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SUMMARY OF SANDHILL CRANE SPORT HARVEST IN CANADA 1975-2006

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Abstract: Knowledge of harvest in all areas where the mid-continent population (MCP) of sandhill cranes (*Grus canadensis*) occurs is critical to managing the population in a sustainable manner. The harvest of MCP in the U.S. has been well documented; however, the harvest in Canada has received less attention. The Canadian Wildlife Service initiated a National Harvest Survey program in 1967, but all sampling variables were not directly comparable until 1975. In this paper, we summarize crane harvest in Canada during the 1975-2006 hunting seasons for Saskatchewan and Manitoba, the 2 provinces with significant sport hunting harvest of sandhill cranes. There has been a significant decline over the last 3 decades in the number of potential resident hunters, a decrease in the estimated number of active non-waterfowl hunters, and a decrease in the estimated number of hunter days afield. Conversely, the number of potential non-resident hunters, active non-waterfowl hunters, and number of hunter days afield in Saskatchewan began to increase after 1995, the year sandhill crane hunting was opened to non-residents. An increasing trend in both the number of sandhill cranes harvested and success rate among non-resident hunters, particularly in Saskatchewan, occurred whereas the number of sandhill cranes harvested and success by residents has remained relatively stable.

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Key words: Canada, *Grus canadensis*, harvest, Manitoba, mid-continent population, sandhill cranes, Saskatchewan.

The mid-continent population (MCP) of sandhill cranes (*Grus canadensis*) is widely distributed in North America and extends into the northeastern region of Siberia. Responsibility for the conservation and management of the MCP was established by international treaties signed by the United States with Great Britain (for Canada in 1916), Mexico (1936), Japan (1972), and the U.S.S.R (1976, now honored by Russia). This cooperative management is essential to maintain the population's long-term stability and to provide opportunities for recreational and subsistence harvests. Since hunting seasons for the MCP were re-established in limited areas in both the U.S. in 1961 and 3 years later in Canada, the areas open for harvest have gradually expanded to areas in 12 U.S. states, 3 Canadian provinces, and 9 northern and central states in Mexico (Tacha et al. 1994). In addition, subsistence harvest occurs in parts of Alaska and Canada.

Since 1966, all migratory game bird hunters in Canada have been required to annually purchase a Migratory Game Bird Hunting Permit as well as fulfill other state or provincial requirements. In 1967, the annual National Harvest Survey (NHS), initiated by the Canadian Wildlife Service (CWS), was developed to collect information needed to manage migratory game

bird species. It is composed of the Harvest Questionnaire Survey (HQS) and the Species Composition Survey (waterfowl only) and draws its sample from the number of permits sold. The HQS sampling frame includes permit holders that reside in each of the 23 geographic zones (Fig. 1) and in each of 4 hunter groups that further detect the frequency of permit renewals over the preceding 2 years (Cooch et al. 1978). The survey requests information about the number of days afield for waterfowl and non-waterfowl hunters as well as the number of birds harvested and retrieved for 10 species, including sandhill cranes. However, the survey does not include a 'diary' for non-waterfowl hunters to record daily harvest as it does for ducks and geese (Gendron and Collins 2007).

Sandhill crane hunting was closed to non-resident hunters from 1964 to 1987. In 1988, Manitoba allowed non-residents to hunt sandhill cranes, and Saskatchewan followed suit in 1995. Between 1988 and 2000, non-resident hunters were required to obtain a CITES permit to transport their harvested sandhill cranes across the Canadian border. This requirement was removed in 2001 when sandhill cranes were removed from the Canadian CITES list.

In this study, we analyzed the data collected from



Figure 1. National Harvest Survey geographic zones in Canada (Gendron and Collins 2007).

both resident and non-resident hunters in Saskatchewan and Manitoba and identified trends in hunters and their success and harvest of sandhill cranes. Summarizing harvest information from Canada will assist authorities in their management of the MCP.

METHODS

We obtained harvest information from the CWS Harvest Surveys website (Gendron and Collins 2007) for hunting seasons in Canada from 1975 to 2006 when all harvest variables were directly comparable. The information was collected from hunters in 3 designated HQS zones in Saskatchewan and 2 in Manitoba. Data summarized from hunter survey responses included the

number of potential hunters (both waterfowl and non-waterfowl), active non-waterfowl hunters, and hunter days afield. Non-waterfowl hunters were those hunting snipe (*Gallinago delicata*), woodcock (*Scolopax minor*), coots (*Fulica americana*), moorhens (*Gallinula chloropus*), doves, band-tailed pigeons (*Patagioenas fasciata*), rails, and sandhill cranes. Because harvest was reported by species, we were able to analyze the harvest of sandhill cranes and enumerate hunters that were successful in harvesting 1 or more cranes. Information reported on the permit application about citizenship allowed us to further separate the overall harvest between resident and non-residents.

By analyzing variables using simple linear or exponential regression models, we wanted to determine if

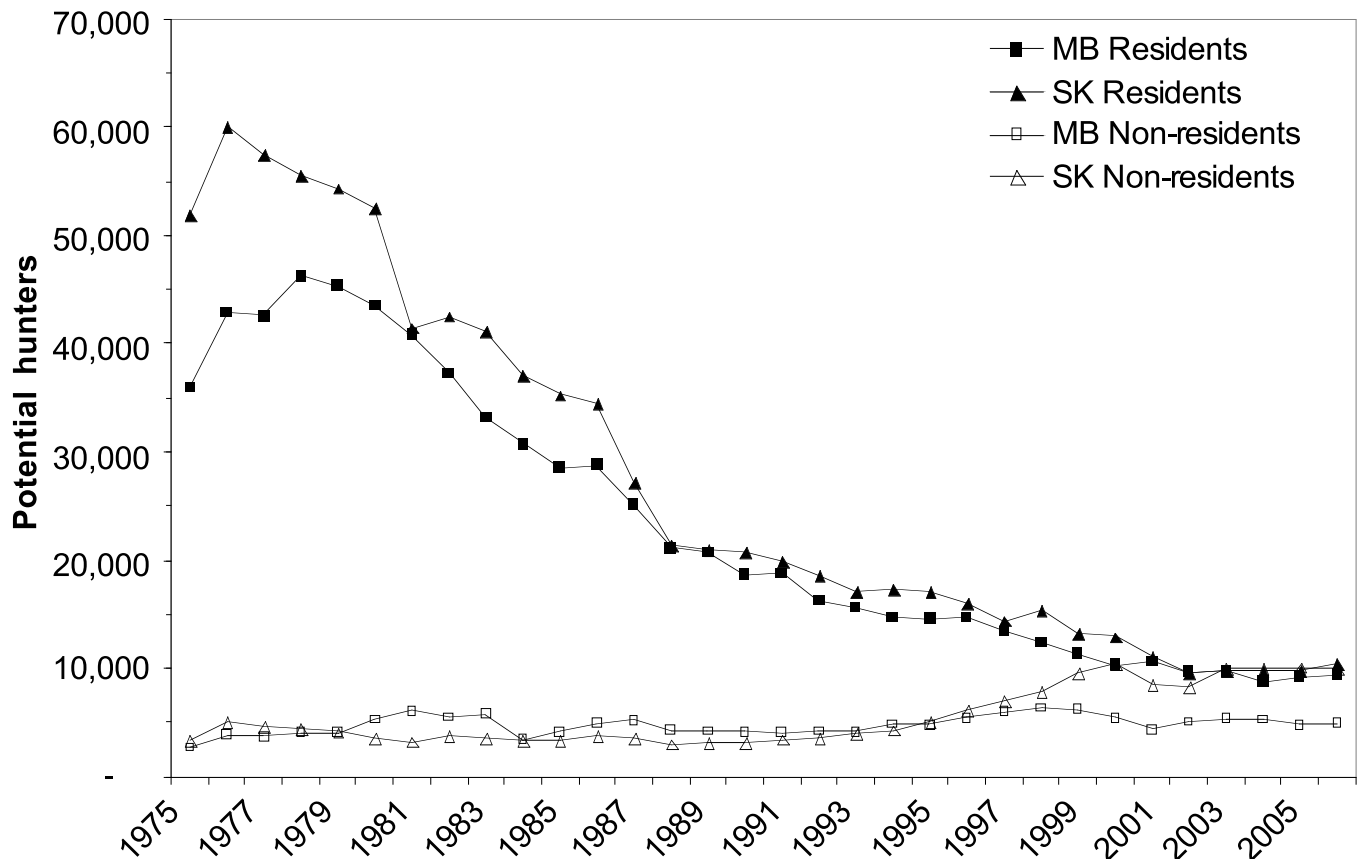


Figure 2. Potential hunters (waterfowl and non-waterfowl) in Saskatchewan and Manitoba, Canada, 1975-2006.

there has been a trend over time in the number of potential hunters, active non-waterfowl hunters, sandhill cranes harvested, and the success of sandhill crane hunters by both resident and non-resident hunters. The data was log-transformed so that we could obtain percent change per year and normalize the residuals. We used a two-sample *t*-test, with Satterthwaite's approximation for degrees of freedom, because of unequal variances and sample sizes, to test for differences among active non-waterfowl hunters over time. A two-sample *t*-test with equal variances also was used to test for differences in crane harvest between zones by resident and non-resident hunters.

RESULTS

Over the last 3 decades there has been a significant decrease, fitted with a negative exponential linear model using pooled data ($R^2 = 0.973$, $P \leq 0.001$), in the number of potential resident hunters in Saskatchewan

and Manitoba. Beginning in 1995, when non-residents were allowed to hunt sandhill cranes in Saskatchewan, the number of potential non-resident hunters increased until 2000, and then leveled off. In Manitoba, the number of potential non-resident hunters has remained relatively stable even with the addition of sandhill crane hunting by non-residents in 1988 (Fig. 2).

The number of active non-waterfowl resident hunters in the 2 provinces also decreased, from a combined high of 13,337 in 1978 to a low of 2,119 in 2005 (Fig. 3). In Manitoba, the number of active non-resident non-waterfowl hunters has remained stable. However, in Saskatchewan the total number of active non-waterfowl hunters between 1988 and 1997 ($\bar{x} = 2,518$) is significantly lower than in 1975-1987 ($\bar{x} = 5,311$; $t = 7.91$, $P < 0.001$, $df = 13$). Since 1998 the total number of active non-waterfowl hunters in Saskatchewan has begun to increase (1998-2006: $\bar{x} = 3,398$; $t = 5.56$, $P < 0.001$, $df = 15$) from the previous time period, likely due to the addition of non-resident

Table 1. Sandhill crane harvest in Saskatchewan and Manitoba, Canada, 1975-2006.

Year	Saskatchewan							Manitoba					Overall total	
	Resident			Non-resident				Province total	Resident		Non-resident			Province total
	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1		Zone 2	Zone 1	Zone 2			
1975	1,012	0	4,732				5,744	113	49			162	5,906	
1976	270	54	1,103				1,427	174	35			209	1,636	
1977 ^a								315	52			367	367	
1978 ^a								860	17			877	877	
1979	933	89	1,799				2,821	199	779			978	3,799	
1980	1,325	56	3,317				4,698	440	451			891	5,589	
1981	671	74	1,711				2,456	462	48			510	2,966	
1982	476	261	1,300				2,037	520	215			735	2,772	
1983	786	84	1,841				2,711	233	144			377	3,088	
1984	876	0	2,008				2,884	593	68			661	3,545	
1985	2,092	0	2,356				4,448	551	140			691	5,139	
1986	1,658	105	2,689				4,452	1,400	262			1,662	6,114	
1987	392	859	3,229				4,480	359	305			664	5,144	
1988 ^b	1,212	147	3,631				4,990	1,345	568	0	45	1,958	6,948	
1989	714	0	1,609				2,323	1,328	1,324	0	0	2,652	4,975	
1990	1,536	158	2,118				3,812	968	45	10	0	1,023	4,835	
1991	533	0	3,014				3,547	1,528	221	0	22	1,771	5,318	
1992	1,108	136	3,474				4,718	834	269	107	11	1,221	5,939	
1993	671	63	1,699				2,433	197	274	11	0	482	2,915	
1994	1,377	114	1,766				3,257	326	184	34	0	544	3,801	
1995 ^c	1,288	73	3,104	273	22	63	4,823	695	100	209	0	1,004	5,827	
1996	664	56	1,504	174	51	512	2,961	1,143	151	37	20	1,351	4,312	
1997	959	57	2,071	605	123	806	4,621	1133	136	0	10	1,279	5,900	
1998	2,821	202	2,463	845	48	2,258	8,637	537	192	160	0	889	9,526	
1999	1,379	59	1,954	1,937	20	1,751	7,100	891	253	118	38	1,300	8,400	
2000 ^d	1,883	22	2,344	1,622	188	2,586	8,645	526	174	94	11	805	9,450	
2001	1,808	12	1,810	1,667	21	2,221	7,539	642	115	478	12	1,247	8,786	
2002	1,083	16	1,833	1,308	130	2,295	6,665	540	218	488	36	1,282	7,947	
2003	1,201	257	1,490	2,496	125	2,542	8,111	631	602	241	0	1,474	9,585	
2004	860	25	2,607	2,283	351	3,644	9,770	839	37	355	36	1,267	11,037	
2005	1,200	0	1,363	3,034	0	2,503	8,100	586	0	1,139	51	1,776	9,876	
2006	1,239	54	1,352	2,632	137	2,315	7,729	591	510	1,587	0	2,688	10,417	

^a Season was cancelled in Saskatchewan due to presence of whooping cranes in the area.

^b In Manitoba, non-residents allowed to hunt sandhill cranes with CITES export permit.

^c In Saskatchewan, non-residents allowed to hunt sandhill cranes with CITES export permit.

^d Non-residents are not required to possess a CITES export permit.

hunters.

The number of hunter days afield by all resident non-waterfowl hunters has steadily decreased in both provinces from a combined high of 59,960 in 1978 to a low of 13,272 in 1997. With the addition of non-resident sandhill crane hunters in 1988 and 1995 for Manitoba and Saskatchewan, respectively, the total number of days afield began increasing after 1997 reaching a high of 18,667 in 2006, of which 8,051 were by non-residents and 10,616 were by residents.

The estimated sport harvest of sandhill cranes in Canada has nearly doubled over the last 30 years from 5,906 in 1975 to 10,417 in 2006 (Fig. 4, Kruse et al. 2008), primarily due to increases in harvest by non-residents. Sandhill crane harvest by residents in both provinces (using the log-transformed values) during 1975-2006 was stable ($R^2 = 0.843$, $P = 0.001$, $B_1 < 0.001$), indicating that even though the number of resident hunters declined, the sandhill crane harvest rate by residents increased. During the period 1988-

Table 2. Season dates and bag limits for sandhill crane hunting in Saskatchewan and Manitoba, Canada, 1964-2006.

Year	Saskatchewan		Manitoba		
	Season dates	Bag ^a	Season dates	Bag	
1964	1-19 Sep	2/4	1-19 Sep	2/4	
1965	1-18 Sep	2/4	1-18 Sep	2/4	
1966	1-17 Sep	4/8	1-17 Sep	4/8	
1967	1-16 Sep	4/8	1-16 Sep	4/8	
1968	2-19 Sep	4/8	2-16 Sep	4/8	
1969	1-13 Sep	4/8	1-13 Sep	4/8	
1970	1-12 Sep	4/8	1-14 Sep	4/8	
1971	1-11 Sep	4/8	1-14 Sep	4/8	
1972	1-9 Sep	4/8	1-14 Sep	4/8	
1973	2-7 Sep	4/8	2-14 Sep	4/8	
1974	1-8 Sep	4/8	1-15 Sep	4/8	
1975	1-6 Sep	4/8	1-13 Sep	4/8	
1976	1-7 Sep	4/8	1-11 Sep	4/8	
1977 ^b	Season cancelled	4/8	1-10 Sep	4/8	
1978 ^b	Season cancelled	4/8	1-30 Sep	4/8	
1979 ^c	1-8 Sep	17-22 Sep	4/8	1-30 Sep	5/10
1980	1-6 Sep	15-20 Sep	4/8	1-30 Sep	5/10
1981	1-5 Sep	14-19 Sep	4/8	1-30 Sep	5/10
1982	1-4 Sep	13-18 Sep	4/8	1 Sep-2 Oct	5/10
1983	1-6 Sep	14-20 Sep	4/8	1 Sep-1 Oct	5/10
1984	1-11 Sep	12-18 Sep	4/8	1-29 Sep	5/10
1985	2-17 Sep	10-23 Sep	5/10	1-28 Sep	5/10
1986	1-16 Sep	10-23 Sep	5/10	1-27 Sep	5/10
1987	1-15 Sep	9-22 Sep	5/10	1-26 Sep	5/10
1988 ^d	1-13 Sep	12-20 Sep	5/10	1-30 Sep	5/10
1989	1-12 Sep	11-19 Sep	5/10	1-30 Sep	5/10
1990	1-18 Sep	10-25 Sep	5/10	1-29 Sep	5/10
1991	2-17 Sep	9-24 Sep	5/10	2-28 Sep	5/10
1992	1-15 Sep	14-22 Sep	5/10	1 Sep-3 Oct	5/10
1993	1-14 Sep	1-29 Sep	5/10	1 Sep-2 Oct	5/10
1994	1-15 Sep	1-30 Sep	5/10	1 Sep-1 Oct	5/10
1995 ^e	1-16 Sep	10-23 Sep	5/10	1-30 Sep	5/10
1996	2-14 Sep	2-30 Sep	5/10	2-28 Sep	5/10
1997	1-30 Sep	1-30 Sep	5/10	2-27 Sep	5/10
1998	1 Sep-12 Dec	1 Sep-12 Dec	5/10	1 Sep-3 Oct	5/10
1999	1 Sep-11 Dec	1 Sep-11 Dec	5/10	1-27 Sep	5/10
2000 ^f	1 Sep-16 Dec	1 Sep-16 Dec	5/10	1-25 Sep	5/10
2001	1 Sep-16 Dec	1 Sep-16 Dec	5/10	1 Sep-30 Nov	5/10
2002	1 Sep-16 Dec	1 Sep-16 Dec	5/10	1 Sep-30 Nov	5/10
2003	1 Sep-16 Dec	1 Sep-16 Dec	5/10	1 Sep-30 Nov	5/10
2004	1 Sep-16 Dec	1 Sep-16 Dec	5/10	1 Sep-30 Nov	5/10
2005	1 Sep-16 Dec	1 Sep-16 Dec	5/10	1 Sep-30 Nov	5/10
2006	1 Sep-16 Dec	1 Sep-16 Dec	5/10	1 Sep-30 Nov	5/10

^a Daily bag limit/daily possession limit.

^b Season was cancelled in Saskatchewan due to presence of whooping cranes in the area.

^c In 1979 Saskatchewan created 2 hunting districts, North Game Bird District and South Game Bird District, respectively, with differential hunting season dates.

^d In Manitoba, non-residents allowed to hunt sandhill cranes with CITES export permit.

^e In Saskatchewan, non-residents allowed to hunt sandhill cranes with CITES export permit.

^f Non-residents are not required to possess a CITES export permit.

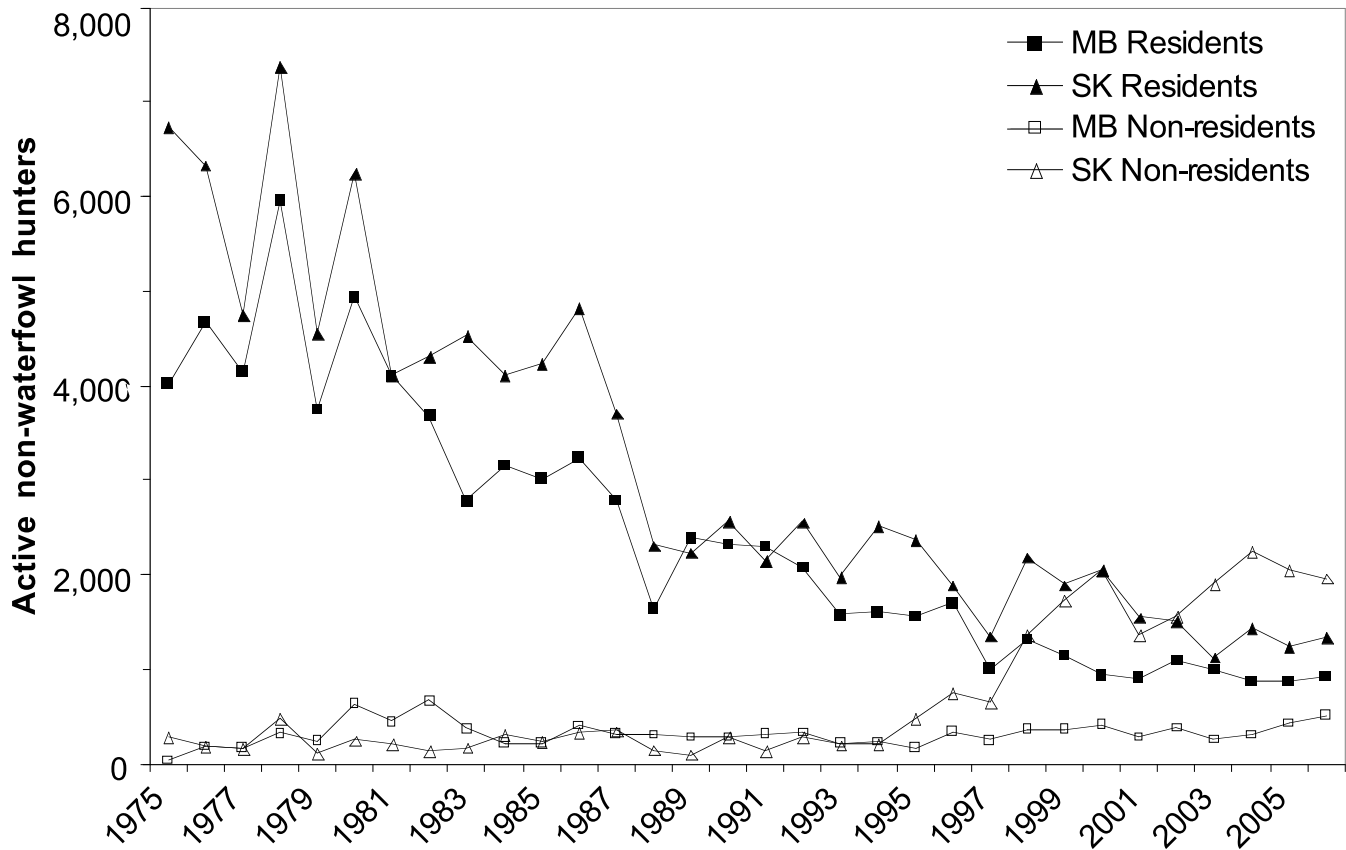


Figure 3. Active non-waterfowl hunters in Saskatchewan and Manitoba, Canada, 1975-2006.

2000, when non-residents were allowed to hunt sandhill cranes but were required to obtain a CITES permit, the trend was not statistically significant for harvest by all hunters (log-transformed values: $R^2 = 0.216$, $P = 0.110$, $B_1 = 0.04$). With the removal of the CITES permit requirement in 2001, the trend for 2001-2006 (entire harvest in Canada) increased by an average rate of 4.7% per year (log-transformed values: $R^2 = 0.549$, $P = 0.092$). The overall harvest in Saskatchewan increased by an average rate of 6.6% per year (log-transformed values: $R^2 = 0.480$, $P = 0.013$) since 1995. In Manitoba, though not statistically significant ($R^2 = 0.446$, $P = 0.147$, $B_1 = 0.252$), the non-resident harvest increased by 224%, from 490 in 2001 to 1,587 in 2006.

The CWS uses geographic zones to group harvest information, which allowed us to analyze the harvest data spatially. Of the average harvest in the 2 provinces combined, 86.3% occurred in Saskatchewan (Table 1). Within Saskatchewan, 97.1% of the average harvest

occurred in the southern portion of the province (Zone 1 = 35.8%, Zone 3 = 61.3%). In Manitoba, the northern zone (Zone 2) accounted for 23.7% of the harvest compared to 76.3% for the southern zone (Zone 1). The number of sandhill cranes harvested by resident hunters compared to non-resident hunters differed only in Manitoba (Zone 1: $t = 2.92$ $P = 0.003$; Zone 2: $t = 2.94$ $P = 0.003$), with more resident hunters harvesting sandhill cranes than non-resident hunters.

The success of resident hunters who harvested at least 1 crane per season was stable ($\bar{x} = 1,113$) over the last 30 years. In comparison, the number of successful non-resident hunters has increased in Manitoba from 15 in 1988 to 287 in 2006, and in Saskatchewan from 106 hunters in 1995 to a high of 1,726 in 2004 (Fig. 5).

DISCUSSION

Harvest surveys, combined with the annual spring population index survey, are important tools necessary

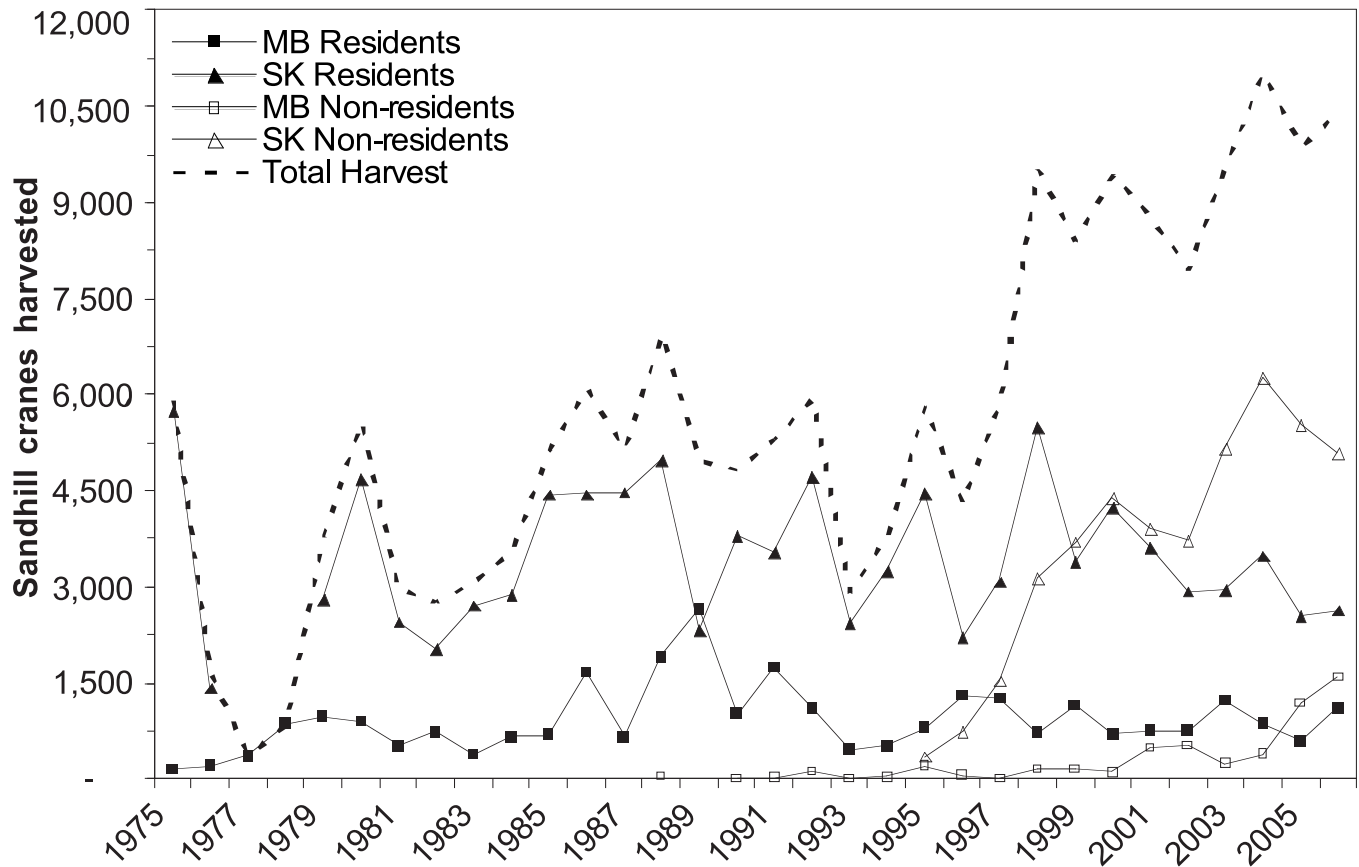


Figure 4. Harvest of mid-continent population of sandhill cranes in Saskatchewan and Manitoba, Canada, 1975-2006. The season was closed in Saskatchewan in 1977 and 1978 due to the presence of whooping cranes (*G. americana*) in the area. Sandhill crane hunting was opened to non-residents in 1988 in Manitoba and 1995 in Saskatchewan.

to manage the MCP as identified by the MCP management plan (Central, Mississippi, and Pacific Flyway Councils 2006). In the early years, the accuracy of the HQS for sandhill cranes was uncertain because the survey was not designed to provide precise data on species not harvested in large numbers. For example, in 1976 only about 15% of hunters responding reported hunting migratory game birds other than waterfowl (Cooch et al. 1978). During the years 1974-1976 an experimental sandhill crane survey was conducted to obtain improved estimates of the number of sandhill cranes harvested in Saskatchewan (Smith and Cooch 1978). Comparisons among the experimental survey, the HQS, and a separate Saskatchewan provincial survey revealed that harvest was most accurately represented by the more intensive experimental sandhill crane survey, whereas the national and provincial surveys overestimated harvest. However, the

NHS results were deemed acceptable within the stated confidence limits even though the limits were large due to a relatively small proportion of resident non-waterfowl hunters. With the increase in the number of sandhill crane hunters in Saskatchewan over the last 11 years, there should be a corresponding improvement in the harvest estimates and smaller confidence limits for this province.

Analyses of the HQS data for active non-waterfowl hunters, which included those hunting sandhill cranes, depicted a significant decrease in the number of resident hunters in Saskatchewan and Manitoba for the 1975-2006 hunting seasons. These results corroborate the well-documented decline in resident migratory bird hunters and corresponding decrease in waterfowl harvest (Boyd et al. 2002). However, since 1988 the total number of active non-waterfowl hunters in Canada began to level off to the current average (1988-

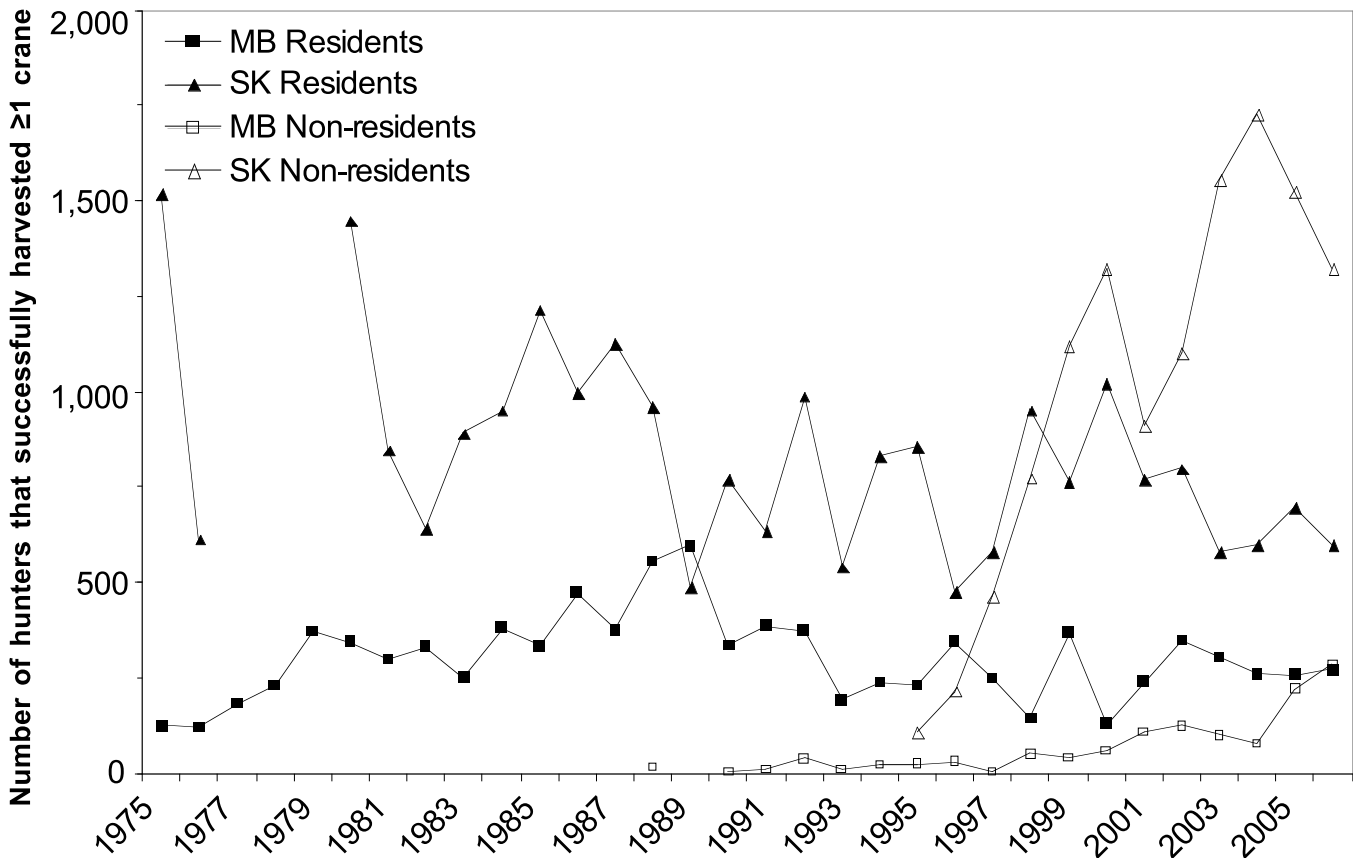


Figure 5. Successful sandhill crane hunters in Saskatchewan and Manitoba, Canada, 1975-2006.

2006) of 4,690 hunters. This coincided with the opening of sandhill crane hunting to non-residents in Manitoba in 1988 and Saskatchewan in 1995. The number of active non-resident non-waterfowl hunters has surpassed resident hunters since 2003, perhaps influenced by the elimination of the CITES permit. Similarly, the total number of non-resident days afield increased. Over the last decade there was a significant increase in the harvest of MCP sandhill cranes and success by hunters, particularly by non-residents hunters in the southeast portion of Saskatchewan. In contrast, the harvest and success by resident hunters was relatively stable. Of the non-resident hunters, 99% were comprised of hunters from the U.S. (D. J. Nieman, Canadian Wildlife Service, personal communication).

Reliable estimates of harvest and hunting activity are critical to making informed management decisions. However, limitations of the HQS for non-waterfowl species preclude species specific estimates of hunting

activity. Information such as number of permits, active hunters, and hunter effort, although important, are not collected for sandhill cranes. Rather, responses are grouped as non-waterfowl and include sandhill cranes among other non-waterfowl species. A follow-up survey similar to the Special Saskatchewan Sandhill Crane Survey, the U.S. Mail Questionnaire Survey, or the U.S. Harvest Information Program, would provide more comprehensive information from hunters. This would enable sandhill crane hunters to be identified and sampled at a higher frequency to gather information about their daily hunting activities, including birds shot but not retrieved, so that a crippling rate could be estimated. This information is particularly important in Canada since sport hunting by non-residents is increasing. However, obtaining this information would require a redesign of the survey, which will cost resources and likely will not be conducted in the near future. Further, some harvest information undoubtedly will remain unavailable, such as the subsistence harvest

by indigenous hunters, because many are exempt from permit requirements.

Causal factors for the increases observed in harvest and success by non-resident hunters in Saskatchewan and Manitoba are difficult to determine. Factors might include Canada's longer hunting seasons (over the last decade) and higher bag and possession limits (Table 2). These factors may be influencing U.S. hunters to hunt sandhill cranes in Canada, particularly those hunters who are already in the area to hunt geese. Additionally, because of the decline in resident hunter numbers, non-resident hunters may be taking opportunities to hunt in areas that had been previously occupied by resident hunters. However, despite these advantages, data are insufficient to demonstrate positive correlations with increased crane harvest. Perhaps as in the U.S., increased success can be attributed to increased hunter knowledge of crane behavior, improvements in equipment (e.g. decoys, calls), and increased proficiency in hunting skills (Sharp and Vogel 1992).

Annual indices to MCP crane abundance, based on extensive, spring aerial surveys on major concentration areas, have been relatively stable since the early 1980s. However, recent analyses of long-term trends (1982-2004) indicate that the harvest of the MCP (which includes the harvest in Canada) has been increasing at a greater rate (+2.6% per year) than population growth (+0.7% per year) (Kruse et al. 2008). While abundance objectives in the MCP management plan are presently being met, management actions may be necessary to alter harvest rates if the harvest continues to increase to the point where annual mortality exceeds recruitment. Bag limits and season lengths are the primary tools that managers can use to affect harvest. We suggest further research into the effects of season lengths and bag limits in Canada on the overall harvest of the MCP.

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