Digue	7 June 1991	2.0	1.50	0	0
Cape Brûlé East	3 June 1991	0.3	0.50	0	0
Cape Bimet West	6 June 1991	1.2	1.00	0	0
Petit Barachois	6 June 1991	1.3	3.00	1	2
Landry East	3 June 1991	1.3	2.50	0	0
Little Cape	8 June 1991	1.0	1.00	1	2
Johnson Point	15 June 1991	1.0	1.00	0	0
Cadman Beach	8 June 1991	1.7	2.00	0	0
Waterside Beach	16 June 1991	1.0	1.00	1	2
Long Point Beach	1 June 1991	0.4	0.83	0	0
Total		164.2	125.80	91	203

^a NWA = National Wildlife Area.

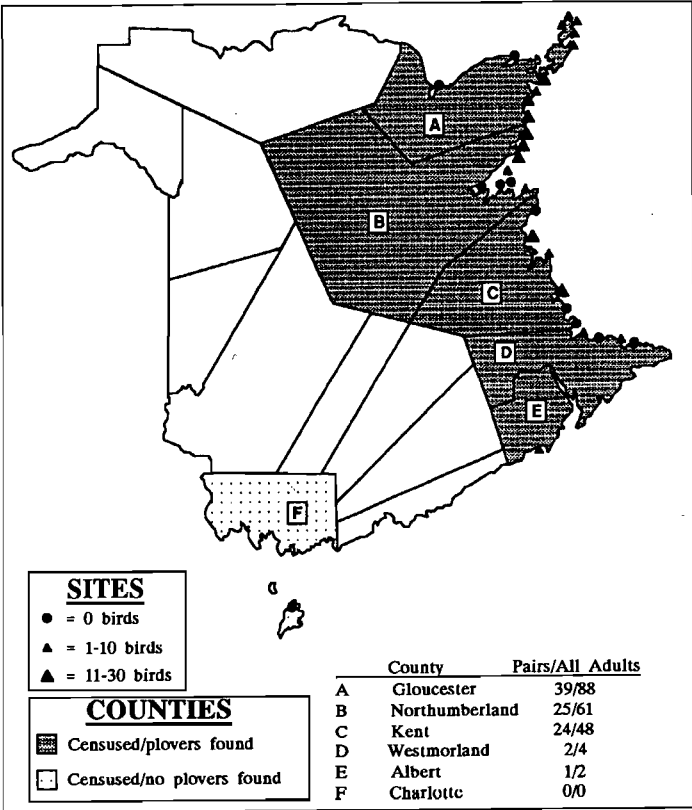
required several counts of brood size over the course of the fledging period. Only the authors or their staff were involved in determining fledging success. Human disturbance was also assessed. Disturbance levels were based on the number of vehicles and people actually seen and/or the tracks that they left in the sand (Low, 0–1; Moderate, 2–5; High, 6–10; Extreme, more than 10 vehicles and humans in nesting area per week). Volunteers did not assess human disturbance.

Results

Thirty-eight people walked 164.2 km of potential Piping Plover habitat. This required 125.8 hours of actual survey time, plus many more hours in travel to the sites. In total, 41 sites were visited and 203 individual Piping Plovers, including 91 pairs, were counted (Table 1). Nine sites had 10 or more breeding Piping Plovers, accounting for 76.4% of the New Brunswick population. These included Kouchibouguac National Park (30 birds), Tabusintac Spit (21 birds), Grand Passage (20 birds), Neguac (19 birds), Cedar Road South (16 birds), Buctouche Bar (14 birds), Pointe à Bouleau (13 birds), Tracadie Dune

(12 birds), and Green Point South (10 birds). The remainder of the population occurred on 15 other sites (Fig. 1). Northeastern New Brunswick On the northeastern coast of New Brunswick, 129 plovers were recorded in 1991, 112–114 in 1990, 86–89 in 1989 (without Miscou Island), 120–128 in 1988, and 116 in 1987 (Table 2). On 14 June, a severe storm accompanied by a tidal surge destroyed all but one nest. Post-storm censuses of most of the sites revealed a reduced number of plovers and nesting pairs. The reproductive success of 12 reneating pairs was determined in 1991. These plovers fledged an average of 1.3 young/pair. By combining fledging success data for 1990 (n = 21 pairs, 1.5 young/pair fledged) and 1991 (n = 12 pairs) for areas of documented disturbance, we found that 1.3 young/pair fledged in high-disturbance areas (n = 14 pairs), whereas 1.6 young/pair fledged in low-disturbance areas (n = 19 pairs).

Figure 1
Distribution of Piping Plovers in New Brunswick, 1991



Kouchibouguac National Park

Fifteen pairs of Piping Plovers were found in Kouchibouguac National Park during the census period. Table 3 summarizes the 1988–91 population surveys for Kouchibouguac National Park. The average number of territorial pairs (annual maximum estimate) for the period 1988–91 was 15.3. The highest was 17 pairs (only 15 pairs in the census period) in 1991, and the lowest, 13 pairs in 1988. The preferred areas for nesting were North Kouchibouguac Dune, both tips (north and south) of South Kouchibouguac Dune, and Tern and North islands.

All nests were destroyed by the high water levels of the 14 June storm. Following the storm, two additional pairs of plovers settled in the Park. Hatching success was low, at 1.7 eggs hatched/pair (n = 16 nests). Similarly, fledging success was also low, at 1.2 chicks/pair (n = 17 pairs).

Several management strategies were implemented in 1991. Two exclosures were placed on renests. Both of these nests successfully hatched. Partial or complete closure of nesting areas was also implemented to reduce or eliminate pressure from human disturbance. Finally, education about the Piping Plover was continued in 1991. Displays, outdoor theatre events, pamphlets, interpretive signs, and media broadcasts were all elements of the Piping Plover education program.

Discussion

The 1991 Piping Plover census of New Brunswick resulted in 203 adult plovers counted at 24 sites. Previous provincial estimates have ranged from 150 to 178 birds (B. Johnson, unpubl. data). Although the number of Piping

Table 2
Census results for northeastern New Brunswick, 1987–91^a

Year	No. of pairs	No. of singles	Total
1987	46	24	116
1988	53–56	14–16	120–128
1989 ^b	35–36	16–17	86–89
1990	52–53	8	112–114
1991	58	13	129

^a R. Chiasson and S. Dietz (unpubl. data).
^b Miscou Island was not censused in 1989.

Table 3
Piping Plover population estimates for Kouchibouguac National Park, 1988–91

Year	No. of pairs	No. of nests located	No. of hatched eggs per nest	No. of fledged young per pair
1988	13	9	2.6	2.2
1989	16	16	2.6	2.1
1990	15	15	3.4	1.9
1991	17	16	1.7	1.2
Mean	15.3	14.0	2.6	1.9

Plovers observed was 14% higher in 1991 than in previous years, many more sites were visited. Variation in past provincial population estimates may be due to incomplete and/or late coverage of potential sites.

Censuses for determining the provincial population size may be unreliable if done after the third week of June. Many past censuses have been conducted after this date. We have observed that some Piping Plovers, probably failed breeders, start to migrate by then. Extensive censuses in 1990 and 1991 in northeastern New Brunswick indicated that many birds had left the region by the third week of June. Therefore, the 1991 census data may not indicate a real population increase. The data suggest, for recent years at least, that the population in New Brunswick is stable.

Northeastern New Brunswick

Although the 1991 estimate of 128 plovers is among the highest estimates made to date, it likely reflects increased effort, rather than an increase in the population. The population appears to be stable in this region.

Plover breeding sites on the northeastern coast have remained relatively constant over the last five years. Extensive habitat provides ample nesting opportunity for Piping Plovers in northeastern New Brunswick (Flemming et al. 1992). Human-induced habitat change is a relatively minor concern in the coastal dune system.

Fledging success on the northeastern coast may have been negatively influenced by human disturbance over the period 1990–91. Further, overall fledging success was lower in 1991 than in 1990 because of a storm-driven flood tide. Factors such as late-season storm tides (Flemming 1992a), human disturbance (Flemming et al. 1988; Strauss 1990), and predation (Strauss 1990; MacIvor 1990) can combine to significantly depress the productivity of Piping Plovers in some years. The 1991 breeding season was such a year on the northeastern coast of New Brunswick.

Kouchibouguac National Park

Although the Park population appears to be stable, ranging from 13 to 17 pairs over the period 1988–91, the conservation goal for Kouchibouguac National Park is to achieve 18 breeding pairs. It is unclear whether this goal can be met, but high fledging success is encouraging. The average hatching success rate for 1988–91 was 2.6 eggs/nest, and the mean fledging success rate for the same period was 1.9 young/pair. The goal of the National Park Piping Plover Recovery Plan (Corbett 1988a) is a productivity rate of two young/pair. The mean fledging rate at Kouchibouguac National Park has nearly met the goal and should be high enough to be contributing to an expanding population of Piping Plovers (C. Griffin and S.M. Melvin, pers. commun.).

In 1991, only 1.2 young fledged per pair. This low fledging success could have been the result of the major storm that struck the coast on 14 June and destroyed all the nests in the Park. The delay in the nesting chronology caused by the storm coincided with peak visitor season and may have resulted in increased human disturbance.

All the data collected between 1982 and 1991 on the locations of nests were digitized, and a spatial analysis was done with a SPANS Geographic Information System (Tremblay et al. 1992). The analysis showed that the areas most used by nesting Piping Plovers over that period were also the most unstable. The majority of the nests were found in washovers or at highly exposed areas that were subject to frequent flooding and high winds. These areas may have constituted better habitat for the Piping Plover because of their stony and pebbled substrate, which is characteristic of unstable sections of dunes (Flemming et al. 1992).

From 1989 to 1991, five nest exclosures were used in the Park to protect nests from predators. Four of these five nests were successful, but one was vandalized by one or more persons who took three eggs. Further experiments with the use of exclosures are planned for the future. In addition to continuing education programs, it is also hoped that greater human resources can be devoted to resource conservation for the protection and monitoring of this endangered bird.

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Recensement du Pluvier siffleur au Québec, en 1991

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Résumé

Un inventaire systématique des habitats potentiels du Pluvier siffleur *Charadrius melodus* au Québec a été effectué en 1991 dans le cadre du recensement international des Pluviers siffleurs de 1991. L'inventaire a permis de couvrir une superficie de 203 km répartie sur trois régions. Aucun Pluvier siffleur n'a été recensé dans les régions de la Basse Côte-Nord et de la Gaspésie, bien que l'espèce y ait été historiquement présente. Dans l'archipel des Îles-de-la-Madeleine, compte tenu de la présence de 38 nids au début de la saison de reproduction, la population a été évaluée à 76 individus. En regard des données antérieures, ces résultats illustrent la diminution de l'aire de répartition de l'espèce au Québec et l'amorce d'une stabilité des effectifs pour les Îles-de-la-Madeleine à partir de 1987.

Abstract

A systematic survey of the potential habitat of Piping Plovers *Charadrius melodus* in Quebec was carried out in 1991 as part of the 1991 International Piping Plover Census. The inventory covered an area of 203 km in three regions. There were no sightings of Piping Plovers in the Lower North Shore or the Gaspé, despite their historical presence in the two regions. In the Îles-de-la-Madeleine (Magdalen Islands), the population was estimated at 76 birds on the basis of 38 nests inventoried at the beginning of the breeding season. A comparison of these results with previous data shows that the range of the Piping Plover in Quebec has declined and that its numbers began to stabilize in the Îles-de-la-Madeleine in 1987.

Introduction

Dans le cas d'une espèce en danger de disparition, une bonne estimation des effectifs totaux de sa population constitue une étape préliminaire à l'élaboration de moyens d'action visant à assurer son rétablissement. Le recensement international des Pluviers siffleurs de 1991 a donc été planifié de façon à obtenir l'image la plus exacte possible de la répartition actuelle de l'espèce *Charadrius melodus* ainsi qu'une estimation de sa population aussi bien dans les territoires de reproduction que les lieux d'hivernage. Au Québec, le Pluvier siffleur se retrouve à la limite

septentrionale de son aire de reproduction. Néanmoins, la présence de l'espèce n'y est pas récente. Les premières mentions d'observation du Pluvier siffleur au Québec sont parmi les plus anciennes en Amérique du Nord, et l'espèce est régulièrement signalée aux Îles-de-la-Madeleine depuis le milieu du siècle dernier (Fradette 1992).

Historiquement, le Pluvier siffleur se rencontrait dans les régions de la Basse Côte-Nord, de la Gaspésie et des Îles-de-la-Madeleine. Cependant, ce n'est qu'au cours de la dernière décennie que l'on a déployé des efforts afin de mieux connaître sa population, alors que cette dernière montrait déjà des signes de déclin en Amérique du Nord. Ces efforts ont porté principalement sur la région des Îles-de-la-Madeleine. Ainsi, en 1979, Winifred Cairns a effectué un inventaire des plages des Îles-de-la-Madeleine (Cairns et McLaren 1980); en 1983, un inventaire similaire a été réalisé, qui semblait indiquer une diminution de la population (Yves Aubry, commun. pers.).

Des inventaires systématiques des habitats de nidification potentiels du Pluvier siffleur ont été effectués aux Îles-de-la-Madeleine en 1987 (Shaffer et Pineau 1987) et, en 1988, sur la Basse Côte-Nord et en Gaspésie (Demers et Laporte 1988). Ces inventaires ont été repris en 1991 dans le cadre du recensement international des Pluviers siffleurs. Le présent document fournit les résultats du recensement de 1991 et résume les données antérieures connues pour la province de Québec. Ces informations sont analysées de façon à faire ressortir la tendance actuelle de la population de cette espèce en danger de disparition.

Méthodes

Pour les trois grandes régions où l'espèce était susceptible d'être rencontrée, nous avons examiné les cartes d'habitats potentiels pour les oiseaux migrateurs (Dryade 1980). Ces cartes sont le résultat d'un travail de photo-interprétation et permettent de classer différents types d'habitats en fonction des oiseaux de ce type. Dans l'analyse de ces cartes, nous avons retenu les habitats constitués de plages sablonneuses. Pour la région de la Basse Côte-Nord, l'examen des cartes a porté sur la distance s'étendant de Sept-Îles jusqu'à Blanc-Sablon, soit 277 km d'habitat. Pour la Gaspésie, la région retenue s'étendait de la presqu'île de Penouille jusqu'au fond de la baie des Chaleurs, soit 68 km d'habitat. Le recensement de ces deux

Tableau 1
Résultats du recensement international des Pluviers siffleurs dans la région de la Basse Côte-Nord, 1991

Emplacement	Longueur (km)	Date de l'inventaire	Longueur inventoriée (km)	N ^a
Plage est, Rivière-Brochu	6,7	nil	nil	-
Plage Sainte-Marguerite, Sept-Îles	1,7	6 juin	1,7	0
Baie de la Boule, Sept-Îles	5,7	3 juin	5,7	0
Moisie	1,0	6 juin	1,0	0
Matamec	4,5	6 juin	4,5	0
Rivière-aux-Graines	5,6	4 juin	2,6	0
Rivière Saint-Jean	1,8	4 juin	1,0	0
Longue-Pointe	4,0	4 juin	3,3	0
Baie de Mingan, Mingan	9,0	4 juin	9,0	0
Pointe Matsitew, Mingan	1,5	6 juin	1,3	0
Pointe du Curé, Mingan	3,2	6 juin	2,8	0
Pashashibou	3,3	5 juin	3,3	0
Aguanish	7,2	5 juin	7,2	0
Natashquan	6,8	5 juin	6,8	0
Île Sainte-Hélène	0,8	5 juin	0,8	0
Pointe du Vieux Poste	3,5	5 juin	3,5	0
Chevery	2,0	5 juin	2,0	0
Total	68,3		56,5	0

^a Nombre d'individus recensés.

régions fut coordonné par le ministère du Loisir, de la Chasse et de la Pêche du Québec, selon son ancienne désignation (Lebel et Brault 1992). Enfin, l'ensemble de l'archipel des Îles-de-la-Madeleine a été retenu, soit 127 km de plage. Les trois régions ont été divisées en unités géographiques en fonction de l'aspect physiographique de l'habitat.

À l'exception de la Basse Côte-Nord où un hélicoptère a été utilisé, les déplacements vers les différentes unités étaient effectués en automobile ou en bateau. Cependant toutes les unités ont été parcourues à pied par deux observateurs. Ces derniers marchaient en parallèle, l'un près de la dune et l'autre près de la ligne des hautes eaux. Aux endroits qui s'étendaient sur une plus grande largeur, les observateurs parcouraient la plage en zigzag afin de couvrir toute la surface. Les quelques plages plus courtes et étroites ont été parcourues par un seul observateur. Pour chaque unité, la nature du substrat, la pente et la présence de cailloux sur la plage étaient notées, de même que les signes de dérangements pouvant affecter les oiseaux.

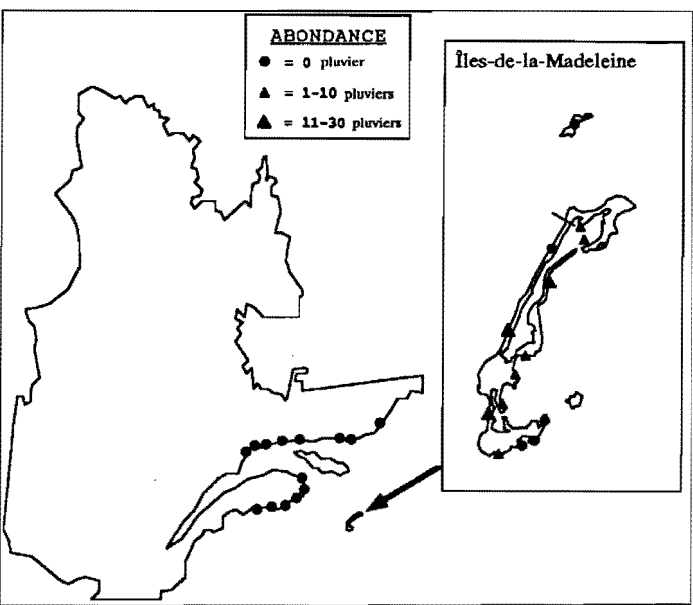
Cette méthode d'inventaire a été appliquée en 1987 pour l'archipel des Îles-de-la-Madeleine, et en 1988 pour la Gaspésie et la Basse Côte-Nord. Elle a été reprise intégralement en 1991 dans le cadre du recensement international. En raison de l'importance du territoire des Îles-de-la-Madeleine, deux inventaires ont été effectués en 1991: le premier a été fait dans le cadre d'un programme de recherche sur la reproduction du Pluvier siffleur aux Îles-de-la-Madeleine; le second a été effectué en une seule journée, le 16 juin 1991, avec la collaboration de 46 membres du Club d'ornithologie des Îles-de-la-Madeleine.

Résultats

Basse Côte-Nord

Les unités géographiques présentant des habitats potentiels pour le Pluvier siffleur sont indiquées au tableau 1 et à la figure 1. L'inventaire de la région de la

Figure 1
Répartition du Pluvier siffleur au Québec, 1991



Basse Côte-Nord a été réalisé du 3 au 6 juin 1991. Cet inventaire a couvert près de 85 % de l'habitat potentiel dans cette région. Seule la plage à l'est de Rivière-Brochu n'a pas été recensée; à cause du dérangement humain, il est peu probable qu'on y aurait trouvé des Pluviers siffleurs. Sur l'ensemble de ces plages, aucun Pluvier siffleur n'a été observé (Lebel et Brault 1992).

Gaspésie

L'inventaire de la région de la Gaspésie a été effectué du 7 au 9 juin 1991. Cet inventaire a couvert tout l'habitat considéré comme acceptable entre la presqu'île de Penouille et le fond de la baie des Chaleurs (tableau 2, fig. 1). Dans cette région également, aucun Pluvier siffleur n'a été dénombré (Lebel et Brault 1992).

Îles-de-la-Madeleine

Dans l'archipel des Îles-de-la-Madeleine, les deux inventaires réalisés en 1991 ont couvert la totalité de l'habitat disponible (tableau 3, fig. 1). Du 12 mai au 7 juillet, tous les habitats potentiels ont fait l'objet de plusieurs visites. Les résultats cumulatifs de ces visites ont permis d'établir avec précision le nombre de couples reproducteurs pour chaque plage. Les effectifs signalés pour l'inventaire de cette région sont basés sur le nombre de nids de première ponte repérés. La présence de certains individus isolés n'ayant pas été confirmée au cours de visites subséquentes, nous avons présumé que ces derniers étaient des reproducteurs temporairement absents de leur territoire: ils n'ont donc pas été dénombrés. Au total, 76 reproducteurs ont été dénombrés. Le second inventaire, effectué le 16 juin 1991, a couvert, en une seule journée, l'ensemble des plages des Îles-de-la-Madeleine, à l'exception de celles de l'île Brion. Vingt-deux couples et 17 individus isolés ont été dénombrés. Cependant, quelques jours auparavant, soit le 14 juin, une importante tempête, accompagnée de la plus forte marée de la saison, avait détruit 12 des 38 nids présents. Ce fait explique probablement pourquoi la plupart

Tableau 2

Résultats du recensement international des Pluviers siffleurs dans la région de la Gaspésie, 1991

Emplacement	Longueur (km)	Date de l'inventaire	Longueur inventoriée (km)	N ^a
Barre de Sandy Beach, Gaspé	4,7	8 juin	3,5	0
Plage Haldimand, Douglastown	2,5	7 juin	2,5	0
Coin-du-Banc, Barachois	9,0	8 juin	5,0	0
Plage du Grand Pabos, Chandler	1,3	8 juin	1,3	0
Anse aux Îlots, Newport	0,9	8 juin	0,9	0
Paspébiac	2,0	8 juin	2,0	–
New-Carlisle	1,6	8 juin	0,5	0
Bonaventure	2,1	8 juin	1,5	0
Île Laviolette, Saint-Omer	2,5	9 juin	2,0	0
Île aux Groseilles, Saint-Omer	0,7	9 juin	0,7	0
Total	27,3		19,9	0

^a

Nombre d'individus recensés.

des individus isolés ont été observés à cette date. La même année, un nid a été trouvé à l'île Brion; cependant, ce nid a été considéré comme un nid de remplacement à cause de la date tardive de découverte des oeufs.

Analyse

Basse Côte-Nord

Les résultats de 1991 confirment l'absence du Pluvier siffleur dans la région de la Basse Côte-Nord. En 1988, aucun Pluvier siffleur n'avait été signalé à la suite d'un inventaire exhaustif (Demers et Laporte 1988). Dans cette région, la dernière mention de nidification du Pluvier siffleur remonte à 1986, année où un nid contenant quatre oeufs a été découvert sur la plage à Chevery (C. Drolet, commun. pers.). Cependant, la présence de l'espèce sur la Basse Côte-Nord remonte au début du siècle. Des nids étaient en effet régulièrement trouvés dans la région de Natashquan, soit durant les années 1909 et 1912 (Townsend 1913), 1915 (Townsend 1917), 1928 (Lewis 1928; Todd 1963), 1932 (Lewis 1934). L'occupation de ce secteur semble avoir été régulière dans la première moitié du XX^e siècle. La difficulté d'accès de la région en a limité l'exploration. D'autres mentions proviennent de la région de Sept-Îles et de Moisie en 1947 et 1982 (Todd 1963; Club des ornithologues du Québec 1982; David et Gosselin 1983). Des observations au cours de la période de reproduction dans les régions de Havre-Saint-Pierre et de Mingan en 1979 et 1981 (Club des ornithologues du Québec 1981; Gosselin et David 1981) laissent croire que l'espèce a pu s'y reproduire.

Bien que la région de la Basse Côte-Nord se situe à la limite nord de l'aire de répartition du Pluvier siffleur, l'espèce y a été observée de façon régulière jusqu'à ces dernières années. Cette région est demeurée longtemps isolée, n'étant accessible qu'en avion et en bateau jusqu'en 1973, année où le réseau routier local a été relié à celui du reste de la province. L'utilisation des véhicules tout-terrain et la multiplication des lieux de villégiature dans cette région ont probablement contribué à l'extirpation du Pluvier siffleur de ce secteur. Il est également possible que la diminution générale des effectifs de la population de

Tableau 3

Résultats du recensement international des Pluviers siffleurs aux Îles-de-la-Madeleine, 1991

Emplacement	Longueur (km)	Nombre de reproducteurs en 1991	Inventaire du 16 juin	
			Individus isolés	Individus en couple
Dune Sandy Hook	12,2	0	0	0
Plage du Havre	4,4	0	0	0
Dune du Bassin	3,2	0	0	0
Plage de l'Ouest	11,0	16	3	10
Plage de La Martinique, Havre-Aubert	12,6	4	2	6
La Digue	2,1	2	0	0
La Pointe	1,5	2	0	0
Plage de l'Hôpital, Dune du Nord	17,5	12	2	2
Dune du Nord	16,4	0	0	0
Dune du Sud	19,9	18	5	10
Pointe de l'Est	19,5	4	1	4
Bassin aux Huîtres (est)	1,7	4	1	4
Bassin aux Huîtres (ouest)	0,6	0	0	0
Pointe de la Grande-Entrée	0,8	0	0	0
Îlot B	–	4	1	2
Îlot C	–	10	2	6
Île Brion	3,5	0	–	–
Total	126,9	76	17	44

Pluviers siffleurs ait entraîné une régression de son aire de reproduction et son retrait consécutif de la région limitrophe de la Basse Côte-Nord.

Gaspésie

Aucun Pluvier siffleur n'a été observé en Gaspésie lors des inventaires de 1988 et de 1991. La dernière mention de nidification du Pluvier siffleur remonte à 1973. Depuis, aucun individu n'a été signalé dans la région malgré une augmentation du nombre d'observateurs d'oiseaux qui la fréquente. La première mention de nidification du Pluvier siffleur remonte à 1929, année où quatre oeufs ont été récoltés à des fins muséologiques (Bell 1978). En 1955, des observations effectuées en période de reproduction laissent croire que l'espèce aurait niché à Coin-du-Banc (Province of Quebec Society for the Protection of Birds 1955). De 1968 à 1973, certains individus nicheurs ont été observés dans les régions de Paspébiac et de Carleton.

Ces données sur la nidification indiquent que l'espèce se reproduisait régulièrement dans la région de la baie des Chaleurs. L'utilisation des plages pour la baignade y est très importante, car l'économie locale est grandement basée sur le tourisme. Le dérangement sur les territoires de reproduction a probablement provoqué le retrait du Pluvier siffleur de la région.

Îles-de-la-Madeleine

La première mention d'observation de Pluviers siffleurs aux Îles-de-la-Madeleine date du 11 juin 1833, lors du passage de John James Audubon dans l'archipel (Audubon 1840). Par la suite, la présence du Pluvier siffleur a été notée par plusieurs visiteurs de la fin du XIX^e siècle et du début du XX^e siècle (annexe 1).

Plus récemment, différentes estimations de la population de Pluviers siffleurs aux Îles-de-la-Madeleine ont été faites. En 1969, la population était évaluée à 50 couples (Strauch 1971). En 1970 et en 1971, on

Tableau 4

Résultats des différents inventaires du Pluvier siffleur effectués aux Îles-de-la-Madeleine

Plage	Nombre d'individus recensés					
	1979	1983	1987	1989	1990	1991
Dune Sandy Hook	4	0	0	0	2	0
Plage du Havre	0	0	0	0	0	0
Dune du Bassin	–	0	0	0	0	0
Plage de l'Ouest	8	9	6	14	12	16
Plage de La Martinique, Havre-Aubert	2	6	14	8	2	4
La Digue	0	0	2	0	0	2
La Pointe	0	0	2	4	4	2
Plage de l'Hôpital	3	10	10	10	12	12
Dune du Nord	2	1	2	0	0	0
Dune du Sud	17	6	16	14	18	18
Pointe de l'Est	1	2	4	2	4	4
Bassin aux Huîtres (est)	4	1	2	2	2	4
Bassin aux Huîtres (ouest)	–	0	0	0	0	0
Pointe de la Grande-Entrée	–	0	0	0	0	0
Îlot B	–	–	6	6	4	4
Îlot C	–	–	10	10	10	10
Île Brion	–	–	0	0	0	0
Total	41	35	74	70	70	76

présumait la population à plus de 250 individus durant les mois de juillet et août, qui correspondent à l'époque où les jeunes sont sur le point de prendre leur envol (McNeil et al. 1973). Au milieu des années 1970, Mousseau et al. (1976) estimaient que la population reproductrice se situait entre 50 et 70 couples. Il y a lieu toutefois d'indiquer que ces présomptions proviennent d'une appréciation globale de la situation et qu'elles ne s'appuient pas sur un inventaire systématique.

Un inventaire plus systématique, effectué en 1979, a permis d'évaluer les effectifs à une trentaine de couples (Cairns et McLaren 1980). En 1983, un autre inventaire systématique des plages permet de recenser une vingtaine de couples tout au plus (David 1983; Yves Aubry, commun. pers.). En 1987, un inventaire exhaustif ayant couvert toutes les plages a révélé la présence de 37 couples (Shaffer et Pineau 1987). Par la suite, en 1989 et 1990, un total de 35 couples ont été recensés lors d'inventaires du même type (Shaffer et Laporte 1989, 1990). Finalement en 1991, la présence de 38 couples a fait ressortir une tendance à la stabilité de la population. Le tableau 4 présente les résultats de ces inventaires pour chacune des plages de l'archipel.

Les valeurs issues des résultats des inventaires effectués en 1979 par Cairns (Cairns et McLaren 1980) et en 1983 par Y. Aubry (commun. pers.) sont inférieures aux valeurs actuelles. La méthodologie employée par les auteurs des deux communications susmentionnées se rapproche de celle à laquelle on a eu recours depuis 1987. Les plages ont été parcourues à pied par un observateur seul ou deux observateurs jumelés, et à l'occasion en véhicule tout-terrain dans le cas de W.E. Cairns (commun. pers.). Nos travaux ont montré que plus d'une visite par plage est nécessaire pour repérer tous les couples. De plus, les îlots B et C ont été construits en 1980 et 1981 à la suite de travaux de dragage dans la lagune. C'est donc dire que ces îlots n'existaient pas lors de l'inventaire de 1979. De plus, ces îlots n'ont pas été visités lors de l'inventaire de 1983.

Les inventaires de 1987 à 1991 sont basés sur des visites répétées aux plages alors que ceux de 1979 et 1983 sont basés sur une seule visite de chaque secteur. En 1987, trois inventaires successifs, faits du 30 mai au 21 juillet, ont

permis de dénombrer respectivement 57, 73 et 51 individus. Il existe un rapport d'efficacité quantifiable entre les résultats de ces inventaires et le dénombrement des couples reproducteurs effectué à la suite de chacun d'eux. Si l'on omet le dernier inventaire réalisé à des dates tardives, à une époque où des oiseaux auraient pu avoir quitté les territoires de reproduction, les rapports d'efficacité des premier et second inventaires ont été établis respectivement à 1,30 et 1,01. On peut également calculer un rapport d'efficacité similaire en 1991 entre le nombre de reproducteurs recensés et l'inventaire d'une seule journée : ce rapport a été établi à 1,25. Cette dernière valeur permet d'estimer l'efficacité d'un seul inventaire en vue d'un dénombrement total de la population. Après application d'un facteur de correction de 1,30 aux inventaires de 1979 et 1983, on obtient respectivement 53 et 46 individus, valeurs qui demeurent encore bien inférieures à celles provenant des inventaires récents. Il y a donc lieu de croire que la population de Pluviers siffleurs des Îles-de-la-Madeleine était, vers les années 1980, inférieure à ce qu'elle est actuellement.

Malheureusement, les données fragmentaires que nous possédons ne permettent pas d'évaluer la taille de la population de Pluviers siffleurs du point de vue historique aux Îles-de-la-Madeleine avant 1979. Si l'on accepte les présomptions basées sur les estimations faites durant les années 1970, la différence entre les résultats obtenus à cette époque et ceux provenant des inventaires actuels pourrait être interprétée comme un indice d'une baisse de la population. Cette baisse pourrait être associée aux dérangements sur les lieux de reproduction et d'alimentation. L'utilisation des plages, autant par les baigneurs que par les véhicules motorisés, s'est en effet accrue de façon importante aux Îles-de-la-Madeleine. Au cours de ces années, le nombre de touristes a également augmenté considérablement, avant de connaître une nouvelle augmentation de 63 % durant la période 1975–1991 (Association touristique régionale, commun. pers.). Par ailleurs, on peut également interpréter la tendance à la hausse récente des effectifs comme étant le résultat d'un déplacement d'oiseaux en provenance d'autres régions. Les données provenant de la Nouvelle-Écosse indiquent en effet une perte de 15 à 20 couples reproducteurs entre 1983 et 1987 (Flemming et al. 1988).

Depuis 1989, une campagne d'information et de sensibilisation se poursuit afin de favoriser le rétablissement de l'espèce. Cette initiative a permis de réduire de façon importante la destruction et le dérangement des sites de nidification. Le taux de productivité de la population de Pluviers siffleurs des Îles-de-la-Madeleine est évalué à près de 1,4 jeune par couple (n = 63), à l'âge de l'envol (Shaffer et Laporte 1992). Ce taux de productivité semble être suffisant pour assurer la stabilité de la population. Par contre, la période d'élevage des jeunes avant l'envol demeure un facteur limitant dans la dynamique de la population de Pluviers siffleurs. Les facteurs de dérangement ont une influence sur le comportement des jeunes (Flemming et al. 1988) et sur la productivité des couples (Cairns 1977, 1982; Flemming 1984). Si l'on peut réduire le dérangement dans les zones d'alimentation durant cette période, il sera permis d'espérer atteindre les objectifs d'augmentation de la population et de capacité de support du milieu.

L'habitat du Pluvier siffleur aux Îles-de-la-Madeleine offre des caractéristiques intéressantes. La diversité des

prédateurs susceptibles d’affecter la population y est en effet réduite du fait du caractère insulaire de l’habitat. Les immenses lagunes offrent des zones d’alimentation supplémentaires, et le dynamisme des dunes permet d’assurer un renouvellement de l’habitat. Une analyse de l’habitat disponible et de l’occupation des territoires de reproduction permet de croire que la capacité de support du milieu se situerait à environ 65 couples (Shaffer et Laporte 1992).

Remerciements

Plusieurs personnes ont participé à la réalisation de l’un ou l’autre des inventaires de Pluviers siffleurs. Nous tenons à souligner particulièrement la contribution de M^{me} Winifred (Cairns) Wake et de M. Yves Aubry, qui ont fait oeuvre de pionnier. Nous les remercions chaleureusement de nous avoir donné accès à leurs carnets d’observations sur le terrain et de nous avoir fourni de précieux commentaires sur le présent document. De plus M. Aubry a eu l’amabilité de nous faire partager les résultats de son enquête auprès de divers musées d’histoire naturelle sur les collections de spécimens d’oiseaux effectuées aux Îles-de-la-Madeleine.

Il faut également souligner le travail de MM. Jean-Pierre Lebel et Michel Brault, du ministère de l’Environnement et de la Faune du Québec, ainsi que celui de M. Alain Demers, qui ont eu le courage d’inventorier un important territoire dans les régions de la Basse Côte-Nord et de la Gaspésie, sans avoir eu l’occasion en retour de dénombrer un seul Pluvier siffleur.

Nous tenons par ailleurs à signaler le travail tout empreint de persévérance de M^{mes} Nathalie Poirier et Chantal Pineau lors des inventaires effectués aux Îles-de-la-Madeleine depuis 1987. Nous remercions également les membres du Club d’ornithologie des Îles-de-la-Madeleine pour leur participation au recensement de 1991, et plus particulièrement M^{me} Bernise Leblanc, qui a assuré la coordination de cette activité.

Nos remerciements s’adressent également à M. Stephen Flemming pour son aide et ses observations judicieuses dans l’élaboration du présent rapport. Enfin, mentionnons que l’inventaire de 1987 n’aurait pu être réalisé sans le soutien financier de la Société québécoise pour la protection des oiseaux et ceux de 1989 à 1991, sans l’aide financière du Fonds mondial pour la nature Canada et de l’Association québécoise des groupes d’ornithologues.

Annexe 1		
Résumé des informations sur la présence du Pluvier siffleur aux Îles-de-la-Madeleine		
Année	Commentaires	Références
1833	<i>many that were paired and had eggs</i> (Trad.) un grand nombre d’individus observés en couple, avec une nichée	Audubon 1940
1873	deux spécimens mâles et adultes	Bell 1978 et American Museum of Natural History
1878	<i>an abundant species</i> (Trad.) une espèce abondante	Cory 1878
	Spécimens	Field Museum of Natural History of Illinois
1882	Spécimens	Field Museum of Natural History of Illinois
1887	<i>more common than the last (Semipalmated Plover), and breeding in the same situations</i> (Trad.) plus commune que la dernière espèce (Pluvier semipalmé) et présentant les mêmes conditions de nidification	Bishop 1889
	Deux spécimens (un mâle et une femelle adultes)	Bell 1978 et United States National Museum of Natural History
	<i>common on Amherst Island, Magdalens</i> (Trad.) espèce commune à l’île Amherst (anc. nom de l’île du Havre-Aubert), Îles-de-la-Madeleine	Palmer 1890
	Spécimens	Field Museum of Natural History of Illinois
1897	<i>numerous, four nests</i> (Trad.) espèce nombreuse, quatre nids repérés	Young 1897
	Quatre oeufs recueillis	Bell 1978
1898	Spécimens	Field Museum of Natural History of Illinois
1900	<i>Piping and Ring-necked Plover were breeding abundantly on the long sand-bar between Grand Entry and Grindstone</i> (Trad.) Le Pluvier siffleur et le Pluvier semipalmé nichaient en grand nombre sur la barre située entre l’île de Grande Entrée et Cap-aux-Meules	Job 1901
1901	Trois spécimens (un mâle et deux femelles adultes)	Carnegie Museum of Natural History
1908	Spécimens	Field Museum of Natural History of Illinois
1909	Spécimen (un mâle adulte)	Bell 1978 et American Museum of Natural History
	Spécimens (un mâle et une femelle adultes, deux jeunes)	Cornell University
	Spécimen (jeune)	Museum of Vertebrate Zoology of University of California
1911	<i>nesting, summering</i> (Trad.) nichant, estivant	Moore 1912
1926	Six oeufs (deux oeufs d’une ponte de quatre et quatre de quatre)	Carnegie Museum of Natural History
1927	<i>A few Semi-palmated and Piping Plovers still breed about Grosse Isle and along the shores of the "Lagoon" towards Grand-Entry, but in much reduced numbers.</i> (Trad.) Quelques Pluviers semipalmés et Pluviers siffleurs nichent toujours à proximité de la Grosse Île et le long du rivage de la « lagune » de la Grande Entrée, quoique en plus petit nombre.	Young 1931
1934	<i>very common along the sandy beaches of Amherst Island where it probably breeds</i> (Trad.) espèce très commune le long des plages sablonneuses de l’île Amherst, où elle niche probablement	Gross 1937
1939	<i>very plentiful, and nest</i> (Trad.) très abondante, et effectifs nicheurs	Harrison 1940
1949	« voit sept »	Hagar 1949
1956	« un individu seul, les 6, 7 et 14 août »	Gaboriault 1961
1958	« un, le 19 août »	Gaboriault 1961

The 1991 Piping Plover census in Ontario

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Abstract

Former breeding locations of the Piping Plover *Charadrius melodus* in Ontario were censused as part of the 1991 International Piping Plover Census. Five adult birds were observed on 6 June on the Sable Islands, Lake of the Woods. Two young were successfully fledged. The Piping Plover population on the Sable Islands appears to be stable, whereas the last recorded nesting attempt on nearby Windy Point occurred in 1989.

Résumé

Dans le cadre du recensement international des Pluviers siffleurs de 1991, on a effectué des relevés aux endroits où les Pluviers siffleurs *Charadrius melodus* avaient déjà niché dans le passé. On a observé cinq pluviers adultes le 6 juin sur les îles Sable du lac des Bois. Deux jeunes ont atteint l'âge de l'envol. La population de Pluviers siffleurs des îles Sable semble être stable tandis que la dernière tentative de nidification signalée à la pointe Windy, située près de ces îles, remonte à 1989.

Introduction

An intensive survey of former breeding locations of the Piping Plover *Charadrius melodus* in Ontario was conducted during 1991 as part of the International Piping Plover Census. Former breeding locations along the Lake Erie shoreline and known breeding locations at Lake of the Woods, Ontario, were surveyed as part of this census. Here, I describe the 1991 census results and, where possible, relate historical numbers and distribution of the Piping Plover in Ontario. Lastly, a brief examination is made of available habitat and threats to the species' continued existence in the province.

Methods

Three locations in Ontario were censused. Long Point Beach on Lake Erie was censused on 12 June 1991 (10:00–14:00). Approximately 25 km of suitable habitat were covered by all-terrain vehicle (ATV) or on foot.

Two known plover nesting sites on the Ontario portion of Lake of the Woods were also censused. Windy Point and the Sable Islands Provincial Nature Reserve were surveyed on 5 June (16:00–18:00) and 6 June (9:30–14:30), respectively. These sites were accessed by boat. The entire length of the Sable Islands (6 km) was walked, and approximately 1 km of suitable habitat at the tip of Windy Point was covered on foot. In addition, a notice placed in the *Journal of the Ontario Field Ornithologists* requested sightings of Ontario Piping Plovers.

Results

Piping Plovers were located at only one of the three sites censused (Table 1, Fig. 1). Five adults were observed at the Sable Islands Provincial Nature Reserve. All birds appeared to be territorial; census takers elicited distress calls and broken wing displays. No attempt was made to locate actual nest sites. Piping Plovers were not found at Windy Point (Lake of the Woods) or at Long Point (Lake Erie). The Sable Islands Provincial Nature Reserve was again censused on 26 July to determine fledging success. One adult and two fledged young were present at this time (Table 2). Earlier surveys indicate that the plover numbers and fledging success rates on the Sable Islands have remained relatively constant (Table 2).

Discussion

Piping Plovers were once widespread throughout the Great Lakes region, with approximately 150 breeding pairs estimated (Cadman et al. 1987). Significant population declines occurred during the 1960s and 1970s, with the last known breeding in southern Ontario occurring in 1977 at Long Point Beach on Lake Erie. Piping Plovers are still sighted almost annually at Long Point and Turkey Point beaches (M. Bradstreet, pers. commun.). However, these birds appear to be transients, as they do not remain at these sites during the breeding season.

Several explanations have been put forward to explain the population decline, including the increasing use of beach habitat for recreational purposes. The destruction of nests and young by pedestrian and vehicular traffic and the disturbance of nesting birds by recreationists are the

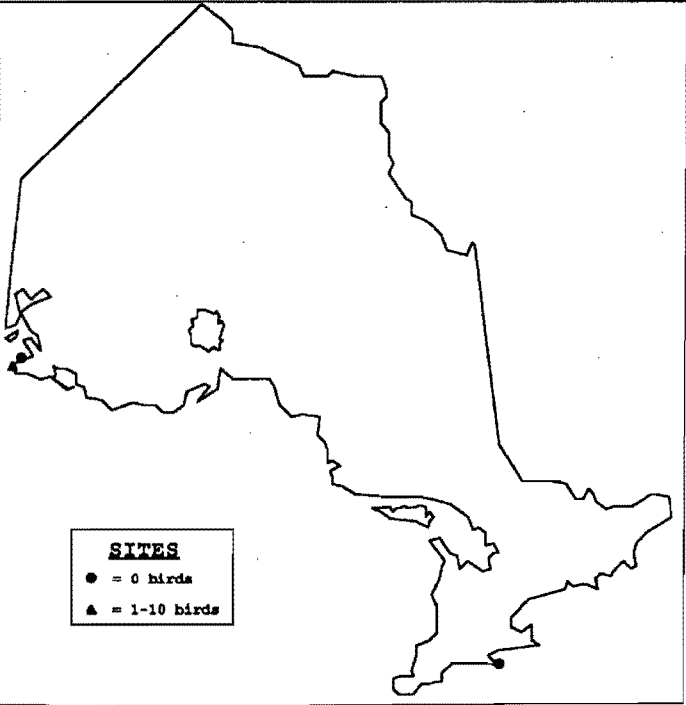
Table 1 Locations and numbers of Piping Plovers found in Ontario, 1991				
Date	Map sheet	Site location	Distance searched (km)	No. of adults
5 June 1991	52 D/15	Windy Point (Lake of the Woods)	1	0
6 June 1991	52 D/15	Sable Islands (Lake of the Woods)	6	5
12 June 1991	40 I/9	Long Point (Lake Erie)	25	0

Table 2 Number of Piping Plovers observed at Lake of the Woods, Ontario, 1938–91 ^a				
Year	Sable Islands		Windy Point	Total
	No. of adults	No. of young	No. of adults	No. of adults
1938	6	n.d. ^b	n.d.	6+
1974	5	n.d.	n.d.	5+
1975	0	n.d.	n.d.	0
1978	5	n.d.	n.d.	5+
1979	2	n.d.	4	6
1980	3	n.d.	n.d.	3+
1981	4	n.d.	n.d.	4+
1983	2	2	n.d.	2+
1986	6	n.d.	n.d.	6+
1987	5	1	5	10
1988	3	3	n.d.	3+
1989	6	7	2	8
1990	4	1	0	4
1991	5	2	0	5

^a Adapted from Lambert and Risley (1989).

^b n.d. = No data were collected.

Figure 1
Distribution of Piping Plovers in Ontario, 1991



main concerns. It has also been suggested that increasing numbers of natural predators have contributed to the decline (Cairns and McLaren 1980).

A small population of Piping Plovers continues to breed on Lake of the Woods in the extreme northwestern portion of the province. This population consists of an Ontario and Minnesota segment. The Minnesota population breeds primarily on two offshore barrier sand islands (Pine and Curry islands). This group has continued to decline, from a high of approximately 50 adults during the early 1980s to 14 adults in 1991 (Maxson and Haws 1991).

In recent years, the Ontario population has been restricted to the Sable Islands Provincial Nature Reserve and to Windy Point. The number of adult plovers and fledging success rates on the Sable Islands have remained relatively constant, whereas the last recorded nesting attempt on Windy Point occurred in 1989 (Lambert and Risley 1989). Apparently, predation is the primary factor contributing to unsuccessful nesting attempts at Windy Point (Heyens 1986–88, 1990–91). Availability of suitable habitat on Windy Point or on the remainder of Lake of the Woods does not seem to be a limiting factor. Lambert and Risley (1989) found that six of 19 sites were categorized as fair or good habitat, whereas the remaining areas were categorized as marginal or unsuitable.

Extensive habitat is available at the Sable Islands. The major threats to this population are from recreationists and fluctuating water levels on Lake of the Woods. Both of these impacts are manageable, and the Ontario Ministry of Natural Resources has attempted to educate recreationists regarding the protection of Piping Plovers and their habitat. Signs are in place advising recreationists of the protected status of the islands and that the use of ATVs is prohibited. The Lake of the Woods Water Control Board is the agency responsible for controlling water levels on the lake and has been made aware of the habitat requirements of this endangered species.

Acknowledgements

I wish to thank T. Lunny and R. Hanlan (Ontario Ministry of Natural Resources) for their assistance during the census of Sable Islands and Windy Point; M. Bradstreet (Long Point Bird Observatory) for his census of Long Point; and D. Elder (Ontario Field Ornithologists) and R. Hanlan, who reviewed an earlier draft of this manuscript.

The 1991 Piping Plover census in Manitoba

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Abstract

Annual Piping Plover *Charadrius melodus* breeding pair and productivity surveys have been conducted in Manitoba since 1981. These surveys were intensified in 1991 as part of the International Piping Plover Census. Forty-five beach sites, plus over 30 islands in Lake Manitoba and 50 islands in Lake Winnipeg, were censused during 24 May – 15 June 1991. In total, 80 adult plovers were found at 13 locations. Significant breeding areas were the Gull Bay Sandspits, West Shoal Lake, and Grand Marais. The 1991 census in Manitoba recorded fewer plovers than any previous census, despite greater census effort. This may reflect the poor productivity of Piping Plovers in Manitoba in recent years.

Résumé

Au Manitoba, on effectue chaque année depuis 1981 des relevés des couples nicheurs de Pluviers siffleurs *Charadrius melodus* et de la productivité de cette espèce. On a intensifié ces relevés en 1991 dans le cadre du recensement international des Pluviers siffleurs. On a couvert 45 sites littoraux et plus de 30 îles du lac Manitoba et 50 îles du lac Winnipeg, du 24 mai au 15 juin 1991. On a observé au total 80 adultes à 13 endroits. Les lieux de nidification importants étaient les flèches de sable de la baie Gull, le lac West Shoal et Grand Marais. On a dénombré au Manitoba moins de pluviers durant le recensement de 1991 que durant tout autre recensement antérieur, malgré des recherches plus poussées. Il se pourrait que cela témoigne d'une faible productivité chez les Pluviers siffleurs ces dernières années au Manitoba.

Introduction

Little information existed on the status of the Piping Plover *Charadrius melodus* in Manitoba prior to 1981. From 1981 to 1986, Haig (1987) contacted naturalists and reviewed aerial photos and historic literature regarding possible Piping Plover nesting areas in Manitoba. Haig (1987) also visited many of these areas and produced a file of potential breeding sites (Haig 1986). Over 500 km of shoreline were surveyed in 1987 (Moszynski et al. 1988), and annual results from the known active sites have been

recorded since 1986 (Koonz 1987–91). Some of the locations identified as probable nesting sites have been surveyed annually from 1988 to 1991. The 1991 census in Manitoba was the first survey of all available habitat in the same year.

Methods

The 1991 census was conducted on 24 May – 15 June, according to the International Piping Plover Breeding Census Guidelines (Haig 1991a). Eighteen staff and volunteers contributed to the survey.

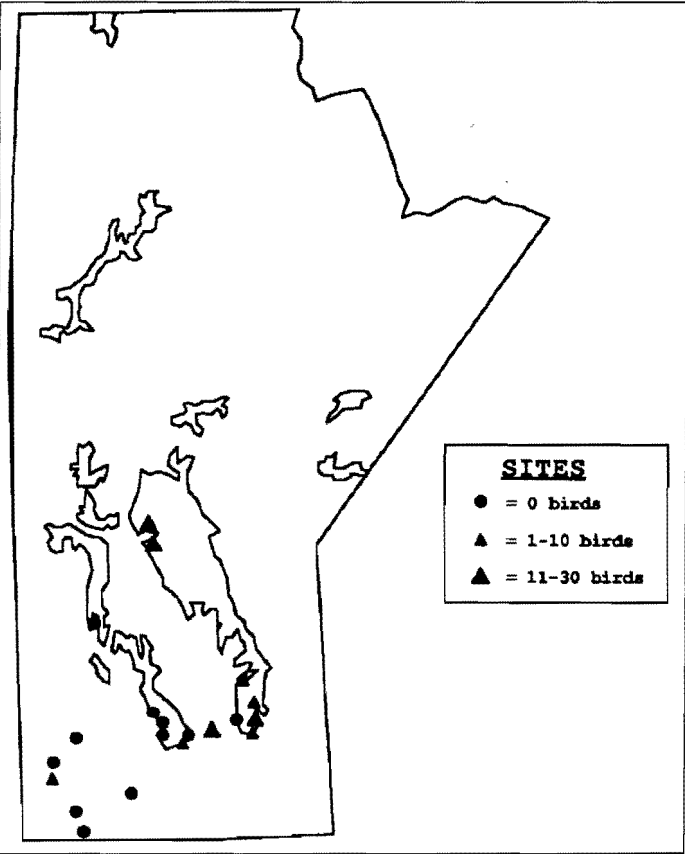
Surveys in the southwestern portion of the province were generally conducted later in the survey period than those in the remainder of the province. Surveys concentrated on historic breeding sites and on potential breeding habitats identified from aerial photographs, aerial surveys, and, in southwestern Manitoba, local area knowledge.

The census covered about 150 km of beach shoreline, not including the island surveys, and required more than 100 hours of searching. Field equipment included 1:50 000 contour maps, spotting scopes, and 10 × 50 binoculars. All surveys were done on foot except for surveys of three small water bodies (Tiger Hills), where one observer walked the lake shoreline while the other observer used a 20–60× spotting scope from a vehicle to check for plovers at higher elevations on the beach. Remote areas were first evaluated from photos kept in the provincial air photo library. Surveys of at least 70 islands on Lakes Manitoba and Winnipeg were conducted because postbreeding groups of plovers on Lake Winnipeg beaches have, in the past, been larger than the estimated breeding adult population. Only a small portion of Lake Winnipeg's islands remain to be surveyed.

Results

In total, 45 potential breeding locations were censused, plus the shorelines of approximately 30 Lake Manitoba and 50 Lake Winnipeg islands. Eighty adult plovers, including 37 pairs, were observed at 13 sites (Fig. 1). Piping Plovers were not found during the island surveys. Table 1 identifies the sites censused in 1991 and includes the results for each location.

Figure 1
Distribution of Piping Plovers in Manitoba, 1991



Three-quarters of the plovers were found at three locations—Gull Bay (North and South Bars) (38 birds), West Shoal Lake (13 birds), and Grand Marais (nine birds). Two nests at Oak Lake represent the first nesting Piping Plover record for this large southwestern Manitoba lake. Four remote historic sites were not censused. Even without these sites, the 1991 census was the most thorough Piping Plover census ever done in Manitoba, both in the amount of area surveyed and in the quality of survey technique. Only some Lake Winnipeg islands (52°30'N to 53°10'N) remain unsurveyed and may contain unrecorded breeding plovers in Manitoba.

Discussion

Piping Plover populations are declining in Manitoba. Haig (1987) estimated 50–60 breeding pairs from 1982 to 1986. Her estimate from surveys of only half the now-known breeding areas compares with 89 adults recorded in 1987, 120 in 1988, 103 in 1989, 130 in 1990, and 80 in 1991 (Koonz 1987–91; Moszynski et al. 1988). The large number recorded in 1990 may be attributed to birds overflying drought areas on the Northern Great Plains (Caswell and Didiuk 1989).

Four Manitoba sites with previous Piping Plover activity were not surveyed in 1991. These include two Lake Winnipeg islands surveyed in 1990 (Koonz 1987–91), one site on the north side of Long Point (53°10'N, 98°10'W), and a site at the south end of Kawinaw Lake surveyed in 1987 (Moszynski et al. 1988). These sites each contained one pair of Piping Plovers during their initial surveys.

As of 1991, the only habitat yet to be surveyed for Piping Plovers in Manitoba is a section of Lake Winnipeg islands. Large numbers of postbreeding Piping Plovers in the Gull Bay area of Lake Winnipeg indicate that there may yet be unaccounted-for breeding plovers. Islands in Lake Winnipeg north of Long Point (53°10'N) are probably icebound too late in the spring for Piping Plover use (the shoreline and islands close to the west shore of Lake Winnipeg north of Long Point appeared suitable, but no birds were seen there). The lake typically remains frozen in the north basin until the end of May.

Piping Plovers use new breeding areas when these become suitable, and they will abandon sites that no longer supply their habitat needs. For example, the south end of West Shoal Lake was abandoned during 1991 owing to low water and a lack of relief along the emerging shoreline. A ridge used in earlier years was too far from the water, and the lack of relief close to the shoreline made nests vulnerable to wind tides and sheet water runoff. Oak Lake had two breeding pairs of Piping Plovers in 1991, the first year adequate habitat was available there for plover nesting. Sites along southern Lake Manitoba shorelines are no longer used because of vegetation encroachment from water stabilization (in 1960, a dam was put in to hold water levels within a fluctuation of 61 cm).

Piping Plovers continue to suffer from habitat loss, water level stabilization, beach development, predation, and disturbance by use of all-terrain vehicles (ATVs) and people walking on beaches. Water level stabilization has allowed vegetation to encroach on Lake Manitoba nesting beaches and threatens Lake Winnipeg beaches. Beach developments continue for both public and private use; sites at Grand Beach Provincial Park, Patricia Beach, Clandeboye Bay, and Elk Island are overrun with people on weekends. Predators that search for food along beaches have also increased in number (Koonz and Rakowski 1985; McMahon and Koonz 1991). People continue to illegally ride ATVs along beaches, but law enforcement personnel are rarely available, and these people are difficult to catch. Shell casings and missing plovers on the North Bar of Gull Bay during the productivity survey in July indicate that birds may have been shot there in 1991 (Koonz 1987–91). A lack of productivity and low numbers of adults recorded at that location in 1989 and 1990 indicate a continuing problem with human disturbance.

Management and public education programs have been and are constantly being developed to assist Piping Plovers in Manitoba. Special Conservation Areas were established at Gull Bay and Clandeboye Bay, specifically to protect breeding plovers using those beaches. Television and radio programs, as well as newspaper and magazine articles, frequently describe the problems facing plovers at public beaches and elsewhere. Nest protection efforts have included fencing to prevent people from accessing nests and nest enclosures using wire mesh to prevent predators from taking the eggs. Slide talks describing the plight of the plovers have been delivered to high school students, commercial fishermen, and Provincial Park visitors. Habitat succession has been set back in some areas by rototilling beaches. Proposals are pending to set commercial fishing season dates so that disturbance to nesting plovers by commercial fishermen will be minimized, and funds have been requested for mound development at West Shoal Lake.

More work needs to be done to protect and enhance the productivity of Piping Plovers in Manitoba. Without

Table 1
Locations and numbers of Piping Plovers found in Manitoba, 1991

Site name	Location	Distance covered (km)	No. of observers	No. of pairs	No. of birds
Lake Manitoba (30+ islands)	51°00'N, 98°45'W	30.0	3	0	0
Big Point	50°24'N, 98°31'W	1.0	2	0	0
Hollywood Beach	50°30'N, 98°36'W	1.0	2	0	0
Big Sandy Point	50°46'N, 98°44'W	5.0	2	0	0
Lake Francis	50°18'N, 97°58'W	4.0	2	0	0
Sandy Hook	50°30'N, 97°05'W	1.0	2	0	0
Stony Beach	50°14'N, 98°07'W	3.0	2	0	0
Twin Lakes Beach	50°20'N, 97°53'W	2.0	2	0	0
Clandeboye Bay	50°15'N, 98°06'W	3.6	2	1	3
Lake Winnipeg (50+ islands)	52°00'N, 97°00'W	50.0	3	0	0
Grand Marais ^a	50°30'N, 96°40'W	7.0	4	4	9
Gull Bay North Bar	52°50'N, 98°44'W	10.0	3	7	15
Gull Bay South Bar	52°48'N, 98°45'W	3.5	3	11	23
Riverton Island ^b	51°00'N, 96°53'W	2.0	3	1	2
Hecla Island Sandbar	51°01'N, 96°51'W	7.0	3	1	2
Elk Island	50°45'N, 96°32'W	2.0	2	1	2
Grand Beach Provincial Park	50°32'N, 96°37'W	3.0	3	1	2
Patricia Beach	50°29'N, 96°36'W	1.0	2	1	2
Willow Island	50°35'N, 96°53'W	1.0	3	1	2
Victoria Beach	50°40'N, 96°35'W	2.0	1	0	1
Winnipeg Beach	50°28'N, 97°05'W	3.0	2	0	0
Whitewater Lake	49°14'N, 100°19'W	1.5	2	0	0
North Salt Lake	50°25'N, 100°25'W	3.0	1	0	0
South Salt Lake	50°21'N, 100°25'W	3.0	1	0	0
Red Deer Point (4 beaches)	51°40'N, 99°55'W	25.0	2	0	0
Poker Lake	49°02'N, 100°19'W	2.0	1	0	0
Breadon Lake	49°02'N, 100°14'W	2.0	1	0	0
Nellie Lake	49°04'N, 100°16'W	2.0	1	0	0
Sharpe Lake	49°03'N, 100°03'W	2.0	1	0	0
Cavalier Lake	49°00'N, 100°13'W	1.0	1	0	0
Hartley Lake	49°00'N, 100°11'W	2.0	1	0	0
Max Lake	49°04'N, 100°09'W	2.0	1	0	0
Lenore Lake	49°59'N, 100°48'W	1.0	1	0	0
Tiger Hills (5 lakes)	49°24'N, 99°20'W	2.0	2	0	0
West Shoal Lake ^c	50°19'N, 97°36'W	10.0	3	6	13
Oak Lake	49°40'N, 100°45'W	12.0	2	2	4
Total		200.6		37	80

^a Includes island, sandbar, and sandspit.

^b Includes three sand islands.

^c South shore site was abandoned by 1991; birds occupied a site along the lake's west side after 1986.

active management, education, and adequate protective measures, the species may be lost as a regular breeding resident over much of its breeding range in Manitoba.

Acknowledgements

I wish to thank World Wildlife Fund (Canada), which made surveys possible in 1986–88, and the Endangered Species Recovery Fund, for covering most of the survey costs in 1988–91. The Province of Manitoba has supported Piping Plover studies since Haig's initial surveys in 1981. The Canadian Wildlife Service provided literature and moral support. Provincial regional staff who directly contributed to the 1991 census in Manitoba include D. Chranowski, P. Ewashko, D. Roberts, B. Hagland, J. Sinclair, K. Whaley, G. Cress, and L. Huculak. A special thanks goes to staff from Grand Beach Provincial Park, especially A. Fay, and K. Porteous, who located and protected high-risk nests and presented amphitheatre talks on Piping Plovers. Winnipeg staff included J. Koonz, J. Suggitt, and T. Muir. Other assistance came from H. Brown, H. Helgason, D. Olson, and Mr. and Mrs. Biznaugh. I wish to thank CBC television's 24 Hours and Noon Day staff and CBC Radio's North Country and Information Radio staff for their coverage of Manitoba's Piping Plovers in 1991.

The 1991 Piping Plover census in Saskatchewan

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Abstract

Shorelines of 486 water bodies in Saskatchewan were surveyed for Piping Plovers *Charadrius melodus* between 25 May and 21 June 1991. The 1991 census included all sites where plovers had been previously observed, all sites identified as having potential plover habitat, and a sample of small basins of unknown potential. I estimate that 95% of the total known plover habitat in Saskatchewan was surveyed.

The total count for Saskatchewan was 1172 adult Piping Plovers, including at least 481 breeding pairs. Plovers were found at 71 sites, with one or more pairs found at 57 of these. However, four sites accounted for 651 Piping Plovers, or 56% of the Saskatchewan population. These sites were Lake Diefenbaker with 276 plovers, Big Quill Lake with 151, Chaplin Lake with 113, and Manito Lake with 111. The number of Piping Plovers in Saskatchewan accounts for 21.4% of the total North American population.

The population is less than the 1984 estimate of 2000–2500 plovers but higher than the estimates of 700–800 in 1986 and 500 in 1988. The higher count in 1991 compared with the previous two estimates is probably a combination of low estimates for 1986 and 1988 and an actual increase in the plover population since then.

Several factors threaten Piping Plovers in Saskatchewan. In recent years, the most significant has been natural drought. Another major threat is rapid increases in water level in June and early July at Lake Diefenbaker. Other problems include trampling by cattle and human disturbance in breeding areas.

Résumé

On a effectué des relevés des Pluviers siffleurs *Charadrius melodus* sur les rives de 486 plans d'eau de la Saskatchewan du 25 mai au 21 juin 1991. Dans ce recensement, on a couvert tous les sites où des pluviers avaient déjà été observés dans le passé, tous les sites reconnus comme étant susceptibles d'être fréquentés par des pluviers ainsi que certaines petites cuvettes de potentiel inconnu. J'estime que 95 % de l'habitat connu du Pluvier siffleur en Saskatchewan a été couvert.

On a dénombré dans la province 1172 adultes, dont au moins 481 couples nicheurs, répartis dans 71 sites; on a

observé un couple ou plus à 57 de ces sites. Les quatre sites suivants abritaient ensemble 651 Pluviers siffleurs, soit 56 % de la population de la Saskatchewan : le lac Diefenbaker (276 pluviers), le lac Big Quill (151), le lac Chaplin (113) et le lac Manito (111). Les effectifs de la Saskatchewan représentent 21,4 % de la population de l'ensemble de l'Amérique du Nord.

La population estimée en 1991 est inférieure à celle de 1984 (2000–2500), mais supérieure à celles de 1986 (700–800) et 1988 (500). Le fait que l'estimation de 1991 soit supérieure aux deux dernières estimations s'explique probablement par une sous-estimation des effectifs en 1986 et 1988, combinée à une augmentation réelle de la population de pluviers.

Plusieurs facteurs menacent le Pluvier siffleur en Saskatchewan. Ces dernières années, ce sont les sécheresses qui l'ont le plus gravement menacé. Les hausses rapides du niveau du lac Diefenbaker en juin et au début de juillet constituent une autre menace importante. Parmi les autres problèmes, on compte le piétinement du sol par le bétail et les nuisances anthropiques dans les secteurs de reproduction.

Introduction

Historical information on Piping Plovers *Charadrius melodus* in Saskatchewan is limited (Ferry 1910; Renaud 1974; Renaud et al. 1979; A.R. Smith, pers. commun.). Since 1984, Piping Plover censuses have been conducted in Saskatchewan to determine numbers and important breeding sites (Harris et al. 1985, 1987; Weidl 1986; Harris 1988b; Purdy and Weichel 1988; Harris and Lamont 1989, 1990, 1991; Johnson and Seguin 1989; Hjertaas 1991). The focus of the 1989 and 1990 surveys was to prepare for the 1991 International Piping Plover Census by identifying occupied and potential habitat in areas that had previously remained unchecked.

All previous surveys addressed only part of the species' range in any one season and have left open the question of whether the population changes observed were due to movement or reflected real population change. This lack of information has made it difficult to obtain a clear picture of the species' status. The 1991 International Piping Plover Census gives us our first complete look at the Piping Plover population in Saskatchewan.

Methods

Selection of sites

Study areas under consideration for this survey included all Saskatchewan wetlands south of the boreal forest, lakes along the southern edge of the boreal forest, and the south shoreline of Lake Athabasca in the boreal forest zone. All available data on basins with previous Piping Plover use and on areas previously searched for Piping Plovers were evaluated to select census sites (Skeel 1990a, 1990b). Available data included earlier studies of Piping Plover locations (Renaud 1974; Renaud et al. 1979; A.R. Smith, pers. commun.), systematic surveys conducted since 1984 (Harris et al. 1985, 1987; Weidl 1986; Harris 1988b; Purdy and Weichel 1988; Harris and Lamont 1989, 1990; Johnson and Seguin 1989; Hjertaas 1991), and recent unpublished information on Piping Plover sightings and habitat (W.C. Harris, J.P. Goossen).

Topographical maps (1:250 000) were examined to locate water bodies for which we had no previous information on plovers. All water bodies more than 2–3 km in length (or larger than 100–200 ha) were considered for the census. Habitat information for some of these sites was obtained from biologists. Those believed to have potential breeding habitat were selected for the census. Many of those for which there was no habitat information were also selected subjectively, with preference given to those located in areas of previous Piping Plover records. There are thousands of small basins under 40 ha. Only a sample of small basin shorelines was censused.

The survey work was divided into three categories: high-priority basins, low-priority basins, and small water bodies in the Missouri Coteau. The high-priority basins included wetlands of recent (1984 or later) use or good potential for Piping Plovers. A few wetlands never surveyed or not recently surveyed but with previous records were included as high priority if located in a geographically favourable area. The high-priority basins were divided into manageable blocks of wetlands; these blocks were surveyed by biologists from the Saskatchewan Wildlife Branch and Canadian Wildlife Service, or the surveys were tendered out to consulting biologists on a contract basis. Five wetlands were surveyed as part of a separate Piping Plover project (Harris and Lamont 1991) but within the guidelines of this survey. In total, 90 high-priority wetlands were surveyed.

Low-priority basins included wetlands with records of Piping Plovers no more recent than 1983, wetlands surveyed from 1984 onwards that had no plovers but were identified as having potential habitat, and wetlands for which there was no previous information. Most of these sites were surveyed by volunteers, many of whom were skilled bird-watchers (over 80 individuals). The census included 208 low-priority basins.

The Missouri Coteau was treated separately because it was impractical to visit each of the hundreds of small lakes. Twelve of the larger lakes were included in the high-priority blocks. Nine smaller lakes also had recent Piping Plover records, indicating that smaller water bodies can support Piping Plovers.

An aerial survey of the Missouri Coteau in a small fixed-wing aircraft was conducted on 8–10 May 1991 in order to identify suitable wetlands. The pilot flew over all basins larger than 40 ha and hundreds of smaller basins in

the entire coteau between the Trans Canada highway and the U.S. border. Observers marked wetlands that appeared to possess sand or gravel beaches and water directly onto 1:50 000 topographical maps. These 200 selected basins were grouped and assigned to five teams of surveyors. Surveyors included biologists from the Saskatchewan Wildlife Branch, Canadian Wildlife Service, and U.S. Fish and Wildlife Service.

Sites are identified by name from a 1:50 000 topographical map sheet. In cases of unnamed sites, identification is by Universal Transverse Mercator (UTM) grid number, used in conjunction with the map sheet.

Surveying of sites

Surveys of potential nesting areas followed the schedule and procedure set out in the Guidelines for the 1991 International Piping Plover Census. All surveys were conducted between 26 May and 21 June 1991. All sites designated as high priority were searched in the more preferred time period of 1–14 June 1991.

At all sites of known recent use or with good potential, 90–100% of the suitable habitat was surveyed. At all but about 22 of the 208 lower-priority sites, at least 90% of the suitable habitat was surveyed. An estimated 95% of the total known habitat was surveyed.

For each site, surveyors mapped all observations of breeding pairs, single adults with nests, and unpaired adults. Counts of adults and breeding pairs were reported for the total adult count. Only actual observed individuals were reported on the report form. If a pair was suspected, an effort was made to find both adults, but pairs were recorded only where two territorial adults, presumed mated, were seen. A single adult with a nest or young was also considered a pair. Family groups and nests were recorded when located but in most cases were not intentionally located in order to keep disturbance to a minimum.

Habitat suitability of the site and potential threats to the habitat were recorded on a habitat evaluation form (Skeel 1991). Beach areas were outlined on 1:50 000 maps with the beach substrate marked as gravel, gravel/sand, sand/silt, or mud/saline. All surveyors received a detailed survey methodology handout (Skeel 1991). Most surveyors filled out survey reports and habitat forms in the field.

To minimize disturbance, observers were to spend no more than five minutes in any one Piping Plover territory. Also, surveys were not conducted on very hot, cold, or rainy days or in other extreme weather conditions.

Surveys were conducted by traversing suitable beaches on foot, by all-terrain vehicle, or, primarily in the case of river surveys, by canoeing near suitable beaches. In some cases, spotting scopes and binoculars were used to scan basins for suitable habitat and to scan beaches for Piping Plovers from vantage points.

Results

The total count of Piping Plovers for Saskatchewan in late May and June 1991 was 1172 adult birds, including at least 481 breeding pairs. Piping Plovers were counted at 71 of the 486 water bodies surveyed, with the number of birds at each ranging from one to 276 (Table 1). The number of pairs ranged from zero to a high of 122. All but 15 of the

Table 1
Locations and numbers of Piping Plovers found in Saskatchewan, 1991

No.	Date	Water level	Map sheet	Site ^a	No. of birds	No. of pairs	% ^b of habitat
1	2 June 1991	Low	62 E/14	Rock Lake	1	0	100
2	5 June 1991	Normal	72 H/1	613 345	7	3	100
3	5 June 1991	Normal	72 H/1	615 375 Sandoff Lake	25	8	95
4	13 June 1991	Normal	72 H/1	East Coteau Lake	23	10	100
5	13 June 1991	High	72 H/1, 2	West Coteau Lake	7	3	100
6	10 June 1991	Low	72 H/11	635 075 Dryboro Lake	5	3	100
7	7 June 1991	Low	72 H/11	650 075	2	0	95
8	7 June 1991	Low	72 H/11	660 070 Burn Lake	4	2	95
9	7 June 1991	Low	72 H/11	705 056	15	7	97
10	10 June 1991	Low	72 H/11	741 095 Shoe Lake	4	2	92
11	5 June 1991	Low	72 H/11	825 855 Channel Lake	19	5	90
12	8 June 1991	Low	72 H/11	840 020	8	3	100
13	8 June 1991	Low	72 H/11	842 003	2	0	80
14	8 June 1991	Low	72 H/11	846 992	4	2	100
15	8 June 1991	Low	72 H/13	540 279	11	5	90
16	7 June 1991	Low	72 H/13, 12	Lake of the Rivers	6	2	100
17	3 June 1991	Normal	72 H/13, 14	633 135 Bliss Lake	3	1	100
18	6 June 1991	Low	72 H/14	735 197 Skyeta Lake	2	1	95
19	6 June 1991	Low	72 H/14	750 145 Oro Lake	1	0	100
20	9 June 1991	Low	72 H/14	842 162	2	1	90
21	6 June 1991	Normal	72 H/2	355 290 Lonetree Lake	2	1	100
22	7 June 1991	Low	72 H/2	Big Muddy Lake	26	8	95
23	9 June 1991	Normal	72 H/3, 4	Coronach Reservoir	5	1	100
24	8 June 1991	Low	72 H/4	370 484 Grant Lake	1	0	100
25	13 June 1991	Normal	72 H/4, 5	Fife Lake	29	9	100
26	12 June 1991	Low	72 H/5	Montague Lake	4	1	100
27	10 June 1991	Low	72 H/5, 6	Willow Bunch Lake	31	16	100
28	6 June 1991	Low	72 H/7	060 725 Edna Lake	7	4	95
29	3 June 1991	Low	72 H/7	185 646 McGrath Lake	1	0	100
30	3 June 1991	Low	72 H/7	215 590 Salt Lake	1	0	100
31	5 June 1991	Low	72 H/7	310 695 Elsie Lake	15	6	100
32	6 June 1991	Low	72 H/7	335 712 McDonough Lake	11	4	100
33	6 June 1991	Low	72 H/7	360 717	1	0	100
34	5 June 1991	Normal	72 H/8	514 656	3	0	100
35	5 June 1991	Normal	72 H/8	517 656 Karl Lake	2	1	100
36	6 June 1991	Low	72 I/4	435 425 Frederick Lake	12	5	90
37	12 June 1991	Low	72 I/4, 72 J/1	Old Wives Lake	42	17	100
38	7 June 1991	Low	72 J/1	170 394	1	0	100
39	6 June 1991	Low	72 J/6	310 956 Handsome Lake	1	0	40
40	11 June 1991	Normal	72 J/6, 7	Reed Lake	1	0	100
41	11 June 1991	High	72 J/7	Chaplin Lake	113	15	100
42	27 May 1991	Normal	72 K/6	Freeflight Lake	5	2	100
43	27 May 1991	Normal	72 K/6	Ingebright Lake	2	1	60
44	8 June 1991	Low	72 N/15	Tramping Lake, south end	2	1	50
45	4 June 1991	Low	72 O, 73 B	Middle South Saskatchewan River	1	0	100
46	13 June 1991	Low	72 O, 72 J	Lake Diefenbaker	276	122	97
47	11 June 1991	Low	72 P, 72 I	Last Mountain Lake	9	3	95
48	10 June 1991	Low	72 P/10	Kutawagan Lake complex	8	3	100
49	7 June 1991	Low	72 P/10	Lac du Chemin	5	2	100
50	9 June 1991	Normal	72 P/11	Colt Lake	4	2	100
51	10 June 1991	Normal	72 P/11, 12, 13	Little Manitou Lake	28	12	100
52	1 June 1991	Normal	72 P/15	247 380	1	0	100
53	14 June 1991	Low	72 P/15, 16, 73 A/1	Big Quill Lake	151	54	90
54	6 June 1991	Normal	72 P/16, 62 M/13	Little Quill Lake	13	5	100
55	3 June 1991	Low	73 A/11	Basin Lake	4	1	95
56	4 June 1991	Low	73 A/11	Elkona Lake	5	3	100
57	10 June 1991	Low	73 A/11	Middle Lake	4	1	100
58	4 June 1991	Normal	73 A/5	Muskiki Lake	11	5	100
59	16 June 1991	Low	73 A/5, 73 B/8	Buffer Lake	3	2	95
60	4 June 1991	Low	73 A/6	Houghton Lake	7	3	100
61	3 June 1991	Low	73 A/6, 7, 10, 11	Lenore Lake	9	4	75
62	14 June 1991	Normal	73 B/1	103 667	2	1	100
63	14 June 1991	Normal	73 B/1	155 642	1	1	75
64	5 June 1991	Normal	73 B/11, 14	Redberry Lake	21	11	100
65	4 June 1991	Normal	73 B/6	Radisson Lake	5	0	100

continued

Table 1 (continued)
Locations and numbers of Piping Plovers found in Saskatchewan, 1991

No.	Date	Water level	Map sheet	Site ^a	No. of birds	No. of pairs	% ^b of habitat
66	4 June 1991	Normal	73 C/12	694 390	3	1	100
67	7 June 1991	Normal	73 C/12, 13	Manito Lake	111	51	100
68	4 June 1991	Low	73 C/12, 73 D/9	West Reflex Lake, Sask.	5	2	100
69	8 June 1991	Low	73 C/15	Lambert Lake	4	2	100
70	4 June 1991	Low	73 C/6	Killsquaw Lakes	4	1	80
71	11 June 1991	Normal	73 C/7	Aroma Lake	8	3	100
Total					1172	481	

^a Unnamed sites are identified by Universal Transverse Mercator (UTM) grid number.
^b Percentage of Piping Plover habitat that was censused.

71 basins had at least one pair, indicating potential breeding at 56 basins.

The distribution of Piping Plovers was not uniform (Fig. 1). Locations with plovers were clustered in the Missouri Coteau, in the eastern portion of Lake Diefenbaker, and in north-central (Quill and Houghton lakes) and northwest (Manito Lake, also known as Manitou Lake) areas. The sites with the largest concentrations of Piping Plovers were Lake Diefenbaker with 276 plovers (223 in the arms of the lake, 53 in the body of the lake), Big Quill Lake with 151 plovers, Chaplin Lake with 113 plovers, and Manito Lake with 111 plovers. These four sites accounted for 651 plovers, or 56% of the Saskatchewan population. Fewer than 50 plovers were counted at any one of the remaining sites with Piping Plovers. The Missouri Coteau yielded 345 plovers (excluding the 113 plovers at Chaplin Lake). The total count of 996 Piping Plovers at the above four sites and the Missouri Coteau comprises 85% of the known Saskatchewanan population.

In total, 221 sites did not yield Piping Plovers in 1991 but either had habitat in 1991 or had the potential for habitat in a recent year. Many (28) of these have at least one previous record of Piping Plovers. A large number (192) of sites were judged to have no potential for Piping Plovers (Skeel 1991).

Following drought conditions from 1984 to 1990, the spring of 1991 was exceptionally wet (Skeel 1991). At most sites, the heavy precipitation did not affect the census results for 1991. However, at Lake Diefenbaker and Big Quill Lake, the count may be an underestimate owing to high winds and showers. At Chaplin Lake, the count may be an underestimate as a result of heat and blowing dust (Harris and Lamont 1991).

The total effort involved in this census can be measured by the number of wetlands and percentage of each that were surveyed (Table 1). Sections of some sites were missed for a variety of reasons, including weather, fading daylight, inaccessibility because of extensive mudflats, and very wide beaches. Some Piping Plovers may have been missed.

Discussion

Saskatchewan's count of 1172 Piping Plovers comprises 21.4% of the total North American count of 5484 plovers. The largest breeding population of any basin in North America was found at Lake Diefenbaker. With 5.1% of the total population (19.2% of the Ontario and Canadian Prairie population), it attracts large numbers of breeding

plovers. Big Quill Lake ranked sixth in North America, with 2.8% of the population (10.5% of the Ontario and Canadian Prairie population), Chaplin Lake ranked eighth, with 2.1% of the population (7.9% of the Ontario and Canadian Prairie population), and Manito Lake ranked ninth, with 2.0% of the population (7.7% of the Ontario and Canadian Prairie population).

Populations of Piping Plovers at both large and small wetlands in Saskatchewan often fluctuate in number from year to year. Because concurrent surveys of all potential wetlands in the province have not been previously conducted, it is unknown to what degree the fluctuations at individual sites indicate overall population changes, movement from one basin to another, or a combination of both. These fluctuations appear to be in response to changing habitat availability at the time of nest initiation, which results from dynamic interactions of water levels and vegetation growth.

From a high provincial estimate of 2000–2500 plovers in 1984, estimates progressively dropped to a low of 500 plovers in 1988 (Goossen 1990a). A decline in the population would not be surprising because of the drought and subsequent loss of suitable habitat from 1984 to 1990. However, previous estimates, based on only a few surveys, may have been inaccurate, and the population difference may have been less dramatic than estimates indicate. The availability of suitable habitat in Saskatchewan increased in 1991 with that year's exceptionally high precipitation. The 1991 population level of 1172 plovers may be a real increase over recent years if plovers were attracted to Saskatchewan from elsewhere on the prairies.

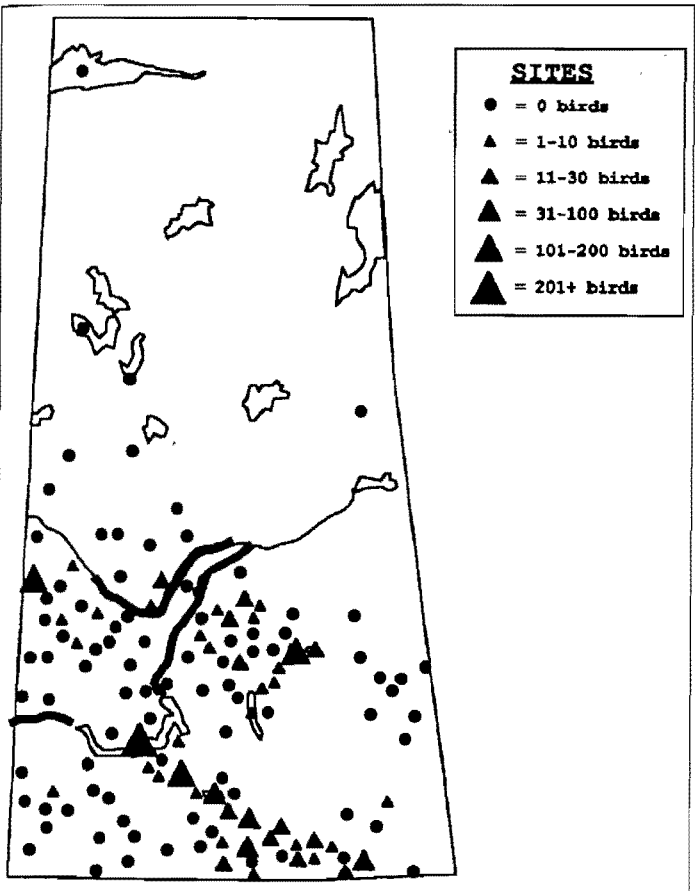
Regional patterns

Lake Diefenbaker

Piping Plovers at Lake Diefenbaker were concentrated in the Thomson and Gordon McKenzie arms. These arms have been surveyed since 1984 (Table 2). Counts have ranged from a low of zero in 1986 (W.C. Harris, unpubl. data) to a high of 223 in 1991 (Harris and Lamont 1991). No Piping Plovers were observed in the western one-third of the body of the reservoir, but 53 plovers were counted in the eastern portion of the lake body. A partial survey of the eastern end in 1984 resulted in a count of 53 plovers (Harris et al. 1985).

Although Piping Plover numbers at Lake Diefenbaker can be very high, brood surveys do not indicate a correspondingly high productivity (Table 3). Habitat is not consistently available throughout June and July of each year.

Figure 1
Distribution of Piping Plovers in Saskatchewan, 1991



Water levels sometimes rise above beaches, flooding nesting or family groups of Piping Plovers. Counts of young were highest in 1988, at 34 young (survey of arms and eastern third of the lake body; W.C. Harris, unpubl. data), and in 1989, at 27 young (Harris and Lamont 1989). Because all beaches were flooded, no young were counted in 1986 (W.C. Harris, unpubl. data) or 1990 (Harris and Lamont 1990). On 6 July 1991, the nesting beaches were flooded by rising water, and only seven young were located on narrow strips of sand (Harris and Lamont 1991). With young/pair ratios ranging from 0.0 to 0.89 (Table 3), productivity is well below the estimate of 1.13 young/breeding female required to maintain a stable population (M.R. Ryan, pers. commun.).

Lake Diefenbaker has the largest population of Piping Plovers of any site in North America. During periods of drought, when smaller basins have little or no habitat, its importance may even increase owing to enhanced use. However, the current low productivity at this site indicates that action is required to help ensure the recovery of the Piping Plover. Management of Piping Plover habitat on Lake Diefenbaker must be incorporated into current policies on water level management.

Big Quill Lake

Annual surveys began in 1984 at Big Quill Lake (Table 2). Counts ranged from 43 in 1989 to a peak of 300+ in 1985 (Harris and Lamont 1985, 1989). In 1991, 151 were observed. Use around the entire shoreline of Big Quill Lake has been documented. Surveys in July suggest that this lake

Table 2
Counts of adult Piping Plovers at surveyed sites, 1984–91

Year	Lake Diefenbaker arms		Big Quill Lake		Chaplin Lake	
	No. of individuals	No. of pairs	No. of individuals	No. of pairs	No. of individuals	No. of pairs
1984 ^a	(180)	—	(138)	—	(253)	—
1985	—	—	(300+) ^g	—	—	—
1986	0 ^e	—	136 ^h	—	—	—
1987	—	—	151 ⁱ	—	57 ^k	—
1988	75 ^f	31	(107) ^j	—	17 ^l	—
1989 ^b	94	33	(43)	12	—	—
1990 ^c	33	10	(98)	43	66	30
1991 ^d	223	102	(151)	54	113	51

Notes:

1. Parentheses denote a partial survey. A breeding pair is defined as an adult pair exhibiting territorial behaviour or a single adult with a nest.
2. The arms of Lake Diefenbaker include the Thomson arm to and including the point at the juncture with the body of the lake, and the Gordon McKenzie arm to the shore directly across from the point marking the end of the Thomson arm.
- ^a Harris et al. (1985). *Lake Diefenbaker*: approx. 70–75% of lakeshore of the arms surveyed; 223 adults were seen on a survey of 63% of the lakeshore, including the arms and the eastern one-third (from near Riverhurst Ferry) of the lake. *Big Quill Lake*: 74% of lakeshore surveyed; estimate of 263 Piping Plovers. *Chaplin Lake*: 48% of lakeshore surveyed; estimate of 527 Piping Plovers.
- ^b Harris and Lamont (1989). *Big Quill Lake*: 100% of nesting areas surveyed; a broad band >1 km on the W, N, and NE shorelines was impassible owing to wet conditions and was not surveyed.
- ^c Harris and Lamont (1990). *Big Quill Lake*: estimate of a minimum of 110 Piping Plovers; 100% of nesting areas surveyed; a broad band 200 m – 1 km on the W, N, and NE shorelines was impassible owing to wet conditions and was not surveyed. *Chaplin Lake*: estimate of 68 Piping Plovers.
- ^d Harris and Lamont (1991). *Big Quill Lake*: 90% of lakeshore surveyed, and 100% of nesting areas; for 60% of the lake, a broad band 200 m – 1 km near the water's edge on the W, N, and NE shorelines was impassible owing to wet conditions and was not surveyed.
- ^e W.C. Harris (unpubl. data). *Lake Diefenbaker*: water level too high for Piping Plovers at the time of the survey on 28 June 1986.
- ^f Harris (1988a).
- ^g Harris and Lamont (1985). 300+ estimated; 75% of lakeshore surveyed (all except S shore).
- ^h Harris (1986).
- ⁱ Harris (1987).
- ^j W.C. Harris (unpubl. data). 100% of nesting areas surveyed; some of the shore was inaccessible.
- ^k Harris et al. (1987).
- ^l Harris (1988b).

is also a main staging area for plovers, particularly along the south shore (Renaud 1974; Harris and Lamont 1990).

From 1986 to 1989, water levels receded, resulting in distances of 1–10 km between traditional nesting beaches and the water line. Gravel beaches closer to the existing water line began supporting some nesting plovers in 1990 as a result of vegetative growth on these previously barren sites (Harris and Lamont 1990). There was increased use of these beaches in 1991 (Harris and Lamont 1991). Low water level, resulting in vegetative encroachment on traditional nesting areas, is the greatest threat to Piping Plover habitat and, hence, to plover numbers and productivity at Big Quill Lake.

Brood surveys indicate that productivity in recent years is well below the 1985 and 1986 levels (Table 3). With young/pair ratios of 0.37–0.72, productivity at Big Quill Lake is well below that estimated to maintain a stable population (M.R. Ryan, pers. commun.).

Table 3

Counts of young Piping Plovers at surveyed sites, 1984–91

Year	Lake Diefenbaker arms		Big Quill Lake		Chaplin Lake	
	No. of young	No. of young/pair	No. of young	No. of young/pair	No. of young	No. of young/pair
1984	—	—	—	—	—	—
1985	—	—	125 ^f	—	—	—
1986	0 ^d	—	137 ^g	—	—	—
1987	—	—	74 ^h	—	23 ^j	—
1988	—	0.89 ^e	17 ⁱ	—	3 ^k	—
1989 ^a	27	0.82	7	0.58	—	—
1990 ^b	0	0.0	16	0.37	59	1.97
1991 ^c	7	0.07	39	0.72	82	1.61

^a Harris and Lamont (1989). *Lake Diefenbaker*: survey dates 8 and 11 July.

^b Harris and Lamont (1990). *Lake Diefenbaker*: survey date 4 July.

^c Harris and Lamont (1991). *Lake Diefenbaker*: survey date 6 July.

^d W.C. Harris (unpubl. data). Survey date 28 June.

^e W.C. Harris (unpubl. data). Calculated from counts for the arms of the lake and the eastern one-third of the body: 38 pairs (97 adults) and 34 young.

^f Harris and Lamont (1985).

^g Harris (1986).

^h Harris (1987).

ⁱ W.C. Harris (unpubl. data).

^j Harris et al. (1987).

^k Harris (1988a).

Chaplin Lake

Chaplin Lake, in the Missouri Coteau, consistently attracts Piping Plovers (Table 2). The highest count of 253 plovers occurred in a 1984 survey of 48% of the shoreline (Harris et al. 1985). Complete surveys previous to 1991 were done in 1987, when most of the lake was dry (Harris et al. 1987), and in 1990, when water levels were very low but all basins had water for the first time since 1984 (Harris and Lamont 1990). Counts were low, 57 and 66 plovers, respectively, and birds were concentrated on basins with the most water. Heavy precipitation in 1991 caused an increase in water levels, and the population also increased to 113 Piping Plovers (Harris and Lamont 1991).

Brood counts at Chaplin Lake in 1990 and 1991 indicated high productivity (Table 3). In 1990 and 1991, the young/pair ratios were 1.97 and 1.61, respectively. These exceed the estimated 1.13 young/female required to maintain a stable population (M.R. Ryan, pers. commun.).

With productivity at Chaplin Lake higher than at other sites where it has been monitored, this site may be especially important to the recovery of the species. Except for unpredictable drought conditions, few factors appear to threaten the population here.

Manito Lake

The entire shoreline of Manito Lake was surveyed for the first time in 1991 and yielded 111 Piping Plovers, 81 of these along the lakeshore and 30 on the island. In a 1984 survey of 40% of the shoreline (excluding the large island) that included much of the best habitat, 27 plovers were counted (Harris et al. 1985). In 1979, 20 Piping Plovers were estimated to be on the west and south shores, and in 1986, 44 plovers were found on the south shore (G.J. Wapple, unpubl. data). As occurs elsewhere in the province, numbers have fluctuated from year to year.

In 1991, use of this large saline lake by Piping Plovers appeared to be restricted to good quality habitat. The high count of plovers at Manito Lake in 1991 demonstrates that the lake can support a large number of plovers. Because road access to the lake is limited to one

area on the north end, human disturbance is minimal. Shoreline use by cattle is currently light or moderate over most of the lake, but habitat suitability has been reduced in some areas by trampling.

Missouri Coteau (excluding Chaplin Lake)

The Missouri Coteau consists of hilly terrain with hundreds of basins of varying size, many of these with gravelly beaches. The 345 Piping Plovers counted here in 1991 were scattered over 39 of the 112 sites that were censused. Including the 113 Piping Plovers at Chaplin Lake, the total count of 458 for the Missouri Coteau comprises 39% of the Saskatchewan population.

The highest count of 42 plovers occurred at Old Wives Lake, a very large saline basin. This lake had been largely dry the last few years, and, despite the heavy precipitation in 1991, water levels remained very low. Continued low levels are likely due to low groundwater levels. In 1984, when water levels were slightly higher, a survey of 72% of the shoreline yielded a similar count of 39 Piping Plovers (Harris et al. 1985).

Sandoff Lake had only one plover on a 1990 census (Hjertaas 1991), as did East Coteau Lake in 1986 (W.C. Harris, unpubl. data). In 1991, they had 25 and 23 plovers, respectively. In 1986, Big Muddy (partial survey) and Fife lakes had two and seven Piping Plovers, respectively (W.C. Harris, unpubl. data), compared with 26 and 29 plovers, respectively, in 1991. At Willow Bunch Lake, seven plovers were counted over 47% of the shoreline in a 1984 survey (Harris et al. 1985), but 31 were observed in 1991. Several other sites (West Coteau, Edna, Elsie, and McDonaugh lakes) also had noticeably higher counts in 1991 than in 1990 (Hjertaas 1991). This is likely due to the wet spring of 1991 replenishing water in basins that had become very low or dry.

Montague Lake is an exception to the observed pattern. Twelve plovers were counted in a 1984 survey of 53% of the shoreline (Harris et al. 1985), but only four were seen in 1991. The water level at Montague Lake was very low in 1984, exposing over 1 km of mudflat around the lake (Harris et al. 1985). Beach width was reduced to about 10–30 m in 1991, likely accounting for the drop in plover numbers.

Natural drought is an important factor in habitat availability. Missouri Coteau sites tend to be shallow and often small, resulting in transitional habitat where suitability to plovers changes in response to precipitation and vegetative growth. In 1991, habitat availability increased as a result of heavy rainfall after a prolonged drought. The elevation in Piping Plover numbers is evidence of the opportunistic and transient nature of plover use at these basins. In years when little habitat is available, plovers likely use larger basins, such as Chaplin Lake or Lake Diefenbaker.

Cattle were identified as posing a threat to plovers at 11 sites in the Missouri Coteau, including three sites with 10–20 plovers (Skeel 1991).

Redberry Lake

At Redberry Lake, surveys since 1984 indicate a declining population. During surveys in 1984 and 1985, 40 (Harris et al. 1985) and 41 (Kerbes and Howard 1986) Piping Plovers were counted, respectively. The population

dropped to counts of 21, 25, and 21 during surveys in 1989, 1990, and 1991, respectively (Harris and Lamont 1989, 1990, 1991). In these last three years, a large number of gulls were noted at Redberry Lake. Gull numbers were not noted in 1984, and gulls were not noted as a concern to the Piping Plover population in 1985. An increase in the gull population may be responsible for the decline in plovers, as the habitat was judged to be excellent in 1991 (Harris and Lamont 1991). Gulls may be impacting on Piping Plover productivity, as only one, zero, and three young, respectively, were counted in 1989, 1990, and 1991 (Harris and Lamont 1989, 1990, 1991).

Muskiki and Lenore lakes area

In the area of Muskiki and Lenore lakes, 43 plovers were counted in 1991 at seven of the 16 basins with suitable habitat in the region. At no site were plovers abundant, the highest count being 11 plovers at Muskiki Lake. Six of the basins (Muskiki, Buffer, Basin, Middle, Houghton, and Lenore lakes) have at least one previous record of Piping Plover (Skeel 1991).

Last Mountain and Little Manitou lakes area

Last Mountain Lake is a long, narrow, deep lake with relatively fresh water. In a 1984 survey of 55% of the shoreline, 43 Piping Plovers were counted (Harris et al. 1985). Only nine plovers were counted on the 1991 complete survey. The drop in numbers may be due to the low lake level since 1987 (Saskatchewan Water Corp.), which has enabled vegetation to encroach and shrink beaches.

Little Manitou Lake is notably saline, with steep relief resulting in narrow beaches. The only suitable plover habitat is found at the extreme east and west ends. Past records suggest the population may fluctuate. In 1978, at least 22 pairs were present (Renaud et al. 1979). However, in complete surveys in 1984 (Harris et al. 1985) and 1991, seven and 28 plovers, respectively, were counted.

Low numbers of Piping Plovers have been found consistently in the Kutawagan Lake complex. Surveys in 1990 (Hjertaas 1991) and 1991 yielded three and eight plovers, respectively. There are also seven records from previous years (W.C. Harris, unpubl. data).

Southwest area

The area near the Great Sandhills of southwestern Saskatchewan has shown consistent use by a small population of Piping Plovers. Seven plovers were counted in 1991 at two sites, Freefight and Ingebright lakes. Two plovers were counted at Freefight Lake in 1982 (C. Harris, unpubl. data) and 1984 (Harris et al. 1985). At Antelope Lake, 14 plovers were present on 17 July 1986, when habitat was noted as excellent (Weidl 1986). Piping Plovers were also present at Antelope Lake in 1988 and 1989 (W.C. Harris, unpubl. data). No plovers were observed at Antelope Lake in 1991.

West area

Piping Plovers were found at three sites in the western portion of the province between the South Saskatchewan River and North Battleford: two plovers at

the south end of Tramping Lake, four plovers at Killsquaw Lakes, and eight plovers at Aroma Lake. One plover was counted at Killsquaw Lakes in a 1984 partial survey (Harris et al. 1985), and 23 at Aroma Lake in 1978 (Renaud et al. 1979). Historical records indicate that other scattered wetlands in this area supported plovers during the 1970s and up to 1990 (Skeel 1990a). There are 15 basins with records of up to six plovers at any one basin. Most of these basins had low water or were dry and overgrown with weedy annuals in 1991.

Lake Athabasca

At the Archibald River, on Lake Athabasca, there are reports of a single plover in 1981 and a single and one pair with flightless young in 1982 (Adam 1984). A single was photographed on 1 July 1989 at the mouth of the Archibald River (Goossen 1990b). The 1991 survey of about 75% of the south shore of Lake Athabasca yielded no Piping Plovers. This area does not appear to have consistent use by the species and probably represents the northern edge of its range in the province.

Conservation actions

Action has been taken to ensure the conservation success of the 1991 census. Critical Piping Plover breeding habitat has been identified (Skeel 1991) and transferred to the Saskatchewan Parks and Renewable Resources Geographic Information System (GIS). The GIS is currently being integrated in many areas of resource management within government and industry, ensuring that this information is widely available.

Future actions could include long-term productivity studies at selected basins, designing North American Waterfowl Management Plan projects to benefit Piping Plovers as well as ducks and geese, and reducing or eliminating threats to plover habitat where these have been identified (Skeel 1991).

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The 1991 Piping Plover census in Alberta

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Abstract

The 1991 International Piping Plover Census in Alberta resulted in 180 adult Piping Plovers *Charadrius melodus* being counted at 27 sites. Forty-eight sites were surveyed from 29 May to 17 June 1991. Significant breeding areas were Killarney Lake, Dowling Lake, Reflex Lake, Handhills Lake, Little Fish Lake, and Sunken Lake. The 1991 estimate was lower than estimates from past years, although it was obtained from the most thorough census ever conducted in Alberta. The low 1991 figure may reflect poor productivity owing to drought conditions in central Alberta during the 1980s.

Résumé

Lors du recensement international des Pluviers siffleurs *Charadrius melodus* de 1991, on a dénombré en Alberta 180 adultes à 27 sites. Des relevés ont été effectués à 48 sites, du 29 mai au 17 juin 1991. Les secteurs de reproduction importants étaient les lacs Killarney, Dowling, Reflex, Handhills, Little Fish et Sunken. L'estimation de 1991 a été inférieure à celles des années antérieures en dépit du fait qu'elle est le résultat du recensement le plus poussé jamais effectué dans la province. Les faibles effectifs observés en 1991 pourraient refléter une faible productivité des pluviers attribuable aux sécheresses qui ont sévi dans le centre de l'Alberta durant les années 1980.

Introduction

Prior to 1974, very little information existed on the distribution and status of the Piping Plover *Charadrius melodus* in Alberta. Weseloh and McKeane Weseloh (1983) conducted the first systematic censuses. They surveyed selected areas of central Alberta from 1974 to 1977. In 1986 and 1988, Wershler and Wallis (1987) and Wershler (1990), respectively, also surveyed selected areas and, based on these surveys, gave vastly different provincial estimates. It was clear that a good population estimate would require a complete count of the birds in one breeding season. The 1991 census was the first complete census of Piping Plovers in Alberta.

Methods

Potential census locations for Alberta were identified by reviewing the plover literature and by discussing sites with C. Wershler. In total, 48 sites were selected to be surveyed: 31 priority sites, 12 secondary sites, and five historical nesting sites.

The censuses were conducted from 29 May to 12 June 1991, with the exception of Lesser Slave Lake, which was surveyed on 17 June 1991. A total of 166.7 km of habitat was searched on 29 of 48 sites for which data on search effort are available.

Counts of Piping Plovers during the 1991 International Piping Plover Census were conducted following methods recommended in Goossen (1990b). A survey route was established to provide the best coverage of the current habitat while minimizing disturbance to the plovers. An attempt was made to walk about two-thirds of the distance between the water's edge and the vegetation zone (closer to vegetation zone). On beaches that were particularly wide, a "zigzagging" course was used. Very wide beaches (>100 m) necessitated two or more passes. Surveys were not conducted during periods of inclement weather (rain, extreme wind, hot or cold days).

Data collected included survey date, name of site, observers' names, description of weather, general habitat conditions, exact location, number of adult Piping Plovers seen, number of pairs of Piping Plovers seen, criteria for counting pairs, length of habitat covered, mode of transportation, and notes on any circumstances that may have affected the census. In addition, census takers in Alberta were given topographical maps (scales 1:250 000 and 1:50 000) and air photos (various scales) of their assigned sites to document locations of pairs, single birds, nests, and other features. Observers were also encouraged to take photographs of nesting areas and draw diagrams of the beach and shoreline profiles. This was done to avoid confusion about breeding habitat locations as a result of future changes in habitat.

The entire shoreline of each site was searched, unless the lake was particularly large, in which case a search was made of the habitat on which plovers were previously located, as well as adjacent potential or known habitat.

All Alberta Fish and Wildlife Division census personnel were given identical field equipment and

materials for collecting field data, and all census participants were briefed on procedures for conducting a Piping Plover census, given a list of sites to survey, and asked to conduct surveys during the recommended time frame of the International Piping Plover Census.

In addition to the census form, a habitat evaluation form was included with the survey material to record data on the present state of the nesting habitat. The information recorded included site name, water level (dry, low, normal, high), beach width (unvegetated), details about the nesting habitat substrate (localized/extensive, soft/firm, mud/gravel/sand), extent of alkali deposits (localized, extensive, absent), nesting habitat (island, shoreline, point of land), feeding habitat (shoreline, seepage), habitat occupation, and type of disturbance (vehicle, human, cattle, cultivation, oil, gas, weather).

Information on the habitat evaluation form will be used to assess potential Piping Plover habitat in the province and to monitor habitat changes in the future. Here, I use it to clarify questions regarding the distribution of Piping Plovers in 1991.

Results

Forty-eight sites were censused, resulting in 180 Piping Plovers being seen on 27 sites (Table 1). The distribution of the Piping Plover in Alberta is restricted to the southeastern portion of the province, from Red Deer east to the Saskatchewan border and south to Lethbridge and Medicine Hat (Fig. 1). Twenty-one of the sites with Piping Plovers had fewer than 10 birds, whereas six had 10 or more birds. These latter sites were Dowling Lake (21 adults on 1 June), Little Fish Lake (19 on 3 June), the southern portion of Handhills Lake (18 on 4 June), the Alberta portion of Reflex Lake (12 on 4 June), Killarney Lake (22 on 5 June), and an unnamed lake south of Sunken Lake (12 on 6 June). These plovers represented 58% (n = 104) of all Piping Plovers seen in Alberta during the 1991 census.

Of the 27 sites where plovers were found, five were not completely covered owing to their large size and the time required to search the entire shoreline. However, these sites (Baxter Lake, Leane Lake, Keho Lake, Newell Lake, and Dowling Lake) were completely searched along the portions of shoreline where plovers would most likely nest. Plovers found on these sites represented 16% (n = 29) of all plovers seen. Incomplete searches were made at eight other sites where no plovers were found. These were Horseshoe Lake, Gillespie Lake, Lesser Slave Lake, the middle and westernmost Miquelon lakes (#2 and #3), Buffalo Lake, Goosequill Lake, and Sounding Lake. The possibility that plovers were overlooked on these sites is remote, as nesting habitat was limited and past nesting areas were searched.

The distribution of the Piping Plover in Alberta was examined with respect to water level conditions. Three sites were dry, 26 had low water levels (below average), 16 were normal, and three had high water levels (Table 2). Plovers were found on one of the dry sites (33%), 18 of the low water level sites (69%), seven of the normal sites (44%), and one of the high water level sites (33%).

Thirty-six of 44 sites (82%) where information on alkali deposits was recorded contained either local or extensive deposits; of these, 20 (56%) contained Piping Plovers. Of the 27 sites that had adult Piping Plovers, 13

(48%) were characterized by extensive alkali deposits, seven (26%) by localized deposits, and five (19%) by no deposits. Beaches were categorized with respect to the width of the unvegetated area. Of the sites where plovers were found, 59% (n = 16) were characterized by a beach width of 10–30 m, 30% (n = 8) by a beach width of greater than 30 m, and 11% (n = 3) by a beach width of less than 10 m.

Discussion

The 1991 census of the Alberta population of Piping Plovers was the most thorough ever undertaken. Despite this, it is possible that the actual population figure is higher than the 180 plovers that were counted.

Factors that may have influenced the results include weather, sites not searched that may have contained plovers, lack of experience with Piping Plovers by some census personnel, and a lack of familiarity with some census sites. Weather did not pose a problem, as censuses were carried out only when conditions were suitable. However, early spring rains may have replenished vacant habitat adjacent to permanent water bodies supporting plovers. Areas that were dry during the late 1980s were not included on the census list and may have contained some plovers if they once again contained water in 1991 and became “attractive” to breeding birds. All census personnel had training in Piping Plover identification and census techniques or accompanied someone with this knowledge. As a result, this was not regarded as a shortcoming. However, a lack of direct knowledge and experience with census areas may have posed a problem. Although an attempt was made to pair investigators with sites that were familiar to them, this was not always possible, and in some instances the investigators visited sites for the first time.

Estimates of the number of Piping Plovers have varied in the past. The population estimate for 1974–77 on 15 sites was 100–110 pairs (Weseloh and McKeane Weseloh 1983). In 1986, Wershler and Wallis (1987) checked (but did not completely census) 118 sites in southern and central Alberta; 28 of these sites contained plovers. They estimated that the provincial population was 300+ adult plovers, representing at least 98 breeding pairs. This figure was the highest estimate ever made. In 1988, the provincial population was estimated to be 220+ individuals (Wershler 1990). Wershler (1990) believed that drought conditions resulted in a decrease in suitable habitat in that year. Also in 1988, Goossen (1989) monitored breeding Piping Plovers at three lakes in central Alberta and found at least 40 breeding pairs; Haig estimated the total Alberta population in 1988 at 295 adults (S.M. Haig, unpubl. data, cited in Goossen 1989). In 1989, Wershler (1989) again carried out censuses at 15 sites in central Alberta to assess habitat availability and census Piping Plovers. Plovers were found on only three of the lakes. In 1989, the Canadian Wildlife Service and the Alberta Fish and Wildlife Division conducted censuses on eight and 15 other sites, respectively (Goossen 1990b). As there did not appear to be significant changes in numbers, the provincial population estimate remained unchanged at 220+ (Wershler 1990). Finally, in 1990, censuses were carried out by the Canadian Wildlife Service at seven sites and by the Alberta Fish and Wildlife Division at four sites, resulting in a count of 123 plovers (Goossen 1991) and 57

Table 1
Locations and numbers of Piping Plovers found in Alberta, 1991

Date	Map sheet	Site name	Location ^a	Distance searched (km)	No. of adults
Southern region					
29 May 1991	72 L/1	Chappice Lake	14-3-16	6.5	2
29 May 1991	72 L/1	Sam Lake	14-2-6	10.0	4
30 May 1991	72 L/1	Unnamed Lake	13-2-33	6.0	0
31 May 1991	72 L/5	Newell Lake	17-15-1	25.0	1
8 June 1991	82 H/14, 15	Keho Lake	11-22-31	16.0	3
Subtotal				63.5	10
Central region					
31 May 1991	83 H/7	Miquelon Lake #2	49-20-15, 22	N/A	0
31 May 1991	83 H/2	Miquelon Lake #3	49-20, 21-(many)	6.4	0
1 June 1991	82 P/9, 16, 72 M/12, 13	Dowling Lake	31, 32-14, 15-(many)	N/A	21
1 June 1991	83 A/7	Stinky Lake	40-20-34	0.3	0
3 June 1991	82 P/8	Little Fish Lake	28-16, 17-(many)	9.6	19
3 June 1991	83 A/2	Lowden Lake	36, 37-19-(many)	3.0	0
3 June 1991	73 D/2	Neutral Hills “B2”	36-7-16, 17	N/A	0
3 June 1991	73 D/2	Neutral Hills “C1”	36-7-27	N/A	5
3 June 1991	73 D/2	Neutral Hills “C2”	36-7-29	N/A	0
4 June 1991	82 P/8, 9	South Handhills Lake	29-15, 16-(many)	12.8	18
4 June 1991	82 P/4	McDonald Lake	26-29-2	1.0	0
4 June 1991	73 D/2	Neutral Hills “A”	36-7-4	N/A	2
4 June 1991	73 D/1, 2	Sounding Lake	37-4-9, 10, 11	N/A	0
4 June 1991	73 D/2	Unnamed Lake	37-4-31	N/A	0
4 June 1991	73 D/2	Neutral Hills “B1”	36-7-9	N/A	0
4 June 1991	73 D/2	Greenlee Lake	37-4-29	N/A	4
5 June 1991	82 P/8, 9	North Handhills Lake	29-16-35	3.2	2
5 June 1991	83 A/7	Buffalo Lake	40, 41-21-4, 17, 34	6.4	0
6 June 1991	83 A/10	Rockland Bay	41-20-(many)	8.0	6
6 June 1991	83 A/2	Lonepine Lake	37-17-31, 32	4.0	0
6 June 1991	83 A/3	Goosequill Lake	36-23-1	1.5	0
7 June 1991	73 D/2	Gooseberry Lake	36-6-(many)	8.0	9
10 June 1991	82 P/16	Pearl Lake (Chain #1)	32-15-29	N/A	2
10 June 1991	82 P/16	Clear Lake (Chain #3)	32-15, 16-31, 36	N/A	2
10 June 1991	82 P/16	Chain Lake #3A	32-15-31	N/A	0
10 June 1991	82 P/16	Chain Lake #4	33-16-1, 2, 11	N/A	5
11 June 1991	83 A/10	Messner Pond	41-21-25, 26	4.8	0
11 June 1991	82 P/16	Chain Lake #6	33-16-15, 23	N/A	2
11 June 1991	82 P/16	Chain Lake #7	33-16-22, 27	N/A	0
11 June 1991	82 P/16	Chain Lake #8	33-16-28, 33	N/A	0
11 June 1991	82 P/16	Spiers Lake	34-16-8, 17	N/A	2
12 June 1991	83 A/10	Rider Lake	41-20-(many)	3.5	7
Subtotal				72.5+	106
Northeast region					
4 June 1991	73 D/9	Cipher Lake	43-1-3, 4, 10	2.5	4
4 June 1991	73 D/15	Baxter Lake	45, 46-5, 6-(many)	3.5	2
4 June 1991	73 D/9	West Reflex Lake	42, 43-1-36, 1	N/A	12
5 June 1991	73 D/9	Leane Lake	41-1-34, 27	2.0	2
5 June 1991	73 D/9	Killarney Lake	41, 42-1-(many)	8.0	22
6 June 1991	73 D/7	Horseshoe Lake	39-6-24	1.0	0
6 June 1991	73 D/7	Sunken Lake	39-5-(many)	4.3	8
6 June 1991	73 D/7	Unnamed Lake	39-5-2, 3	2.5	12
6 June 1991	73 D/7	Metiskow Lake	40-5-10, 15	2.5	2
7 June 1991	73 D/8	Gillespie Lake	40-2-22, 23	1.6	0
Subtotal				27.9+	64
Peace River region					
17 June 1991	83 O/7	Lesser Slave Lake	73, 74, 75-6, 6-(many)	2.8	0
Subtotal				2.8	0
Total				166.7+	180

NA = not available

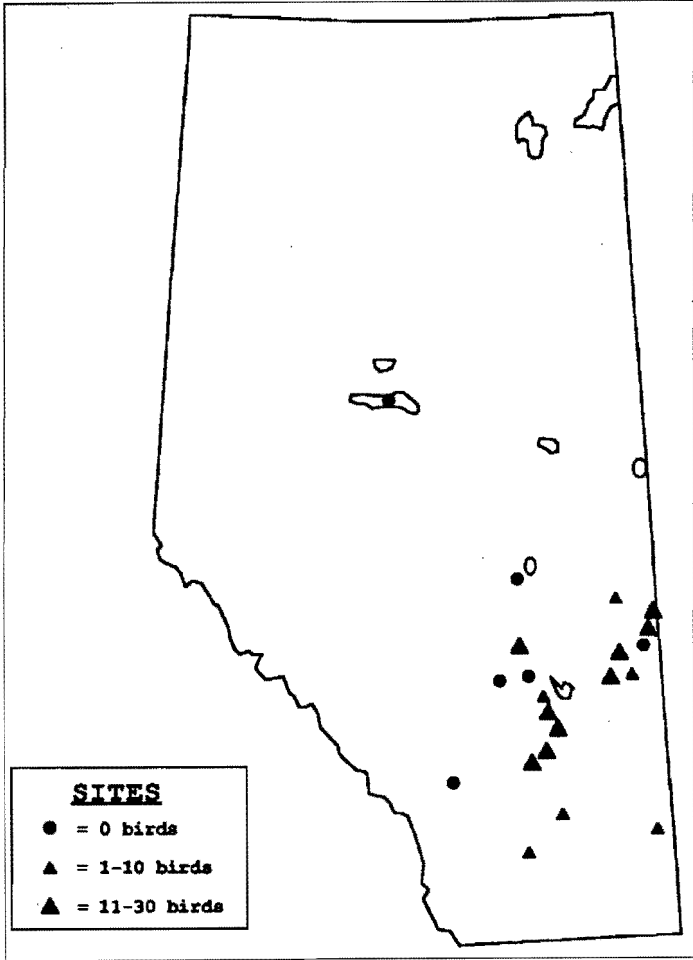
^a Township–Range–Section(s).

plovers (Hofman 1990), respectively. This total of 180 adult Piping Plovers counted on 11 sites is identical to the 1991 result of 180 plovers counted on 48 sites (27 sites had plovers), indicating either population dispersal or more likely a population decline, as greater effort did not result in more birds being counted.

The 1991 census results may indicate a decrease of more than 100 birds since 1986. The exact reason for the decline is unknown. However, I suspect that habitat loss as a result of abnormally dry conditions in the 1980s could be a

contributing factor. Water levels have receded on many of the lakes, especially in east-central Alberta, in many cases resulting in reduced nesting habitat owing to invading vegetation. Piping Plover nest success was reduced on territories with extensive vegetative cover and on territories with dispersed vegetation in North Dakota (Prindiville Gaines and Ryan 1988). As most (69%) plovers were found at sites with low water levels in 1991, habitat availability may continue to decline unless water levels are replenished. Ideally, fluctuating water levels maintain nesting habitat by

Figure 1
Distribution of Piping Plovers in Alberta, 1991



periodically flooding beaches, thus removing or inhibiting the growth of vegetation. In 1991, most Piping Plovers occurred on sites with wide beach widths (>10 m) because of the low water levels.

The presence of alkali deposits is important to Piping Plovers (Wershler 1990), as highly saline water inhibits growth of vegetation on gravel nesting beaches. Regular annual flooding of beaches reduces excessive vegetation and, together with suitable food availability, maintains the attractiveness of an area to breeding plovers. In 1991, most of the breeding plovers found occurred at sites characterized by having extensive or localized alkali deposits and vegetation-free beaches.

Monitoring of key Piping Plover breeding areas in Alberta is proposed in future years. This includes censuses, habitat protection and enhancement, and public education and awareness programs. Proposals will be submitted for fencing of nesting areas on both public and private lands to reduce human and cattle disturbance. Creation or enhancement of breeding habitat through controlled burning may also be considered. All work will be conducted jointly by the Alberta Fish and Wildlife Division, the Canadian Wildlife Service, and other interested agencies (e.g., Alberta Agriculture, Ducks Unlimited [Canada], World Wildlife Fund [Canada]).

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Table 2
Summary of habitat conditions recorded during the 1991 International Piping Plover Census in Alberta

Site	Water level	Beach width (m)	Nesting shore			Alkali deposits	Habitat characteristics			Types of disturbance ^c
			Size	Consistency	Substrate		Nesting ^a	Feeding ^b	Habitat occupied	
Southern region (5 sites)										
Chappice	Low	10-30	Local	Soft	Mud	Extensive	S	SE	No	C
Sam	Low	10-30	Local	Firm	Gravel	Local	S	SE/S	Yes	O/G
Unnamed	High	<10	Local	Soft	Sand	Extensive	P	SE	No	V/C
Newell	Normal	<10	Local	Firm	Gravel/sand	Absent	I/P	S	No	V/C/H
Keho	Normal	<10	Local	Firm	Gravel/sand	Absent	S	S	No	V/H
Central region (32 sites)										
Miquelon #2	Normal	<10	Local	Soft	Silt/mud	Local	- ^d	-	Yes	None
Miquelon #3	Normal	<10	Local	Soft	Sand/silt	-	I	-	Yes	-
Dowling	Low	10-30	-	-	Gravel/mud	-	-	-	No	C
Stinky	Normal	<10	Local	Soft	Sand/mud	Local	S	S	Yes	None
Little Fish	Low	10-30	Extensive	Firm	Gravel	Extensive	S	S	No	V/C
Lowden	Low	>30	Local	-	-	Extensive	P	-	No	-
Neutral Hills "B2"	Normal	10-30	Local	Soft	Gravel/sand	Extensive	S	S	No	None
Neutral Hills "C1"	High	10-30	Local	Firm	Gravel	Local	S	S	No	None
Neutral Hills "C2"	Normal	10-30	Local	Firm	Gravel	Local	S	SE	No	None
South Handhills	Low	>30	Local	Soft	Gravel	Extensive	S	SE/S	No	V/C
McDonald	Low	<10	Local	Soft	Gravel/mud	Local	S	S	Yes	None
Neutral Hills "A"	Normal	10-30	Local	Firm	Gravel	Extensive	S	S	No	None
Sounding	Dry	-	-	-	-	Absent	-	-	Yes	None
Unnamed	Low	10-30	Local	Firm	Gravel	Extensive	S	SE	No	None
Neutral Hills "B1"	High	10-30	Local	Soft	Gravel/mud	Extensive	P	S	No	None
Greenlee	Normal	>30	Local	Soft	Gravel	Extensive	S	S	Yes	O/G
North Handhills	Dry	>30	Local	Firm	Gravel	Extensive	S	SE/S	No	C
Buffalo	Normal	<10	Local	Firm	Gravel/sand	Local	P	S	Yes	None
Rockland Bay	Normal	10-30	Local	Firm	Gravel	Extensive/local	P/S	S	Yes	C
Lonepine	Low	10-30	Local	Firm	Gravel	Local	S	S	No	None
Goosequill	Normal	10-30	Local	Firm	Gravel/mud	Extensive	I/P	S	No	H
Gooseberry	Normal	10-30	Local	Soft	Gravel	Local	S	S	No	C
Pearl	Low	10-30	Extensive	Firm	Gravel	Local	S	SE/S	No	C/V
Clear	Low	>30	Extensive	Firm	Gravel/sand	Absent	S	S	No	Cu
Chain #3A	Low	10-30	Local	Firm	Gravel	Local	S	S	No	None
Chain #4	Low	10-30	Extensive	Soft	Gravel	Local	P	S	No	V/C
Messner Pond	Normal	<10	Local	Firm	Gravel/sand	Local	P	S	No	None
Chain #6	Low	>30	Local	Firm	Gravel	Local	S	S	No	C
Chain #7	Low	0	-	-	-	Absent	-	-	Yes	C/V
Chain #8	Dry	<10	-	-	-	Local	-	-	Yes	C
Spiers	Low	<10	Local	Firm	Gravel	Local	S	S	No	C
Rider	Normal	10-30	Local	Firm	Gravel/sand	Absent	P	SE	No	C
Northeast region (10 sites)										
Cipher	Low	>30	Local	Soft	Gravel/mud	Extensive	S	S	Yes	None
Baxter	Low	10-30	Local	Firm	Sand	Absent	-	S	Yes	O
West Reflex	Low	10-30	-	-	Gravel/sand	-	S	S	No	C/V
Leane	Low	>30	Local	Firm	Gravel	Extensive	S	S	No	None
Killarney	Low	10-30	Local	Firm	Gravel	Extensive	S	S	Yes	C
Horseshoe	Low	>30	Local	Soft	Gravel/mud	Extensive	S	S	Yes	O/G
Sunken	Low	>30	Local	Firm	Gravel	Extensive	P	S	No	C
Unnamed	Low	10-30	Local	Firm	Gravel	Extensive	P	S	Yes	C
Metiskow	Low	10-30	Local	Soft	Mud	Extensive	P	S	Yes	C
Gillespie	Low	<10	-	-	-	Absent	-	S	Yes	Cu
Peace River region (1 site)										
Lesser Slave	Normal	10-30	-	-	Gravel/sand	-	S	S	No	H/W

Total = 48 sites

^a Nesting habitat: S = shoreline, P = points of land, I = islands.

^b Feeding habitat: S = shoreline, SE = seepage or springs.

^c Types of disturbance: C = cattle, V = vehicle, H = human, O = oil, G = gas, Cu = cultivation, W = weather.

^d Not available

The 1991 International Piping Plover Census in the United States, Mexico, and the Caribbean: breeding and winter populations

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Abstract

Assessing status and recovery of the threatened/endangered Piping Plover *Charadrius melodus* requires knowledge of the species' current distribution throughout the annual cycle. To address this issue, 673 biologists and volunteers from the United States collaborated in the 1991 International Piping Plover Census. Approximately 1270 sites were censused or surveyed, resulting in the highest number of breeding (3536 adults) and wintering (3384 birds) Piping Plovers ever recorded in the United States. Most (93%) wintering birds occurred along U.S. Gulf coast sites, with 55% occurring in Texas. Only 2% of wintering birds occurred along the coasts of Mexico and the Caribbean. Among wintering birds, 51% occurred on ocean beaches, 43% used sandflats or algal flats in protected bays, and 6% used areas where protected bays met ocean beaches. Breeding birds were widely distributed in small populations in the Northern Great Plains (58%) and the Atlantic coast (41%). Few birds (n = 39) remain on the Great Lakes. Habitat use among breeding birds varied considerably across the species' range. Whereas most Atlantic (93%) and Great Lakes (100%) birds used sandy beaches, 48% of Northern Great Plains birds used shorelines around small alkaline lakes, 29% used large reservoir beaches, 23% used river islands and adjacent sand pits, and <1 % used industrial pond shorelines.

Any change in status from previous censuses is difficult to determine. New populations were found in Montana and Colorado; however, the gap between Atlantic and Northern Great Plains birds grows as numbers decline in Minnesota and the Great Lakes. A better assessment of reproductive success in local populations will help determine future population trends for the species.

Résumé

L'évaluation du statut et le rétablissement du Pluvier siffleur *Charadrius melodus*, espèce menacée ou en danger de disparition, exige que nous connaissions sa répartition actuelle dans toutes les périodes de l'année. Pour contribuer à la poursuite de cet objectif, 673 biologistes et bénévoles américains ont participé au recensement international des Pluviers siffleurs de 1991. On a dénombré à environ 1270 sites 3536 pluviers nicheurs (adultes) et 3384 hivernants,

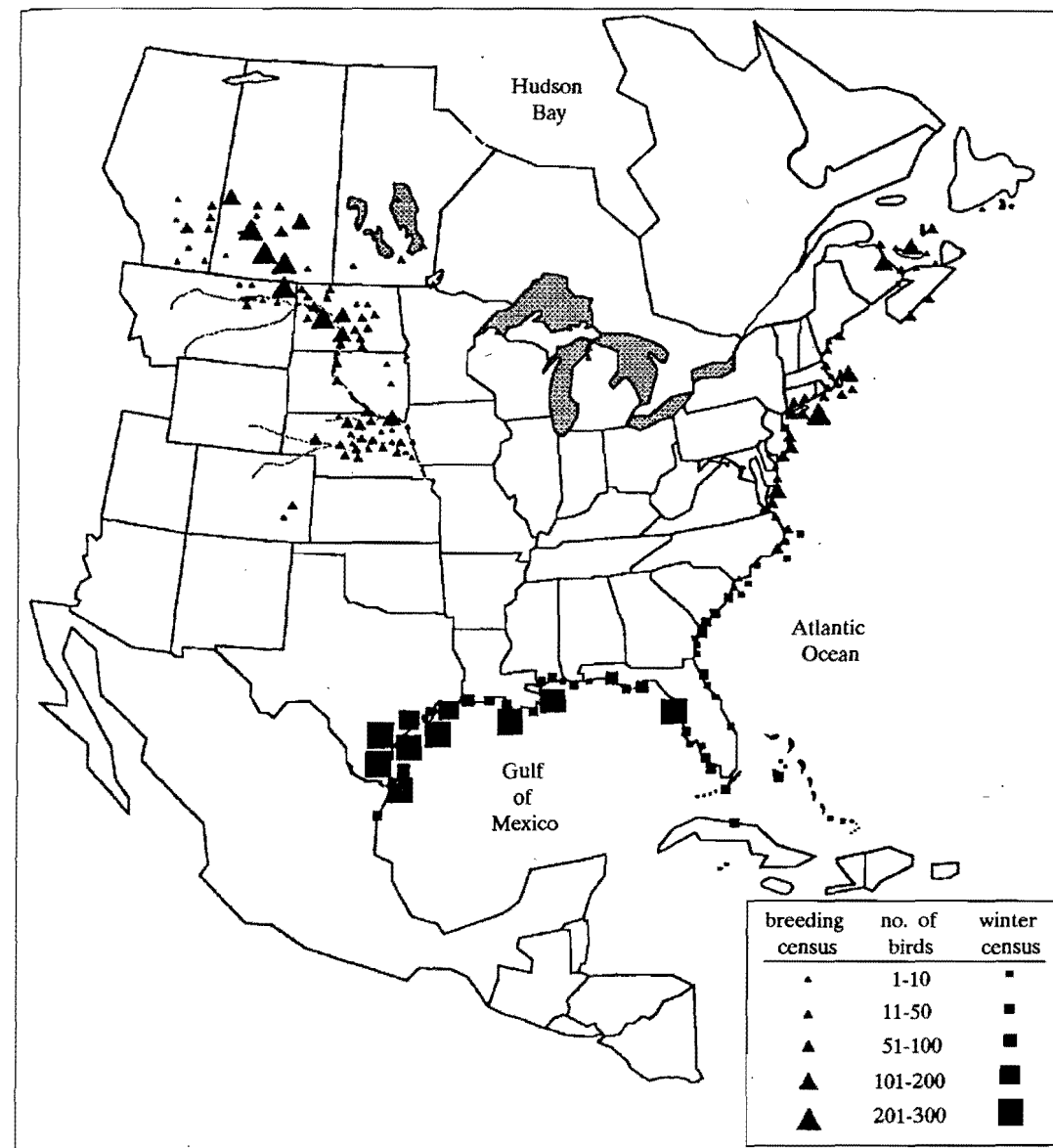
soit les effectifs les plus élevés jamais signalés aux États-Unis. La plupart des hivernants (93 %) ont été observés sur la côte américaine du golfe du Mexique, dont 55 % au Texas. Seulement 2 % des hivernants se trouvaient sur les côtes du Mexique et des Antilles. Chez les hivernants, 51 % ont été observés sur des plages océaniques tandis que 43 % fréquentaient l'estran sableux ou les platiers algaux des baies abritées et 6 %, des secteurs situés à la rencontre de baies protégées et de plages océaniques. Les reproducteurs étaient répartis sur de vastes territoires et en petites populations dans les Grandes Plaines septentrionales (58 %) et sur la côte atlantique (41 %). Peu d'oiseaux (n = 39) ont été observés dans la région des Grands Lacs. Les types d'habitats fréquentés par les reproducteurs variaient considérablement dans l'aire de répartition de l'espèce. Tandis que la plupart des oiseaux de la région de l'Atlantique (93 %) et tous ceux des Grands Lacs nichaient sur des plages de sable, 48 % des oiseaux des Grandes Plaines septentrionales nichaient sur les rives de petits lacs alcalins, 29 % sur des plages de grands réservoirs, 23 % sur des îles de cours d'eau et des sablières adjacentes et <1 % sur le pourtour de plans d'eau situés près de secteurs industriels.

Il est difficile de dire si l'état de la population globale a changé depuis les recensements précédents. De nouvelles populations ont été observées au Montana et au Colorado; cependant, le déclin des effectifs au Minnesota et dans la région des Grands Lacs creuse le fossé entre la population de la région de l'Atlantique et celle des Grandes Plaines septentrionales. Une meilleure évaluation du taux de reproduction dans les populations locales aidera à déterminer les tendances futures des effectifs de l'espèce.

Introduction

Since 1985, when the Piping Plover *Charadrius melodus* was listed as a threatened species on the U.S. Northern Great Plains and Atlantic coast and as an endangered species in the Great Lakes, state, federal, and university biologists have worked hard to implement the recovery objectives in their respective recovery plans (Dyer et al. 1987; Haig et al. 1988). Of primary importance was determination of the species' status and abundance throughout its range and throughout the annual cycle. Consequently, many individual efforts have shed light on

Figure 1
Breeding and winter distribution of Piping Plovers in Canada, the United States, Mexico, and the Caribbean, 1991



these issues (e.g., Adam 1984; Haig and Oring 1985; Nicholls and Baldassarre 1990b; Boyd 1991). Unfortunately, owing to differences among techniques, human resources, and accessibility of habitat, these efforts never yielded a comprehensive picture of the species' distribution.

In 1991, biologists from Canada, the United States, Mexico, and various Caribbean nations began a coordinated effort to address this problem by collaborating on a simultaneous census of all known Piping Plover breeding and winter sites. Goals of the census were to establish benchmark population levels for all known Piping Plover sites and to survey additional potential breeding and winter sites in order to gain a better understanding of the species' distribution. This paper will summarize results of the breeding census in the United States and the winter census in the United States, Mexico, and the Caribbean.

Methods

The 1991 International Piping Plover Census was designed and coordinated by the U.S. Great Lakes/Northern Great Plains Piping Plover Recovery Team. The winter census was conducted from 12 to 20 January 1991 along the Gulf coast of the United States and Mexico and the southern Atlantic coast of the United States, Cuba, and several other Caribbean countries (Fig. 1). The breeding census was carried out across the species' range from 1 to 9 June 1991 (Fig. 1). In both breeding and winter censuses, areas to be censused were determined by reviewing previous records of Piping Plover occurrence and by examining aerial photos and topographical maps for appropriate habitat types. Observers walked or drove along a predetermined stretch of beach or sandflat and recorded the number and location of each Piping Plover seen. Areas that were surveyed but did not contain Piping Plovers were recorded as well as those sites with birds present. Ancillary data such as identification of colour bands on banded birds, weather, tide stage, time of

day, habitat type (e.g., river, lake, beach, mudflat, sandflat), and kilometres of habitat covered were also recorded.

To conduct a census of this scale, methods were simplified in order to increase consistency among observers. It was not possible to carry out all censuses at specific times or tide stages because of the length and remoteness of many census routes (i.e., high tide when birds would be roosting and easier to count). Age and sex were also not recorded, as they are currently impossible to determine in wintering Piping Plovers and difficult to determine among breeding birds. To reduce disturbance to areas during the breeding census, nests, eggs, and chicks were not counted. Further, censuses were not carried out in the rain or under exceptionally cold or hot conditions to reduce censusers' impact on birds and to ensure the best opportunity to observe birds. All raw data and maps from the census can be found in Haig and Plissner (1992).

Results and discussion

In the United States, 273 biologists and volunteers took part in the breeding census and 400 participated in the winter census. Thirty-one biologists from eight other countries also participated in the winter census. Approximately 945 breeding sites and 325 winter sites were surveyed or censused, resulting in the highest number of U.S. breeding (3536 adults) and wintering (3384 birds) Piping Plovers ever recorded in the United States.

Winter census

The January 1991 winter census was conducted in all known U.S. Piping Plover winter sites and in many Mexican and Caribbean sites where birds have not been reported but habitat appeared suitable (Table 1, Fig. 1). The total number of wintering birds reported comprised 63% of all birds counted on the breeding grounds in North America (n = 5484 birds; Table 1). The majority of birds (55%, n = 1904) were found in Texas, where census efforts concentrated on previously unsurveyed stretches of back bays adjacent to Laguna Madre. The highest concentration of birds in local sites was also reported in Texas (Fig. 1). Although the 1991 census resulted in the discovery of more wintering birds than had previously been reported, a large proportion of Piping Plovers are not seen in the winter. As relatively few birds are seen on the Atlantic in winter, the largest gap appears to be in our understanding of winter sites for Piping Plovers that breed on the Atlantic coast.

Further investigation into movements of specific birds is helpful in addressing this issue. Few Atlantic coast breeding birds are resighted after they leave breeding sites. Most that are seen in winter are reported on the southern Atlantic coast of the United States and the Caribbean (Haig and Oring 1985, 1988a; Haig and Plissner 1993). Band recoveries indicate that some crossing over to the Gulf has occurred among Atlantic breeders. As there is a banding moratorium on Piping Plovers from the U.S. Atlantic coast, few birds have been banded in the past two years; hence, the magnitude of crossover is difficult to discern. An indication of the extent of crossover may become apparent if current census efforts in Laguna Madre in Texas and Mexico begin to account for more than just inland birds. Better survey effort in northern Cuba may also yield additional Atlantic

Table 1 Locations and numbers of Piping Plovers found during the 1991 Piping Plover winter census			
Location	No. of birds	Total no. of sites	No. of plover sites
U.S. Atlantic	178	132	30
U.S. - Gulf of Mexico	3206	193	126
Total U.S.	3384	325	156
Mexico - Gulf of Mexico	27	18	4
Bahamas	29	1	1
Turks and Caicos	0	1	0
Cuba ^a	11	2	1
Jamaica	0	b	0
Puerto Rico	0	5	0
Cayman Islands	0	b	0
Total Caribbean	40	11+	2
Total	3451	354+	162

^a Partial census in fall 1990.
^b Unknown number of sites surveyed.

breeders. Previous reviews of museum records and historical accounts of Piping Plovers did not indicate that birds moved farther south than the Caribbean (Haig and Oring 1985). Across their winter range, Piping Plovers occurred in less than half of the seemingly appropriate sites surveyed. Of birds censused, 51% (n = 1762) occurred on ocean beaches, 43% (n = 1486) used sandflats or algal flats in protected bays, and 6% (n = 203) used areas where protected bays met ocean beaches. Traditionally, only sand beaches have been protected for wintering Piping Plovers. The discovery of the high proportion of wintering Piping Plovers using algal flats and sandflats has significant implications for future habitat protection efforts. Previous studies have alluded to the importance of sandflats and algal flats (Haig and Oring 1985; Nicholls and Baldassarre 1990a), but it has never been quantified on such a large scale.

Breeding census

Results of the 1991 breeding census in the United States represent a complete census of all known Piping Plover breeding sites and provide the highest count of Piping Plovers to date (Table 2). Currently, Piping Plovers are widely distributed in small populations across their breeding range (Fig. 1). Most U.S. adults (57%) are found in the Northern Great Plains, whereas the numbers of birds and breeding sites on the Great Lakes remain small. Sites with the highest concentrations of breeding birds are also found in the Northern Great Plains; however, the percentage of the total population that each local population comprises is small (5%) (Table 2). Local populations are even smaller on the Atlantic coast. For example, Chincoteague National Wildlife Refuge in Virginia has the highest concentration of breeding Piping Plovers on the Atlantic coast, yet it contains only 2% of all breeding birds. In 1991, Piping Plovers were found in breeding areas where they had not been previously reported: a number of areas in northeastern Montana and the Prewitt Reservoir in Colorado. However, the birds have all but disappeared on the Great Lakes. The gap between Atlantic and Northern Great Plains/Prairie birds widens further as the number of

Table 2 Locations and numbers of Piping Plovers found during the 1991 Piping Plover breeding census in the United States					
Location	No. of adults	No. of pairs	Total no. of sites	No. of plover sites	Census coordinator
Atlantic coast					
Maine	38	18	8	8	Logan
Massachusetts	293	148	86	50	Melvin
Rhode Island	47	22	12	7	Raithel
Connecticut	67	30	20	7	Victoria
New York	338	181	101	69	Liebelt
New Jersey	280	122	51	22	Jenkins
Delaware	10	5	7	3	Gelvin-Innvaer
Maryland	35	16	1	1	MacIvor
Virginia	270	131	15	14	Terwilliger
North Carolina	86	30	37	14	Murdock
South Carolina	2	1	1	1	Murdock
Total	1466	704	339	196	
Great Lakes					
Duluth, Minnesota	0	0	2	0	Pfannmuller
Wisconsin	1	0	12	1	Matteson
Michigan	39	17	32	14	Wiese
Total	40	17	46	15	
Northern Great Plains					
Montana	308	105	79	39	Christopherson
North Dakota	992	496	172+	115	Kreil
South Dakota	293	142	64+	47	McPhillips
Lake of the Woods, Minnesota	13	6	3	1	Maxson
Colorado	13	3	36	4	Nelson
Nebraska	398	139	200+	106	Sidle
Iowa	13	6	2	2	Howell
Kansas	0	0	1	0	King
Oklahoma	0	0	3	0	Boyd
Total	2030	897	560+	314	
Grand total	3536	1618	945+	525	

birds declines at Lake of the Woods in Minnesota and Ontario, and in Manitoba. The growing gap between inland and Atlantic birds suggests that the species may soon have two distinct populations. However, genetic studies do not support this claim (Haig and Oring 1988b). It will take far more time for genotypes to diverge than for the range to change. Piping Plovers used a variety of habitat types across their breeding range. On the Atlantic coast, 93% (n = 1357) of U.S. breeding birds were found on ocean beaches, whereas the remainder used protected bays adjacent to the coast. All Great Lakes birds used Great Lakes beach shoreline. In the Northern Great Plains, 48% (n = 975) of Piping Plovers used alkaline lakes, 29% (n = 578) used reservoirs, 23% (n = 466) used rivers, and <1% (n = 13) used industrial ponds. Similar to winter results, less than half of the seemingly appropriate sites surveyed contained breeding birds. Sites such as Kirwin National Wildlife Refuge in Kansas, Cheyenne Bottoms National Wildlife Refuge in Kansas, and Great Salt Plains National Wildlife Refuge in Oklahoma have what appears to be appropriate Piping Plover breeding habitat, but birds are only occasionally seen there on migration. Thus, extrapolation of bird numbers from one site to the amount of seemingly available breeding habitat will not yield accurate population estimates.

Threats to Piping Plovers in the United States

Because of the species' widespread distribution and diversity of habitats used throughout the range, a variety of threats continue to plague Piping Plovers. In the Northern Great Plains, water level regulation policies on the major rivers (e.g., Platte, Missouri) serve as a direct source of chick mortality and an indirect source of habitat loss through vegetation encroachment (Schwalbach 1988). A 1990 biological opinion issued by the U.S. Fish and Wildlife Service regarding water management on the Missouri River may begin to mitigate this problem. The recent drought in the Northern Great Plains has caused some loss of habitat, although at least some Piping Plovers will use dry or nearly dry alkali flats (Weber and Martin 1991). Avian and mammalian predation continues to be a problem throughout the species' breeding range. However, use of predator exclosures and electric fences is beginning to improve reproductive success in a number of areas (Rimmer and Deblinger 1990; Mayer and Ryan 1991a), particularly on the Great Lakes and Atlantic coast. In the Great Lakes, Piping Plovers may also be suffering from a lack of viable habitat. Comparison of food availability at Northern Great Plains sites with that at Great Lakes sites indicated lower diversity and abundance of invertebrates (Nordstrom 1990). Atlantic coast breeding birds continue to face major threats from direct human disturbance (e.g., stepping on eggs) and habitat destruction because of development of their beach habitat for recreational purposes.

Few studies have been carried out on wintering Piping Plovers, and none has addressed threats to wintering birds. However, at a March 1992 meeting of the Great Lakes/Northern Great Plains Piping Plover Recovery Team in Galveston, Texas, several reports from research in progress indicated that further development of Laguna Madre and the continuing threat of oil spills in the Gulf of Mexico will result in serious loss of Piping Plover habitat. Clearly, additional research is needed to more fully understand the extent of these threats.

Acknowledgements

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General discussion

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Significance of the International Piping Plover Census

The 1991 International Piping Plover Census resulted in the largest tally of breeding Piping Plovers *Charadrius melodus* ever made. However, it does not necessarily represent an increased population size. In many cases, census techniques differed from those used in the past, and many sites were visited for the first time during this census.

The winter census also tallied the highest estimate of plovers ever recorded. Nevertheless, only 62% of the breeding population was located. Most wintering birds (55%) were found in Texas, where plovers were found in previously unsurveyed stretches of coastline in the vicinity of Laguna Madre. As banding studies have shown that the majority of birds found in the region of the Gulf of Mexico are prairie plovers (Haig 1991b), much remains to be learned about the wintering habitat of Atlantic birds.

As a consequence of the enhanced intensity of the 1991 winter census, a new threat to the species' survival may have been identified. Whereas half of wintering plovers were found on ocean beaches (51%), an unexpectedly high proportion of birds occurred on sandflats and algal flats (43%). These sites are threatened by development in areas such as the Laguna Madre (Haig and Plissner, this volume).

Canadian status of the Piping Plover in 1991

As Canada has over one-third (36%) of the entire breeding Piping Plover population, an understanding of the species' population structure in Canada is vital to the recovery of the species. The 1991 census is an important step forward in understanding the distribution and abundance of the species in Canada.

Parts of eastern Canada have been systematically censused for Piping Plovers over many years. With the 1991 results, the initial impression is that the provinces of eastern Canada currently appear to have relatively stable populations. However, it is worth noting that just prior to the 1991 census, the Nova Scotia Piping Plover population was in a dramatic decline (Flemming et al. 1988). For reasons that remain unclear, the rate of population decline seems to have slowed in Nova Scotia.

Overall, fledging success in 1991 may have been indicative of a stable population in eastern Canada, as it was greater than one fledged chick/pair, the modelled minimum

fledging success rate for a stable population (S.M. Melvin, pers. commun.). Quebec (Laporte and Shaffer, this volume), New Brunswick (Chiasson et al., this volume), and Prince Edward Island National Park (McAskill et al., this volume) reported values reflecting a healthy population. However, sites in Nova Scotia (Austin-Smith et al., this volume) and outside Prince Edward Island National Park (McAskill et al., this volume) had poor fledging success.

It is clear that the eastern Canada population is not increasing. Given the past population trend in Nova Scotia and the low fledging success in some areas, the stability of the eastern Canada population is not assured. The 1991 census has provided encouraging results, but it appears that more information is required before the population can be considered stable.

Since the original report of the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Bell 1978), the distribution of Piping Plovers in Canada has remained constant, with the exception of the Great Lakes subpopulation within Ontario, which is now believed to be extirpated (five birds remain at Lake of the Woods). This gap may be significant, because the loss of intermediate sites between major breeding areas may inhibit interregional movements of birds (Haig and Oring 1988a). At present, however, breeding populations are not considered to be genetically separated (Haig and Oring 1988c).

Population estimates for the Prairie provinces have varied widely in recent years, making even a preliminary status assessment difficult. Still, the 1991 census is the most accurate to date for the region (Hofman, Koonz, Skeel; this volume). In 1991, the population appeared to be higher in Saskatchewan (Skeel, this volume) and lower in Manitoba (Koonz, this volume) and Alberta (Hofman, this volume) than in past years.

Few recent data exist on the productivity of Piping Plovers in the Prairie provinces. However, brood surveys conducted in Saskatchewan reveal very poor success in some areas. Productivity on Lake Diefenbaker, the single largest concentration of Piping Plovers in Canada, has ranged from 0 to 0.89 young/pair (W.C. Harris, unpubl. data; Harris and Lamont 1989, 1990, 1991). Likewise, productivity on Big Quill Lake has ranged from 0.37 to 0.72 young/pair (Harris and Lamont 1989, 1990, 1991). These values are well below the estimated minimum of 1.13 young/pair needed to maintain a stable population (M.R.

Ryan, pers. commun.). Fortunately, not all areas have had such poor success (Harris and Lamont 1990, 1991). Nevertheless, if a trend can be gleaned from the available productivity data, it is that the Prairie population may be at some risk. Efforts to monitor productivity must be stepped up in the future.

Conservation initiatives

Most management initiatives have been designed to mitigate the factors limiting plover productivity. Efforts have been made to educate the public about the species; to reduce human disturbance, predation, and the disturbance or trampling of nests and young by cattle; to enhance productivity through intensive management; and to influence water level policy.

Education programs have been implemented throughout the species' range. Most of these actions seek to reduce the impact of human intrusion into plover breeding and wintering areas. In Canada, major programs are ongoing in New Brunswick and Îles-de-la-Madeleine (Quebec).

Efforts to reduce disturbance of breeding Piping Plovers by humans include beach closures, informational signs in nesting habitat, and stewardship programs. On lands where special protective laws can be implemented, such as provincial/state or federal parks, public access to many breeding areas is prohibited. However, a more commonly employed technique is the placement of signs in plover habitat to inform the public of the presence of the birds and of appropriate actions. Stewardship programs use elements of both techniques. Signs are posted and volunteers "guard" the posted nesting area by verbally explaining to people why they should avoid the nesting area to reduce disturbance of the birds.

Intensive management techniques to reduce predation on eggs and chicks are used in many protected areas. Nest exclosures (Rimmer and Deblinger 1990; Kenney 1991; Flemming 1992b) and electric fences (Mayer and Ryan 1991a) have been shown to reduce predation and increase productivity. Other intensive management techniques include double clutching/fostering (Shaffer and Laporte 1992), egg rescue from spring tides (Flemming 1992b), incubation and fostering of chicks from abandoned eggs (Flemming 1987, 1992b), and intentional management for plovers to nest with species of birds that mob predators (Burger 1987; Mayer and Ryan 1991b; Flemming 1991). To date, these techniques have met with mixed success.

Cattle disturb Piping Plovers or trample their eggs or young while seeking access to fresh water or shoreline grasses for forage (Cairns 1977). Further, after a shoreline is trampled, it may also be more prone to invasion by vegetation, and deep cattle tracks can trap chicks that fall into them (Haig et al. 1988). Fencing of nesting areas to exclude cattle has become an important management action (Haig et al. 1988; Wershler 1990; Skeel 1991).

Great efforts have been devoted to mitigation of water level regulation policy in the U.S. Great Plains and the Canadian Prairies. The main thrusts include avoiding dam discharges during the nest phase of the breeding season, water flow regulation to avoid encroachment of vegetation into nesting areas, sufficient habitat maintained above maximum water levels during the breeding season, and habitat creation to replace habitat lost as a result of

water control programs (Wershler 1990; Sidle et al. 1991; Haig 1991b).

Towards the next international census

The 1991 International Piping Plover Census is the most accurate census of the species ever conducted. Not only did it record more birds than all previous estimates, it also provided new insights about the wintering range of the species. However, despite its success in documenting the distribution and abundance of the Piping Plover, the census has not, by itself, clearly documented the current status of the species. This can occur only when subsequent censuses are conducted at the same range-wide scale and with clearly documented effort. The authors of this Occasional Paper look forward to the next international census. May it be as successful as the first one.

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