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SUMMARY OF SANDHILL CRANE HUNTING SEASONS IN KANSAS 1993-2007

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Abstract: The mid-continent population of sandhill cranes (*Grus canadensis*) is the largest population of cranes in North America. Hunting seasons for sandhill cranes were closed in 1916 and gradually resumed in Mexico (1940), the United States (1961), and Canada (1964). As knowledge of the biology of cranes and experience with hunting seasons increased, areas in which hunting was permitted expanded, and by 1992 all but 2 states (Nebraska and Kansas) in the U.S. portion of the Central Flyway conducted sport hunting seasons for this population. In 1993 Kansas resumed hunting and initial seasons were limited to specified geographic areas of the state with relatively restrictive bag limits. Hunting restrictions were influenced by the presence of whooping cranes (*G. americana*) and limited public acceptance to the hunting of cranes. As experience with hunting sandhill cranes in Kansas increased, the number of sandhill crane hunters and the crane harvest nearly doubled. However, the illegal take of 2 whooping cranes in 2004 prompted a reassessment of the season structure. This resulted in further delay of the opening date for sandhill crane hunting and the development of additional tools to assist hunters in better discriminating whooping cranes from other hunted species.

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Key words: *Grus canadensis*, harvest, hunting, Kansas, mid-continent population, sandhill cranes, whooping cranes.

Sandhill cranes (*Grus canadensis*) are classified into 6 subspecies; 3 are sedentary (non-migratory) and the other 3 are migratory (Walkinshaw 1949, Braun et al. 1975). For management purposes, sandhill cranes have been grouped into 9 populations (Drewien and Lewis 1987, Tacha et al. 1994). The 3 sedentary populations are relatively small (<7,000-8,000) and are not hunted (Lewis 1977). Two of the migratory populations, the Rocky Mountain population of greater sandhill cranes and the mid-continent population (MCP) are relatively large (approximately 20,000 and 550,000 birds, respectively), and have carefully designed sport hunting programs with a goal to maintain stable population levels. The Lower Colorado River Valley population is relatively small (approximately 2,500), but an Environmental Assessment (U.S. Department of the Interior 2007) determined that a limited harvest could be allowed. The MCP occurs in the U.S. portion of the Central Flyway during the fall and winter and is composed of 3 recognized subspecies: the lesser (*G. c. canadensis*), Canadian (*G. c. rowani*), and greater (*G. c. tabida*) sandhill cranes (Braun et al. 1975, Tacha et al. 1992). During the summer the MCP is distributed from southwestern Ontario, northwestward across central and northern Canada, Alaska, and into eastern Siberia (Lewis 1977; Tacha et al. 1994; G. L. Krapu, U.S. Geological Survey, personal communication). In September, MCP cranes begin migration to traditional staging areas in the

southern Canadian prairie provinces of Alberta, Saskatchewan, and Manitoba and in North Dakota (Lewis 1977). Prairie staging areas provide opportunities for the birds to assimilate critical nutrients, primarily from small grain crops, necessary to complete fall migration and to physiologically prepare for winter (Madsen 1967, Sugden et al. 1988). In spring, abundant foods available in the Canadian prairie habitats and staging areas along the Platte River Valley in Nebraska facilitate completion of nutrient acquisition to meet migration demands and to enhance body condition for nesting (Krapu et al. 1985, Iverson et al. 1987).

Beginning in 1983 Kansas was included in Federal frameworks established for the hunting of MCP sandhill cranes in the Central Flyway; however, a proposal to have a season in the early 1980s was not approved by the Kansas Wildlife Commission because of opposition to crane hunting. A second proposal to initiate sandhill crane hunting in the late 1980s also was not approved because of continuing concerns over potential impacts of sandhill crane hunting to both sandhill and whooping cranes (*G. americana*). In the early 1990s, crop depredation complaints by landowners on milo, corn, and wheat fields increased in the vicinity of Quivira National Wildlife Refuge (NWR). In 1993 the increased depredation concerns coupled with strong sandhill crane hunter interests prompted biologists in the Kansas Department of Wildlife and Parks to assemble biological

information necessary to again propose a season. This proposal was controversial and again prompted criticism from anti-crane hunting organizations and individuals. As a result, the Kansas Wildlife Commission conducted a series of public meetings to gather public input. Major criticisms about the initiation of a hunting season on sandhill cranes that surfaced during these hearings were related to: 1) increased potential threats to sandhill crane subspecies, 2) the use of a Flyway Management Plan that would not reduce harvests in Kansas even if local mortality was unacceptably high, 3) hunting activity that may displace cranes from preferred roosting sites, 4) beliefs that hunting would not help address increasing reports of depredation by sandhill cranes in agricultural fields, 5) increased risk to whooping cranes, and 6) concerns that an unacceptably large kill of cranes near Quivira NWR would occur.

After careful consideration of these concerns, the Kansas Wildlife Commission approved a limited hunting season in 1993. The resumption of hunting of sandhill cranes in Kansas followed a 77-year closure following the 1916 Convention for the Protection of Migratory Birds. This season and the regulation of annual sandhill crane harvests through Federal frameworks were guided by the *Management Guidelines for the Mid-Continent Population of Sandhill Cranes* (Central, Mississippi, and Pacific Flyway Councils 2006).

In Kansas, as with other states in the Central Flyway, the resumption of crane hunting followed a gradual pattern of expansion. Initiation of crane hunts and expansion of seasons has always come under intense scrutiny by anti-crane-hunting groups and individuals and hence have been controversial. The controversy prompted studies about 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 Kansas, 1993-2007, 2) harvests, 3) hunter activity and success, 4) population status of the MCP, and 5) potential incidental take of whooping cranes and efforts to reduce such take.

Kansas Hunting Seasons, 1993-2007

The presence of endangered whooping cranes, patterns of sandhill crane subspecies abundance and distribution, crop depredations, and harvest levels influenced hunting season selections during initial seasons and subsequent expansions of hunting

Table 1. Sandhill crane hunting seasons in Kansas, 1993-2007. Season length = 58 days.

| Year | Bag/ possession | Season dates |
|------|--------------------|--------------|
| 1993 | 2/4 | 6 Nov-2 Jan |
| 1994 | 2/4 | 5 Nov-1 Jan |
| 1995 | 2/4 | 5 Nov-1 Jan |
| 1996 | 4/4 | 2 Nov-29 Dec |
| 1997 | 2/4 | 1 Nov-28 Dec |
| 1998 | 2/4 | 7 Nov-3 Jan |
| 1999 | 2/4 | 6 Nov-2 Jan |
| 2000 | 2/4 | 4 Nov-31 Dec |
| 2001 | 2/4 | 3 Nov-30 Dec |
| 2002 | 2/4 | 2 Nov-29 Dec |
| 2003 | 3/6 | 1 Nov-28 Dec |
| 2004 | 3/6 | 6 Nov-2 Jan |
| 2005 | 3/6 | 9 Nov-5 Jan |
| 2006 | 3/6 | 8 Nov-4 Jan |
| 2007 | 3/6 | 7 Nov-3 Jan |

opportunities. Changes in Kansas crane hunting seasons during 1993-2007 are summarized in Table 1 and Fig. 1. The first 2 hunting seasons included a daily bag of 2 with a possession limit of 4, and was limited to portions of 17 counties. To avoid conflicts with migrating whooping cranes, the start of the 58-day season was delayed until the first Saturday in November. Shooting hours were between sunrise and 1400 hours daily. Non-toxic shot was required and a fee was charged for sandhill crane hunting privileges. Initial seasons were more restrictive than those allowed by Federal frameworks (i.e., the

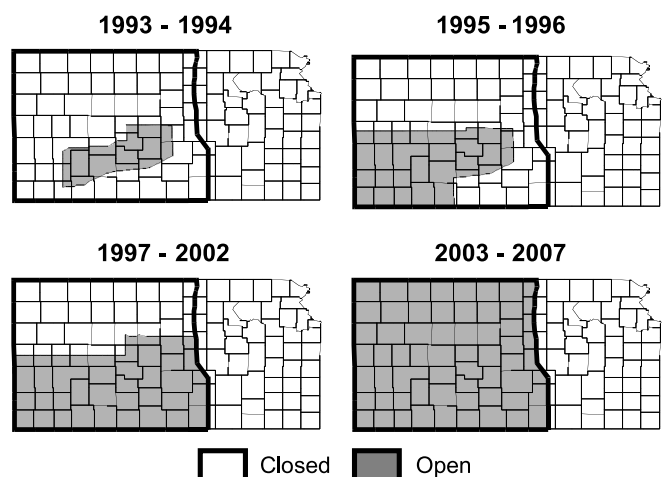


Figure 1. Areas open to the hunting of sandhill cranes in Kansas, 1993-2007.

hunting area and shooting hours were constrained, the bag and possession limits were reduced, and the use of non-toxic shot was required).

By 2003 a total of 62 counties were open for sandhill crane hunting. The daily bag/possession limits were increased from 2/4 to 3/6. As in previous years, the season was opened on the first Saturday in November. The number of counties open for sandhill crane seasons remained the same for 2004-07 seasons. On the first day (Saturday, 6 November) of the 2004 hunting season, 2 whooping cranes were shot prior to the sunrise opening of the season. Numerous discussions between U.S. Fish and Wildlife Service (USFWS, Migratory Bird Program, Ecological Services, and Refuges) and state personnel ensued, and analyses of both sandhill and whooping crane temporal and spatial use information were conducted by the Federal and State agencies. Subsequently, the opening date was delayed until the Wednesday following the first Saturday in November, and shooting hours during November were delayed until 1 half-hour after sunrise to reduce the likelihood of hunters shooting an endangered whooping crane.

Harvests

Sandhill crane harvests in Kansas are estimated annually by the Harvest Surveys Section staff in the USFWS, Division of Migratory Bird Management. MCP harvest is reported in Administrative Reports that are prepared annually (U.S. Fish and Wildlife Service 2006). During 1993-2003 annual harvest estimates for

Kansas were based on surveys of hunters that were issued a validated (purchased) Federal Sandhill Crane hunting permit (Sharp and Vogel 1992). Beginning in 2004 the Harvest Information Program was used to identify sandhill cranes hunters from which to conduct surveys (Moore et al. 2002).

Sandhill crane harvests in Kansas have varied annually. In 1995 and 1997, increases in harvest appeared to have resulted from opening additional counties to hunting; however, adding additional counties in 2003 did not result in increased harvest (Fig. 2). In contrast, crane harvests in the remainder of the U.S. portion of the Central Flyway and in North America remained relatively stable during the entire 1993-2007 period. Stafford County recorded the highest annual harvests in Kansas, generally 500 birds or about 61% of the statewide harvest, followed by Barton County (28%). Nearly 90% of the state's annual harvests have consistently come from these 2 counties.

Since 1993, the Kansas and the U.S. portion of the Central Flyway harvests have averaged approximately 3% and 58%, respectively, of the estimated North American MCP crane harvest (Table 3). Kansas ranked third in U.S. portion of the Central Flyway sandhill crane harvest (1993-2007 mean = 939) behind Texas and North Dakota during 1993-2007 (Kruse et al. 2008). During 1993-2007, crippling rate estimates were lower than the rates reported for the rest of the U.S. portion of the Central Flyway (paired *t*-test, $t = -3.09$, $P \leq 0.01$, Fig. 3). Further, linear regression analyses indicated the crippling rate during this period was declining for the flyway at 0.13% per year ($R^2 = 0.34$, $P = 0.02$), while the crippling rate in Kansas showed no trend ($R^2 < 0.01$, $P = 0.77$). Factors responsible for the declining trend of crippling rates in the U.S. portion of the Central Flyway are unknown, but the use of improved hunting techniques (e.g., decoys, calls, etc.) and enhanced understanding of crane behavior have likely contributed to improved hunter success and reduced crippling losses (Sharp and Vogel 1992).

Hunter Activity and Success

The number of Federal sandhill crane hunting permits issued to Kansas hunters increased during 1993-2007 (mean = 957). Charging a fee for crane hunting permits reduces the number of permits issued to hunters that only occasionally come into contact with sandhill cranes while

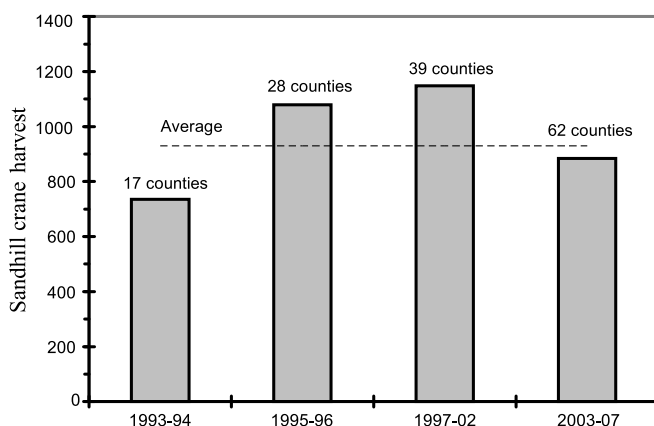


Figure 2. Average annual harvest (retrieved and unretrieved) according to the number of counties open for sandhill crane hunting, 1993-2007.

Table 2. Sandhill crane sport hunting harvests (retrieved) by county^a in Kansas, 1993-2007.

| County | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | Mean % ^b |
|-----------|------|------|------|------|-------|-------|-------|------|-------|-------|------|------|------|-------|------|---------------------|
| Barton | 137 | 148 | 222 | 276 | 281 | 419 | 277 | 148 | 452 | 468 | 223 | 242 | 68 | 245 | 160 | 27.5 |
| Clark | 0 | 0 | 0 | 6 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 |
| Finney | 0 | 0 | 0 | 3 | 0 | 6 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0.1 |
| Ford | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 9 | 12 | 0 | 0 | 0 | 0.2 |
| Gray | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 |
| Hodgeman | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 |
| Kiowa | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0.1 |
| Meade | 0 | 0 | 63 | 19 | 10 | 43 | 55 | 6 | 0 | 16 | 9 | 12 | 0 | 0 | 2 | 1.7 |
| Pawnee | 1 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0.2 |
| Pratt | 0 | 0 | 0 | 0 | 3 | 6 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 76 | 0 | 0.7 |
| Reno | 1 | 0 | 3 | 12 | 0 | 33 | 0 | 0 | 0 | 21 | 28 | 0 | 0 | 18 | 2 | 0.9 |
| Rice | 0 | 0 | 0 | 0 | 24 | 12 | 49 | 55 | 0 | 32 | 6 | 7 | 0 | 18 | 0 | 1.5 |
| Seward | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 6 | 0 | 6 | 0 | 0 | 0 | 0 | 0.1 |
| Stafford | 460 | 566 | 586 | 583 | 767 | 720 | 721 | 316 | 441 | 460 | 571 | 579 | 243 | 956 | 340 | 60.6 |
| Kearney | | | 100 | 20 | 50 | 11 | 64 | 14 | 111 | 0 | 3 | 0 | 0 | 0 | 0 | 2.7 |
| Lane | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0.1 |
| Scott | | | 0 | 0 | 8 | 0 | 0 | 16 | 7 | 6 | 0 | 0 | 0 | 0 | 0 | 0.3 |
| Barber | | | | | 0 | 22 | 67 | 8 | 3 | 16 | 49 | 4 | 148 | 25 | 6 | 2.5 |
| Ellsworth | | | | | 5 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 |
| Harper | | | | | 0 | 0 | 24 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0.2 |
| Russell | | | | | 0 | 15 | 3 | 0 | 3 | 9 | 0 | 0 | 0 | 0 | 6 | 0.3 |
| Cheyenne | | | | | | | | | | | 3 | 0 | 0 | 0 | 0 | 0.1 |
| Phillips | | | | | | | | | | | 9 | 0 | 0 | 0 | 0 | 0.1 |
| Total | 599 | 714 | 974 | 922 | 1,157 | 1,299 | 1,272 | 581 | 1,024 | 1,041 | 942 | 856 | 471 | 1,339 | 516 | |

^a Unknown county harvests are reapportioned according to percentage of known harvests.^b Mean percent each county contributes to the state harvest total.

hunting other species (Sharp and Cornely 1997). During this time, the average number of active hunters (permit holders that hunted cranes 1 or more times) in Kansas is 422, the third highest in the U.S. portion of the Central Flyway behind Texas and North Dakota.

During 1993-2007, the number of days afield by active sandhill crane hunters in Kansas ranged from 2.5 to 3.5 days, which is similar to the days afield spent by crane hunters in other Central Flyway states. Successful Central Flyway hunters (i.e., hunters that harvest at least 1 sandhill crane per season), including those in Kansas, on average harvested about 2.2 cranes during the season. The percentage of days (41%) in which hunters harvested 2 cranes during 1997-2001 was higher than in any other state (Dubovsky and Araya 2008). This level of success has been maintained for all hunting seasons.

Population Status

Few studies of MCP population dynamics have been

conducted, but sandhill cranes are long-lived and probably have the lowest recruitment and highest annual survival of any game bird 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 therefore the potential for overharvest is high, although population declines may not be immediately evident. Therefore, sandhill crane harvest strategies must be conservative to account for these demographics (Lewis 1977, Johnson 1979, Drewien et al. 1995).

Numbers of MCP cranes are unknown, but an index to population size is estimated annually. The spring migration period provides the best opportunity to conduct annual surveys (Benning and Johnson 1987) because the MCP is concentrated in Nebraska's Central Platte River Valley. In 1982 intensive photographic-transect spring surveys estimated the number of MCP cranes at 509,000 (Sharp and Vogel 1992). Subsequent annual indices (1983-2004) derived from photo-corrected surveys, indicate that the spring population was stable (Kruse et al. 2008). These indices are

Table 3. Annual sport hunting mortality (retrieved and unretrieved) for the mid-continent population of sandhill cranes, 1993-2007 (Kruse *et al.* 2008).

| Year | Kansas | | | | Central Flyway | | | | North America | | |
|------|------------------|--------------------|-------|-------------------|----------------|-------|--------|------|---------------|-------|--------|
| | Ret ^a | Unret ^a | Total | % NA ^a | Ret | Unret | Total | % NA | Ret | Unret | Total |
| 1993 | 602 | 53 | 655 | 2.4 | 18,005 | 2,252 | 20,257 | 75.7 | 23,417 | 3,334 | 26,751 |
| 1994 | 767 | 54 | 821 | 3.2 | 16,201 | 1,676 | 17,877 | 68.8 | 22,964 | 3,029 | 25,992 |
| 1995 | 990 | 140 | 1,130 | 3.3 | 20,628 | 2,236 | 22,864 | 66.4 | 30,254 | 4,161 | 34,416 |
| 1996 | 933 | 96 | 1,029 | 3.6 | 17,111 | 2,011 | 19,122 | 66.6 | 25,103 | 3,609 | 28,713 |
| 1997 | 1,167 | 58 | 1,225 | 3.6 | 19,766 | 2,279 | 22,045 | 65.5 | 29,428 | 4,211 | 33,640 |
| 1998 | 1,362 | 103 | 1,465 | 3.8 | 19,831 | 2,142 | 21,973 | 57.0 | 33,624 | 4,901 | 38,524 |
| 1999 | 1,275 | 61 | 1,336 | 4.2 | 16,969 | 1,717 | 18,686 | 58.3 | 27,925 | 3,947 | 32,065 |
| 2000 | 590 | 61 | 651 | 2.0 | 15,504 | 1,429 | 16,933 | 51.4 | 28,826 | 4,093 | 32,919 |
| 2001 | 1,033 | 61 | 1,094 | 3.1 | 15,000 | 1,517 | 16,517 | 52.4 | 27,485 | 4,014 | 31,499 |
| 2002 | 1,067 | 61 | 1,128 | 4.1 | 13,087 | 1,187 | 14,274 | 51.3 | 24,391 | 3,448 | 27,839 |
| 2003 | 942 | 91 | 1,033 | 2.9 | 18,335 | 1,628 | 19,963 | 56.0 | 31,425 | 4,246 | 35,671 |
| 2004 | 856 | 59 | 915 | 2.8 | 14,546 | 1,271 | 15,817 | 47.7 | 29,017 | 4,165 | 33,182 |
| 2005 | 471 | 42 | 513 | 1.4 | 18,263 | 1,800 | 20,063 | 55.2 | 31,819 | 4,511 | 36,330 |
| 2006 | 1,341 | 111 | 1,452 | 4.0 | 17,631 | 2,052 | 19,683 | 53.9 | 31,688 | 4,863 | 36,551 |
| 2007 | 516 | 50 | 566 | 1.4 | 18,610 | 1,676 | 20,286 | 55.5 | 32,177 | 4,389 | 36,567 |
| Mean | 927 | 75 | 998 | 3.0 | 17,299 | 1,792 | 19,091 | 58.4 | 28,636 | 4,061 | 32,711 |

^a Ret = Retrieved, Unret = Unretrieved or crippled, NA = North America.

conservative because each year about 10% of the sandhill cranes counted may occur outside the surveyed area (Solberg 2008).

The size of the MCP during fall is determined by the preceding spring population size, annual production, and summer mortality. Summer mortality has been estimated

at 2% (Miller 1987) and average production was 11% (Drewien *et al.* 1995). Using these values, the estimated annual fall flights during 1993-2007 ranged between 510,000-590,000. From a management perspective, the relatively constant spring populations observed during 1993-2007 suggested that annual mortality, including

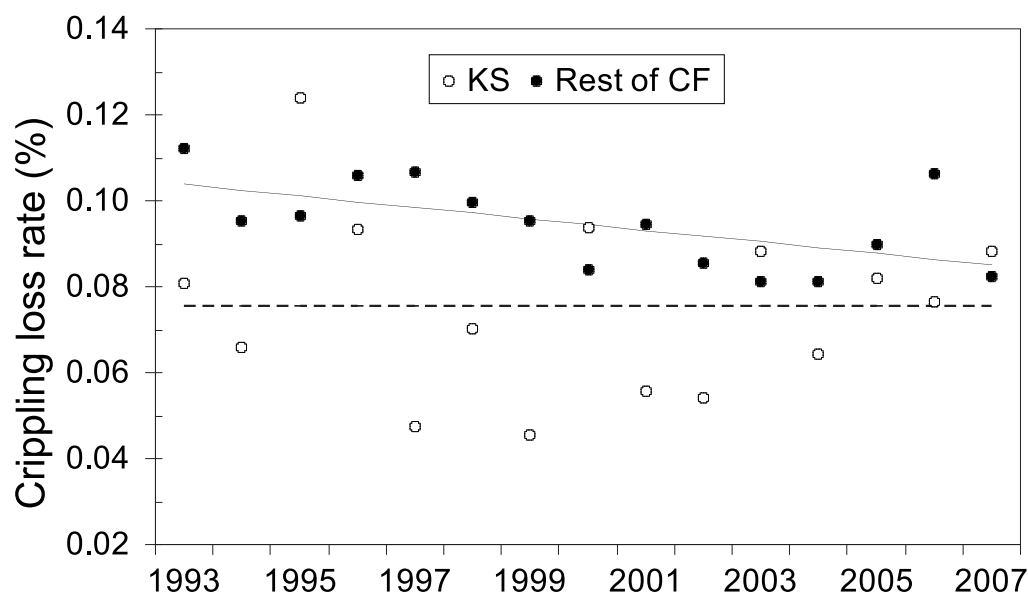


Figure 3. Trend of crippling rates in Kansas and the rest of the Central Flyway, 1993-2007.

sport harvest, had been at a level appropriate to maintain the MCP at objective levels.

Whooping Cranes

As with other sandhill crane hunting seasons in the Central Flyway, concerns about potential impacts to Aransas/Wood Buffalo population whooping cranes were at the forefront of managers' considerations as these seasons were gradually implemented (Sharp and Cornely 1997). These concerns influenced recommendations for season dates and areas open to hunting of sandhill cranes. In developing the initial seasons in Kansas, managers considered the fall distribution of whooping crane sightings and the temporal distribution of whooping crane use-days (i.e., number of birds seen multiplied by the number of days they were observed) to reduce the exposure of birds to hunters. In particular managers wanted to ensure that the majority of whooping cranes had moved through the state prior to the opening date for sandhill crane hunting. Ultimately an opening date of the first Saturday in November (median date = 4 November) was selected when, on average, 75% of the use-days had occurred (i.e., 25% of the whooping crane sightings were yet to occur during the hunting season). Selecting this date also represented a restriction in sandhill crane harvest opportunity because many sandhill cranes typically have migrated through Kansas by early November. Results from sandhill cranes fitted with satellite transmitters suggest many cranes already have left Kansas by mid-November (G. L. Krapu, U.S. Geological Survey, personal communication). Further, shooting hours during the Kansas sandhill crane hunting season began at sunrise (the only state in the Central Flyway to impose such a restriction) and ended at 1400 hours to reduce human disturbance to whooping cranes returning to roost sites in the afternoon.

Each year, the USFWS conducts a consultation under Section 7 of the Endangered Species Act to determine potential effects of migratory bird sport hunting seasons on endangered species. In the Central Flyway, potential impacts of sandhill crane hunting on whooping cranes receive considerable attention (Canadian Wildlife Service and U.S. Fish and Wildlife Service 2007). Further, a contingency plan (Central Flyway Council 2006) was designed to proactively

address situations where whooping cranes are sighted in areas open to hunting, and contains additional protective measures to reduce the risk of whooping cranes being shot. Due to these measures and because few conflicts between sandhill crane hunting and use of areas by whooping cranes were apparent, the area in Kansas where sandhill crane hunting was permitted was gradually expanded after 1994.

In 2004 a group of goose hunters shot and injured 2 whooping cranes near Quivira NWR in central Kansas. These cranes later died from these injuries, and this event prompted a reassessment of the sandhill crane season in Kansas and the efforts designed to protect whooping cranes. In reviewing the data, managers found that whooping cranes were migrating through the state later and tended to stay in Kansas longer than in the years prior to Kansas sandhill crane hunting seasons (Fig. 4). The exposure of whooping cranes to hunting activity had increased. Analyses of whooping crane use-days during 1993-2004 indicated that the average date by which 75% of the sightings had occurred was now approximately 9 November, compared to approximately 4 November during 1982-1992 (Fig. 5). Beginning in 2005 the opening day of sandhill crane hunting in Kansas was moved from the first Saturday in November to the Wednesday following the first Saturday in November (i.e., median date = November 9) to match the date to the original percentage designed to reduce exposure of whooping cranes to hunters. Moving the opening date to a mid-week day instead of a weekend day also had the benefit of reducing hunting pressure during the initial days of the hunting season

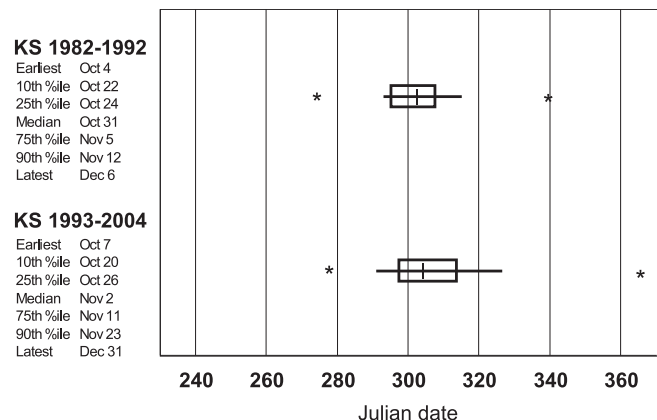


Figure 4. Temporal description of whooping crane use-days in Kansas during fall, 1982-1992 and 1993-2004.

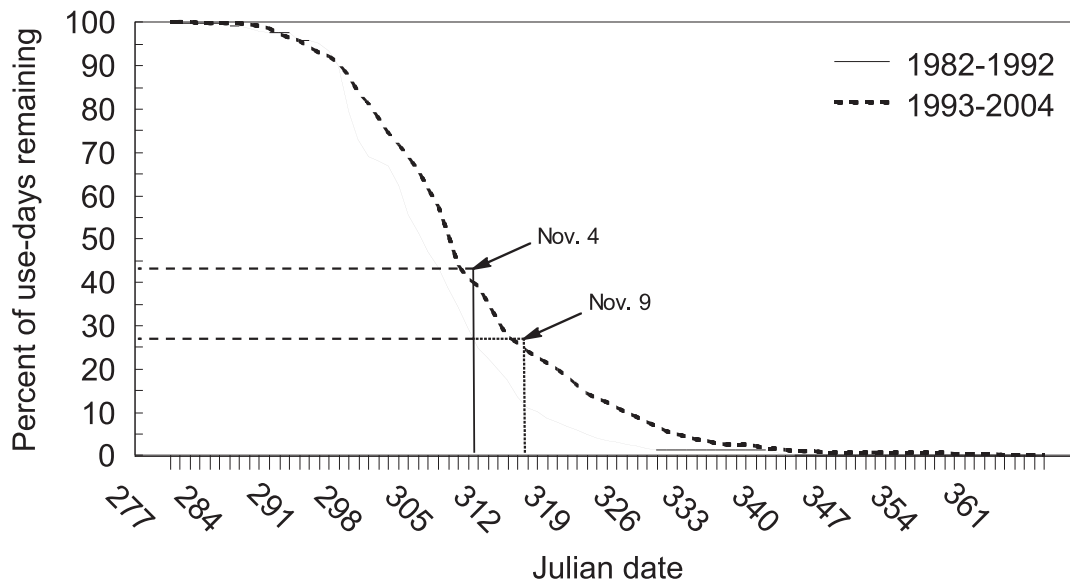


Figure 5. Proportion of fall whooping crane use-days remaining in Kansas relative to Julian day of the year for 2 time periods, 1982-1992 and 1993-2004.

because typically fewer people hunt during weekdays compared to weekend days. Shooting hours also were changed to begin at 30 minutes after sunrise from the start of the season through 30 November, and at sunrise from 1 December through the end of the season.

Data analyses also indicated that the number of whooping crane use-days during fall in Kansas had increased 136% from 1982-1992 (660) to 1993-2004 (1,556). Sightings were more concentrated on and adjacent to the Quivira NWR and Cheyenne Bottoms Wildlife Management Area in Stafford and Barton counties, respectively, during 1993-2004 (89%) than during 1982-1992 (75%), where much of the sandhill crane hunting in Kansas is concentrated (Figs. 6 and 7).

Information is available on the internet to help hunters avoid targeting whooping cranes (www.fws.gov/migratorybirds/CurrentBirdIssues/SandhillCranes/SandhillCraneHunters.htm), as well as an on-line training program designed to improve hunters' awareness of whooping cranes and to assist hunters in discriminating between sandhill and whooping cranes (www.kdwp.state.ks.us/news/Hunting/Migratory-Birds/Sandhill-Crane). This program was first available in 2005, and since 2006, hunters have been required to take this training annually before obtaining a permit to hunt sandhill cranes in Kansas.

Finally, the shooting of the whooping cranes prompted a revision of the Whooping Crane

Contingency Plan (Central Flyway Council 2006). The revision updated contact information for reporting whooping crane sightings and renewed efforts to implement all actions in the document.

MANAGEMENT IMPLICATIONS

In 1983 the USFWS established a broad framework for crane hunting in the Central Flyway to allow states flexibility for setting seasons within the established harvest thresholds (Central, Mississippi, and Pacific Flyway Councils 2006). Federal frameworks for crane hunting have remained essentially unchanged for the MCP since 1983.

Sandhill crane seasons beginning in October in Kansas would likely result in higher annual harvests than seasons beginning in early November. The temporal distribution of crane harvests in Kansas suggest that sandhill crane numbers are building in late October, and by mid-November are already declining in the state (Araya and Dubovsky 2008). Cranes fitted with satellite transmitters suggest that the mean arrival date is at the end of October, and the median departure date is near mid-November (G. L. Krapu, U.S. Geological Survey, personal communication).

Historical MCP distribution and traditional use of fall migration roost sites have been altered due to hunting pressure, drought, increases in acreage enrolled

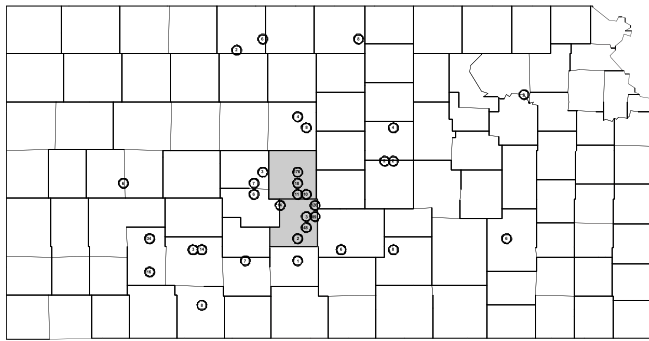


Figure 6. Locations of 660 fall whooping crane use-days in Kansas, 1982-92. The shaded area is comprised of Barton and Stafford counties.

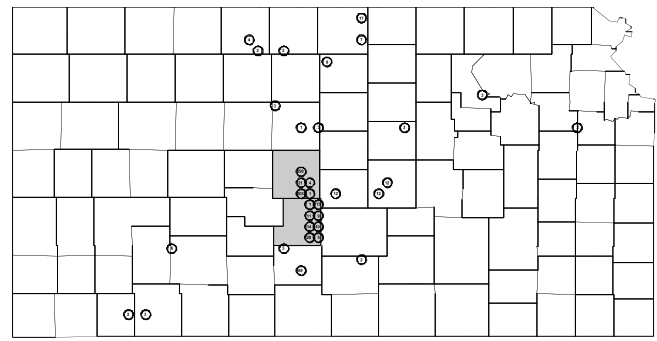


Figure 7. Locations of 1,556 fall whooping crane use-days in Kansas, 1993-2004. The shaded area is comprised of Barton and Stafford counties.

the U.S. Department of Agriculture's Conservation Reserve Program, and a number of other possible influences (Central, Mississippi, and Pacific Flyway Councils 2006). Complaints of depredations by cranes on agricultural crops have been considered in developing current population objectives, current hunting programs, and past expansions in federal hunting frameworks. These issues should be quantified, however, and a comprehensive hunting strategy should be prepared that addresses these concerns throughout the Central Flyway.

The MCP is stable and at objective levels and we foresee this favorable status continuing into the future. Significant management challenges remain, however, including: 1) continuing refinement of international harvest strategies to maintain a stable population, 2) maintaining current harvest distribution patterns, 3) maintaining current subspecies/subpopulation distribution and abundance, 4) developing a recruitment survey, 5) improved understanding of whether harvests alter age structures, 6) ensuring accurate harvest information including the possibility of determining subspecies composition of the harvest, and 7) ensuring compliance with the Whooping Crane Contingency Plan.

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