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POPULATION STATUS, HUNTING REGULATIONS, AND HARVESTS OF THE ROCKY MOUNTAIN POPULATION OF GREATER SANDHILL CRANES, 1981–2005

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Abstract: The Rocky Mountain Population (RMP) of greater sandhill cranes (*Grus canadensis tabida*) was not hunted in the U.S. from 1916 until 1981, when Arizona initiated the first modern-day season. Hunting programs in the U.S. were subsequently expanded to 6 states for the RMP and have been guided by a cooperative flyway management plan, including a harvest strategy, which has been periodically updated and endorsed by the Central and Pacific Flyway Councils. From a management perspective, 3 population parameters have been identified to monitor the status and health of this population: harvest, recruitment, and population size. The number of permits that are allocated each year and issued by cooperating state wildlife agencies is determined by a formula contained in the Cooperative Flyway Management Plan. Average annual harvests of 443 birds have been reported during 1981-2005. Aerial population counts conducted in the San Luis Valley (SLV), Colorado, during the spring migration indicated that the number of RMP cranes was relatively stable during 1984-1996. In 1995, a cooperative 5-state September pre-migration staging-area survey was initiated (as an alternative to the SLV survey) and was designated as the official population survey in 1997. The 3-year population index average for 2003-2005 (19,633) was within the established population objectives of 17,000-21,000. Annual indices of recruitment (% juveniles), conducted during the fall in the San Luis Valley, Colorado, have averaged 7.9% during 1972-2005.

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Key words: *Grus canadensis tabida*, Central Flyway, harvest, management, Pacific Flyway, population status, sandhill crane.

The Rocky Mountain Population (RMP) is comprised exclusively of greater sandhill cranes (*Grus canadensis tabida*) that breed in isolated river valleys, marshes, and meadows of the U.S. portions of the Central and Pacific Flyways (Drewien and Bizeau 1974). The largest nesting concentrations are located in western Montana and Wyoming, eastern Idaho, northern Utah, and northwestern Colorado. The RMP migrates through the San Luis Valley (SLV), Colorado, and winters primarily in the Rio Grande Valley, New Mexico (with smaller numbers that winter in the southwestern part of that state), in southeastern Arizona, and at about 14 locations in the Northern Highlands of Mexico (Fig. 1).

The information provided herein on population status and recruitment for the RMP of sandhill cranes was used to determine allowable annual harvest of this population of sandhill cranes during 1981-2005.

METHODS

Population Surveys

During the period of 1984-1996, the RMP was monitored at a spring stopover site in the SLV. Aerial counts in the SLV conducted during the spring migration suggested that the number of RMP cranes was relatively stable (Table 1). However, survey biologists found that these estimates contained increasing numbers of the Mid-Continent Population (MCP) (Canadian [*G. rowani*] and lesser [*G. canadensis*] subspecies) of sandhill cranes, which confounded estimates of RMP abundance. An adjustment (proportion of lesser to greater subspecies) obtained from ground counts was made to annually correct for the lesser subspecies (Benning et al. 1996). Unfortunately, a similar correction could not be made for the mid-sized Canadian subspecies, and in 1996 the survey was discontinued. In 1997, an attempt was made to count these cranes from aircraft during the fall (October) in the SLV, but MCP sandhill cranes also were present at that time. Biologists concluded that neither a spring nor a fall aerial count in the SLV would result in a reliable index to the abundance of RMP cranes. As an alternative, a cooperative 5-state September pre-migration staging-area aerial cruise survey, experimentally tested in 1987 and 1992, has been operationally conducted during the fall since 1995. It was designated by the Central and Pacific Flyway Councils as the official count for the RMP in 1997 (Table 2).

A recruitment survey that obtains age ratio (index to recruitment) and brood size is conducted annually during the fall in the SLV. This survey has been conducted since 1972. The methods for this survey are described in Drewien et al. (1995).

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Table 1. Spring population indices for Rocky Mountain sandhill cranes in the San Luis Valley, Colo., 1984 – 1996 (Benning 1996).

Year	Raw count	Bias adjustment[a]	Subspecies adjustment[b]	Other areas[c]	Index
1984	10,962	14,488	13,562	550	14,112
1985	18,393	21,773	20,382	0	20,382
1986	14,031	14,031	13,135	20	13,155
1987	13,561	15,661	14,660	0	14,660
1988	17,510	17,510	16,381	22	16,403
1989	17,302	18,389	17,004	0	17,004
1990	20,851	24,593	21,221	275	21,496
1991	19,990	18,405	16,045	175	16,220
1992	23,516	23,516	19,999	9	20,008
1993	17,576	17,576	16,478	1,260	17,738
1994	17,229	16,036	15,063	203	15,266
1995	25,276	23,390	20,229	0	20,229
1996	23,019	26,379	22,737	1,010	23,747

[a] Raw estimate adjusted by photography for estimation bias.
[b] Population estimate adjusted to remove the number of lesser sandhill cranes (non-RMP cranes).
[c] Other areas include N.M., Colo. (areas outside of the San Luis Valley), Ut., Wyo., Id. and Mont.

Table 2. Fall pre-migration population indices for Rocky Mountain Population (RMP) of sandhill cranes obtained by an aerial cruise survey (Drewien et al. 2005).

Year	Colo.	Id.	Mont.	Ut.	Wyo.	Total	3-Yr Avg
1987[a]	1,443	10,686	1,447	1,578	2,327	17,481	
1992[a]	3,181	5,801	5,264	2,810	2,241	19,297	
1995[a]	2,284	6,864	3,681	1,528	1,671	16,028	
1996[a]	1,255	8,334	2,974	1,849	2,526	16,938	
1997[a,b]	1,604	8,132	3,595	2,450	2,255	18,036	17,001
1998	1,273	8,067	3,415	2,185	3,262	18,202	17,725
1999	1,102	8,761	3,141	2,292	4,205	19,501	18,580
2000	749	9,337	3,598	2,416	3,890	19,990	19,231
2001	666	7,160	4,585	1,522	2,626	16,559	18,683
2002	1,355	7,698	4,843	1,869	3,038	18,803	18,451
2003	745	7,822	4,964	2,546	3,446	19,523	18,295
2004	1,410	7,152	4,637	2,239	3,072	18,510	18,945
2005	1,052	7,668	5,588	2,646	3,911	20,865	19,633

[a] Incomplete survey efforts in years prior might have resulted in lower estimates; the official count began in 1997.
[b] In October 1997, a special survey was also conducted in the San Louis Valley, Colo., and other areas, which resulted in a total of 27,089 RMP and Mid-Continent sandhill cranes being counted.

MANAGEMENT AND HARVEST REGULATIONS

The RMP of greater sandhill cranes was not hunted in the U.S. from 1916 until 1981, when Arizona initiated the first modern-day season. Since 1982, hunting programs have been guided by a cooperative flyway management plan, including a harvest strategy, which has been periodically updated and endorsed by the Central and Pacific Flyway Councils. Following Arizona, other states that initiated seasons included Wyoming (1982), New Mexico (1988), Utah (1989), Montana (1992), and Idaho (1996) (Table 3). The hunting seasons are guided by the federal frameworks as set by the U.S. Fish and Wildlife Service. The framework sets the outside dates as between 1 September and 31 January, the season may not exceed 30 days, and the bag limit is 3 daily and 9 per season. There are additional provisions that pertain to specific states for managing the harvest such as monitoring racial composition of the harvest, as these sandhill cranes co-mingle with sandhill cranes from other populations during the fall and winter.

The RMP Cooperative Flyway Management Plan (Pacific and Central Flyway Councils 1997) established population objectives, a survey to monitor recruitment, and harvest levels that were designed to maintain a stable abundance between 17,000-21,000 birds. The plan contains a formula for estimating allowable annual harvests to achieve the population objectives. All sandhill crane hunters in the range of the RMP must obtain a permit issued by the cooperating State Wildlife Agency to hunt cranes, which provides the sampling frame for independent state harvest estimates and allows for assignment of harvest quotas by state. Permit allocation by state is variable depending on specific hunt objectives for specific areas within states. In many areas, harvest estimates are supplemented by mandatory check-stations.

RESULTS

Population Surveys

Although operational in 1995 and 1996, the survey was still experimental, which resulted in variable timing and survey effort. What appears to be lower population estimates in 1995 and 1996 is likely more an artifact of inconsistent survey effort. The 2005 fall survey resulted in an index of 20,865 birds (Drewien and Thorpe 2005). The 2005 survey was determined to be reliable by survey biologists and the resulting 3-year average of 19,633 is within the established

Table 3. Estimated retrieved harvests of the Rocky Mountain Population (RMP) of greater sandhill cranes during 1981–2005 (Sharp et al. 2005).

Yr	Ut.	N.M.	Ark.	Wyo.	Mont.	Id.	Total	Harvest Allocation[c]
1981			20				20	
1982			9	143			152	
1983			35	154			189	
1984			33	101			134	
1985			40	138			178	
1986			23	195			218	
1987			60	190			250	
1988		310	40	128			478	1,171
1989	54	483	51	125			713	746
1990	35	79	9	58			181	342
1991	48	47	44	101			240	755
1992		147	39	168	42		396	763
1993	28	297	61	115	45		546	750
1994	34	416	27	150	40		667	754
1995	27	270	33	77	41		448	533
1996	32	236	27	84	49	20	448	487
1997	30	114	22	82	62	136	446	613
1998	34	180	37	93	59	135	538	672
1999	54	198	21	124	71	190	658[a]	944
2000	69	257	37	163	91	193	810[b]	1,106
2001	77	288	26	142	87	278	898	1,099
2002	60	160	42	132	51	194	639	808
2003	57	169	34	72	50	146	528	648
2004	53	189	35	124	51	142	594	636
2005	62	236	50	116	49	189	702	806

[a] RMP sandhill cranes (40) were also taken as part of a research project in the San Luis Valley, Colo.

[b] RMP sandhill cranes (20) were also taken as part of a research project in the San Luis Valley, Colo.

[c] Use of a harvest allocation formula did not begin until 1988 and in 1997 the formula was updated (Pacific and Central Flyway Councils 1997).

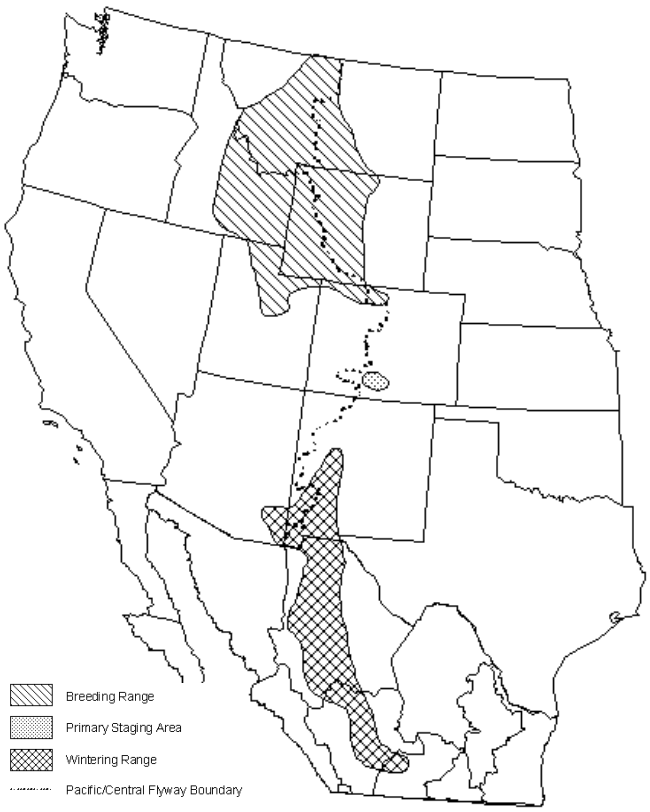

Figure 1. Approximate range of the Rocky Mountain Population of greater sandhill cranes (adapted from Drewien et al. 2000.)

population objectives (17,000-21,000) (Fig. 2). During 1997-2005 (i.e., the period in which surveys were operational and complete), we found no trend in the abundance of RMP cranes counted during the fall survey ($P = 0.28$). The September pre-migration survey for the RMP seems to be a good alternative to either a spring or fall survey in the SLV because no other cranes from other populations are known to co-mingle with them during that time.

The proportion of juveniles in fall has averaged 7.9% and ranged from 3.4 to 12% during 1972-2005 (Fig. 3). During 1986-1995, important breeding areas in the Intermountain West experienced extremely dry conditions and indices of recruitment (% juveniles) were low (generally 4-6%). A return to more favorable breeding conditions (i.e. improved quality and quantity of wetlands) during 1996-1999 resulted in higher index of recruitment rates (8-12%), but drier conditions returned and resulted in lower production during 2000-2002. There was some improvement in wetland conditions in 2003-2005 and the index of recruitment rates again increased to above-average levels.

Management and Harvest Regulations

Limited hunting seasons during 2005-2006 resulted in

an estimated harvest of 702 RMP sandhill cranes (Table 3), which was 18% higher than the previous year. The average annual harvest during 1981-2004 was 443 cranes. Based on current RMP population and recruitment indices management guidelines, contained in the Cooperative Flyway Management Plan, a maximum take of 1,321 birds during the 2006-2007 hunting seasons would be consistent with population objectives.

DISCUSSION AND RESEARCH IMPLICATIONS

The hunting of sandhill cranes in the U.S. was discontinued after the passage of the Migratory Bird Treaty Act of 1918. There was a lack of knowledge about the life history characteristics of sandhill cranes and no monitoring programs were available. A study of marked sandhill cranes allowed researchers to delineate RMP nesting areas which were isolated from other populations of sandhill cranes (Drewien 1973, Drewien and Bizeau 1974). After leaving breeding areas in the northern and central Rocky Mountain states (western Montana and Wyoming, eastern Idaho, northern Utah, and northwestern Colorado), this population was found to co-mingle with sandhill cranes from other populations as it migrated through the San Luis Valley, Colorado and wintered primarily in the Rio Grande Valley, New Mexico, with smaller numbers in southwestern New Mexico, southeastern Arizona and the northern Highlands of Mexico (Fig. 1). This information allowed sport-hunting seasons in the U.S. to resume with the first season in Arizona in 1981. The RMP hunting season has gradually expanded into Wyoming, New Mexico, Utah, Colorado and Idaho.

Sandhill cranes have the lowest recruitment (percent juveniles in the fall) of any migratory bird species hunted in North America (Tacha et al. 1994); however, a limited harvest that is consistent with population objectives is appropriate for this population. The annual level of harvest and distribution of that harvest is determined by use of a formula (based on recruitment and population size) contained in the Cooperative Flyway Management Plan and the recent harvest levels have been consistent with the objective of maintaining a fall population between 17,000–21,000. During 1997-2005, the average annual harvest in the U.S. for this population was 646 birds and the population was stable.

Survival rates estimated from leg-banded RMP cranes was attempted (Drewien et al. 2000). Although this information provided insight into distributions, fidelity, and mortality factors, the sample size was inadequate to estimate precise survival rates. A study has been initiated to estimate survival rates from approximately 10,000 resighting observations of RMP color-marked and neck-collared cranes, which may increase the precision of survival estimates from the leg-banded study (Drewien et al. 2002). Further, the researchers will attempt to develop a model of recruitment for these cranes. The overall goal is to develop a model of population dynamics, which would allow improvements in the harvest strategy for this population of sandhill cranes.

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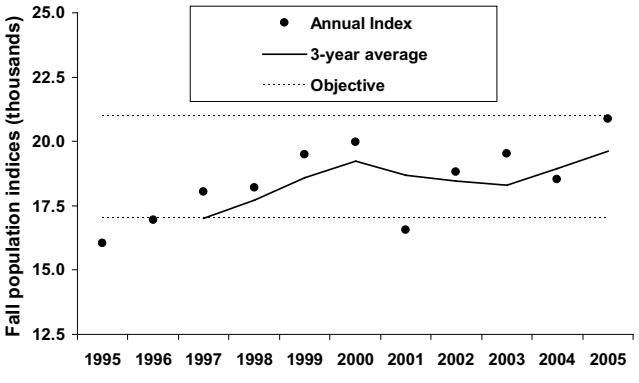
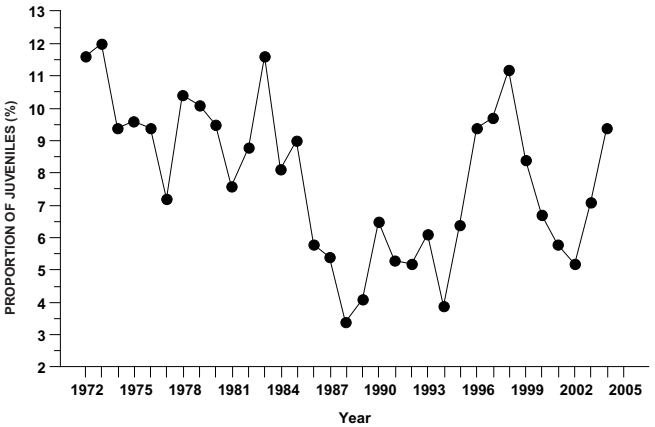


Figure 2. Annual and 3-year average of fall pre-migration indices of abundances for the Rocky Mountain Population of greater sandhill cranes during 1995–2005.



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Lesser sandhill cranes being processed for hunters, Lagune de Babicora, Chihuahua, Mexico, January 1971. Photo by Roderick C. Drewien.