U.S. Fish & Wildlife Service

Status and Harvests of Sandhill Cranes

2010 Mid-Continent, Rocky Mountain, and Lower Colorado River Valley Populations

Acknowledgments

This report provides population status, recruitment indices, harvest trends, and other management information for the Mid-Continent (MCP), Rocky Mountain (RMP), and Lower Colorado River Valley (LCRVP) populations of sandhill cranes. Information was compiled with the assistance of a large number of biologists from across North America. We acknowledge the contributions of: D.S. Benning, J.L. Drahota, R.C. Drewien, J.W. Solberg, P.P. Thorpe, T.S. Liddick and D.L. Fronczak for conducting annual aerial population surveys; R.C. Drewien for conducting RMP productivity surveys; K.D. Richkus and M.H. Gendron for conducting the U.S. and Canadian Federal harvest surveys for the MCP; J.R. Bohne for compiling harvest information collected on sandhill cranes in the Pacific Flyway; M.J. Rabe for compiling information for the LCRVP; and G.L. Krapu and D.A. Brandt for providing preliminary results from satellite-transmittered MCP cranes. We especially want to recognize the support of the state and provincial biologists in the Central and Pacific Flyways for the coordination of sandhill crane hunting programs and especially the distribution of crane hunting permits and assistance in conducting of annual cooperative surveys.

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STATUS AND HARVESTS OF SANDHILL CRANES

MID-CONTINENT, ROCKY MOUNTAIN and LOWER COLORADO RIVER VALLEY POPULATIONS **2010**

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Abstract: Compared to increases recorded in the 1970s, annual indices to abundance of the Mid-Continent Population (MCP) of sandhill cranes have been relatively stable since the early 1980s. The spring 2010 index for sandhill cranes in the Central Platte River Valley, Nebraska, uncorrected for visibility bias, was 451,024 birds. The photo-corrected, 3-year average for 2007-09 was 498,420, which is above the established population-objective range of 349,000-472,000 cranes. All Central Flyway States, except Nebraska, allowed crane hunting in portions of their States during 2009-10. An estimated 7,394 hunters participated in these seasons, which was 23% lower than the number that participated in the previous season. Hunters harvested 15,282 MCP cranes in the U.S. portion of the Central Flyway during the 2009-10 seasons, which was 34% lower than the estimated harvest for the previous year but 6% higher than the long-term average. The retrieved harvest of MCP cranes in hunt areas outside of the Central Flyway (Arizona, Pacific Flyway portion of New Mexico, Alaska, Canada, and Mexico combined) was 7,304 during 2009-10. The preliminary estimate for the North American MCP sport harvest, including crippling losses, was 25,731 birds, which was a 39% decrease from the previous year's estimate. The long-term (1982-2008) trends for the MCP indicate that harvest has been increasing at a higher rate than population growth. The fall 2008 pre-migration survey for the Rocky Mountain Population (RMP) resulted in a count of 20,321 cranes. The 3-year average was 21,433 sandhill cranes, which is above the established population objective of 17,000-21,000 for the RMP. Hunting seasons during 2009-10 in portions of Arizona, Idaho, Montana, New Mexico, Utah, and Wyoming resulted in a record-high harvest of 1,392 RMP cranes, a 49% increase from the harvest of 936 in 2008-09. The Lower Colorado River Valley Population (LCRVP) survey results indicate a slight decrease from 2,401 birds in 2008 to 2,264 birds in 2009. The 3-year average of 2,847 LCRVP cranes is based on counts from 2007, 2009 and 2010 (survey was not complete in 2008) and is above the population objective of 2,500.

Introduction

The MCP of sandhill cranes, numerically the most abundant of all North American crane populations, is comprised of lesser (*Grus canadensis canadensis*) and greater (*G. c. tabida*) subspecies of sandhill cranes. A third intermediate-sized subspecies, the Canadian sandhill crane (*G. c. rowanii*), was identified in the MCP (Walkinshaw 1965); however, recent genetic investigations question the differentiation of this third subspecies (Rhymer et al. 2001, Peterson et al. 2003, Jones et al. 2005). The MCP was believed to have >500,000 individuals in the spring during the 1990s (Tacha et al.1994). The breeding range extends from northwestern Minnesota and western Quebec, then northwest through Arctic Canada, Alaska, and into eastern Siberia. The MCP wintering range includes western Oklahoma, New Mexico, southeastern Arizona, Texas, and Mexico (Fig. 1). Extensive, spring aerial surveys on major concentration areas that are corrected for observer visibility bias provide annual indices of abundance used to measure population trends. These surveys are conducted in late March, at a time when birds that wintered in Mexico, Arizona, New Mexico, and Texas usually have migrated northward to spring staging areas, but before spring "break-up" conditions allow cranes to move into Canada (Benning and Johnson 1987). The MCP Cooperative Flyway Management Plan established regulatory thresholds for changing harvest regulations that are based on an objective of maintaining sandhill crane abundances at 1982-2005 levels (i.e., spring index of 349,000–472,000 [411,000 ± 15%]). Sandhill crane hunters are required to obtain either a Sandhill Crane hunting permit or register under the Harvest Information Program (HIP) to hunt MCP cranes in the U.S. portion of the Central Flyway. The permits or HIP registration records provides the sampling frame to conduct annual harvest surveys. In Canada, the harvest survey is based on the sales of Federal Migratory Bird Hunting Permits, which are required for all crane hunters.

The RMP is comprised exclusively of greater sandhill cranes 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 highest 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) in Colorado and winters primarily in the Rio Grande Valley, New Mexico, with smaller numbers wintering in the southwestern part of New Mexico, in southeastern Arizona, and at several locations (~ 14) in the Northern Highlands of Mexico (Fig. 2). During 1984-96, the RMP was monitored at spring stopover areas in the SLV. However, cranes from the MCP also began to use this area, which confounded estimates of RMP abundance. In 1995, a fall pre-migration (September) survey replaced the spring count as the primary tool for monitoring population change. The RMP Cooperative Flyway Management Plan established a population objective (17,000-21,000 birds), and identifies surveys used to monitor recruitment and harvest levels that are designed to maintain a stable abundance (Pacific and Central Flyway Councils 2007). The plan contains a formula for calculating allowable annual harvests consistent with the goal of staying within the population objectives. All sandhill crane hunters in the range of the RMP must obtain a state permit to hunt cranes, which provides the sampling frame for independent harvest estimates and allows for assignment of harvest quotas by state. In many areas, harvest estimates are supplemented by periodic mandatory check-station reporting.

The LCRVP is numerically the least abundant of the six migratory populations of sandhill cranes recognized in the U.S. (Drewien et al. 1976, Drewien and Lewis 1987). The LCRVP is comprised exclusively of greater sandhill cranes that breed primarily in northeastern Nevada, with smaller numbers in adjacent parts of Idaho, Oregon, and Utah (Fig. 3), and winters in the Colorado River Valley of Arizona and Imperial Valley of California. LCRVP cranes have the

lowest reported recruitment rate (4.8%) of any sandhill crane population in North America (Drewien et al. 1995). In the fall, these cranes leave breeding areas during late September-early October and congregate at staging areas in eastern Nevada. Wintering areas historically extended south along the Colorado River to near its delta with the Gulf of California. However, the current wintering distribution is concentrated at Cibola National Wildlife Refuge and on adjacent areas belonging to the Colorado River Indian Tribes in southwestern Arizona, with a few birds at the Sonny Bono Salton Sea NWR in southern California and the Gila River in Arizona. Collectively, these areas are believed to winter in excess of 90% of the total cranes in the LCRVP. Spring migration is generally initiated as early as the first week of February. Since 1998, an aerial cruise survey has been conducted that covers the four main winter concentration areas.

Mid-Continent Population of Sandhill Cranes

No sport hunting seasons for MCP cranes were allowed in the U.S. between 1918-60. In the Central Flyway, areas open to hunting were gradually expanded during 1961-74, but since that time have remained relatively stable. Operational hunting seasons are now held annually in portions of Colorado, Kansas, Montana, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, and Wyoming. Nebraska is the only Central Flyway state that does not have a sandhill crane sport hunting season. Areas open to crane hunting in the Central Flyway during 2009-10 are shown in Fig. 4.

During 1961-74, hunters gradually improved their knowledge of sandhill cranes and improved their hunting success. During 1975-85, a tradition of sandhill crane hunting became established. Together with improvements in equipment (decoys, calls, clothing, blinds, etc.) and a shift from pass-shooting and hunting on roosts to decoy-hunting in fields, crane hunter success increased (Sharp and Vogel 1992). Dubovsky and Araya (2008) found that in the late 1990s and early 2000s hunters were more successful in harvesting 2 or 3 cranes per day than they were during the early 1980s. However, since the late 1990s, average seasonal bags have declined for the Flyway.

For most states, sandhill crane seasons began in relatively small areas, and expanded incrementally in subsequent years as experience with the seasons was gained. For example, sandhill crane seasons in North Dakota resumed in 1968 after being closed following the signing of the Migratory Bird Act in 1918. During 1968-79, the number of counties open for crane hunting increased from 2 to 8, and increased to 30 during 1980-92 and were grouped into two zones. Beginning in 1993, the zones were eliminated and Federal frameworks were fully utilized for the designated hunting area (Sharp and Cornely 1997). Kansas was the most recent Central Flyway state to initiate a crane hunting season in 1993. Initially, crane hunting was open only in portions of 17 counties, but by 2003 the area was expanded to 62 counties, essentially the entire western portion of the state (Sharp et al., in press). Also, during early years of these seasons, bag limits and shooting hours often were more restrictive than Federal frameworks allowed.

MCP harvest areas have remained relatively consistent from year to year; however, the levels of harvest vary with respect to many factors including changes in hunting pressure, land use, and environmental factors. Most shifts in annual harvests occur locally, but large-scale changes in harvest distributions also have occurred. Since the late 1990s, harvests have increased in Saskatchewan, while harvests have declined in North Dakota (Fig. 5). Causal factors for these changes have not been determined, but are likely different because birds staging in Saskatchewan are largely not from the same group that are harvested in North Dakota (G.

Krapu, Northern Prairie Wildlife Research Center, personal communication). Increased hunting pressure in Saskatchewan has likely contributed to increases in harvests whereas declines in harvests in North Dakota appear to be more complex and involve several interrelated factors, likely including changes in hunting pressure, conversion of cropland to grass cover, and environmental conditions.

The MCP included at least 510,000 sandhill cranes in March 1982, the last extensive survey involving high-altitude vertical photography of major spring migration staging concentrations. Beginning in 1982, an intensive photo-corrected ocular-transect survey of Nebraska's Central Platte River Valley (CPRV) and ocular assessments from other spring staging areas have been used to monitor the annual status and trends for this population (Table 1). Use of the CPRV count in the development of annual harvest recommendations relies on the premise that a high proportion (>90%) of the MCP are in the CPRV at the time of the annual survey. Recent research with radio-tracked birds suggests that the proportion of MCP cranes in the CPRV during the survey varies by year (G. Krapu, Northern Prairie Wildlife Research Center, personal communication). Annual variability in weather patterns can reduce the percentage below 90% in some years. However, conducting the survey a few days earlier or a few days later likely would not result in a 'better' count (i.e., a higher proportion of birds being in the CPRV), because birds migrate into and out of the area continuously (G. Krapu, Northern Prairie Wildlife Research Center, personal communication).

The March 2010 index for the CPRV (451, 024), which has not yet been corrected for visibility bias (Table 1, Fig. 6) was the fourth highest count since 1978. The annual photo-corrected estimates and 95% confidence intervals for the CPRV portion of the survey indicate a relatively stable (P = 0.36) population trend for the MCP since 1982 (Fig. 7). The average index for photo-corrected counts during 2007-09 is 498,420 cranes, which is 30% higher than the previous 3-year average of 382,271 (Solberg 2010), and is above the management objective levels (349,000-472,000) for this population of cranes (Fig. 8).

Since 1975, special Sandhill Crane Hunting Permits or more recently HIP certification have been required for crane hunters participating in seasons in the Central Flyway. A sample of these permittees are mailed questionnaires soon after the completion of each hunting season. The resulting responses enable estimation of hunting activities and success (Martin 2007). During the 2009-10 seasons in the Central Flyway, 26,469 hunters were either HIP-certified or obtained crane hunting permits, which were not limited in number (Table 2), with 7,934 of these individuals hunting at least one time (Table 3). The number of active hunters was 23% lower than that of last year which was the highest recorded since HIP was implemented (Fig. 9). Estimated numbers of hunters registering as sandhill crane hunters in Texas had been increasing since 1997 when crane hunting was included in the combination licenses issued by the state with a record high of 122,533 permits issued in 2008. In 2009, Texas began charging a fee for a separate sandhill crane permit which resulted in 91% decrease in the number of hunters identified as crane hunters from 2008. Charging, even a nominal fee, for a permit has produced decreases in the number of sandhill crane hunters in other states as well (Footnote 1, Table 2). Thus, the number of crane hunters in Texas likely did not decrease as suggested by the data; rather, the number of hunters classified as crane hunters by the Texas registration process declined. The number of hunters in Texas (40%) and North Dakota (45%) combined comprised 85% of all sandhill crane hunters in the Central Flyway.

Federal frameworks allowed daily bag/possession limits of 3/6, which most states selected (only portions of North Dakota and Texas had lower bag and possession limits). Specific dates

selected by states in the Central Flyway for 2009-10 were similar to those of previous hunting seasons (Table 4).

An index to crippling-loss rates (number of cranes lost/[number of cranes lost + retrieved]) in the U.S. portion of the Central Flyway has declined (R^2 = 0.90, P < 0.01) from over 16% in 1975 to a preliminary estimate of about 9.9% during the most recent hunting season (Fig. 10). The number of days afield (3.4) decreased slightly from the previous year (Fig. 11). The preliminary estimate of seasonal bag per hunter was 1.92 birds (Fig. 12), which is slightly lower than that of last year. The preliminary estimate of retrieved and unretrieved mortality associated with the sport harvest in the Central Flyway (16,966) was 31% lower than the previous year's estimate with a 48% decrease in Texas (Fig. 13). The increasing trend (R^2 = 0.56, P < 0.01) in the Central Flyway's harvest of MCP cranes during 1975-2009 likely was related to the gradual increase in hunter opportunity combined with improved knowledge of crane behavior, hunting techniques, and hunter success (Sharp and Vogel 1992, Dubovsky and Araya 2008).

Cranes from the MCP are also harvested in the RMP hunt areas in Arizona, New Mexico, Alaska (Table 5), Canada, and Mexico. The final estimate for the 2009-10 sport harvest in Canada (Manitoba and Saskatchewan) is 4,165 which is a 56% decrease from the previous year (Table 6). The estimated harvest estimate for Alaska and the RMP hunt areas in Arizona and New Mexico combined was 1,806 birds for 2009-10. For Alaska, sandhill crane harvest in harvest zones 1-6 is believed to be mostly MCP cranes and zones 7-12 are sandhill cranes from the Pacific Population of lesser sandhill cranes. There also is some intermingling of MCP cranes with RMP cranes in portions of New Mexico and Arizona; however, periodic bag checks allow estimates of harvests for each population. There are no annual harvest surveys in Mexico, but annual MCP harvests probably are <10% of the retrieved harvest in the U.S. and Canada (R. Drewien and D. Nieman, personal communication). This assumed low level of harvest was supported by an independent assessment of harvest in Mexico (Kramer et al. 1995). The 2009-10 preliminary estimate of retrieved and unretrieved kill of MCP cranes by sport hunters was 25,731, which is a 39% decrease from the record high in 2008 but only a 10% decrease from the average for 2000-08 (Table 7, Fig. 14).

To assess the relative rates of change between population size (abundance) and harvest, we used linear regression on the natural log-transformed values for these variables for the years 1982-2008. Because >10% of the MCP occurs outside the CPRV in the spring of some years, we combined the photo-corrected counts in the CPRV with the ocular cruise estimates from areas outside the CPRV for analyses of population abundance. For harvest, we used only the estimates of 'retrieved' harvest for the Central Flyway, RMP hunt areas in Arizona and New Mexico, Alaska, and Canada, because crippling-loss rates for the latter three areas are unknown and there are no empirical estimates of harvest from Mexico. Regression of the log-transformed values indicate a non-significant slope for the abundance values (P = 0.26; R^2 = 0.05; slope = + 0.5% per year change), suggesting no trend in the abundance of cranes over the time frame. However, the regression of the harvest values suggested an increase in the rate of harvest over that same time period (P < 0.01; R^2 = 0.76; slope = + 2.6% per year) (Fig. 15). These results suggest that the increase in the rate of harvest is increasing faster than the rate of growth in crane abundance, and the divergent trends cannot continue indefinitely. These analyses will be conducted periodically to determine whether these long-term relationships change. Methods have been developed (e.g., Araya and Dubovsky 2008, Dubovsky and Araya 2008) that will assist managers in structuring changes in harvest regulations should such need arise in the future. Results suggest that a bag-limit reduction of 1 bird per day may reduce state-specific harvests by 4%-23%, whereas fairly large restrictions in season framework dates may be needed to realize a perceptible decrease in harvest.

Subsistence harvest levels of MCP sandhill cranes historically were poorly documented. However, the 1997 U.S./Canada Migratory Bird Treaty Amendment identified improvements that should be made to sandhill crane harvest-monitoring programs in both the U.S. and Canada. Intensive studies conducted on the Yukon-Kuskokwim (Y-K) Delta, Alaska, in 2006 reported an MCP harvest of 4,501 adults and fledged young and of 345 eggs (Naves 2010). These estimates are relatively similar to long-term averages (1985-2005) of 3,148 adults and fledged young and 528 eggs taken by subsistence hunters on the Y-K Delta (Wentworth 2007). Efforts are being made to gather additional information on subsistence harvests for the remainder of Alaska, Siberia, and Canada.

Rocky Mountain Population of Greater Sandhill Cranes

The RMP was not hunted in the U.S. from 1918-81. Arizona initiated the first modern-day season in 1982. Since that time hunting programs have been guided by a cooperative management plan, including a harvest strategy that has been periodically updated and endorsed by the Central and Pacific Flyways (Kruse et al. 2008). Special limited hunting seasons during 2009-10 resulted in an estimated record-high harvest of 1,392 RMP sandhill cranes (Table 8), which was 49% higher than that of the 2008-09 estimate (Fig. 16). In 2009 Arizona increased their bag limit from 2 birds to 3 birds, which resulted in a corresponding increase in harvest but still well below their harvest allocation.

Counts conducted in the SLV during the spring migration suggested that the number of RMP cranes was relatively stable during 1984-96 (Table 9). However, survey biologists found that these estimates contained increasing numbers of the MCP (lesser subspecies). An adjustment, using ground-derived proportions, was made to correct for the lesser subspecies but was not a viable approach for the long-term (Benning et al. 1996). In 1996, the survey was discontinued (Fig. 17). In 1997, an attempt was made to survey these cranes during the fall (October) in the SLV, but MCP cranes also were present at that time. Biologists concluded that neither a spring nor a fall count in the SLV would result in a reliable index to the abundance of the RMP. As an alternative, a cooperative 5-state September pre-migration staging-area survey, experimentally tested in 1987 and 1992, has been ongoing operationally since 1995. Because no other crane population co-mingles with them during that time, the September pre-migration survey for the RMP appears to be a good alternative to either a spring or fall survey in the SLV and was designated as the official count for the RMP in 1997 (Table 10). Although operational in 1995 and 1996, the survey was variable in timing and survey effort. What appears to be a decrease in the population estimates (Fig. 17) in 1995 and 1996 is likely more an artifact of inconsistent survey effort (R. Drewien, personal communication).

The Cooperative Flyway Management Plan recommends using the most recent three-year running average of the September survey to determine status of the RMP. The 2009 September pre-migration survey was completed successfully and resulted in 20,321 cranes counted (Drewien et al. 2009). For the 2009-10 RMP hunting seasons, the 3-year average was 21,433, which is above the established population objective (17,000-21,000), and was used to determine the harvest allocation.

During 1986-95, important breeding areas in the Intermountain West experienced extremely dry conditions and indices of recruitment (% juveniles) were low (generally between 4-6%) (Fig. 19). A return to more favorable breeding conditions during 1996-99 resulted in higher recruitment rates (8-12%), but drier conditions resulted in lower production during 2000-02. Since 2003 recruitment rates have again increased to above-average levels due to improved

wetland habitats and favorable spring and summer breeding conditions. Biologists believe that the production outlook for the 2009 breeding season will remain at or above average. Based on population and recruitment indices for the 2007-09 period, management guidelines allow for a record-high maximum allowable take of 1,970 birds during the 2010-11 hunting season.

Lower Colorado River Valley Population of Greater Sandhill Cranes

The LCRVP is the smallest of the migratory populations of sandhill cranes in North America. The range of this population is believed to overlap ranges with the Rocky Mountain and Central Valley populations. Historically, winter counts of the LCRVP have not been well coordinated or conducted using a consistent methodology. However, in recent years efforts have been made to standardize areas surveyed and the timing of the survey to obtain more accurate counts and increased ability to determine trends in population abundance. Beginning in 1998, a coordinated winter aerial cruise survey with a fixed-wing aircraft has been conducted at the 4 major wintering areas: Cibola NWR, the Colorado River Indian Tribes wetland areas, Sonny Bono Salton Sea NWR, and the Gila River. Collectively these counts are believed to contain in excess of 90% of the total number of cranes in this population. The counts are not corrected for cranes present but not seen by aerial crews, and therefore have unknown bias and precision. Survey results suggested an increase from 1,900 birds in 1998 to 2,264 birds in 2010 (Table 11). Using linear regression on log-transformed counts indicates an average growth rate of approximately 3% per year between 1998-2007 (U.S.D.I. 2007). No operational survey is conducted to assess annual recruitment.

The LCRVP has not been hunted since the signing of the Migratory Bird Treaty Act in 1918. In 2007, the Service completed an Environmental Assessment "Proposed hunting regulations for the Lower Colorado River Valley Population of Greater Sandhill Cranes in the Pacific Flyway" (U.S.D.I. 2007). In 2008, the Service determined that a small allowable harvest (about 30) could be allowed on this population in years when the 3-year average of winter counts exceeded 2,500. The current 3-year average for 2007, 2009 and 2010 (survey was not complete in 2008) was 2,847 LCRVP cranes, which is above the population objective. Therefore a hunting season can be initiated for the 2010-11 season. The hunting season is guided by a cooperative management plan (Pacific Flyway Council 1995) which includes methodology for determining allowable harvests and allocation of the harvest. Once a hunting season is initiated, this season will be experimental for 3 years. After the 3 years, the season will be reviewed and revised if necessary.

Priority Research Efforts and Needs for Management of Sandhill Cranes

1. On April 7-9, 2009, a workshop was conducted to discuss the status of North American sandhill cranes and to update research and management priorities. A published document providing outcomes of the workshop is available at: http://www.fws.gov/migratorybirds/NewReportsPublications/Research/WMGBMR/Priority_Information_Needs_for_Sandhill_Cranes_10-09-09_FINAL.pdf. The following five priority information needs were identified *(Case and Sanders, 2009)*.

    Priority 1. Improving Sandhill Crane Harvest-Management Decision Structures- Current methods to manage harvest for RMP and MCP sandhill cranes use threshold approaches based on population objectives. Recent advances in modeling techniques and computer programs allow managers to better integrate empirical estimates of demographic parameters into models of population dynamics. Such techniques will be explored for the RMP and the MCP, which have the greatest amount of monitoring

information of the 6 migratory crane populations. A contract recently has been completed to initiate this work.

Priority 2. Improving the Eastern Population Sandhill Crane Survey- The existing survey established in 1979 for Eastern Population sandhill cranes has documented the rapid increase in abundance and geographic range. However, the design of this survey has not been critically evaluated and assessed for its adequacy for accurately detecting changes in abundance. Reliable population estimates are needed to develop harvest strategies and respond to anticipated requests for establishing new hunting seasons for this population of sandhill cranes.

Priority 3. Information Needs for Sandhill Crane Populations in the West- These populations are monitored relatively poorly, with no standardized surveys to estimate abundance or other demographic parameters. Potential survey methodologies will be explored to provide better information to managers. Understanding use of wintering and breeding areas by these populations will assist in developing monitoring strategies and provide a better biological rationale for harvest and habitat management decisions.

Priority 4. Assessing Effects of Habitat Changes on the Rocky Mountain Population of Sandhill Cranes- The wintering habitat for RMP sandhill cranes has been identified as the limiting factor for this population. A coordinator would be hired and responsible for developing and promoting outreach and grant projects to encourage and enable private land owners to protect and improve crane habitat as well as inform and educate the public of the importance of preserving agricultural land for sandhill crane management.

Priority 5. Improving Population Abundance Estimates for the Mid-Continent Population of Sandhill Cranes- The current survey framework for the annual cooperative spring survey has been in place since 1982 and has provided a reliable index of abundance for MCP sandhill cranes. However, managers are becoming increasingly concerned that habitat changes may be affecting historic spatial and temporal patterns of cranes in the survey area. Evaluation of other survey techniques is needed to compare abundance, variability, and reliability to the existing survey.

2. The agricultural landscape on which sandhill cranes depend for a portion of their annual cycle has undergone dramatic changes in recent years. In particular, some areas have experienced changes in the types of crops being planted, harvest efficiency has increased, and genetically modified crops are being introduced. Additionally, ongoing and proposed research by the Northern Prairie Wildlife Research Center will investigate how reduced waste grain availability in the Platte River Valley may affect the distribution and abundance of cranes. Results of these studies will enable managers to better target habitat actions which will benefit cranes.

3. The standardized timing (4th Tuesday in March) of the cooperative Spring MCP survey in the Central Platte River Valley is being assessed by the Northern Prairie Wildlife Research Center. The intent of the assessment is to determine whether a different timing of the survey would improve estimates of crane abundance in the CPRV. Two years of field work have been completed, however only about 17,000 and 10,000 sandhill cranes were found in 2009 and 2010 respectively. Preliminary information indicates that the current survey timing is appropriate (A. Pearse, personal communication).

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Table 1. Annual spring abundance indices for the Mid-Continent Population of sandhill cranes.

YR	CENTRAL PLATTE RIVER VALLEY, NE				OTHER						ALL AREAS			
	OCULAR CRUISE TRANSECT	OCULAR TRANSECT	PHOTO CORRECTED OCULAR TRANSECT ANNUAL	PHOTO CORRECTED OCULAR TRANSECT 3-YR AVG	OTHER NE	KS	CO[1]	OK[1]	NM[1]	TX	OCULAR CRUISE TRANSECT	OCULAR TRANSECT	PHOTO CORRECTED OCULAR TRANSECT ANNUAL	PHOTO CORRECTED OCULAR TRANSECT 3-YR AVG
1974	162,600				9,000	1,900	0	400	0	3,200	177,100			
1975	223,600				2,300	900	500	100	100	tr	227,500			
1976	147,500				2,800	300	0	100	1,000	800	152,500			
1977	173,400				1,100	1,600	0	400	12,500	30,700	220,000			
1978	149,800	188,582			2,200	700	0	0	2,300	4,900	159,900	198,682		
1979		203,574			2,600	1,100	500	1,500	0	0		209,274		
1980	223,400	254,417			5,000	4,100	0	100	500	1,400	234,500	265,517		
1981		248,882			8,300	11,200	500	0	0	21,800		290,682		
1982		347,996	417,263		7,100	2,000	2,800	0	100	7,800		367,796	437,063	
1983		306,316	343,378		4,100	200	0	200	tr	7,000		317,816	354,878	
1984		222,710	261,802	340,814	18,100	900	0	1,100	tr	800		243,610	282,702	358,214
1985		378,127	514,763	373,314	11,500	3,000				1,200		393,827	530,463	389,348
1986		317,025	353,040	376,535	1,000	200				2,100		320,325	356,340	389,835
1987		383,581	416,058	427,954	0	tr				400		383,981	416,458	434,420
1988		386,853	463,457	410,852	0	0				7,700		394,553	471,157	414,652
1989		391,353	391,995	423,837	100	1,000				800		393,253	393,895	427,170
1990		385,950	412,154	422,535	11,000	5,200				10,300		412,450	438,654	434,569
1991		297,831	340,645	381,598	100	800				200		298,931	341,745	391,431
1992		257,709	406,457	386,419	12,200	300				1,100		271,309	420,057	400,152
1993		253,799	378,883	375,328	16,800	37,750				13,500		321,849	446,933	402,912
1994		395,543	477,215	420,852	14,600	0	2,400			0		412,543	494,215	453,735
1995		273,376	326,181	394,093	30,400	0	6,700			0		310,476	363,281	434,810
1996		318,514	519,984	441,127	7,600	0	3,900			0		330,014	531,484	462,993
1997		350,932	534,630	460,265	16,200	100				0		367,232	550,930	481,898
1998		337,203	530,848	528,487	13,600	100				0		350,903	544,548	542,321
1999		219,794	284,858	450,112	3,500	100,000				0		323,294	388,358	494,612
2000		484,585	490,118	435,275	16,900	26,100				500		528,085	533,618	488,841
2001		387,336	413,498	396,158	10,500	42,300				3,500		443,636	469,798	463,925
2002		309,029	315,044	406,220	17,100	15,100		5,800		1,200		348,229	354,244	452,553
2003		300,918	348,023	358,855	24,800	4,100				3,800		333,618	380,723	401,588
2004		365,370	426,534	363,200	17,700	1,200		100		2,200		386,570	447,734	394,234
2005		412,285	491,915	422,157	27,100	2,900		2,600		8,700		453,585	533,215	453,891
2006		178,564	216,810	378,420	70,000	2,100				5,500		256,164	294,410	425,120
2007		307,094	384,118	364,281	20,400	3,600				5,900		336,994	414,018	413,881
2008		474,051	545,884	382,271	24,500	1,100				0		499,651	571,484	426,637
2009		457,436	565,257	498,420	29,900	tr				10,800		498,136	605,957	530,486
2010 [2]		451,024												

[1] CO, OK, and NM were eliminated from the Official Survey Area in 1985 by the CF CMU.

[2] Preliminary

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Table 2. Federal Mid-Continent sandhill crane permits issued in the Central Flyway.

YR	CO	KS	MT	NM	ND	OK	SD	TX	WY	TOTAL
1975	401		158	1,225	4,172	171	198	5,482	56	11,863
1976	341		117	1,195	4,137	265	200	5,060	37	11,352
1977	374		82	1,452	6,294	519	134	4,897	48	13,800
1978	343		209	956	5,798	620	98	5,198	52	13,274
1979	528		159	1,288	4,949	470	63	5,098	43	12,598
1980	437		118	1,082	5,754	510	240	5,239	33	13,413
1981	397		53	1,022	5,796	466	197	5,297	30	13,258
1982	528		147	962	4,714	750	579	4,650	40	12,370
1983	575		175	706	8,033	909	528	7,317	63	18,306
1984	538		113	721	7,436	1,187	544	6,838	43	17,420
1985	555		143	710	6,802	1,102	656	7,417	59	17,444
1986	617		99	595	8,926	1,073	705	7,258	25	19,298
1987	610		128	502	8,778	1,213	517	6,289	30	18,067
1988	512		162	480	6,214	1,472	437	7,053	38	16,368
1989	434		172	430	6,128	1,717	524	8,066	25	17,496
1990	389		143	533	7,268	1,725	646	11,994	22	22,720
1991	501		238	602	3,353	1,618	668	11,142	25	18,147
1992	498		303	582	3,760	1,397	721	9,848	18	17,127
1993	411	575	336	541	4,572	1,277	708	10,407	37	18,864
1994	427	567	320	547	4,790	1,561	636	10,515	49	19,412
1995	571	711	351	564	5,242	1,323	650	10,755	42	20,209
1996	612	837	369	499	5,570	1,391	677	11,334	41	21,330
1997	572	997	325	454	4,934	1,393	757	37,365 [2]	46	46,845
1998	4,937 [2]	1,088	270	449	6,082	1,385	951	32,523 [2]	49	47,734
1999	4,847 [2]	1,235	279	516	6,050	1,438	810	33,380 [2]	52	48,607
2000	5,169 [2]	1,084	283	493	7,451	1,333	721	44,719 [2]	58	61,311
2001	5,869 [2]	1,374	253	509	8,078	1,315	680	49,410 [2]	72	67,560
2002	5,644 [2]	1,279	303	496	8,245 [3]	1,186	619	37,558 [2]	54	55,384
2003	5,854 [2]	1,206	273	471	6,030 [3]	1,000	563	43,199 [2]	50	58,646
2004	5,784 [2]	1,180 [3]	308	548	5,788 [3]	780 [3]	307	52,161 [2]	61	66,917
2005	5,766 [2]	805 [3]	281	494	7,441 [3]	698 [3]	490	51,511 [2]	68	67,554
2006	4,792 [2]	826 [3]	265	512 [4]	7,410 [3]	615 [3]	445 [5]	70,968 [2]	78	85,911
2007	4,931 [2]	598 [3]	238	480 [4]	7,442 [3]	731 [3]	390 [5]	101,382 [2]	58	116,250
2008	5,772 [2]	655 [3]	272	677 [4]	6,501 [3]	736 [3]	398 [5]	122,553 [2]	73	137,637
2009 [1]	4,038 [2]	540 [3]	139	862 [4]	7,774 [3]	1,029 [3]	693 [5]	11,332 [3]	62	26,469
AVERAGES:										
1975-79	397		145	1,223	5,070	409	139	5,147	47	12,577
1980-89	520		131	721	6,858	1,040	493	6,542	39	16,344
1990-99	1,377	859	293	529	5,162	1,451	722	17,926	38	28,100
2000-08	5,509	1,001	275	520	7,154	933	513	63,718	64	79,686
1975-08	2,075	939	219	685	6,175	1,040	513	24,820	46	36,014

[1] Preliminary

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[2] Harvest Information Program (HIP) or a point-of-sale electronic record (without cost) used to identify crane hunters in lieu of a special sandhill crane hunting permit

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[3] States began charging a fee for crane hunting permits which reduces the number of permits issued to hunters that only occasionally come into contact with sandhill cranes.

[4] NM uses a combination of electronic and paper permits.

[5] SD uses a special question in their HIP questoinnaire to identify sandhill crane hunters.

Table 3. Estimated active Mid-Continent sandhill crane hunters[1] in the Central Flyway.

YR	CO	KS	MT	NM	ND	OK	SD	TX	WY	TOTAL
1975	226		69	806	2,896	80	117	2,733	22	6,949
1976	203		68	752	1,328	148	80	2,497	16	5,092
1977	189		40	921	4,126	339	77	2,329	27	8,048
1978	190		86	836	3,776	334	50	2,390	21	7,683
1979	275		61	745	3,225	307	29	2,356	13	7,011
1980	216		50	625	3,387	275	160	2,439	12	7,164
1981	216		23	598	3,315	269	103	2,543	14	7,081
1982	138		56	386	2,429	342	260	1,553	8	5,172
1983	211		64	253	3,551	384	225	2,435	20	7,143
1984	206		51	301	3,189	467	208	2,380	19	6,821
1985	187		37	216	2,383	372	168	2,613	12	5,988
1986	106		17	178	3,095	299	149	1,991	5	5,840
1987	113		29	133	2,529	358	120	1,942	5	5,229
1988	117		48	171	1,779	531	78	2,497	11	5,232
1989	74		52	152	2,018	492	153	2,805	6	5,752
1990	101		33	180	2,614	395	172	4,130	6	7,631
1991	153		69	220	1,674	370	139	3,231	3	5,859
1992	96		95	182	1,776	330	153	2,655	7	5,294
1993	87	294	97	218	2,223	357	140	3,602	5	7,023
1994	93	293	79	211	2,497	456	151	3,350	11	7,141
1995	154	393	118	211	2,408	331	143	3,707	6	7,471
1996	91	382	82	166	2,744	355	169	3,356	9	7,354
1997	67	452	68	124	2,386	264	178	4,515	10	8,064
1998	96	480	43	155	2,785	345	237	4,022	10	8,173
1999	133	533	60	204	2,444	375	173	2,699	8	6,629
2000	192	430	64	160	2,481	223	209	3,180	11	6,950
2001	202	555	72	173	2,934	391	145	3,554	13	8,039
2002	175	517	85	166	2,407	237	144	4,037	15	7,783
2003	236	495	60	244	2,271	64	114	4,821	10	8,315
2004	315	539	93	252	2,491	265	79	5,121	16	9,171
2005	280	274	90	233	3,370	259	165	5,383	24	10,078
2006	144	445	71	245	3,272	243	144	5,531	25	10,120
2007	158	255	82	241	3,145	166	57	5,685	19	9,808
2008	191	283	84	239	2,815	255	64	6,338	24	10,293
2009 [2]	159	213	50	286	3,546	371	63	3,179	67	7,934
AVERAGES:										
1975-79	217		65	812	3,070	242	71	2,461	20	6,957
1980-89	158		43	301	2,768	379	162	2,320	11	6,142
1990-99	107	404	74	187	2,355	358	166	3,527	8	7,064
2000-08	210	421	78	217	2,798	234	125	4,850	17	8,951
1975-08	166	414	65	321	2,699	314	140	3,365	13	7,277

[1] Those permittees reporting hunting cranes 1 or more times

[2] Preliminary

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Table 4. Season dates (month/day) for the hunting of sandhill cranes in the Central Flyway states.

YR	CO	KS	MT[1]	MT[2]	NM	ND[1]	ND[2]	OK	SD	TX[1]	TX[2]	TX[3]	WY
1960	-	-	-	-	01/01-01/30	-	-	-	-	-	-	-	-
1961	-	-	-	-	11/04-12/03	-	-	-	-	11/04-12/03	-	-	-
1962	-	-	-	-	11/03-12/02	-	-	-	-	11/03-12/02	-	-	-
1963	-	-	-	-	11/02-12/01	-	-	-	-	11/02-12/01	-	-	-
1964	-	-	-	-	10/31-11/29	-	-	-	-	10/31-11/29	-	-	-
1965	-	-	-	-	10/30-11/28	-	-	-	-	10/30-11/28	-	-	-
1966	-	-	-	-	10/29-11/27	-	-	-	-	10/29-11/27	-	-	-
1967	10/01-10/30	-	-	-	11/04-01/02	-	-	-	-	11/04-01/02	-	-	-
1968	10/01-10/30	-	-	-	11/02-12/28	11/09-12/08	-	12/14-01/02	11/09-12/08	11/02-12/28	12/14-01/02	-	-
1969	10/04-11/02	-	-	-	11/01-12/28	11/08-12/07	-	12/13-01/11	11/08-12/07	11/01-12/28	12/13-01/11	-	-
1970	10/03-11/01	-	-	-	10/31-01/10	11/14-12/13	-	12/05-01/10	11/14-12/13	10/31-01/10	12/05-01/10	-	-
1971	10/02-11/07	-	-	-	10/30-01/30	11/13-12/02	-	12/04-01/30	11/13-12/02	10/30-01/30	12/04-01/30	-	-
1972	10/01-11/05	-	10/01-11/06	-	11/03-01/31	11/11-12/10	-	12/02-01/28	11/11-12/10	10/28-01/28	12/02-01/28	-	10/07-11/05
1973	10/01-11/05	-	09/29-11/04	-	10/27-01/27	11/10-12/09	-	12/01-01/27	11/10-12/09	10/27-01/27	12/01-01/27	-	10/13-11/11
1974	10/01-11/05	-	09/28-11/03	-	10/26-01/26	11/09-12/08	-	11/30-01/26	11/09-12/08	10/26-01/26	11/30-01/26	-	10/12-11/10
1975	10/04-11/08	-	10/04-11/09	-	10/25-01/25	11/08-12/07	-	11/29-01/25	11/08-12/07	10/25-01/25	11/29-01/25	-	10/11-11/09
1976	10/02-11/06	-	10/02-11/07	-	10/30-01/30	11/06-12/05	-	11/27-01/23	11/06-12/05	10/30-01/30	12/04-01/30	-	10/09-11/07
1977	10/01-11/06	-	10/01-11/06	-	10/29-01/29	09/07-09/11	-	11/26-01/22	09/07-09/11	11/01-01/31	12/05-01/31	-	10/08-11/06
1978	09/30-11/05	-	09/30-11/05	-	10/28-01/28	09/07-09/11	-	11/25-01/21	09/07-09/11	10/31-01/31	12/05-01/31	-	10/07-11/05
1979	10/13-11/18	-	09/29-11/04	-	10/27-01/27	09/07-09/11	-	11/24-01/20	09/07-09/11	10/30-01/30	12/04-01/30	-	10/13-11/18
1980	10/11-11/16	-	10/04-11/09	-	10/30-01/31	09/06-09/14	09/06-09/10	11/22-01/18	09/20-09/28	10/31-01/31	12/05-01/31	-	10/11-11/16
1981	10/10-11/15	-	10/03-11/08	-	10/31-01/31	09/05-09/20	09/05-09/13	11/22-01/18	09/20-09/28	10/31-01/31	12/05-01/31	-	10/03-11/08
1982	10/02-11/28	-	10/02-11/28	-	10/31-01/31	09/04-09/19	09/04-09/12	10/23-01/23	10/02-11/11	10/30-01/30	12/04-01/30	-	09/25-11/21
1983	10/01-11/27	-	11/01-11/27	11/01-11/27	10/29-01/28	09/10-11/06	09/10-09/30	10/22-01/22	10/01-11/06	11/12-02/12	12/03-02/12	01/14-02/12	09/24-11/20
1984	09/29-11/25	-	09/29-11/25	11/01-11/25	10/27-01/27	09/08-11/04	09/08-09/28	10/13-01/13	09/29-11/04	11/10-02/10	12/01-02/10	01/12-02/10	09/22-11/18
1985	09/28-11/24	-	09/28-11/24	11/01-11/24	10/26-01/26	09/07-11/03	09/07-09/27	10/12-01/12	09/28-11/03	11/09-02/09	11/30-02/09	01/11-02/09	09/21-11/17
1986	10/04-11/30	-	10/04-11/30	11/01-11/30	10/25-01/25	09/06-11/02	09/06-10/03	10/11-01/11	09/28-11/02	11/08-02/08	11/29-02/08	01/03-02/08	09/20-11/16
1987	10/03-11/29	-	10/03-11/29	10/03-11/29	10/24-01/24	09/05-11/01	09/05-10/02	10/10-01/17	09/26-11/01	11/14-02/14	11/28-02/07	01/02-02/07	09/19-11/15
1988	10/01-11/27	-	10/01-11/27	10/01-11/27	10/22-01/22	09/10-11/06	09/10-09/30	10/22-01/22	09/24-10/30	11/12-02/12	11/26-02/05	01/07-02/12	09/17-11/13
1989	09/30-11/26	-	09/30-11/26	09/30-11/26	10/21-01/21	09/09-11/05	09/09-09/29	10/21-01/21	09/30-11/05	11/11-02/11	12/02-02/11	01/06-02/11	09/16-11/12
1990	09/29-11/25	-	09/29-11/25	09/29-11/25	10/20-01/20	09/08-11/04	09/08-10/14	10/20-01/20	09/29-11/04	11/10-02/10	12/01-02/10	01/05-02/10	09/15-11/11
1991	09/28-11/24	-	09/28-11/24	09/28-11/24	10/19-01/19	09/07-11/03	09/07-10/13	10/19-01/19	09/28-11/03	11/09-02/09	12/07-02/09	01/04-02/09	09/15-11/11
1992	10/03-11/29	-	09/26-11/22	09/26-11/22	10/17-01/17	09/05-11/01	09/05-10/11	10/17-01/17	09/26-11/01	11/14-02/14	12/05-02/14	01/02-02/07	09/15-11/11
1993	10/02-11/28	11/06-01/02	09/25-11/21	09/25-11/21	10/16-01/16	09/11-11/07	09/11-11/07	10/16-01/16	09/25-10/31	11/13-02/13	12/04-02/13	01/08-02/13	09/15-11/11
1994	10/01-11/27	11/05-01/01	09/24-11/20	09/24-11/20	10/15-01/15	09/10-11/06	09/10-11/06	10/15-01/15	09/24-10/30	11/12-02/12	12/03-02/12	01/07-02/12	09/15-11/11
1995	09/30-11/26	11/05-01/01	09/23-11/19	09/23-11/19	10/31-01/31	09/09-11/05	09/09-11/05	10/22-01/28	09/23-11/19	11/11-02/11	12/02-02/11	01/06-02/11	09/14-11/10
1996	10/05-12/01	11/02-12/29	09/28-11/24	09/28-11/24	10/31-01/31	09/07-11/03	09/07-11/03	10/26-01/26	09/28-11/24	11/09-02/09	11/30-02/09	01/04-02/09	09/14-11/10
1997	10/04-11/30	11/01-12/28	10/04-11/30	10/04-11/30	10/31-01/31	09/06-11/02	09/06-11/02	10/25-01/25	09/27-11/23	11/08-02/08	11/29-02/08	01/03-02/08	09/13-11/09
1998	10/03-11/29	11/07-01/03	10/03-11/29	09/12-09/20	10/31-01/31	09/05-11/01	09/05-11/01	10/24-01/24	09/26-11/22	11/07-02/07	11/28-02/07	01/02-02/07	09/12-11/08
1999	10/02-11/28	11/06-01/02	10/02-11/28	09/11-09/19	10/30-01/30	09/11-11/07	09/11-11/07	10/30-01/30	09/25-11/21	11/13-02/13	12/04-02/13	01/08-02/13	09/11-11/07
2000	10/07-12/03	11/04-12/31	09/30-11/26	09/09-09/17	10/31-01/31	09/16-11/12	09/16-11/12	11/04-02/04	09/23-11/19	11/11-02/11	12/02-02/11	12/30-02/04	09/09-11/05
2001	10/07-12/03	11/03-12/30	09/29-11/25	09/08-09/16	10/31-01/31	09/15-11/11	09/15-10/21	11/03-02/03	09/22-11/18	11/10-02/10	12/01-02/10	12/29-01/20	09/15-11/11
2002	10/05-12/01	11/02-12/29	09/28-11/24	09/07-09/15	10/31-01/31	09/21-11/17	09/21-10/27	11/09-02/09	09/21-11/17	11/09-02/09	11/30-02/09	12/21-01/19	09/14-11/10
2003	10/04-11/30	11/01-12/28	09/27-11/23	09/06-09/14	10/31-01/31	09/20-11/16	09/20-10/26	10/25-01/25	09/27-11/23	11/01-02/01	11/22-02/01	12/20-01/18	09/13-11/09
2004	10/02-11/28	11/06-01/02	09/25-11/21	09/11-09/19	10/31-01/31	09/18-11/14	09/18-10/24	10/30-01/30	09/25-11/21	11/06-02/01	11/27-02/01	12/18-01/16	09/18-11/14
2005	10/01-11/27	11/09-01/05	09/24-11/20	09/10-09/18	10/31-01/31	09/17-11/13	09/17-10/23	10/29-01/29	09/24-11/20	11/05-02/05	11/26-02/05	12/24-01/29	09/17-11/13
2006	09/30-11/26	11/08-01/04	09/23-11/19	09/09-09/17	10/31-01/31	09/16-11/12	09/16-10/22	10/28-01/28	09/23-11/19	11/04-02/04	11/24-02/04	12/23-01/28	09/16-11/12
2007	10/02-12/02	11/07-01/03	09/22-11/18	09/08-09/16	10/31-01/31	09/15-11/11	09/15-10/21	10/27-01/27	09/22-11/18	11/04-02/04	11/24-02/04	12/23-01/28	09/15-11/11
2008	10/04-11/30	11/05-01/01	09/27-11/23	09/06-09/21	10/31-01/31	09/20-11/16	09/20-10/26	10/25-01/25	09/27-11/23	11/08-02/08	11/28-02/08	12/20-01/25	09/13-11/09
2009	10/03-11/29	11/11-01/07	09/26-11/22	09/05-09/20	10/31-01/31	09/19-11/15	09/19-10/25	10/24-01/24	09/26-11/22	11/07-02/07	11/27-02/07	12/19-01/24	09/19-11/15

MT[1] Central Flyway portion of MT, except that area south of I-90 and west of the Bighorn River and Sheridan Co

MT[2] Sheridan County, MT

ND[1] Area 1, ND.

ND[2] Area 2, ND.

TX[1] Area A, TX

TX[2] Area B, TX

TX[3] Area C, TX

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Table 5. Estimated retrieved harvests of Mid-Continent sandhill cranes in the U.S.

YR	CO	KS	MT	NM	ND	OK	SD	TX	WY	CENTRAL FLYWAY	OTHER SURVEY AREAS				U.S. TOTAL
											AZ [4]	NM [4]	AK [2 3]	TOTAL	
1975	91		16	911	2,122	142	86	6,123	6	9,497			1,094	1,094	10,591
1976	106		29	858	52	200	12	6,122	14	7,393			637	637	8,030
1977	39		18	1,456	4,078	410	47	6,094	9	12,151			471	471	12,622
1978	106		36	1,089	2,777	389	19	5,720	10	10,146			239	239	10,385
1979	129		14	1,170	2,733	397	19	5,917	0	10,379			517	517	10,896
1980	68		16	1,019	2,245	363	130	6,305	6	10,152			809	809	10,961
1981	92		11	907	2,395	397	78	6,245	9	10,134	20		383	403	10,537
1982	49		21	335	2,469	535	212	4,295	0	7,916	62		1,160	1,222	9,138
1983	70		28	354	6,471	373	177	5,471	15	12,959	17		1,540	1,557	14,516
1984	85		15	414	4,367	433	139	5,811	7	11,271	23		1,986	2,009	13,280
1985	82		7	334	4,650	416	101	7,184	2	12,776	48		1,197	1,245	14,021
1986	33		1	250	6,563	392	99	5,149	0	12,487	108	184	539	831	13,318
1987	86		15	159	5,334	957	99	6,117	3	12,770	127	318	836	1,281	14,051
1988	68		18	372	3,815	1,061	100	7,330	8	12,772	172	127	1,241	1,540	14,312
1989	25		33	319	4,656	1,003	194	7,400	9	13,639	126	138	545	809	14,448
1990	87		44	377	6,804	698	165	9,865	1	18,041	114	259	918	1,291	19,332
1991	224		31	593	4,580	604	128	6,916	3	13,079	172	235	677	1,084	14,163
1992	84		103	505	4,654	478	141	6,455	13	12,433	139	54	640	833	13,266
1993	112	602	95	506	6,985	826	110	8,769	0	18,005	113	178	201	492	18,497
1994	143	767	56	357	6,235	1,167	239	7,233	4	16,201	86	153	648	887	17,088
1995	208	990	156	673	7,017	1,091	170	10,322	1	20,628	124	111	812	1,047	21,675
1996	91	933	58	332	6,639	1,066	166	7,816	10	17,111	114	78	1,205	1,397	18,508
1997	168	1,167	45	248	6,545	600	189	10,800	4	19,766	171	45	870	1,086	20,852
1998	64	1,362	17	258	7,967	645	454	9,054	10	19,831	114	55	1,042	1,211	21,042
1999	56	1,275	29	321	5,748	879	184	8,469	8	16,969	92	101	NA*	193	17,162
2000	363	590	15	311	5,081	552	374	8,208	10	15,504	166	100	985	1,251	16,755
2001	257	1,033	43	297	5,173	713	478	6,999	7	15,000	154	106	941	1,201	16,201
2002	294	1,067	23	342	2,852	490	160	7,837	22	13,087	197	92	850	1,139	14,226
2003	230	942	49	617	4,564	200	166	11,560	7	18,335	155	162	330	647	18,982
2004	92	856	54	350	3,967	441	67	8,715	4	14,546	192	167	438	797	15,343
2005	265	471	65	578	3,721	511	190	12,446	16	18,263	227	175	384	786	19,049
2006	96	1,341	12	682	3,906	538	202	10,834	20	17,631	201	245	313	759	18,390
2007	149	516	51	427	4,501	272	163	12,511	20	18,610	268	331	596	1,195	19,805
2008	32	453	73	483	4,179	493	83	17,169	24	22,989	138	329	1,249	1,716	24,705
2009 [1]	58	447	34	584	4,436	737	96	8,882	8	15,282	305	332	449	1,086	16,368
AVERAGES:															
1975-79	94		23	1,097	2,352	308	37	5,995	8	9,913			592	592	10,505
1980-89	66		17	446	4,297	593	133	6,131	6	11,688	78	192	1,024	1,171	12,858
1990-99	124	1,014	63	417	6,317	805	195	8,570	5	17,206	124	127	779	952	18,159
2000-08	198	808	43	454	4,216	468	209	10,698	14	17,107	189	190	676	1,055	18,162
1975-08	122	898	38	535	4,584	580	157	8,037	8	14,484	130	163	797	990	15,475
CURRENT YEAR PERCENT CHANGE FROM:															
2008	81%	-1%	-53%	21%	6%	49%	16%	-48%	-67%	-34%	121%	1%	-64%	-37%	-34%
1975-79	-38%		50%	-47%	89%	140%	162%	48%	3%	54%			-24%	84%	56%
1980-89	-12%		106%	31%	3%	24%	-28%	45%	36%	31%	290%	73%	-56%	-7%	27%
1990-99	-53%	-56%	-46%	40%	-30%	-8%	-51%	4%	48%	-11%	146%	162%	-42%	14%	-10%
2000-08	-71%	-45%	-21%	29%	5%	58%	-54%	-17%	-45%	-11%	62%	75%	-34%	3%	-10%
1975-08	-52%	-50%	-11%	9%	-3%	27%	-39%	11%	-4%	6%	135%	104%	-44%	10%	6%

[1] Preliminary

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[2] A proportion of the Alaskan harvest is composed of lesser sandhill cranes from the Pacific Coast Population

[3] Harvest data are from state harvest surveys for only the MCP portion of the state, except in 1977-81, 1986, 1991, and 1998-99 where federal MQS state totals are prorated by the long-term percent MC cranes; data from 2000 forward are MC portion from HIP.

[4] This MC harvest for AZ and NM represents MC sandhill cranes that were harvested in RMP areas and are not represented in the CF MC Sandhill Crane Federal Harvest Survey

* No estimate is available.

Table 6. Estimated retrieved harvests of Mid-Continent sandhill cranes in Canada.

YEAR	MB	SK	TOTAL
1971	228	2,715	2,943
1972	113	2,030	2,143
1973	683	3,592	4,275
1974	58	6,641	6,699
1975	162	5,744	5,906
1976	209	1,427	1,636
1977	367	N/A	367
1978	877	N/A	877
1979	978	2,821	3,799
1980	891	4,698	5,589
1981	510	2,456	2,966
1982	797	2,037	2,834
1983	377	2,711	3,088
1984	661	3,042	3,703
1985	691	4,448	5,139
1986	1,662	4,452	6,114
1987	664	4,480	5,144
1988	1,958	4,990	6,948
1989	2,652	2,323	4,975
1990	1,023	3,812	4,835
1991	1,771	3,547	5,318
1992	1,221	4,718	5,939
1993	482	2,433	2,915
1994	544	3,286	3,830
1995	1,004	4,823	5,827
1996	1,351	2,961	4,312
1997	1,279	4,621	5,900
1998	889	8,637	9,526
1999	1,300	7,100	8,400
2000	805	8,645	9,450
2001	1,247	7,539	8,786
2002	1,282	6,665	7,947
2003	1,474	8,111	9,585
2004	1,267	9,770	11,037
2005	1,776	8,100	9,876
2006	2,688	7,729	10,417
2007	3,554	8,232	11,786
2008	742	8,697	9,439
2009	1,037	3,128	4,165
AVERAGES:			
1971-79	408	3,567	3,183
1980-89	1,086	3,564	4,650
1990-99	1,086	4,594	5,680
2000-08	1,648	8,165	9,814
1971-08	1,059	5,001	5,797
CURRENT YEAR PERCENT CHANGE FROM:			
2008			-56%
1971-79			31%
1980-89			-10%
1990-99			-27%
2000-08			-58%
1971-08			-28%

Table 7. Annual sport hunting mortality estimates for the Mid-Continent Population of sandhill cranes in North America.

YR	SPORT HUNTING MORTALITY: Retrieved: Central Flyway	Retrieved: Other Survey Total	Retrieved: Canada	Retrieved: Mexico[2]	Unretrieved: No. Am.[3]	Total
1975	9,497	1,094	5,906	1,650	3,615	21,762
1976	7,393	637	1,636	967	2,032	12,665
1977	12,151	471	367	1,299	2,440	16,728
1978	10,146	239	877	1,126	2,308	14,697
1979	10,379	517	3,799	1,470	2,807	18,972
1980	10,152	809	5,589	1,655	3,351	21,556
1981	10,134	403	2,966	1,350	2,724	17,577
1982	7,916	1,222	2,834	1,197	2,451	15,620
1983	12,959	1,557	3,088	1,760	3,501	22,865
1984	11,271	2,009	3,703	1,698	3,372	22,053
1985	12,776	1,245	5,139	1,916	3,520	24,596
1986	12,487	831	6,114	1,943	3,648	25,023
1987	12,770	1,281	5,144	1,920	3,379	24,493
1988	12,772	1,540	6,948	2,126	3,751	27,137
1989	13,639	809	4,975	1,942	3,626	24,992
1990	18,041	1,291	4,835	2,417	4,228	30,811
1991	13,079	1,084	5,318	1,948	3,438	24,867
1992	12,433	833	5,939	1,921	3,198	24,323
1993	18,005	492	2,915	2,141	3,362	26,915
1994	16,201	887	3,830	2,092	3,038	26,048
1995	20,628	1,047	5,827	2,750	4,161	34,413
1996	17,111	1,397	4,312	2,282	3,609	28,711
1997	19,766	1,086	5,900	2,675	4,211	33,638
1998	19,831	1,211	9,526	3,057	4,901	38,526
1999	16,969	193 [4]	8,400	2,556	3,947	32,065
2000	15,504	1,251	9,450	2,621	4,093	32,919
2001	15,000	1,201	8,786	2,499	4,014	31,500
2002	13,087	1,139	7,947	2,217	3,448	27,838
2003	18,335	647	9,585	2,857	4,246	35,669
2004	14,546	797	11,037	2,638	4,165	33,183
2005	18,263	786	9,876	2,893	4,511	36,328
2006	17,631	759	10,417	2,881	4,863	36,551
2007	18,610	1,195	11,786	3,159	4,904	39,654
2008	22,989	1,716	9,439	3,414	4,432	41,990
2009 [1]	15,282	1,086	4,165	2,053	3,145	25,731
AVERAGES:						
1975-79	9,913	592	2,517	1,302	2,641	16,965
1980-89	11,688	1,171	4,650	1,751	3,332	22,591
1990-99	17,206	1,036	5,680	2,384	3,809	30,032
2000-08	17,107	1,055	9,814	2,798	4,297	35,070
1975-08	14,484	1,015	6,006	2,148	3,626	27,255
CURRENT YEAR PERCENT CHANGE FROM:						
2008	-34%	-37%	-56%	-40%	-29%	-39%
1975-79	54%	84%	65%	58%	19%	52%
1980-89	31%	-7%	-10%	17%	-6%	14%
1990-99	-11%	5%	-27%	-14%	-17%	-14%
2000-08	-11%	3%	-58%	-27%	-27%	-27%
1975-08	6%	7%	-31%	-4%	-13%	-6%

[1] Preliminary

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[2] Unknown harvests (Mexico) were assumed to be 10% of harvests in the U.S. and Canada.

[3] Unretrieved kill as reported by hunters is used for the Central Flyway; for the remainder of harvest areas, it is assumed to be 20% of retrieved harvests.

[4] There is no estimate available for AK in that year.

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Table 8. Estimated retrieved harvests of the Rocky Mountain Population of sandhill cranes.

YR	UT	NM	AZ	WY	MT	ID	TOTAL
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
1989	54	483	51	125			713
1990	35	79	9	58			181
1991	48	47	44	101			240
1992		147	39	168	42		396
1993	28	297	61	115	45		546
1994	34	416	27	150	40		667
1995	27	270	33	77	41		448
1996	32	236	27	84	49	20	448
1997	30	114	22	82	62	136	446
1998	34	180	37	93	59	135	538
1999	54	198	21	124	71	190	658 [1]
2000	69	257	37	163	91	193	810 [2]
2001	77	288	26	142	87	278	898
2002	60	164	42	132	51	194	643
2003	57	169	34	72	50	146	528
2004	53	189	35	124	51	142	594
2005	62	236	50	116	49	189	702
2006	87	327	10	194	54	235	907
2007	103	276	43	138	73	187	820
2008	101	379	24	162	85	185	936
2009	149	603	67	195	124	254	1,392
AVERAGES:							
1981-89	54	397	35	147			259
1990-99	36	198	32	105	51	120	457
2000-08	74	254	33	138	66	194	760
1981-08	55	241	33	128	59	172	491
CURRENT YEAR PERCENT CHANGE FROM:							
2008	48%	59%	179%	20%	46%	37%	49%
1981-89	176%	52%	94%	33%			437%
1990-99	316%	204%	109%	85%	143%	111%	205%
2000-08	100%	138%	100%	41%	89%	31%	83%
1981-08	171%	150%	101%	52%	111%	48%	184%

[1] RMP Sandill cranes (40) were also taken as part of research project in the San Luis Valley, CO

[2] RMP Sandill cranes (20) were also taken as part of research project in the San Luis Valley, CO

Table 9. Spring population indices for Rocky Mountain sandhill cranes, 1984-96.

	SAN LUIS VALLEY, COLORADO					
YR	RAW COUNT	ADJ. FOR EST. BIAS[1]	ADJ. TO REM. LES.[2]	OTHER AREAS	INDEX	SURVEY COND.
1984	10,962	14,488	13,562	550	14,112	POOR
1985	18,393	21,773	20,382	0	20,382	GOOD
1986	14,031	14,031	13,135	20	13,155	POOR
1987	13,561	15,661	14,660	0	14,660	POOR
1988	17,510	17,510	16,381	22	16,403	POOR
1989	17,302	18,389	17,004	0	17,004	GOOD
1990	20,851	24,593	21,221	275	21,496	GOOD
1991	19,990	18,405	16,045	175	16,220	GOOD
1992	23,516	23,516	19,999	9	20,008	GROUND
1993	17,576	17,576	16,478	1,260	17,738	POOR
1994	17,229	16,036	15,063	203	15,266	FAIR
1995	25,276	23,390	20,229	0	20,229	GOOD
1996	23,019	26,379	22,737	1,010	23,747	GOOD

[1] Raw estimate adjusted by photography for estimation bias
[2] Population estimate adjusted to remove the number of lesser sandhill cranes (non-RMP cranes).

Table 10. Fall pre-migration population indices for Rocky Mountain sandhill cranes.

YR	UT	CO	ID	WY	MT	TOTAL	3-YR AVG
1987	1,578	1,443	10,686	2,327	1,447	17,481	
1992	2,810	3,181	5,801	2,241	5,264	19,297	
1995	1,528	2,284	6,864	1,671	3,681	16,028	
1996	1,849	1,255	8,334	2,526	2,974	16,938	
1997[1, 2]	2,450	1,604	8,132	2,255	3,595	18,036	17,001
1998	2,185	1,273	8,067	3,262	3,415	18,202	17,725
1999	2,292	1,102	8,761	4,205	3,141	19,501	18,580
2000	2,416	749	9,337	3,890	3,598	19,990	19,231
2001	1,522	666	7,160	2,626	4,585	16,559	18,683
2002	1,869	1,355	7,698	3,038	4,843	18,803	18,451
2003	2,546	745	7,822	3,446	4,964	19,523	18,295
2004	2,239	1,410	7,152	3,072	4,637	18,510	18,945
2005	2,646	1,052	7,668	3,911	5,588	20,865	19,633
2006 [3]						NS	19,633
2007 [4]	2,401	1,743	8,262	3,907	6,509	22,822	20,732
2008 [5]	3,708	1,080	6,123	3,826	6,419	21,156	21,614
2009	2,283	1,162	6,934	3,613	6,329	20,321	21,433

[1] Incomplete survey efforts in years prior might have resulted in lower estimates; the official count begins in 1997.
[2] In October 1997, a special survey was also conducted in the SLV, Colorado and other areas, which resulted in a total of 27,090 Rocky Mountain and Mid-Continent cranes being counted.
[3] In 2006, the survey was not conducted due to mechanical issues with the survey plane. The 3-yr Avg for 2006 is calculated using 2003-05. *07/01/10*
[4] The 3-yr average for 2007 was calculated using 2004, 2005, and 2007 because there was no survey in 2006.
[5] The 3-yr average for 2008 was calculated using 2005, 2007, and 2008 because there was no survey in 2006. *S:\CF_D\projects\CRANES\Status Reports\Shcranerep.xls*

Table 11. Winter counts of Lower Colorado River Valley Population of sandhill cranes in Arizona and California

YR	Cibola NWR	Colorado River Indian Tribe	Salton Sea NWR	Gila River	TOTAL	3-YR AVG
1998	775	596	351	178	1,900	
1999	1,200	511	325	163	2,199	
2000	820	1,259	235	252	2,566	2,222
2001	961	952	350	134	2,397	2,387
2002	1,003	168	417	52	1,640	2,201
2003	1,200	455	430	0	2,085	2,041
2004	1,341	354	521	312	2,528	2,084
2005	1,513	457	476	191	2,637	2,417
2006	1,141	673	493	360	2,667	2,611
2007	2,322	809	295	450	3,876	3,060
2008 [1]	115	NS	687	413	1,215	3,060
2009 [2]	289	1216	603	293	2,401	2,981
2010 [2]	266	729	904	365	2,264	2,847

NS = No survey was conducted.

[1] In 2008, the survey was not complete. The 3-YR average for that year was calculated using 2005-07.

[2] In 2009 and 2010, the estimate for 2008 was not included in the 3-YR average due to an incomplete survey in 2008.

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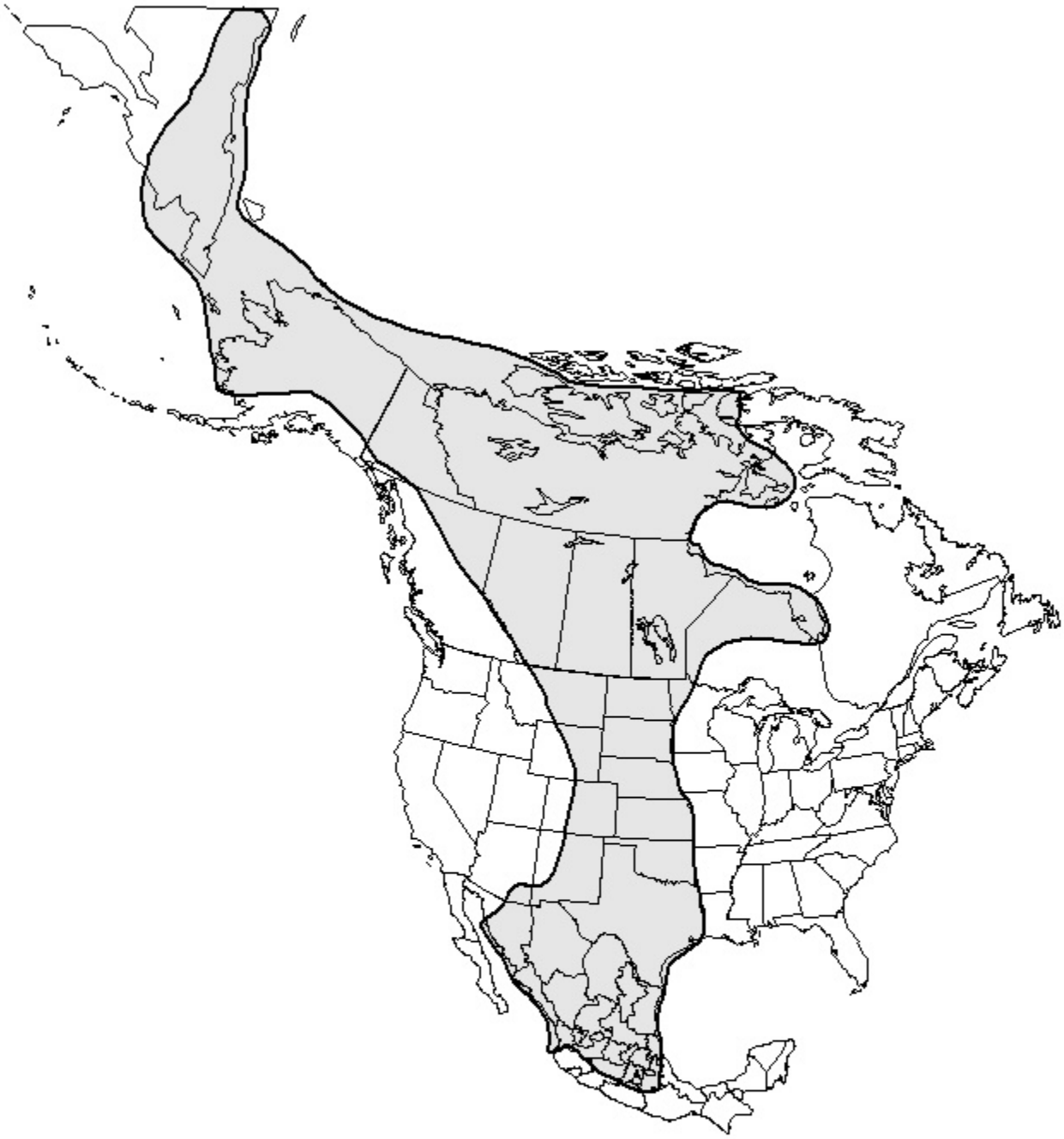


Fig. 1. Approximate range of Mid-Continent sandhill cranes (based on figures in Sharp et al. 2000, Tacha et al. 1994, and data from radio-telemetered birds provided by G. Krapu, Northern Prairie Wildlife Research Center, Jamestown, ND).

Figure 2. Approximate range of the Rocky Mountain Population of Greater Sandhill Cranes.

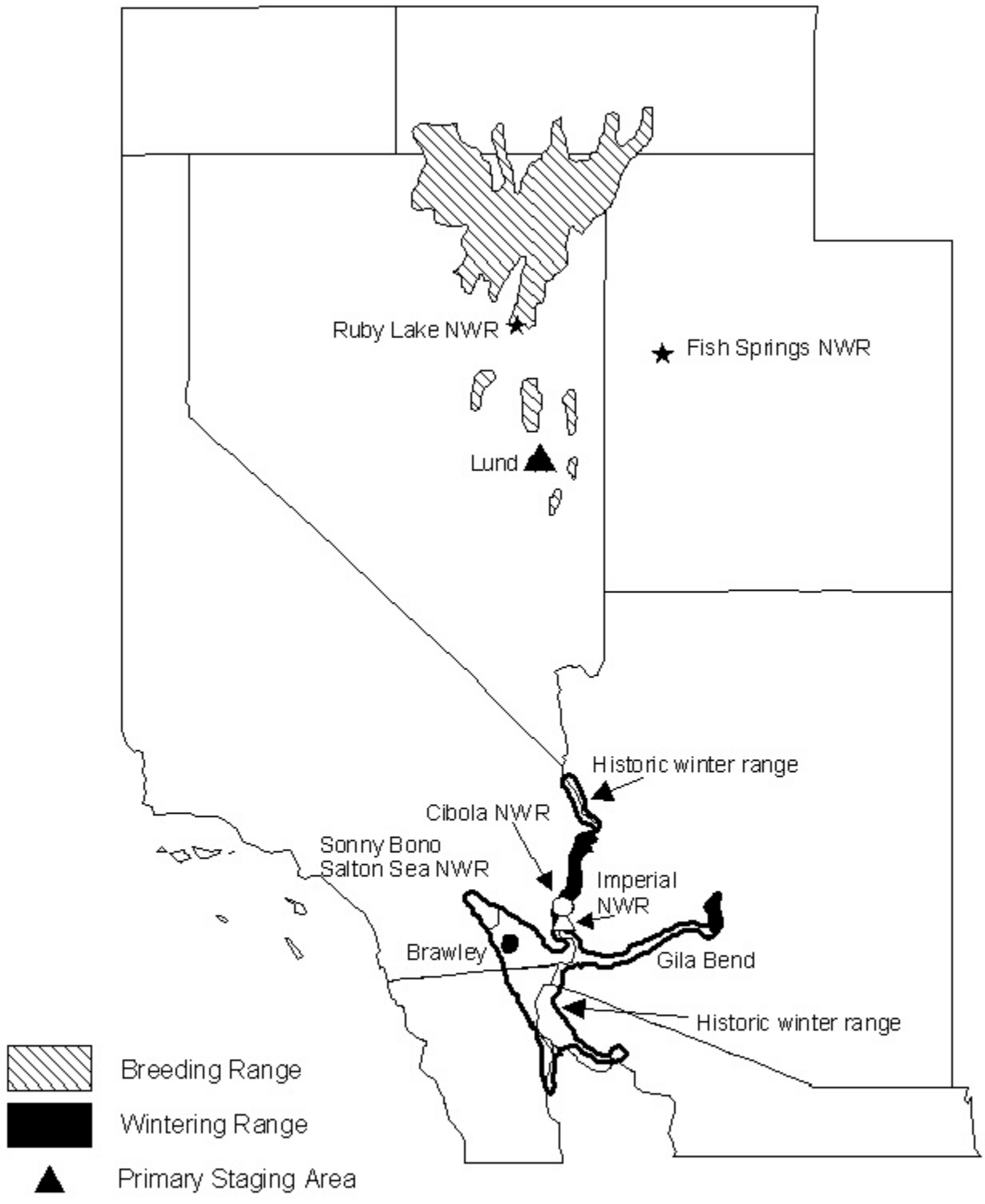


Figure 3. Approximate range of the Lower Colorado River Population of Greater Sandhill Cranes (Pacific Flyway Council 1995).

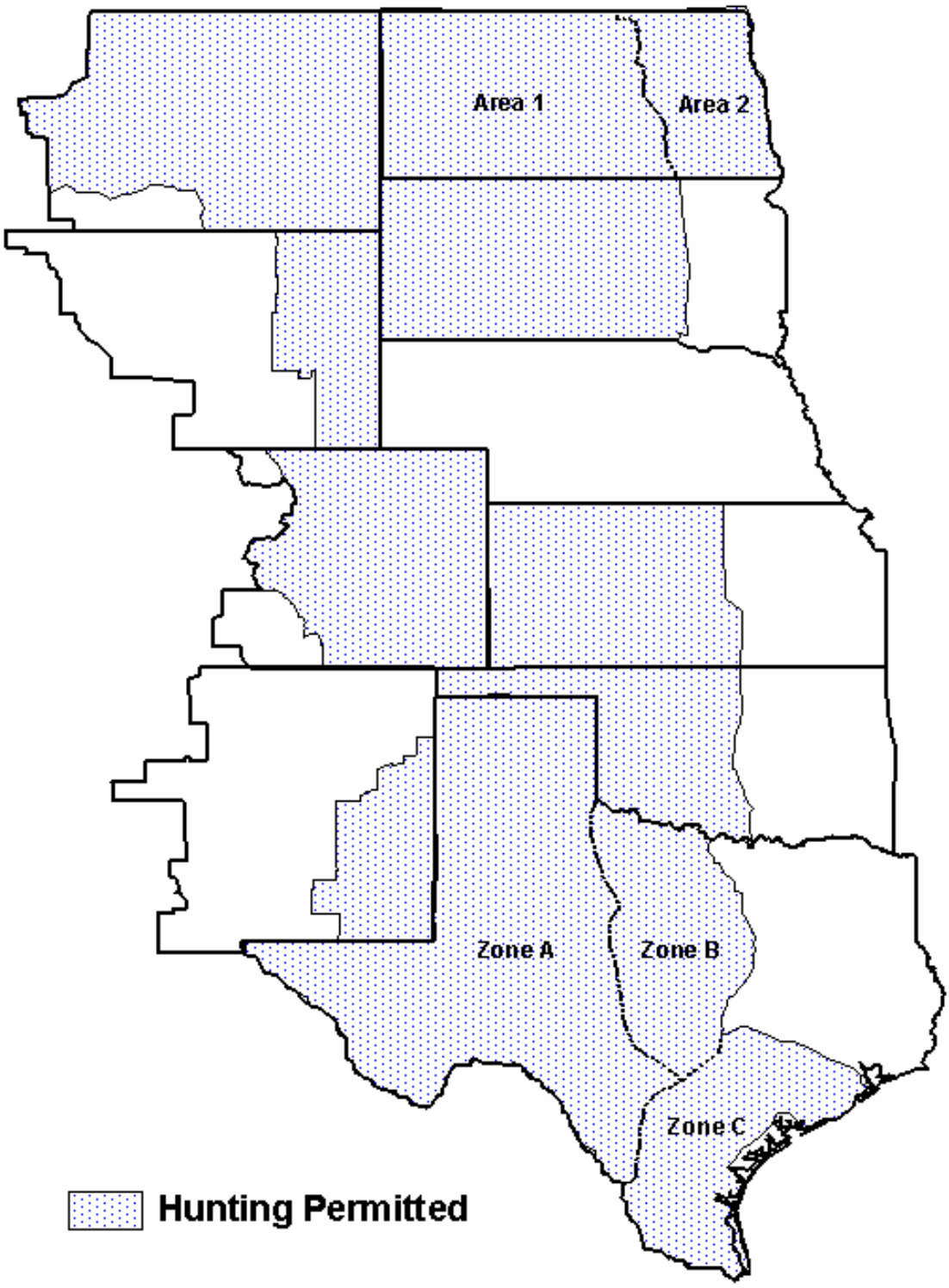


Figure 4. Areas open to the hunting of Mid-Continent sandhill cranes by Federal frameworks in the Central Flyway states, 2009-10.

Figure 5. Annual harvests of Mid-Continent sandhill cranes in Saskatchewan and North Dakota, 1980-2009.

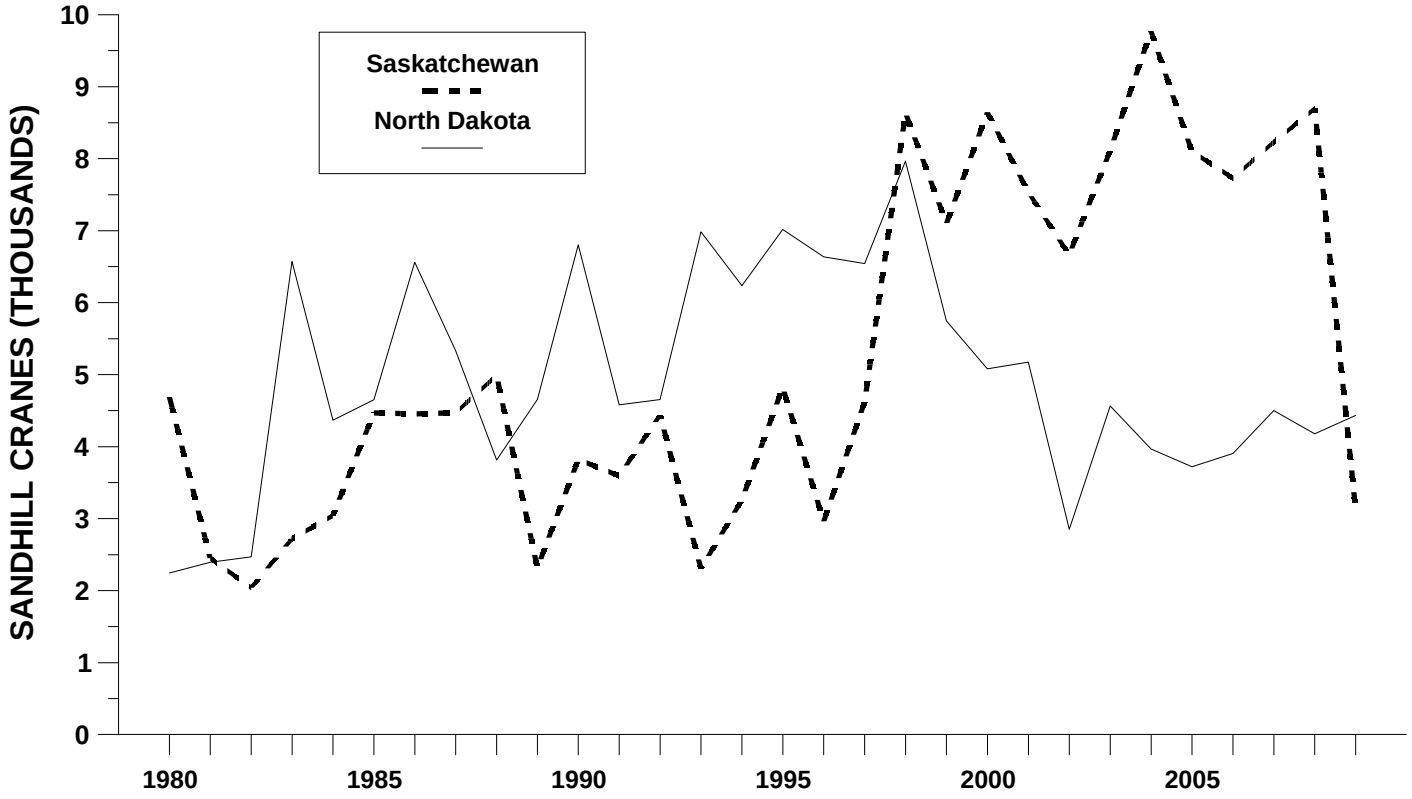


Figure 6. Spring population indices for Mid-Continent sandhill cranes on the Central Platte River Valley, Nebraska.

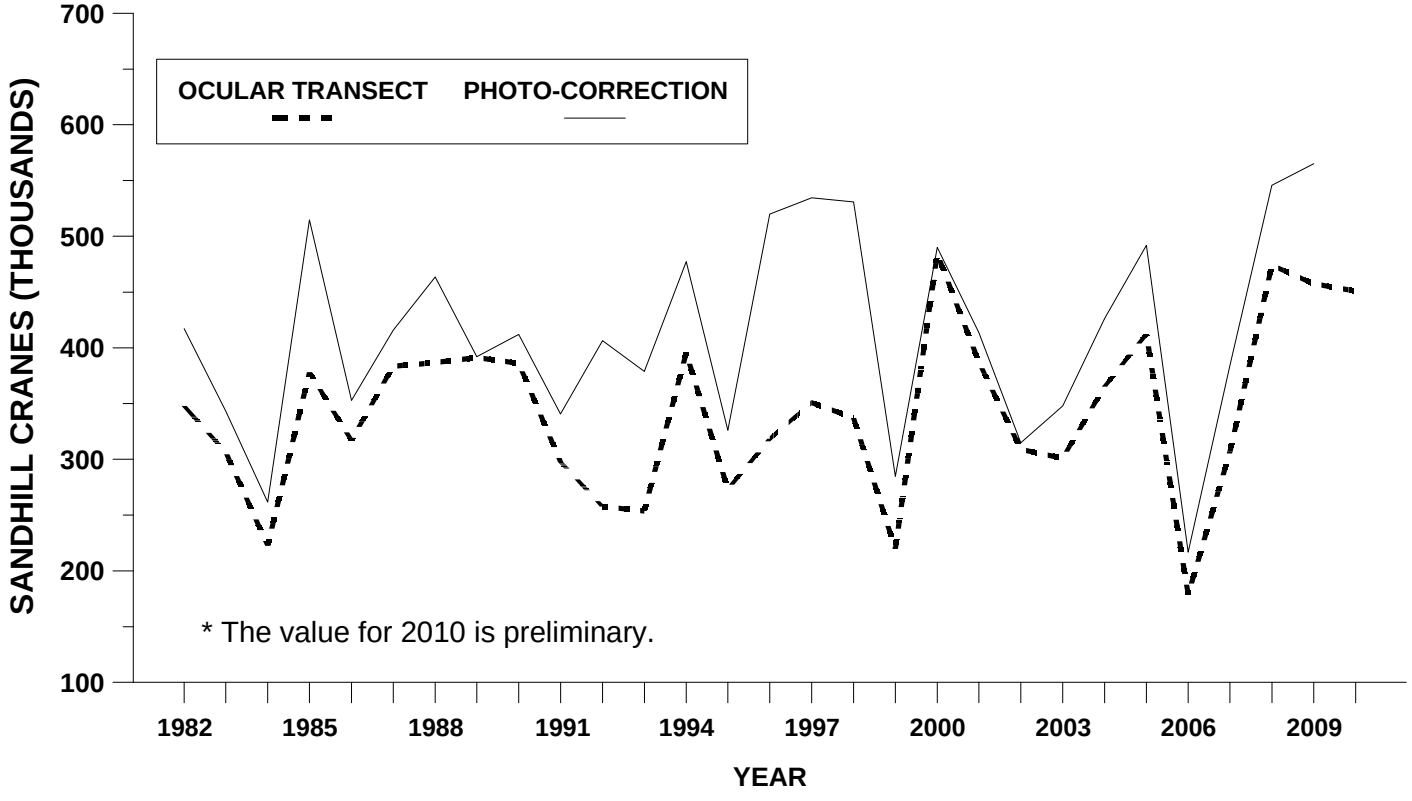


Figure 7. Photo-corrected spring population estimates (solid line) and the 95% confidence intervals (dashed lines) for Mid-Continent sandhill cranes on the Central Platte River Valley, Nebraska.

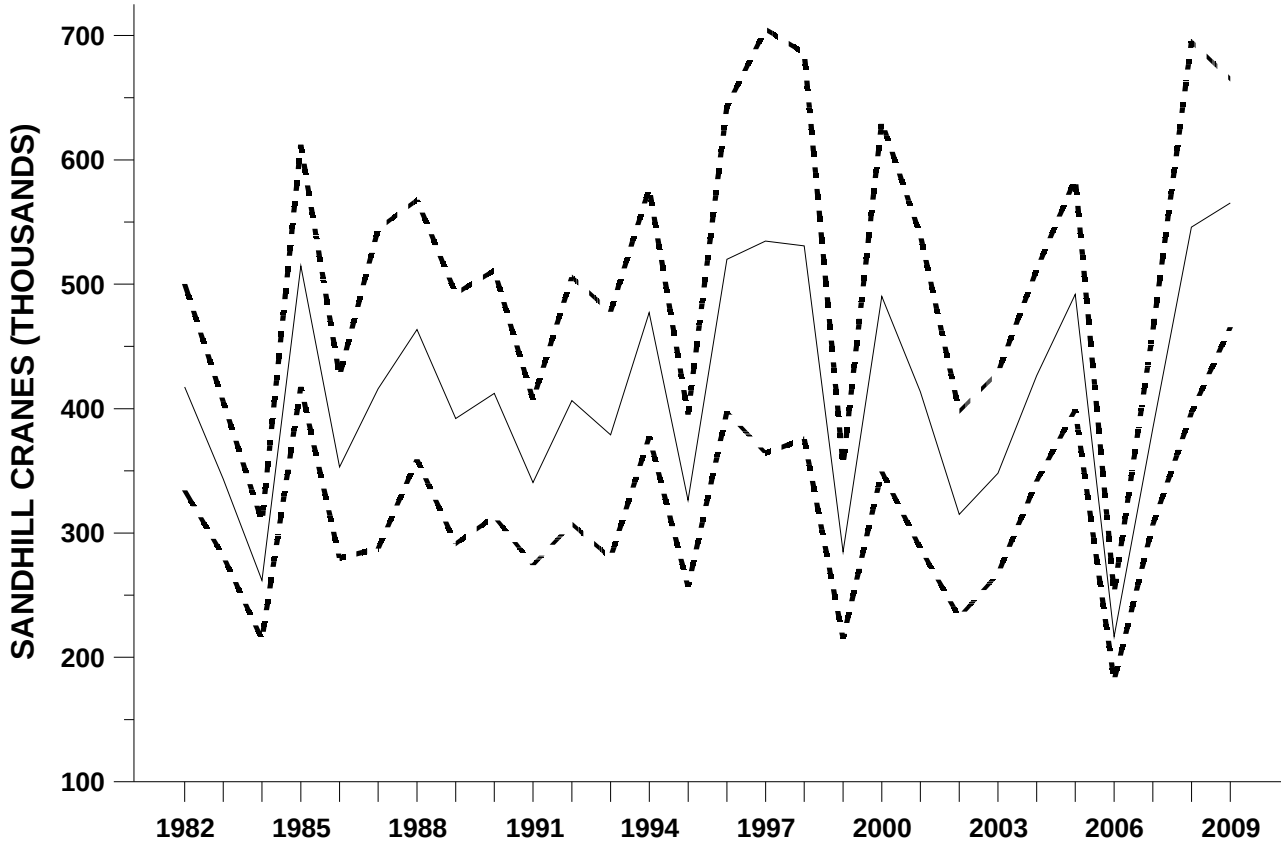


Figure 8. Annual and three-year average photo-corrected ocular transect spring population indices and population objective thresholds for Mid-Continent sandhill cranes.

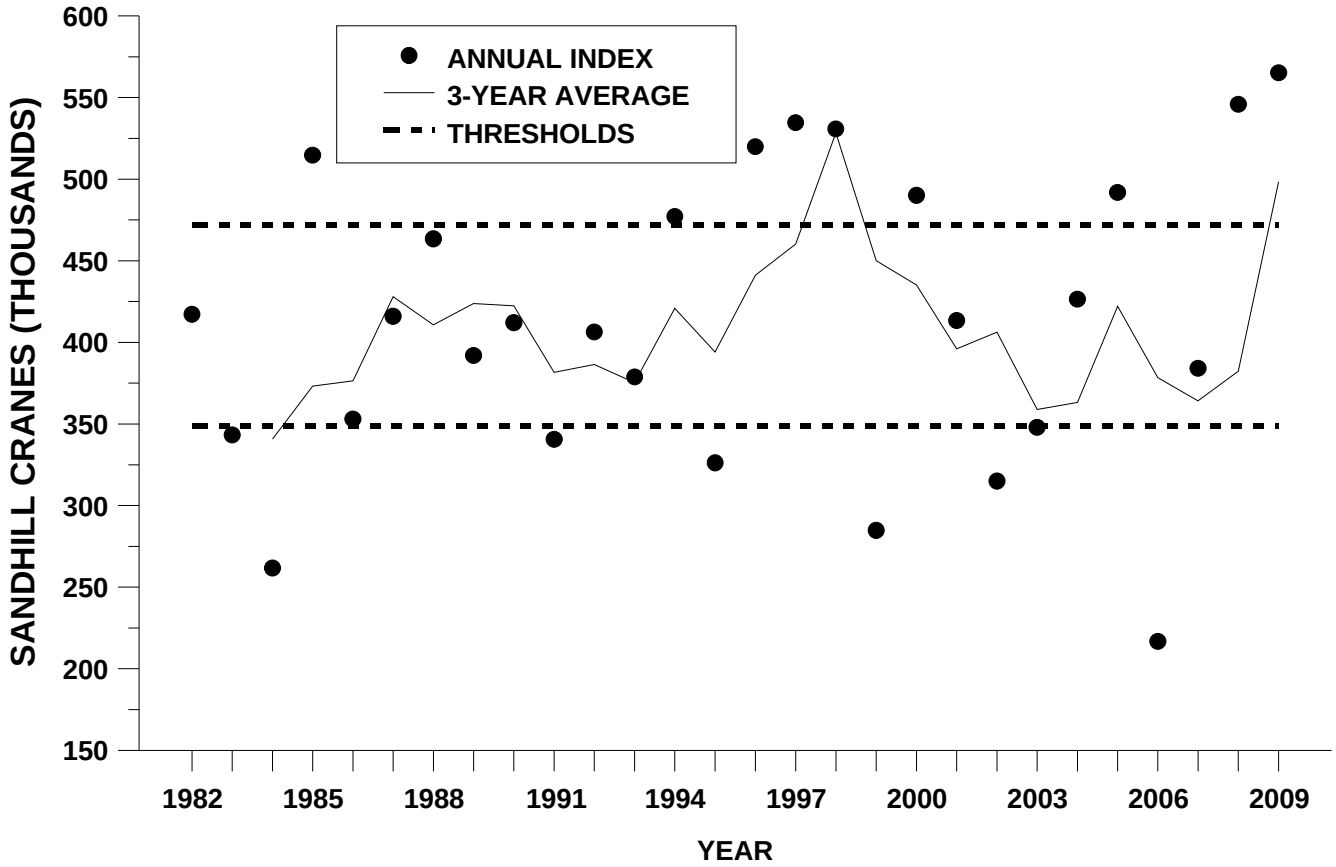


Figure 9. Active Mid-Continent sandhill crane hunters in the U.S. portion of the Central Flyway.

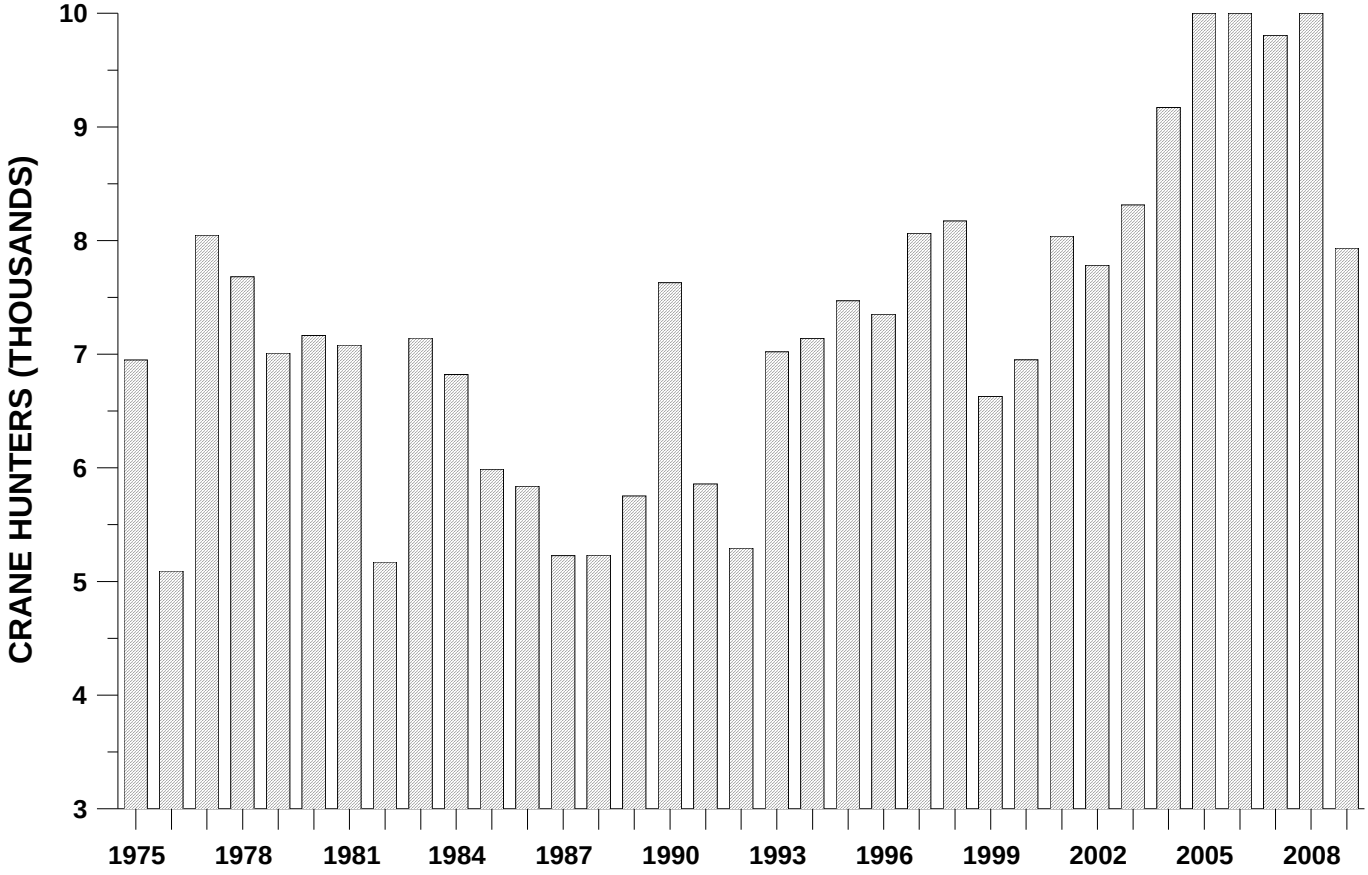


Figure 10. Crippling-loss rate (number lost/[number retrieved + lost]) of Mid-Continent sandhill cranes in the U.S. portion of the Central Flyway.

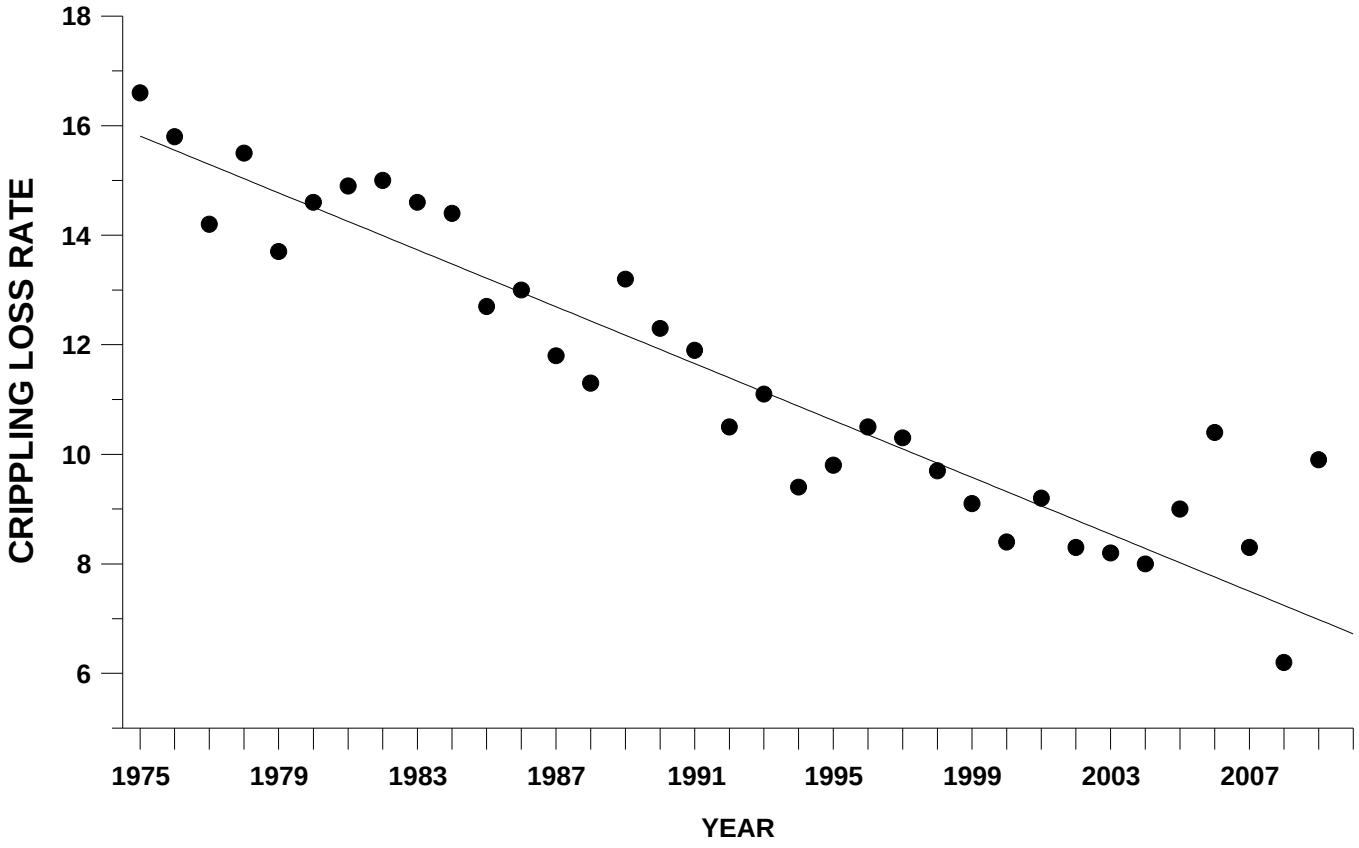


Figure 11. Average number of hunting days afield reported by active Mid-Continent sandhill crane hunters in the U.S. portion of the Central Flyway.

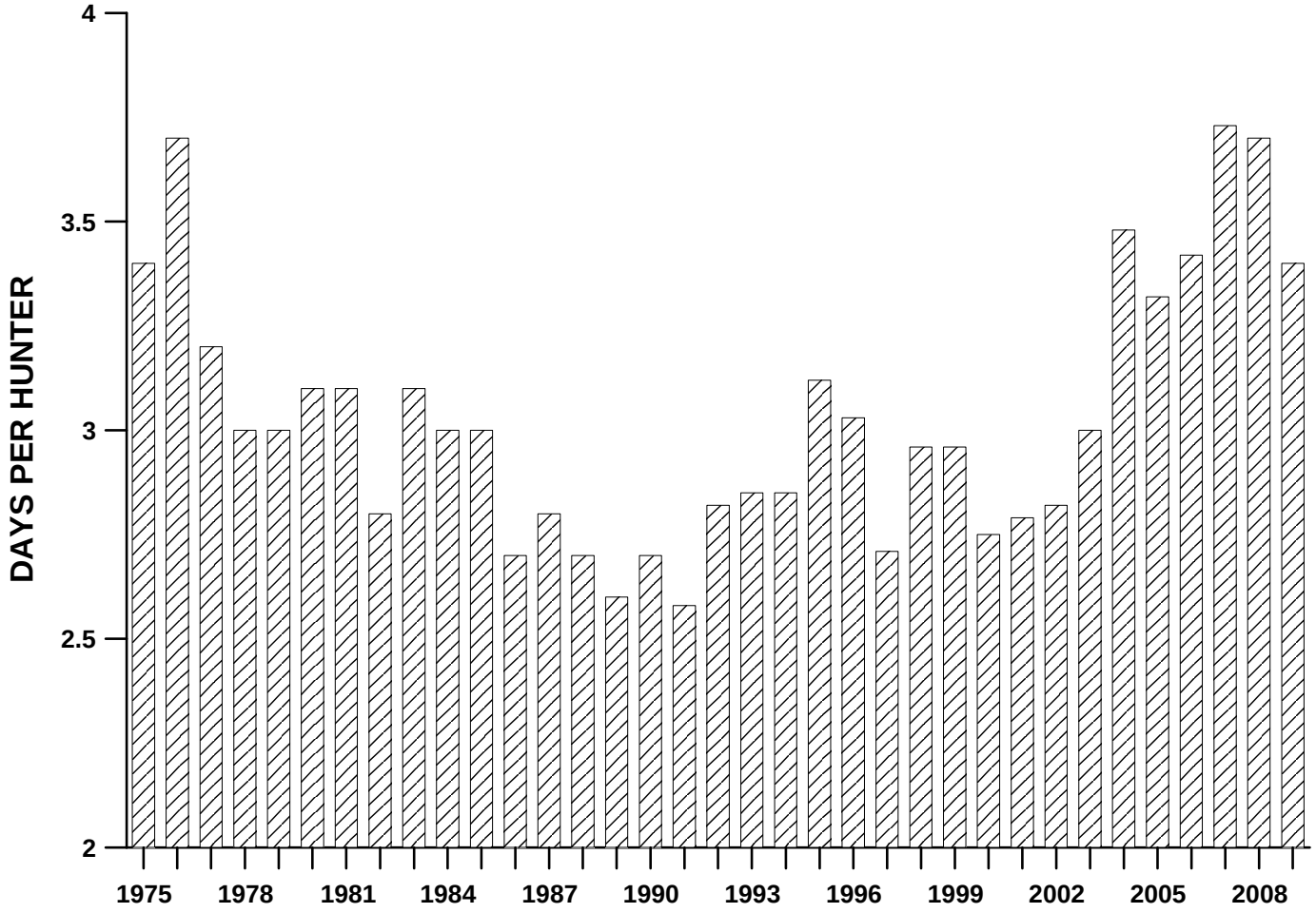


Figure 12. Seasonal bag per Mid-Continent sandhill crane hunter in the U.S. portion of the Central Flyway.

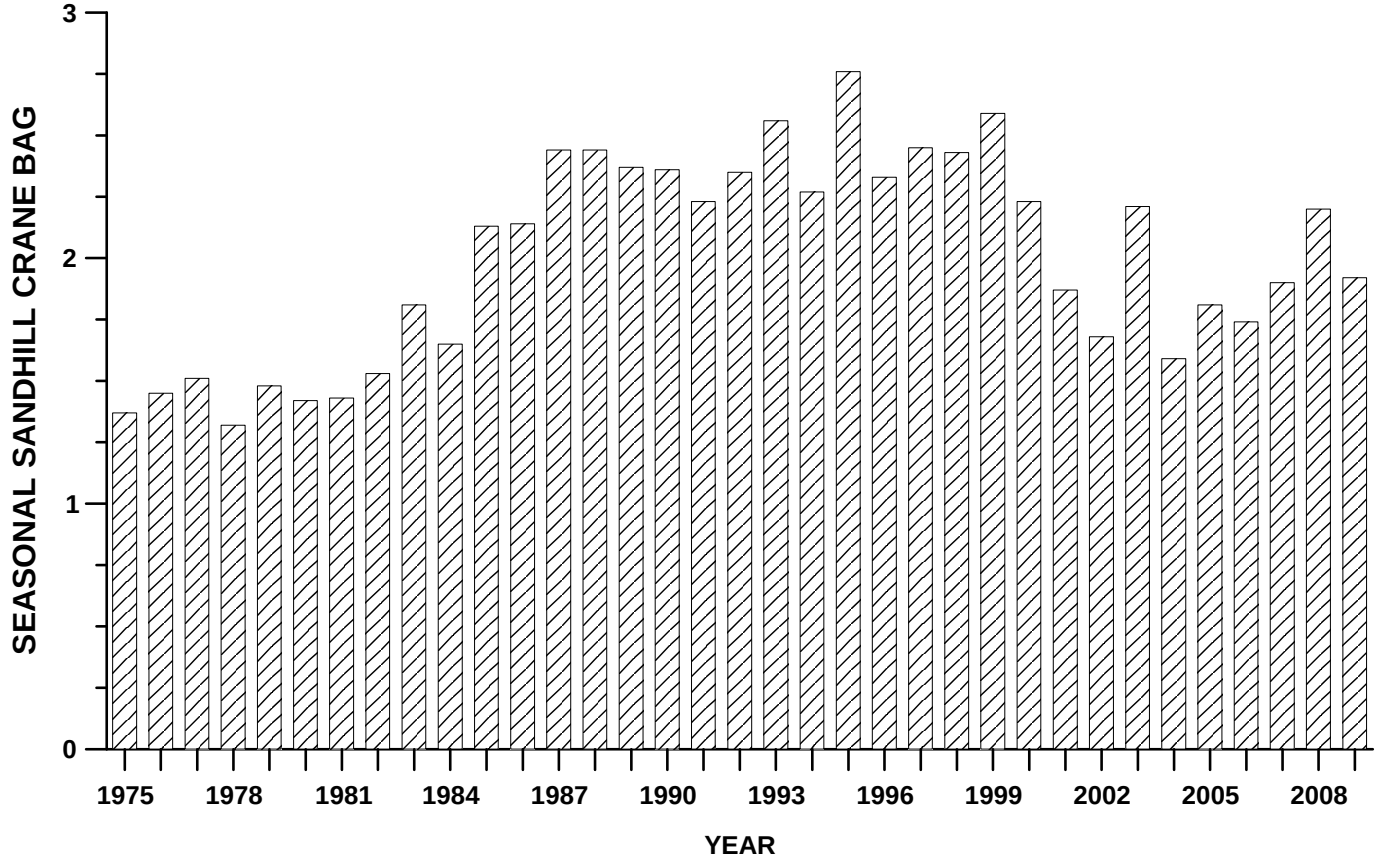


Figure 13. Estimated hunting mortality (retrieved and unretrieved) of Mid-Continent sandhill cranes in the U.S. portion of the Central Flyway.

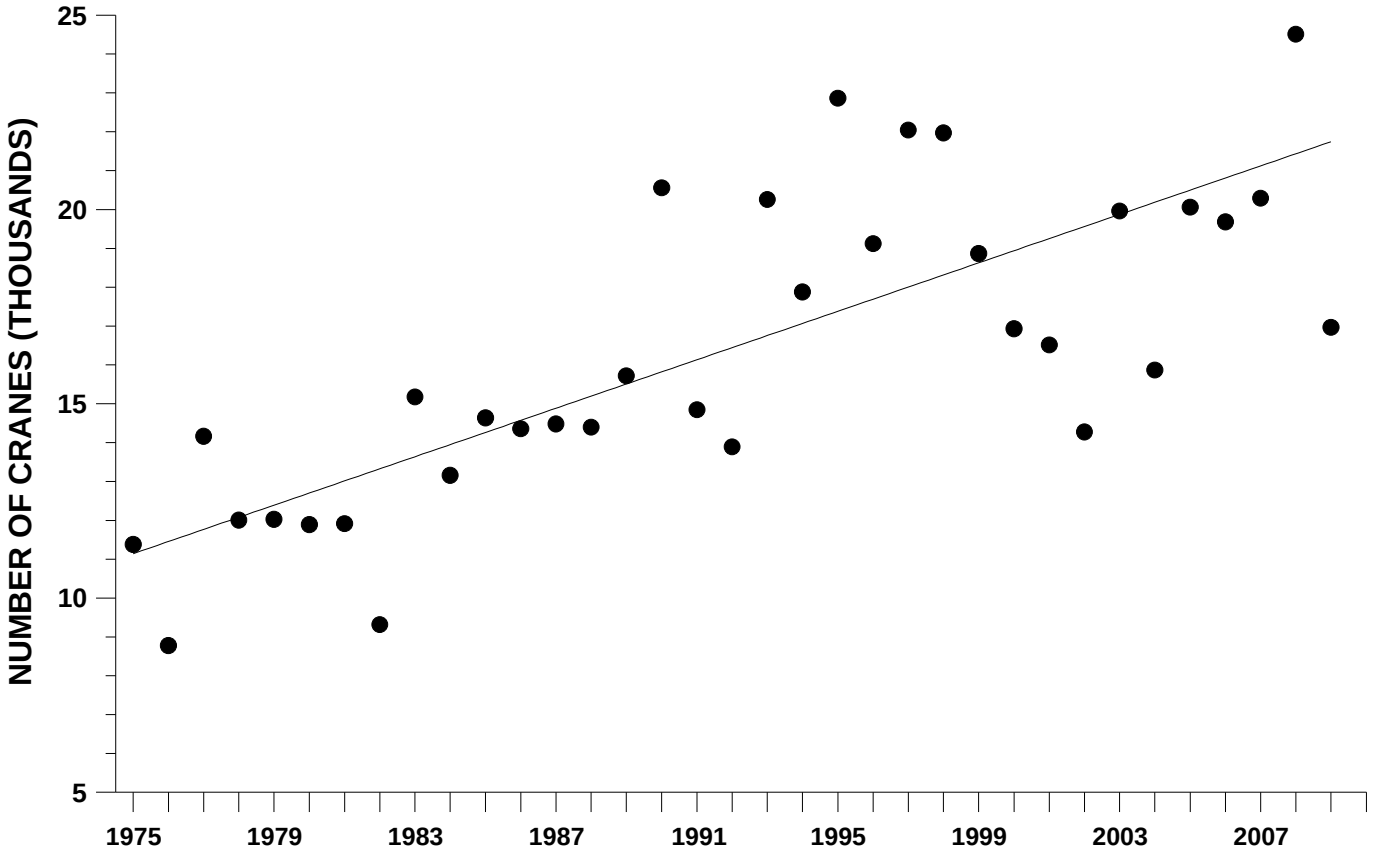
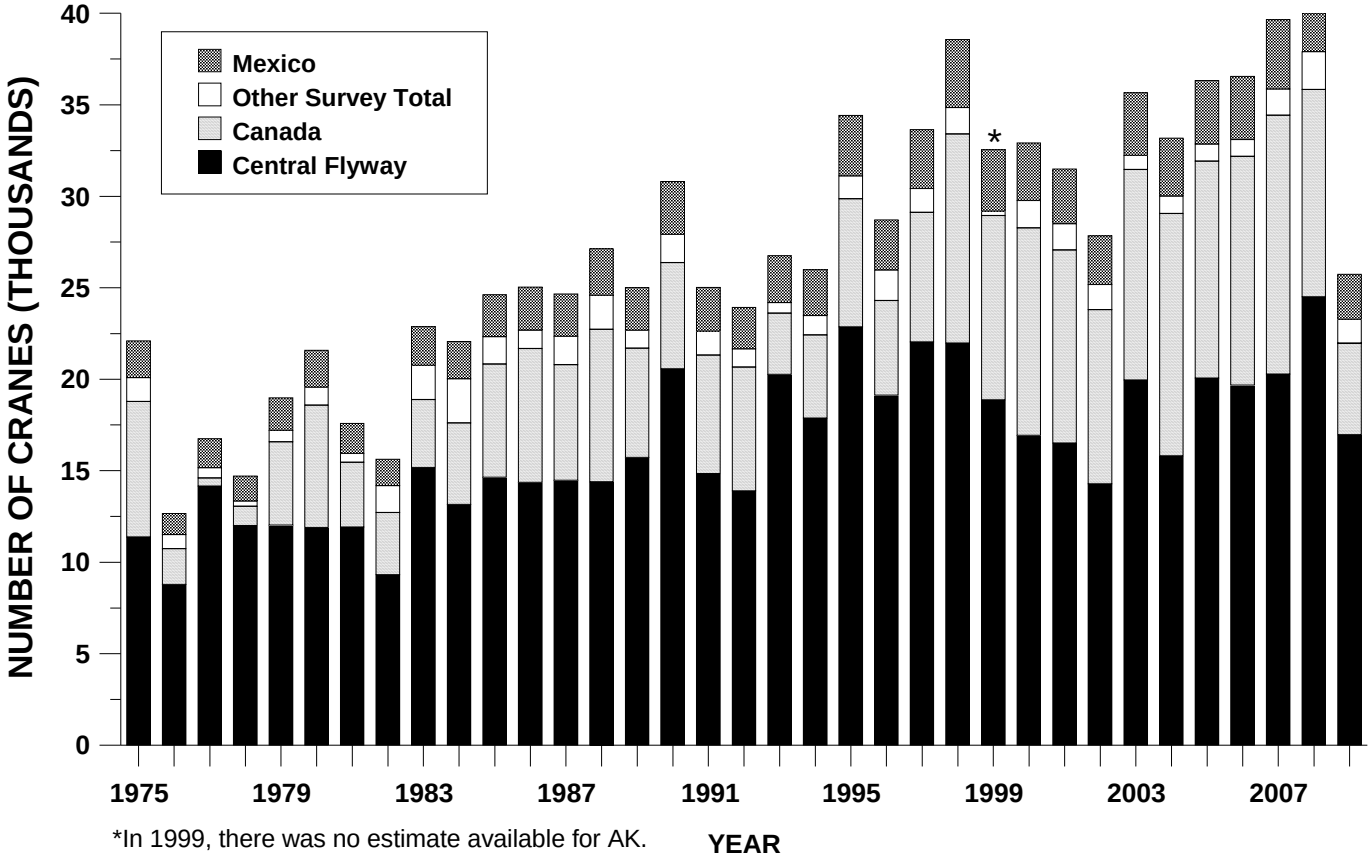


Figure 14. Estimated hunting mortality (retrieved and unretrieved) of Mid-Continent sandhill cranes in North America.



*In 1999, there was no estimate available for AK.

Figure 15. Trend analyses of indices to abundance and harvest of Mid-Continent sandhill cranes.

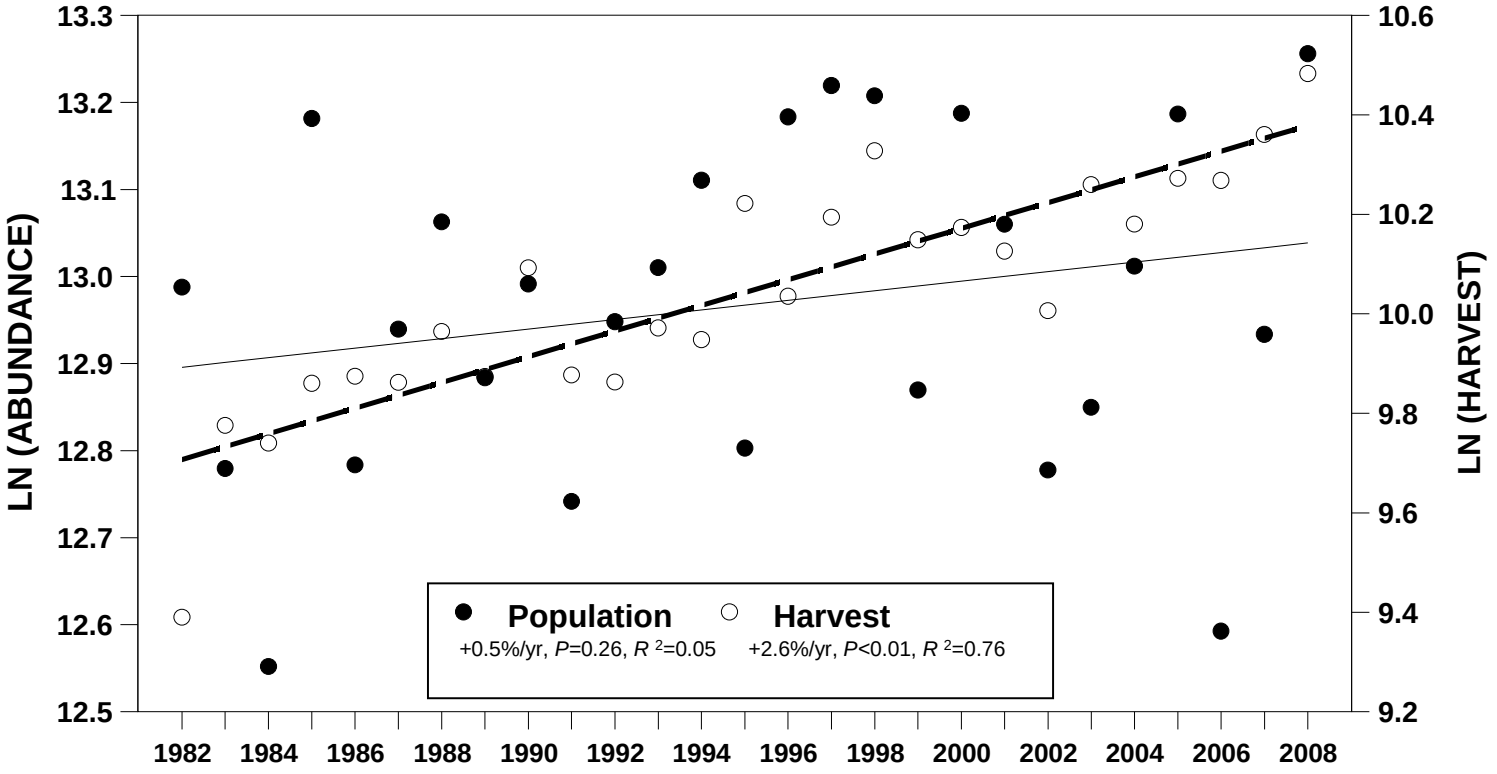


Figure 16. Estimated harvest of Rocky Mountain Population sandhill cranes.

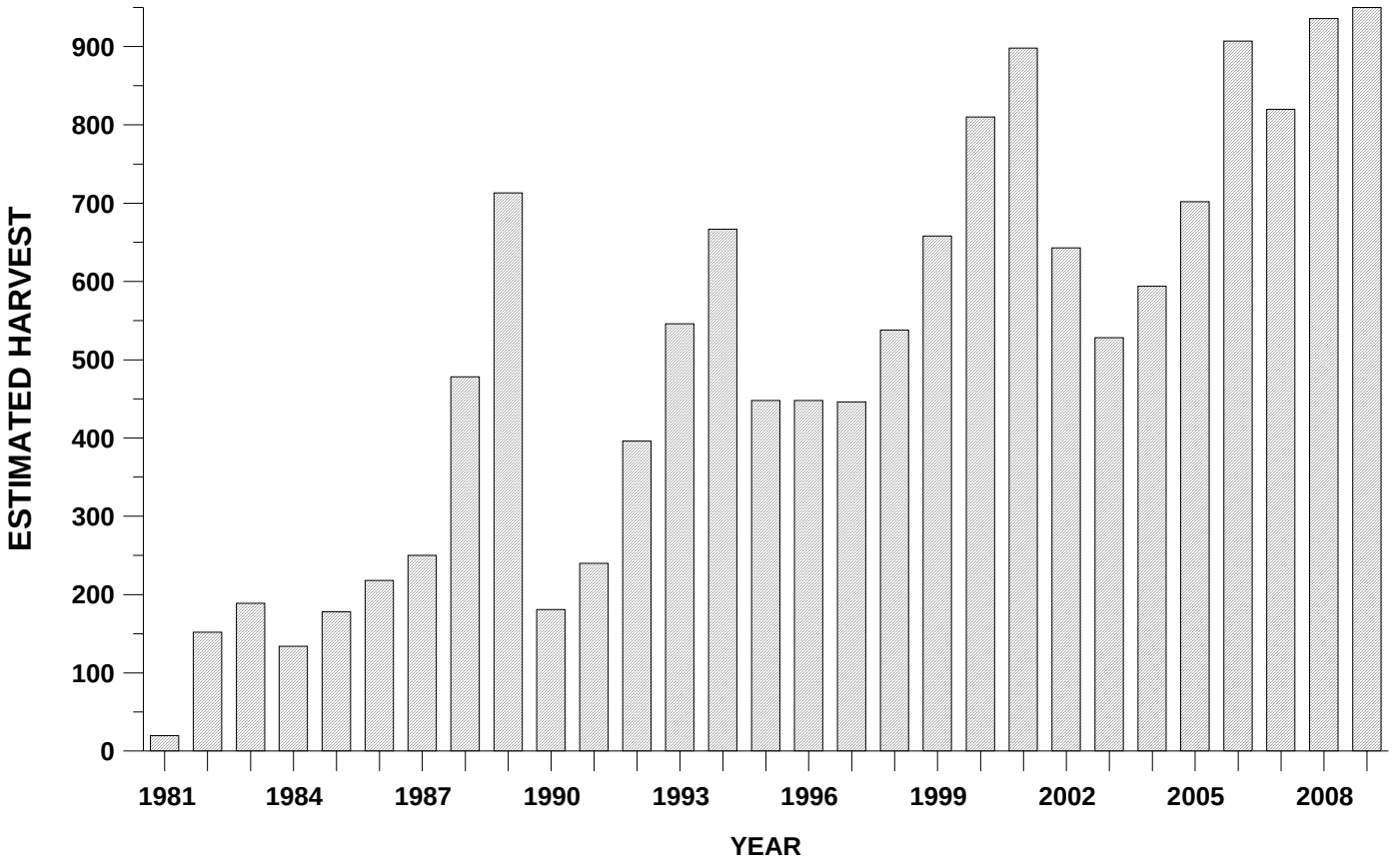


Figure 17. Abundance indices for the Rocky Mountain Population of sandhill cranes
(Incomplete survey efforts in years prior to 1997 might have resulted in lower estimates; the official count begins in 1997. In 2006, survey was not conducted due to mechanical issues with the aircraft.)

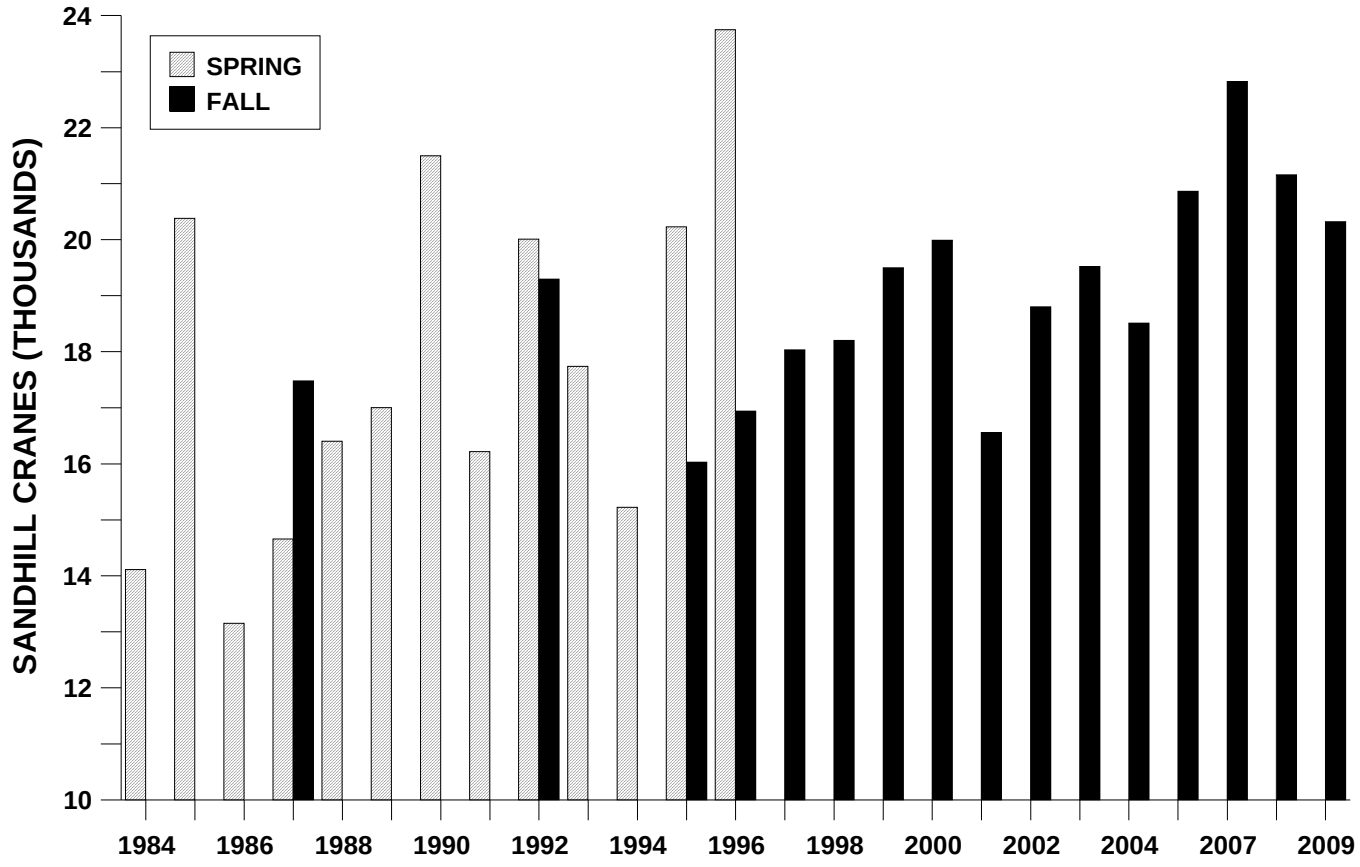


Figure 18. Annual and three-year average of fall pre-migration abundance indices for the Rocky Mountain Population of sandhill cranes.

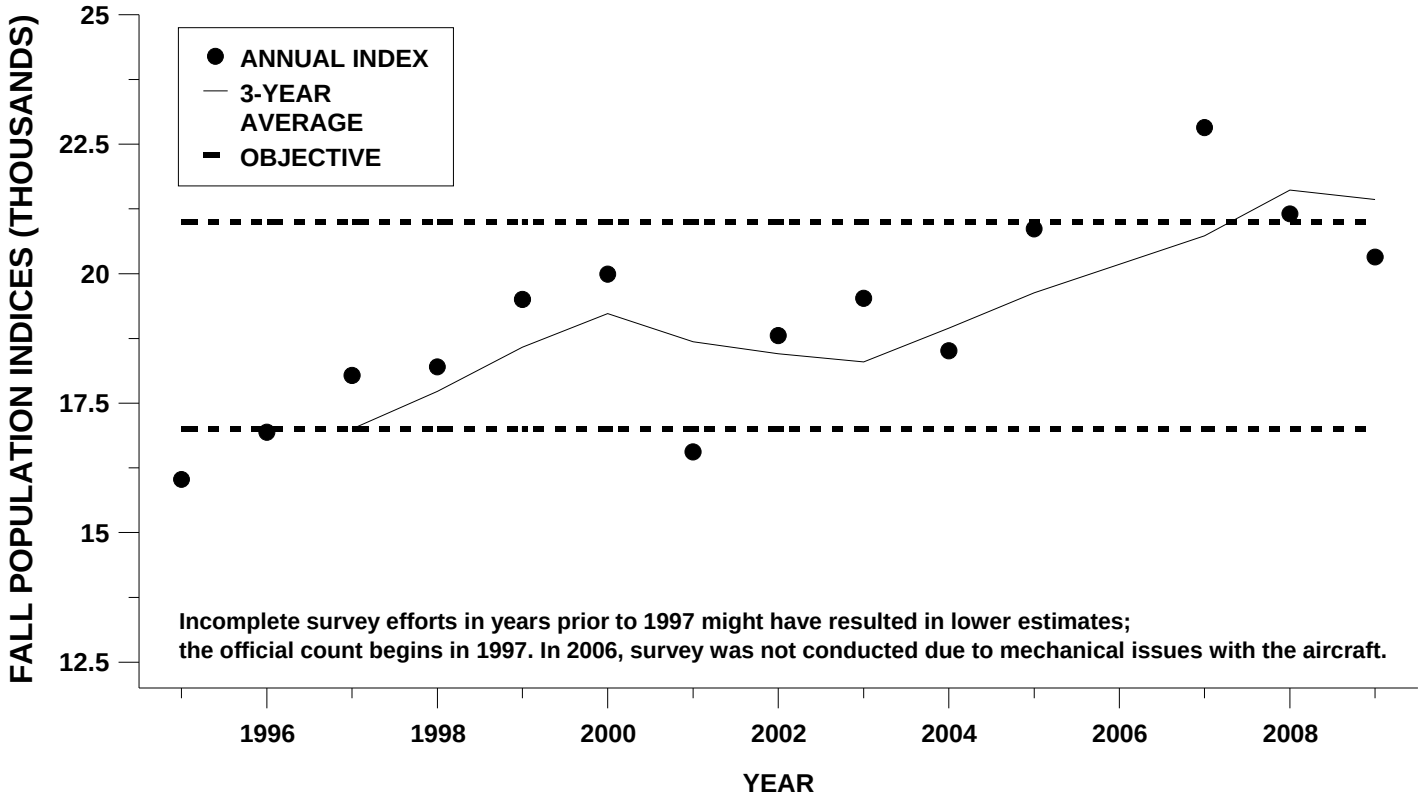
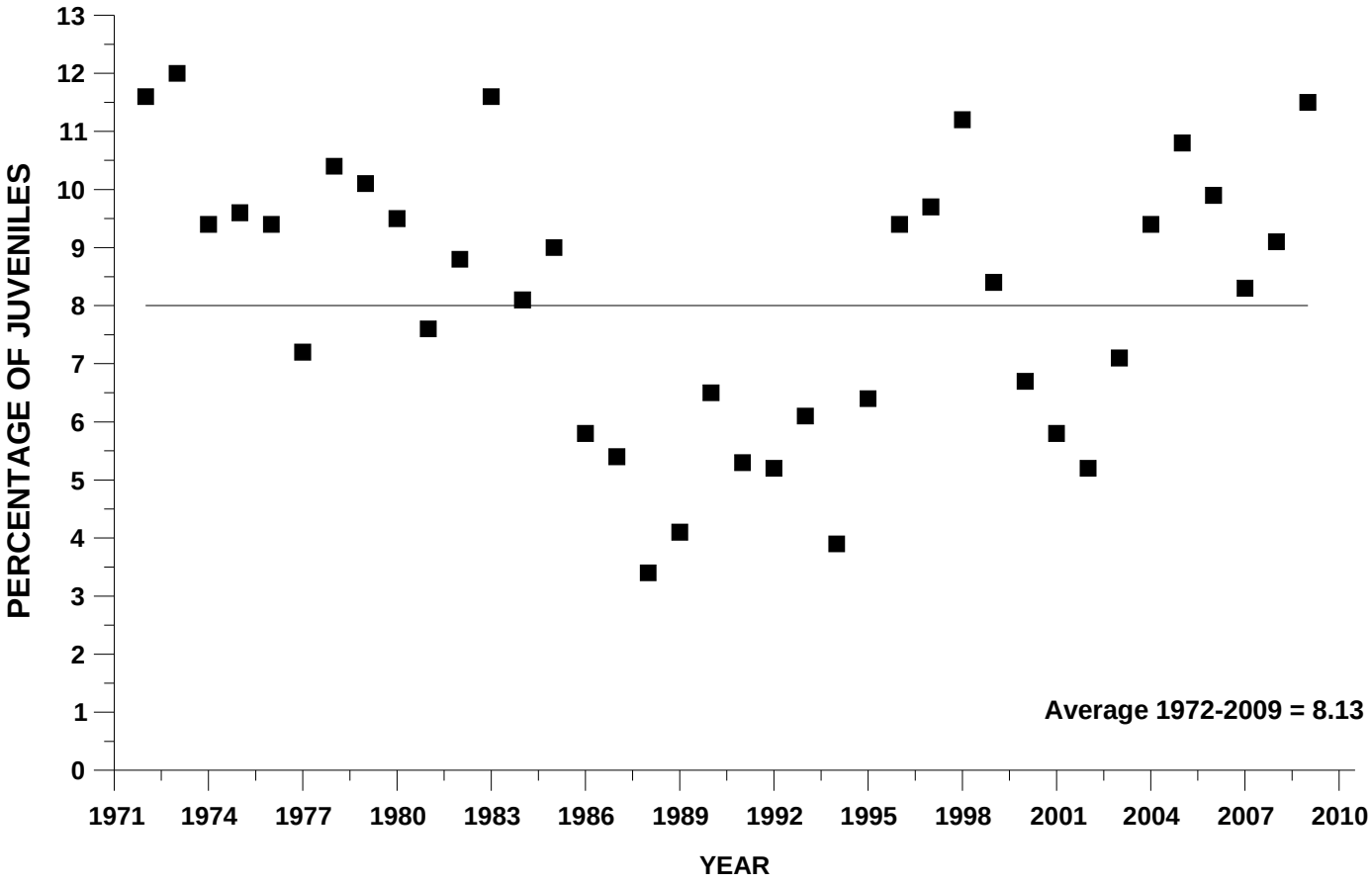


Figure 19. Annual indices for recruitment (% juveniles) of the Rocky Mountain Population of sandhill cranes.



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