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SUMMARY OF SANDHILL CRANE HUNTING SEASONS IN NORTH DAKOTA, 1968-94

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Abstract: The migratory Mid-continent Population (MCP), containing 3 subspecies, is the most numerous of all sandhill crane (*Grus canadensis*) populations. During fall the MCP uses major staging areas in the Canadian prairie provinces and northcentral United States. In North Dakota, sport hunting of the MCP resumed in 1968, after being closed during 1916-67. The resumption and expansion of crane hunting in North Dakota during 1968-94 followed a gradual pattern of implementation. Subspecies considerations, the presence of whooping cranes (*G. americana*), crop depredation complaints, and public reaction influenced the geographic and temporal expansion of seasons. Harvests gradually increased following each expansion and in 1993-94 reached near record levels (6,200-7,000), as seasons utilizing the full federal frameworks were implemented. Spring surveys indicate that the MCP is relatively stable, and current sport harvest levels appear appropriate to maintain current population size. A primary management concern is to maintain subspecies abundance, especially of the less numerous greater sandhill crane (*G. c. tabida*).

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Key Words: *Grus canadensis*, *Grus americana*, harvest, hunting, Mid-continent Population, North Dakota, sandhill cranes, whooping cranes.

Sandhill cranes are classified into 6 subspecies; 3 subspecies are sedentary and 3 are migratory (Walkinshaw 1949, 1965; Braun et al. 1975). For management purposes, sandhill cranes have been grouped into 9-10 populations (Drewien and Lewis 1987, Tacha et al. 1994). Nonmigratory populations are relatively small (<7,000-8,000) and are not hunted (Lewis 1977). Two migratory populations, the Rocky Mountain Population of greater sandhill cranes and the MCP, have carefully designed sport hunting programs with a goal to maintain stable population levels (Sharp 1995). The MCP, the largest hunted population, occurs in the Central Flyway during the fall and winter and is composed of 3 recognized subspecies: lesser (*G. c. canadensis*), Canadian (*G. c. rowani*), and greater (Braun et al. 1975, Tacha et al. 1994).

During the summer cranes of the MCP are distributed from western Ontario northwestward across central and northern Canada, Alaska, and into eastern Siberia (Lewis 1977). In September, cranes begin migration to traditional staging areas in the southern Canadian prairie provinces of Alberta, Saskatchewan, and Manitoba and in North Dakota (Buller 1967, Lewis 1977). Prairie staging areas provide opportunities to assimilate critical nutrients, primarily from small grain crops, necessary to complete fall migration and to prepare for winter (Madsen 1967, Sugden et al. 1988). In spring these habitats and the staging area along the Platte River Valley in Nebraska facilitate completion of nutrient acquisition to meet migration demands and to enhance body conditioning for nesting (Krapu et al. 1985, Iverson et al. 1987).

Sandhill crane hunting seasons (crane hunting) in North Dakota were closed for 52 years following the 1916 Convention for the Protection of Migratory Birds. In 1968 an experimental hunting season was initiated, and in 1975 the season was considered operational (Miller 1987). A Cooperative Management Plan for the MCP was prepared in 1981 (Central Flyway Council 1981) and was revised in 1993 (Central Flyway Council 1993). Since 1981 these plans have guided the regulation of annual crane harvests in the Central Flyway.

In North Dakota and the remainder of the Central Flyway, the resumption of crane hunting followed a gradual pattern of expansion. Crane hunting and expansion of seasons have come under intense scrutiny and controversy by anti-crane hunting groups and individuals (Miller 1974, Konrad 1977, Johnsgard 1982, Thompson and George 1987). However, this controversy also prompted studies of cranes (Miller 1987) and resulted in expansion and refinement of cooperative survey programs. In this paper we report (1) history and changes in sandhill crane hunting seasons in North Dakota, 1968-94, (2) harvests, (3) hunter activity and success, (4) population status of the MCP, and (5) impacts of hunting on whooping cranes.

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NORTH DAKOTA HUNTING SEASONS, 1968-94

Crane hunting seasons in North Dakota resumed in 1968. The presence of endangered whooping cranes, sandhill crane subspecies abundance and distribution patterns, crop depreda-

Table 1. Sandhill crane hunting seasons in North Dakota, 1968-94.

Year	Area	Bag/ possession	Season dates	Length (days)
1968		2/4	9 Nov- 8 Dec	30
1969		3/6	8 Nov- 7 Dec	30
1970		3/6	14 Nov-13 Dec	30
1971		3/6	13 Nov-12 Dec	30
1972		3/6	11 Nov-10 Dec	30
1973		3/6	10 Nov- 9 Dec	30
1974		3/6	9 Nov- 8 Dec	30
1975		3/6	8 Nov- 7 Dec	30
1976		3/6	6 Nov- 5 Dec	30
1977		3/6	7 Sep-11 Sep	5
1978		3/6	7 Sep-11 Sep	5
1979		3/6	7 Sep-11 Sep	5
1980	1	3/6	6 Sep-14 Sep	9
	2	3/6	6 Sep-10 Sep	5
1981	1	3/6	5 Sep-20 Sep	16
	2	3/6	5 Sep-13 Sep	9
1982	1	3/6	4 Sep-19 Sep	16
	2	3/6	4 Sep-12 Sep	9
1983	1	3/6	10 Sep- 6 Nov	58
	2	3/6	10 Sep-30 Sep	21
1984	1	3/6	8 Sep- 4 Nov	58
	2	3/6	8 Sep-28 Sep	21
1985	1	3/6	7 Sep- 3 Nov	58
	2	3/6	7 Sep-27 Sep	21
1986	1	3/6	6 Sep- 2 Nov	58
	2	3/6	6 Sep- 3 Oct	28
1987	1	3/6	5 Sep- 1 Nov	58
	2	3/6	5 Sep- 2 Oct	28
1988	1	3/6	10 Sep- 6 Nov	58
	2	3/6	10 Sep-30 Sep	21
1989	1	3/6	9 Sep- 5 Nov	58
	2	3/6	9 Sep-29 Sep	21
1990	1	3/6	8 Sep- 4 Nov	58
	2	3/6	8 Sep-14 Oct	37
1991	1	3/6	7 Sep- 3 Nov	58
	2	3/6	7 Sep-13 Oct	37
1992	1	3/6	5 Sep- 1 Nov	58
	2	3/6	5 Sep-11 Oct	37
1993		3/6	11 Sep- 7 Nov	58
1994		3/6	10 Sep- 6 Nov	58

tions, and harvest levels influenced season selections during subsequent expansions of hunting opportunities (Miller 1987). The following information summarizes changes in North Dakota crane seasons during 1968-94 (Table 1, Fig. 1).

1968

The first hunting season included a daily bag of 2 with a possession limit of 4 and was limited to Kidder and Stutsman Counties. The 30-day season was delayed until 9 November to avoid conflicts with migrating whooping cranes. A relatively small harvest resulted, because most cranes had migrated from the hunt area prior to the season. No conflicts with whooping cranes were reported.

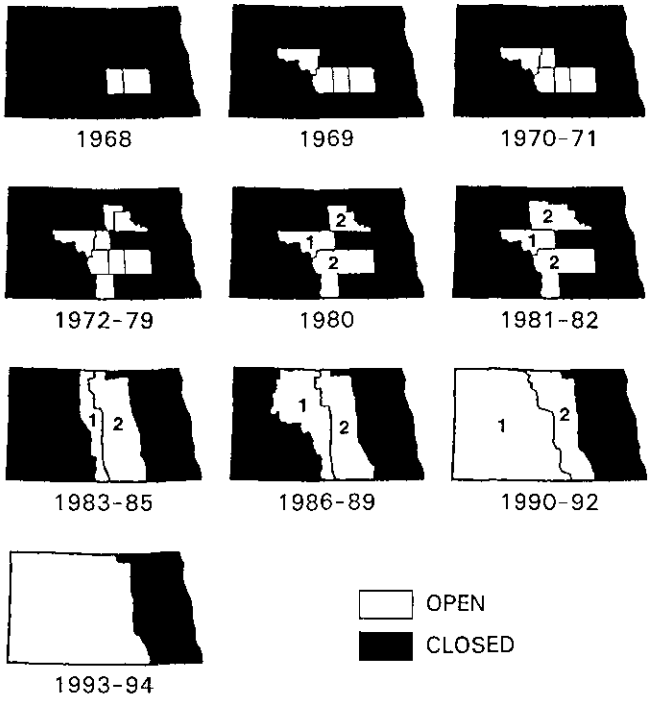

Fig. 1. Areas open to the hunting of sandhill cranes in North Dakota, 1968-94.

1969

Two additional counties were opened in 1969 (McLean and Burleigh), and these encompassed several additional crane concentration areas, which were probably used mainly by lessers and Canadians. A 30-day season was again held primarily in November to minimize conflicts with whooping cranes. Flyway-wide depredation concerns were addressed by increased bag and possession limits to 3 and 6, respectively. These bag and possession limits were followed during all subsequent seasons in North Dakota. Harvests were again relatively low and, because of historical knowledge of subspecies distributions during fall, likely contained a representation of all 3 subspecies (Johnson and Stewart 1973).

1970-71

In the third and fourth years, Sheridan County was

opened to hunting. A 30-day season was retained, but the opening date was delayed about 1 week, the 1970 and 1971 seasons beginning on 14 and 13 November, respectively. Harvests remained low but were reported to be increasing, as hunters learned more about crane behavior and improved their hunting skills.

1972-76

In years 5-9, Benson, Emmons, and Pierce Counties were opened to hunting. The season length remained 30 days, with opening dates of 6-11 November. Harvests during 1972-74 were believed to be low because of late opening dates. In 1975 a federal sandhill crane hunting permit was required for the first time, and a hunter survey indicated that 2,624 cranes were either retrieved or crippled and unretrieved (Fig. 2). In 1976 an early freeze-up occurred and most cranes departed before the 6 November opening date; consequently, only 84 cranes were retrieved or crippled. All seasons focused on the later migrating cohort of lessers; no conflicts with whooping cranes were reported.

1977-79

To increase hunting opportunity, a short, early season was offered and selected in favor of the later, longer season. A federal framework of 5 days in September was established for 1977-79. These seasons resulted in higher harvests (3,273-4,833). Again, no conflicts with whooping cranes were reported. In 1977, because of concern for increased harvest of the greater subspecies, hunter bag checks for subspecies composition were initiated by the North Dakota Game and Fish Department.

1980

To protect whooping cranes, reduce harvest of greaters, and increase hunter opportunity on the more numerous lessers, separate federal frameworks were established for 2 areas. Area 1 (McLean and Sheridan Counties) focused hunting on lessers and had more liberal September seasons of 9 days, while Area 2 (Kidder, Stutsman, Benson, Emmons, Pierce, and Burleigh counties) had reduced September seasons of 5 days. Statewide harvest declined to 2,688 (Fig. 2).

1981-82

In 1981 McHenry County (added to Area 2) was opened, representing the first area expansion since 1972. The season length was increased in both areas (from 9 to 16 days in Area 1 and from 5 to 9 days in Area 2). Harvest increased slightly but was <3,000 annually.

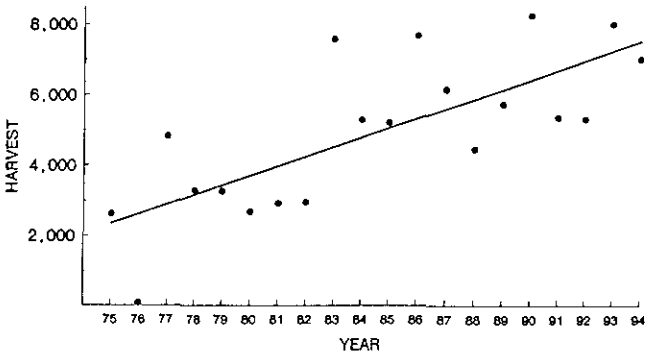

Fig. 2. Hunting mortality (retrieved and unretrieved) of sandhill cranes in North Dakota, 1975-94.

1983-85

The 1983 season marked the greatest change in the Central Flyway's crane hunting federal framework. The Central Flyway Council (1981) completed a management plan for MCP cranes, and frameworks for the 8 Central Flyway states had been gradually expanded since 1968. By 1985, annual flyway harvests reached 14,000, and North American harvests of 25,000 were believed to be appropriate for maintaining the current population status (Central Flyway Council, Recommendation 2, 18 March 1990). Therefore, instead of specific season descriptions, the FWS agreed to set a broad framework that allowed states flexibility in setting seasons to address local issues but maintain North American harvests near 25,000. Due to this more liberal framework, 12 additional counties were opened, totaling 21 open counties, that were grouped into 2 zones. The zones were oriented in a north-south direction, corresponding to known distributions and abundance of the 3 subspecies that were divided into the Western and Gulf Coast subpopulations (Tacha and Vohs 1984). In 1983, cranes were rarely found east of U.S. Highway 281 (Carlisle and Tacha 1983), which became the eastern boundary of Zone 2. A full federal framework of 58 days was selected in Zone 1, while a more restrictive 21-day season was selected in Zone 2. Seasons began in early September (Table 1) in both zones, but ended during early November in Zone 1 and during late September in Zone 2. As with earlier regulatory changes, the harvest more than doubled (150%) during the first year of expansion, from about 3,000 in 1982 to more than 7,500 in 1983. However, this increase was not maintained in the following 2 years, stabilizing at about 5,300 cranes during these seasons (Fig. 2). The relative proportion of the harvest of each subspecies

was not known, but it was estimated that 13% (804/5,960) of the 1983 harvest was composed of greaters (S. C. Kohn, N.D. Game and Fish Dep., Bismarck, pers. commun.).

1986-89

In 1986, 3 more counties (Ward, McLean, and Renville) were opened to hunting. Most increases in harvest from the new areas were probably lesser and Canadian subspecies. The season was increased to 28 days in 1986-87, but decreased to 21 days in 1988-89. Harvests increased in 1986 to near 7,700 but declined in 1987 to about 6,200. In 1988 and 1989, harvests were ~4,500 and 5,700, respectively.

1990

The largest increase in harvest occurred in 1990 with the expansion of hunting seasons. Northwestern counties and other counties west of the Missouri River were opened, and the boundary between Zones 1 and 2 in Kidder County was changed; most of the county was placed in Zone 1. The harvest in Kidder County increased 128% from 1,192 to 2,721, and the statewide harvest increased 44% from 5,736 to 8,255.

1991-92

The federal sandhill crane hunting permit, first required in 1975, was issued free of charge to all Central Flyway crane hunters and facilitated compilation of a list of hunters and addresses for sampling purposes. In 1991 North Dakota established a $5 charge for the permit, and number of permits issued dropped 54% (7,268 to 3,353), active hunters fell 36% (from 2,684 to 1,684), and harvests decreased 32% (from 6,804 to 4,650). Reduced hunter participation and lower harvests were also reported in 1992.

1993-94

In 1993-94, zones were eliminated and the full federal framework was selected for crane hunting. The long-term impact of this change is unknown but initially resulted in higher harvests for those counties that were formerly in Zone 2. It may also have contributed to shifting cranes eastward into closed areas due to increased hunting activity (D. H. Johnson, Northern Prairie Sci. Cent., Jamestown, N.D., pers. commun.). In contrast to the 1990 expansion, any increases in harvest in the short- or long-term would likely involve higher numbers of Canadian and greater subspecies. Hunter numbers and harvests reached near record high levels during 1993-94 and effectively erased declines resulting from fee charges for hunting permits in 1991.

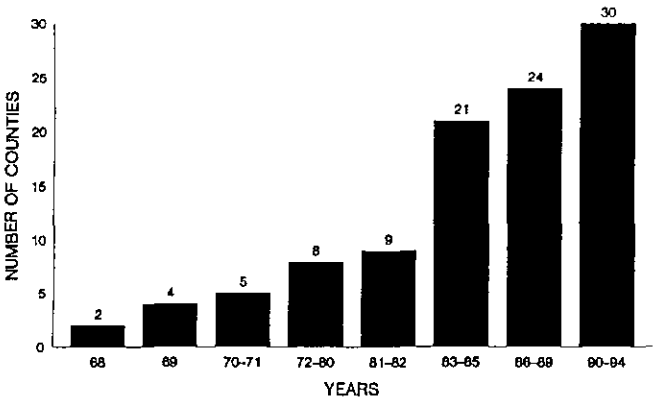

Fig. 3. Number of counties open to sandhill crane hunting in North Dakota, 1968-94.

HARVESTS

Crane harvests in North Dakota have increased since modern day seasons resumed (Fig. 2). Most increases appeared to have resulted from opening additional counties to hunting (Fig. 3). In contrast, crane harvests in the remainder of the Central Flyway and in North America remained relatively stable since the current federal framework was established in 1983. Kidder County usually recorded the highest annual harvests, generally >1,000 or about 32% of the statewide harvest, followed by McLean and Pierce Counties. More than 50% of the state's harvests have consistently come from these 3 counties (Table 2).

Since 1975 the North Dakota and Central Flyway harvest has averaged about 21% and 60%, respectively, of the estimated North American MCP crane harvest (Table 3). North Dakota has maintained this proportion of harvest by expanding hunting opportunity, while the comparatively stable hunting opportunity in the remainder of the Central Flyway has resulted in a decline in the proportion of birds harvested in other states (Martin 1995).

Although the 1993 revision of the MCP Cooperative Management Plan eliminated the harvest threshold established in the 1981 plan, the FWS believed that past harvest levels should be maintained (59 Federal Register 67:16765, 1994). This decision was based on the belief that harvests were at an appropriate level for maintaining a stable population and were within established thresholds and near the long-term objective level. In addition, improved monitoring of the harvests and population status of MCP greaters were needed before any significant expansion of hunting occurred within the range of the Gulf Coast subpopulation (59 Federal Register 67:42477, 1994).

Table 2. Sandhill crane sport hunting harvests (retrieved) as reported by county in North Dakota, 1975–94.

County	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	%
Benson	118	5	500	287	339	361	228	119	305	159	265	554	511	228	328	448	316	486	638	489	8.6
Burleigh	153	5	91	147	165	81	145	95	678	491	543	565	240	381	324	412	562	460	611	875	9.1
Emmons	24	2	14	9	6	0	7	0	86	54	88	79	32	0	17	105	88	188	78	68	1.2
Kidder	513	3	1,320	939	867	643	528	520	1,996	1,246	1,320	1,556	1,831	1,290	1,192	2,721	1,401	1,149	2,115	1,515	31.8
McLean	1,020	18	264	182	450	259	526	845	2,003	1,002	600	783	533	344	615	535	548	439	878	897	16.4
Pierce	35	11	1,301	656	532	501	390	271	168	270	285	544	364	154	212	312	212	374	679	640	10.2
Stutsman	32	0	279	251	162	203	136	55	79	266	140	136	185	156	400	487	304	284	327	121	5.3
Sheridan	86	4	100	72	68	78	227	308	400	346	581	419	521	316	497	342	328	323	396	362	7.4
McHenry							84	99	264	225	205	189	230	132	144	156	120	87	275	378	3.3
Bottineau									6	82	78	108	103	125	58	213	118	168	99	0	1.5
Eddy									0	0	0	9	0	3	0	15	0	0	1	0	tr
Foster									0	0	0	0	0	0	6	3	2	0	0	16	tr
LaMoure									0	0	0	0	0	0	0	0	0	0	0	0	0.0
Logan									36	0	0	0	0	0	45	99	23	41	10	105	0.5
Mcintosh									0	0	0	0	0	0	0	0	0	0	0	0	0.0
Mercer									228	45	78	132	38	162	15	96	25	32	20	30	1.2
Ramsey									0	0	0	0	3	0	0	9	10	11	29	80	0.2
Rolette									0	10	6	3	0	0	24	66	32	81	97	15	0.4
Towner									0	0	0	0	0	0	12	9	0	11	6	0	tr
Ward									10	10	26	761	278	157	230	231	160	115	102	98	2.8
Wells									19	0	130	47	76	78	191	162	51	39	164	165	1.4
Burke												20	0	0	46	21	3	6	3	0	0.1
Mountrail												388	245	122	166	45	41	76	18	30	1.5
Renville												0	29	0	0	6	6	7	0	0	0.1
Bowman																0	0	5	0	0	tr
Divide																33	9	0	3	8	0.1
Dunn																3	1	0	0	0	tr
McKenzie																0	0	2	3	24	tr
Morton																12	0	0	1	0	tr
Stark																3	0	0	0	0	tr
Williams																0	0	0	12	0	tr
Unknown	141	4	209	134	144	114	124	157	193	161	186	270	115	157	134	215	218	223	413	319	4.7
Total	2,122	52	4,078	2,777	2,733	2,240	2,395	2,469	6,471	4,367	4,531	6,563	5,334	3,806	4,656	6,759	4,578	4,607	6,978	6,235	

During 1975–94 North Dakota's estimated crippling loss rates were generally higher (+2%) than those in the other Central Flyway states (Fig. 4). However, a declining trend in crippling rates is evident for North Dakota and the Central Flyway. Factors responsible for these trends are unknown, but the use of improved hunting techniques (e.g., decoys and calls) and enhanced understanding of crane behavior have likely contributed to improved hunter success and reduced crippling losses (Sharp and Vogel 1992).

In 1987 North Dakota implemented non-toxic shot shell requirements for crane hunting (M. A. Johnson, N.D. Game and Fish Dep., Bismarck, pers. commun.). Little public opposition to these regulations occurred, and a comparison of crippling loss rates for the pre- (1975–86) and post-implementation (1987–94) periods indicates no increase in crippling loss rates related to the use of non-toxic shot. Conversely, North Dakota's crippling rate declined from 18.0% to 15.3%; this followed similar declines of 14.6% to 11.8% in the remainder of the Central Flyway during the same period (Fig. 4).

HUNTER ACTIVITY AND SUCCESS

The number of federal crane hunting permits issued to North Dakota hunters increased during 1975–90 (Martin 1995). Beginning in 1991, North Dakota required a $5 fee for validation of the free federal permit. Subsequently, the number of permits issued declined, while the trend in total number of active hunters was unchanged (Fig. 5). This suggested that the additional fee had little effect on those hunters who previously hunted cranes, but eliminated casual crane hunters who acquired a free permit. It is not known if

Table 3. Annual sport hunting mortality (retrieved and unretrieved) of the Mid-continent Population of sandhill cranes, 1975–94.

	North Dakota				Central Flyway				North America		
Year	Retrieved	Unretrieved	Total	% N.A.[b]	Retrieved	Unretrieved	Total	% N.A.[b]	Retrieved	Unretrieved	Total
1975	2,122	502	2,624	11.5	9,497	1,885	11,382	49.8	18,272	4,568	22,840
1976	52	32	84	0.6	7,393	1,384	8,777	67.2	10,455	2,614	13,069
1977	4,078	755	4,833	27.9	12,251	2,013	14,164	81.7	13,874	3,468	17,342
1978	2,777	517	3,294	22.0	10,146	1,860	12,006	80.3	11,966	2,992	14,958
1979	2,733	540	3,273	16.7	10,379	1,655	12,029	61.4	15,684	3,921	19,605
1980	2,245	443	2,688	12.1	10,150	1,740	11,890	53.7	17,724	4,431	22,155
1981	2,395	533	2,928	16.2	10,130	1,780	11,910	66.0	14,431	3,608	18,039
1982	2,469	487	2,956	17.8	7,920	1,400	9,320	56.2	13,265	3,316	16,581
1983	6,471	1,114	7,585	32.1	12.960	2,220	15,180	64.3	18,880	4,720	23,600
1984	4,367	933	5,300	23.1	11,270	1,890	13,160	57.3	18,368	4,592	22,960
1985	4,531	690	5,221	20.5	12,580	1,860	14,440	56,8	20,331	5,083	25,414
1986	6,563	1,119	7,682	29.7	12,490	1,870	14,360	55.5	20,714	5,179	25,893
1987	5,334	832	6,166	24.5	12,770	1,710	14,480	57.6	20,119	5,030	25,149
1988	3,815	650	4,465	15.8	12,772	1,628	14,400	50.8	22,662	5,665	28,327
1989	4,656	1,080	5,736	22.3	13,639	2,081	15,720	61.2	20,543	5,136	25,679
1990	6,804	1,451	8,255	25.7	18,041	2,519	20,560	64.0	25,716	6,429	32,145
1991	4,580	785	5,365	20.3	13,079	1,768	14,847	56.3	21,098	5,274	26,372
1992	4,654	665	5,319	21.1	12,433	1,459	13,892	55.1	20,186	5,047	25,233
1993	6,985	1,023	8,008	27.3	18,005	2,252	20,257	69.2	23,429	5,857	29,286
1994	6,235	785	7,020	23.9	16,201	1,676	17,877	60.7	23,546	5,886	29,432
$\bar{x}$	4,193	747	4,940	21.3	12,200	1,832	14,033	60.5	18,563	4,641	23,204

[a] Percentage of total sport hunting mortality in North America.

this fee reduced recruitment of new crane hunters who previously acquired free permits and then participated in hunts opportunistically.

Numbers of active hunters declined during 1975–94 in North Dakota (Fig. 6) and in other Central Flyway states, but the decline was not as large as the drop in the sales of federal duck stamps. In the Central Flyway, duck populations declined, goose populations increased, and crane populations remained stable during 1985–94. The overall numbers of hunters declined but were probably greater for duck hunters than for crane or goose hunters. The downward trend in number of North Dakota crane hunters might have been larger without the expansion in hunter opportunity during 1975–94.

In North Dakota, during 1975–94, the numbers of days afield by active crane hunters increased from <2 to >3 days

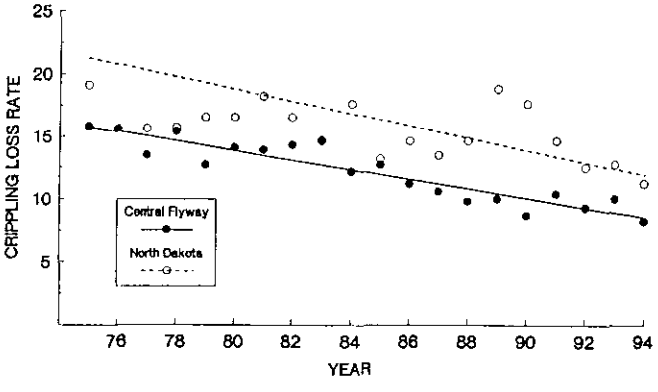

Fig. 4. Crippling loss rates (number crippled/total harvest) of sandhill cranes harvested in North Dakota and the remainder of the Central Flyway states, 1975–94.

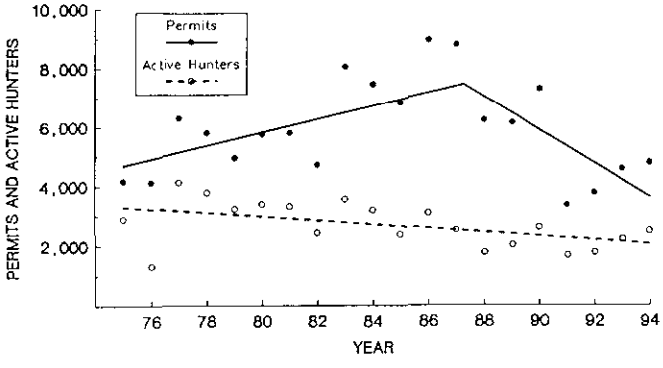

Fig. 5. Number of federal sandhill crane hunting permits and estimated active sandhill crane hunters in North Dakota, 1975–94.

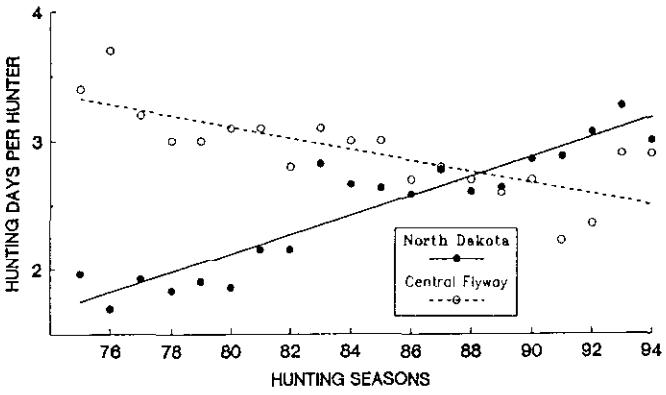

Fig. 6. Hunting days per active crane hunter in North Dakota and the Central Flyway, 1975–94.

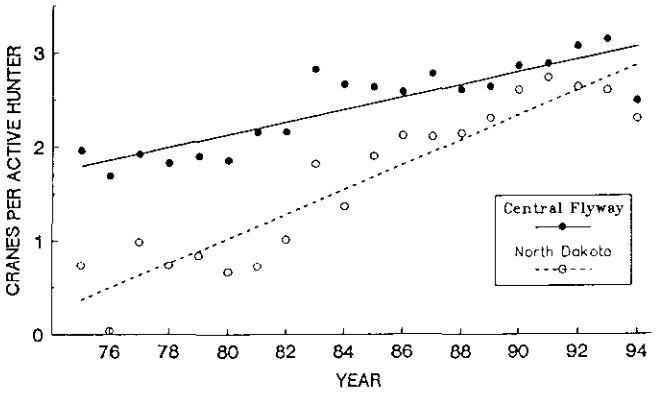

Fig. 7. Seasonal sandhill crane bag per active crane hunter in North Dakota and the Central Flyway, 1975–94.

annually (Fig. 6), but for Central Flyway hunters the number of days afield declined from ~3.5 to 2.5 days. During this period seasons were generally stable for most Central Flyway States but were greatly expanded in North Dakota.

A comparison of average seasonal crane bag of North Dakota hunters with other Central Flyway hunters indicates similar increasing trends during 1975–94 (Fig. 7). In 1994, Central Flyway hunters, including those in North Dakota, harvested >2 cranes per active adult hunter. This level of success has been maintained since 1987 and appears to have stabilized following increases from just over 1 crane per hunter in 1975.

POPULATION STATUS

The population dynamics of MCP cranes are poorly understood, but sandhill cranes are long-lived and have the lowest recruitment and highest survival of any game birds in North America (Lewis 1977, Drewien et al. 1995). In addition, MCP cranes may not breed until 5 years old (Tacha et al. 1994) and the potential for overharvest is high, although population declines may not be immediately evident. Crane harvest strategies must be conservative (Miller 1974, Lewis 1977, Johnson 1979, Drewien et al. 1995).

Numbers of MCP cranes are unknown. The spring migration period provides the best opportunity to conduct annual surveys (Benning and Johnson 1987) because the MCP is confined almost entirely to Nebraska's Central Platte River Valley. The 1993–95 3-year running average index for this area was 420,866, and was within the established population objective range of 343,000–465,000 (Walter 1995). In 1982 intensive photographic-transect spring surveys estimated the MCP at ~509,000 (Sharp and Vogel 1992). Subsequent annual indices (1983–95), derived from photo-correction of ocular-cruise surveys, indicate that the spring population was stable.

The size of the MCP during fall is related to the preceding spring population size, annual production, and summer mortality. Summer mortality was estimated at ~2% (Miller 1987) and average production was ~11% (Buller 1979, Drewien et al. 1995). During 1983–94 the estimated, annual fall flights probably ranged between 510,000 and 590,000 (Sharp and Vogel 1992). From a management perspective, the relatively constant spring populations observed during 1982–92 suggested that annual mortality, including sport harvest, has been at a level appropriate to stabilize the MCP at objective levels.

SUBSPECIES CONSIDERATIONS

The 1981 MCP Cooperative Management Plan (Central Flyway Council 1981) estimated that 65–70% of the MCP were lessers, 25–30% were Canadians, and 1–5% were greaters. Subsequent investigators have questioned this abundance of greaters and have estimated the population wintering on the Gulf Coast of Texas at ~5,000 greaters (C. D. Littlefield, Muleshoe, Tex., pers. commun.); others have estimated the subpopulation to be near 60,000 (Tacha et al. 1986, Muehl 1994). However, the current status of the Gulf Coast subpopulation is unknown, and its distribution patterns and abundance by subspecies and among states are poorly understood.

Before 1968 in the Central Flyway, subspecies were generally distributed according to size along a west-to-east gradient; lessers were most abundant along the western portion of the migration pathway, greaters along the eastern portion, and Canadians were primarily found in the central portions with interchange, especially Canadians and lessers, in most areas (Buller 1979). It is unknown if current fall distribution patterns are being influenced by hunting, but

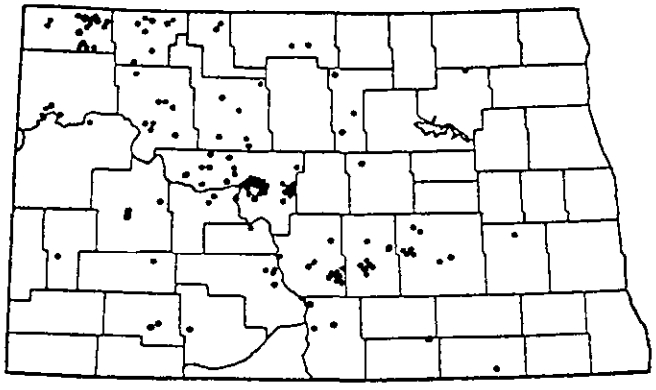

Fig. 8. Locations of 215 fall whooping crane sightings in North Dakota, 1955-93.

some changes were documented (Johnson 1976). Recently in North Dakota, cranes were observed east of U.S. Highway 281, but the relative abundance of each subspecies was unknown (S. C. Kohn, pers. commun.). Similar eastern directional shifts in winter distributions were also reported in Texas (R. R. George, Texas Parks and Wildl. Dep., Austin, pers. commun.).

In 1977 the North Dakota Game and Fish Department initiated annual crane bag checks and collected certain diagnostic morphometric measurements and data on sex of cranes. Discriminant function analysis was used to determine subspecific composition in the harvest (Johnson and Stewart 1973).

WHOOPING CRANES

The whooping crane is the only other species of crane native to North America. Only 22 individuals existed in 1941, and the species was designated as endangered in 1973 (U.S. Fish and Wildlife Service 1994). Recovery has been slow, and during winter 1992-93 a total of 136 wintered at Aransas National Wildlife Refuge, Texas. Historically, the species nested in North Dakota until 1915 (Konrad 1987).

Locations of 215 whooping crane fall migration sightings in North Dakota were recorded during 1955-93 (Fig. 8) and included at least 539 individuals. Observations occurred between 5 September and 9 November but mainly during October (70%), followed by September (22%), and November (8%). Most observations were reported from McLean County, followed by Divide, Burleigh, Kidder, Stutsman, and Mountrail. These observations indicated that during fall most whooping cranes moved southeasterly from Divide and Mountrail Counties in the northwest to McLean, Burleigh, Kidder, and Stutsman Counties in southcentral North Dakota.

Because of potential conflicts between whooping cranes and sandhill crane hunting (Thompson and George 1987), seasons in North Dakota were gradually expanded geographically and temporally (Konrad 1987). The FWS consults annually under Section 7 of the Endangered Species Act and develops a biological opinion for the migratory bird hunting program; potential conflicts between sandhill crane seasons and whooping cranes receive considerable attention. A contingency plan (U.S. Fish and Wildlife Service 1994) allows sandhill crane hunting to proceed, while providing for monitoring and protective actions, including temporary spot closures and public service announcements, if a whooping crane is discovered in a hunting area. Since sandhill crane seasons were resumed in 1968, no whooping crane has been accidentally shot by a sandhill crane hunter.

MANAGEMENT IMPLICATIONS

In North Dakota, seasons beginning in early September have higher annual harvests than those late seasons beginning in October-November. Whooping cranes are present during these early seasons, but the monitoring and protective actions have been adequate for their protection.

Concern over harvest levels of greaters in eastern North Dakota prompted annual collection of morphometric measurements since 1977. In 1980 the open portion of the state was divided into Area 1 (western), which had more liberal seasons, and harvest was focused on the more numerous lesser subspecies; and Area 2 (eastern), which had more restrictive seasons because all 3 subspecies were present. Data on subspecies are currently being analyzed and will be incorporated into the next revision of the MCP management plan.

In 1983 the FWS established a broad framework for crane hunting in the Central Flyway to allow states flexibility for setting seasons within the harvest threshold identified in the Cooperative Management Plan (Central Flyway Council 1981). federal frameworks for crane hunting have remained essentially unchanged for the MCP since 1983. The Central Flyway Council has recommended no change in hunting seasons until the MCP Cooperative Management Plan is revised in 2000.

Historical MCP distribution and traditional use of fall migration roost sites have been altered due to hunting pressure, drought, increases in acreages enrolled in the U.S. Department of Agriculture's Conservation Reserve Program, and any number of other possible influences. Complaints of depredations by cranes on agricultural crops have been used to help justify current population objectives, current hunting programs, and past expansions in federal hunting frameworks. However, these issues should be quantified and

a comprehensive hunting strategy should be prepared that addresses these concerns throughout the Central Flyway.

In 1993 North Dakota recommended that the open area be expanded to counties east of U.S. Highway 281. The FWS denied this request until staff from the Office of Migratory Bird Management and the North Dakota Game and Fish Department could cooperatively assess the subspecies information gathered since 1977 and determine geographic and temporal harvest of greaters. The proposed change in hunting regulations upon the harvest of greaters in the Gulf Coast subpopulation should also be evaluated.

The MCP is currently at objective levels and its future remains favorable. However, significant management challenges remain, including (1) development of harvest strategies to maintain a stable population, (2) maintenance of current harvest distribution patterns, (3) maintenance of current subspecies abundance, and (4) assessment of the status and distribution of the numerically less abundant greater subspecies in North Dakota and throughout the Central Flyway. Data bases need much improvement and more attention should be directed to monitoring subspecies status for the future development and implementation of MCP hunting programs.

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