STATUS and HARVESTS of SANDHILL CRANES

MID-CONTINENT & ROCKY MOUNTAIN POPULATIONS

2003

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Acknowledgments

This report provides population status, recruitment information, harvest trends, and other information for the Mid-Continent (MCP) and Rocky Mountain (RMP) 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, and R.A. Walters for conducting annual aerial population surveys; R.C. Drewien for conducting RMP productivity surveys; J.-F. Gobeil, E.M. Martin, M.T. Moore, and P.I. Padding for conducting FWS and CWS harvest surveys for the MCP; J. Bohne for compiling harvest information collected on sandhill cranes in the Pacific Flyway; G.L. Krapu for providing preliminary results from satellite-transmittered MCP cranes; and to D.S. Benning, E.L. Boeker, D.H. Johnson, and W.L. Kendall for consultation on the analysis of data on the status of 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 the conduct of annual cooperative surveys.

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POPULATION STATUS AND HARVESTS

MID-CONTINENT AND ROCKY MOUNTAIN POPULATIONS of SANDHILL CRANES

2003

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Abstract: The abundance of the Mid-Continent Population of Sandhill Cranes has been relatively stable since the early 1980s, compared to the dramatic increases that were recorded in the 1970s. The Central Platte River Valley, Nebraska spring index for 2003, uncorrected for visibility bias, was 316,676. The photo-corrected 3-year average for 2000-2002 was 375,875, which is within the established population-objective range of 343,000-465,000 cranes. All Central Flyway states, except Nebraska, allowed crane hunting in portions of their respective states during 2002-03. About 8,800 hunters participated in these seasons, which was 10% higher than the number that participated in the previous year's seasons. About 16,650 cranes were harvested in the Central Flyway during the 2002-03 seasons, which was 11% higher than the estimated harvest for the previous year. The retrieved harvest in the Pacific Flyway, Canada, and Mexico combined was estimated to be about 11,650 during 2002-03. The preliminary estimate for the North American sport harvest, including crippling losses, was 31,830, and similar to the previous year's estimate of 31,498. The long-term (1982-2000) trends for the Mid-Continent Population indicate that harvests have been increasing at a higher rate than population growth. The fall 2002 pre-migration survey estimate for the Rocky Mountain Population was 18,803, which was 12% higher than the previous year's estimate of 16,559. The 3-year average for 2000-2002 is 18,451, which is within established population objectives of 17,000 - 21,000. Hunting seasons during 2002-03 in portions of Arizona, Idaho, Montana, New Mexico, Utah, and Wyoming, resulted in a harvest of 639 cranes, a 29% decrease from the record high harvest of 898 from the year before.

Introduction

The Mid-Continent Population (MCP) of sandhill cranes, the largest of all North American crane populations, is comprised of about two-thirds lesser (*Grus canadensis canadensis*), one-fourth Canadian (*G. c. rowani*), and the remainder greater (*G. c. tabida*) sandhill cranes. Collectively this population was believed to number over one-half million during the decade of the 1990's (Tacha et al.1994). The breeding range extends from northwestern Minnesota northward into 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 south to near Mexico City (Fig. 1). Extensive aerial spring surveys, corrected for observer visibility bias on major concentration areas, provide annual indices of abundance used to that depict population trends. These surveys are conducted in late March, 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 establishes regulatory thresholds for changing harvest regulations, which are based on an objective of maintaining sandhill crane abundances at 1982-92 levels (i.e., spring index of 404,000 ± 15%). Hunters are required to obtain either a Federal crane hunting permit or register under the Harvest Information Program (HIP) to hunt MCP cranes in the U.S. The permits or HIP registration records provide 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 Rocky Mountain Population (RMP) is comprised exclusively of greater sandhill cranes that breed in isolated, well-watered river valleys, marshes, and meadows of the U.S. portions of the Central and Pacific Flyways (Drewien and Bizeau 1974). The largest recorded nesting concentrations are located in western Montana and Wyoming, eastern Idaho, northern Utah, and northwestern Colorado. The RMP migrates through the San Luis Valley (SLV), Colorado and winters primarily in the Rio Grande Valley, New Mexico (with smaller numbers that winter in the southwestern part of that state), in southeastern Arizona, and at several ($14) locations in the Northern Highlands of Mexico (Fig. 2). During 1984-96, the RMP was monitored at a spring stopover site in the SLV. However, cranes from the MCP also began to use this area, which confounded estimates of RMP abundance. In 1996, 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 population objectives, a survey to monitor recruitment, and harvest levels that are designed to maintain a stable abundance between 17,000 - 21,000 birds (Pacific and Central Flyway Councils 1997). 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 state harvest estimates and allows for assignment of harvest quotas by state. In many areas, harvest estimates are supplemented by mandatory check-station reporting. The cooperative management plan contains a formula for calculating allowable annual harvests to achieve population objectives.

Mid-Continent Population of Sandhill Cranes

No sport hunting seasons for MCP Cranes were allowed in the U.S. between 1916-60. In the Central Flyway, areas open to hunting were gradually expanded during 1961-74, but have subsequently remained relatively stable, with operational hunting seasons now conducted annually in portions of Colorado, Kansas, Montana, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, and Wyoming. During the 1961-74 expansions of sandhill crane hunting, hunters gradually improved knowledge of sandhill cranes and improved their hunting success. During 1975-85, a tradition of sandhill crane hunting became established. Together with improvements in the 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). Since the mid-1980s, average seasonal bags which are an indicator of hunter success have been relatively stable.

In North Dakota, sandhill crane seasons resumed in 1968 and were incrementally expanded thereafter. During 1968-79, the number of counties open for crane hunting increased from 2 to 8. From 1980-92, the number of counties with open seasons increased to 30, 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). In 1993, Kansas became the ninth Central Flyway state to initiate a crane hunting season within established Federal frameworks. As with most other states, initial seasons in Kansas have been more restrictive than Federal frameworks allowed. In 2001, designated hunt areas in North Dakota and Texas were expanded, with the new areas having reduced frameworks. Nebraska is the only Central Flyway state that currently does not have a crane sport hunting season. Areas open to crane hunting in the Central Flyway during 2002-03 are shown in Fig. 3.

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 (because >95% of MCP sandhill cranes are generally found in this area during late March) and ocular assessments from other spring staging areas have been used to monitor the annual status and trends for this population (Table 1). The March 2003 index for the Central Platte River Valley, which has not yet been corrected for visibility bias (Table 1, Fig. 4) was 316,676 birds. This value was 2% higher than the previous year's index of 309,000. The annual photo-corrected estimates and 95% confidence intervals for the Central Platte River portion of the survey indicate a relatively stable (P=0.53) population trend for the MCP since 1982 (Fig. 5). The average index for photo-corrected counts during 2000-02 is 375,875 cranes, which is 5% below the previous 3-year average (Solberg 2002), but is within the management thresholds (343,000 - 465,000 cranes) (Fig. 6). This spring, average spring breakup conditions were reported across much of the MCP's primary breeding range and average fall flights are expected for the MCP this fall.

Since 1975, special Federal Sandhill Crane Hunting Permits or HIP certification have been required for all 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 in each geographic area or state (Martin 2002).

During the 2002-03 seasons in the Central Flyway, 55,384 hunters were either HIP-certified or obtained crane hunting permits, which were not limited in number (Table 2), with 8,827 individuals hunting $1 time (Table 3). The number of active hunters increased (10%) from the previous year (Fig. 7). The number of hunters in Texas (53%) and North Dakota (31%) combined comprised 84% of 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, Texas, and Kansas had lower bag and possession limits). Specific dates selected by states in the Central Flyway for 2002-03 were similar to those of previous hunting seasons (Table 4).

Crippling-loss rates (number of cranes lost/[number of cranes lost + retrieved]) in the U.S. portion of the Central Flyway continued a long-term decline (R^2 = 0.913, P<.01) from over 16% in 1975 to a preliminary estimate of about 7% during the most recent hunting season (Fig. 8). The number of days afield per hunter increased from less than 3 days to over 3.5 days in 2002 (Fig. 9). In contrast, the preliminary estimated seasonal bag per hunter which had begun to stabilize at about 2.5 cranes (1987-2000) suggested a decline back to levels recorded in the mid-1970s of about 1.5 (Fig. 10). The preliminary estimate of retrieved and unretrieved mortality associated with the sport harvest (17,908) was 8% higher than the previous year's estimate (16,516) (Fig. 11). The increasing trend (R^2 = 0.622, P<.01) in the Central Flyway's harvest of MCP Cranes during 1975-2002 likely was related to the gradual increase in hunter opportunity combined with improved knowledge of crane behavior and hunting techniques (Sharp and Vogel 1992).

Cranes from the MCP also are harvested in the Pacific Flyway portions of Alaska, Arizona, and New Mexico (Table 5), and in Canada and Mexico. Estimates of the 2002-03 sport harvests in Canada (Manitoba and Saskatchewan) were 7,948, which were 15% lower than the previous year's estimate (Table 6). The preliminary harvest estimate for the Pacific Flyway states of Arizona, Alaska, and New Mexico combined was 1,129 birds for 2002-03. For Alaska, sandhill crane harvest in harvest zones 1-6 are 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, bag checks allow individual harvest estimates 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, pers. comm.). This assumed low level of harvest was supported by an independent assessment of harvest in Mexico (Kramer et al. 1995). The 2002-03 preliminary estimate of retrieved and unretrieved kill of MCP cranes by sport hunters was 31,830 was similar to last year's estimate of 31,498 (Table 7, Fig. 12).

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 1982-2000. Because >10% of the MCP crane population occurs outside the Central Platte River Valley (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, the Pacific Flyway, and Canada, because crippling-loss rates for the latter two areas are unknown and no empirical estimates of harvest from Mexico are available. For both variables, linear regressions adequately described the data (population: R^2 = 0.23, P = 0.04; harvest: R^2 = 0.73, P < 0.01)(Fig. 13). Results suggest that the rate of increase in harvest (3.4% per year) during 1982-2000 was about twice that for abundance (1.6% per year).

Subsistence harvest levels of MCP sandhill cranes historically were poorly documented. However, the ratification of the U.S./Canada Migratory Bird Treaty Amendment will result in future improvements in sandhill crane harvest-monitoring programs in both the U.S. and Canada. Intensive studies conducted on the Yukon-Kuskokwim (Y-K) Delta, Alaska in 1999 reported an MCP harvest of 3,907 adults and fledged young and 920 eggs. These estimates are similar to long-term averages (1989-98) of 3,362 adults and fledged young and 547 eggs taken by subsistence hunters on the Y-K Delta. 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 of greater sandhill cranes was not hunted in the U.S. from 1916 until 1981, when Arizona initiated the first modern-day season. Since 1982, hunting programs have been guided by a cooperative management plan, including a harvest strategy, that has been periodically updated and endorsed by the Central and Pacific Flyways. Special limited hunting seasons during 2002-03 resulted in an estimated harvest of 639 RMP sandhill cranes (Table 8), which was 41% lower than the previous year (Fig. 14).

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 (Canadian and lesser subspecies). An adjustment, using ground-derived proportions, was made to correct for the lesser subspecies (Benning et al. 1996). Unfortunately, a similar correction could not be made for the mid-sized Canadian subspecies, and in 1996 the survey was discontinued (Fig. 15). In 1997, an attempt was made to survey these cranes during the fall (October) in the SLV, but MCP Sandhill Cranes also were present at that time. Biologists concluded that neither a spring nor a fall count in the SLV would result in a reliable index to the abundance of RMP cranes. As an alternative, a cooperative 5-state September pre-migration staging-area survey, experimentally tested in 1987 and 1992, has been ongoing operationally since 1995, and it was designated as the official count for the RMP in 1997 (Table 10). The 2002 fall survey resulted in an index of 18,803 birds (Drewien et al. 2001). The 2002 survey was determined to be reliable by survey biologists and the resulting 3-year average of 18,451 is within the established population objectives (17,000 - 21,000)(Fig. 16). The September pre-migration survey for the RMP appears to be a good alternative to either a spring or fall survey in the SLV, because no other known crane population co-mingles with them during that time.

During 1986-94, important breeding areas in the Intermountain West experienced extremely dry conditions and indices of recruitment (% juveniles) were low (generally between 4-6%) (Fig. 17). A return to more favorable breeding conditions in 1995-99 resulted in higher recruitment rates (8-12%), but a return to drier conditions has again resulted in lower production during the past three years. Biologists believe that the production outlook for the 2003 breeding season will also be below average because drought conditions were reported over much of the winter and primary breeding areas. Based on current RMP population and recruitment indices, management guidelines allow for a maximum take of 668 birds during 2003-04 hunting seasons.

Discussion and Research Implications For Management of Sandhill Cranes

1. Satellite transmitters placed on sandhill cranes during spring at the Platte River, Nebraska allowed the tracking of MCP cranes as they traversed U.S. states, provinces and territories in Canada, northeastern Asia, and Mexico during 1998-2003. The study ultimately will track 150 cranes during their annual cycle and will have far-reaching management implications, including: (1) resolving critical issues related to harvest regulations, (2) determining spatial and temporal distribution patterns of subspecies, (3) assessing annual bias of population estimates, (4) identifing breeding, migration, and wintering habitat affinities and thus target habitat conservation programs, and (5) refining techniques for monitoring a wide range of species of migratory birds that spend parts of their annual cycle in remote regions of North America or Asia. Satellite tracking information is available at the following Internet address (G.L. Krapu, personal communication):
   http://www.npwrc.usgs.gov/perm/cranemov/cranemov.htm

2. A research study to estimate survival rates from leg-banded RMP cranes recently has been completed (Drewien et al. 2000). Although this information provided insight into distributions, fidelity, and mortality factors, the sample size was inadequate to accurately estimate survival rates. A new study has been initiated to estimate survival rates from approximately 10,000 resighting observations of RMP color-marked and neck-collared cranes (Drewien et al. 2002). Further, the researchers will attempt to develop a model of recruitment for these cranes. The overall goal is to develop a model of population dynamics, which would allow improvements in the harvest strategy for this population of cranes. This model is essential to completion of revision of the cooperative management plan for the RMP.

3. During 1975-79, MCP harvest surveys indicated that a 14% reduction in harvest would be realized with a bag limit change from 3 to 2, and a 43% reduction in harvest with a bag limit change from 2 to 1 (Miller 1987). Since that time, the effect of bag limit on harvest levels has not been updated, however daily bag information from the harvest survey is being analyzed and these results will be incorporated into the 2004 planned MCP management plan update.

4. During the spring of 2002, experimental aerial infra-red video photography of sandhill cranes roosts along the Platte River, Nebraska showed promise in improving survey approaches for MCP sandhill cranes staging during spring. Additional development of the techniques for collecting the video photography and computer software for counting cranes will be necessary, but early results are encouraging.

5. North American sandhill crane biologists currently recognize three subspecies of sandhill cranes in the MCP. Recent genetics research suggests substantial interbreeding between the greater (*G.c. tabida*) and the mid-sized subspecies (*G.c. rowanii*)(Rhymer et al. 2001, Johnson et al. 2003). The existence of the mid-sized crane subspecies has been questioned for many years and final results from the current genetics research and subsequent morphological investigations may allow biologists to make determinations regarding the classification of MCP into subspecies and implications for management.

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Back

Table 1. Annual spring population 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		OTHER NE	KS	CO	OK	NM	TX	OCULAR CRUISE TRANSECT	OCULAR TRANSECT	PHOTO CORRECTED OCULAR TRANSECT	
			ANNUAL	3-YR AVG									ANNUAL	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		219,800	284,900	450,126	3,500	100,000				0		323,300	388,400	494,626
2000		484,600	490,100	435,283	16,900	26,100				500		528,100	533,600	488,849
2001		387,300	413,500	396,167	10,500	42,300				3,500		443,600	469,800	463,933
2002		309,000	315,000	375,875	17,100	15,100				1,200		342,400	348,400	435,050
2003		316,676												

D.E. SHARP S:\CF_D\EXCEL\CRANES\Shcranerep.xls 06/17/03

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	46,843
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[1]	5,644 [2]	1,279	303	496	8,245 [2]	1,186	619	37,558 [2]	54	55,384
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	28,099
2000-01	5,519	1,229	268	501	7,765	1,324	701	47,065	65	64,436
1975-01	1,185	941	204	726	5,966	1,096	528	13,502	42	23,563
CURRENT YEAR PERCENT CHANGE FROM:										
2001	-4%	-7%	20%	-3%	2%	-10%	-9%	-24%	-25%	-18%
1975-79			109%	-59%	63%	190%			14%	
1980-89			131%	-31%	20%	14%	26%		40%	
1990-99		49%	3%	-6%	60%	-18%	-14%	110%	42%	97%
2000-01	2%	4%	13%	-1%	6%	-10%	-12%	-20%	-17%	-14%
1975-01		36%	49%	-32%	38%	8%	17%		29%	135%

[1] Preliminary

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[2] Harvest Information Program (HIP) or a point-of-sale electronic record used to identify crane hunters in lieu of a special sandhill crane hunting permit

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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[2]	245	511	80	155	2,757	252	137	4,676	14	8,827
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
2000-01	197	493	68	167	2,708	307	177	3,367	12	7,495
1975-01	153	424	60	344	2,666	340	148	2,871	11	6,735
CURRENT YEAR PERCENT CHANGE FROM:										
2001	21%	-8%	11%	-10%	-6%	-36%	-6%	32%	8%	10%
1975-79	13%		23%	-81%	-10%	4%	94%	90%	-29%	27%
1980-89	55%		87%	-49%	0%	-33%	-16%	102%	25%	44%
1990-99	129%	27%	8%	-17%	17%	-30%	-17%	33%	87%	25%
2000-01	24%	4%	18%	-7%	2%	-18%	-23%	39%	17%	18%
1975-01	60%	21%	32%	-55%	3%	-26%	-7%	63%	22%	31%

[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	MT¹	MT²	NM	ND¹	ND²	OK	SD	TX¹	TX²	TX³	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	12/12-02/11	12/30-02/04	09/09-11/05
2001	10/07-12/03	11/03-12/30	09/11-11/25	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

MT¹ Central Flyway portion of MT, except that area south of I-90 and west of the Bighorn River and Sheridan Co.
MT² Sheridan County, MT.

ND¹ Area 1, ND.
ND² Area 2, ND.

TX¹ Area A, TX
TX² Area B, TX
TX³ 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	AZ	NM	AK [2 3]	PACIFIC FLYWAY	U.S. 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			620	620	12,771
1978	106		36	1,089	2,777	389	19	5,720	10	10,146			310	310	10,456
1979	129		14	1,170	2,733	397	19	5,917	0	10,379			675	675	11,054
1980	68		16	1,019	2,245	363	130	6,305	6	10,152			1,050	1,050	11,202
1981	92		11	907	2,395	397	78	6,245	9	10,134	20		553	573	10,707
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	731	1,023	13,510
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	1,047	1,454	14,533
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	1,370	1,539	21,370
1999	56	1,455	29	321	5,748	879	184	8,469	8	17,149	92	101	2,400	2,593	19,742
2000	363	590	15	311	5,081	552	374	8,208	10	15,504	166	100	995	1,261	16,765
2001	257	1,033	43	297	5,173	713	478	6,999	7	15,000	154	106	941	1,201	16,201
2002[1]	390	1,051	24	298	2,867	536	134	11,331	20	16,651	197	82	850	1,129	17,780
AVERAGES:															
1975-79	94		23	1,097	2,352	308	37	5,995	8	9,913			667	667	10,580
1980-89	66		17	446	4,297	593	133	6,131	6	11,688	78	192	1,084	1,231	12,919
1990-99	124	1,039	63	417	6,317	805	195	8,570	5	17,224	124	127	1,011	1,262	18,486
2000-01	310	812	29	304	5,127	633	426	7,604	9	15,252	160	103	968	1,231	16,483
1975-01	111	989	36	545	4,746	622	160	7,118	6	13,674	108	140	971	1,138	14,812
CURRENT YEAR PERCENT CHANGE FROM:															
2001	52%	2%	-44%	0%	-45%	-25%	-72%	62%	186%	11%	28%	-23%	-10%	-6%	10%
1975-79	314%		6%	-73%	22%	74%		89%	156%	68%			27%	69%	68%
1980-89	493%		45%	-33%	-33%	-10%	1%	85%	239%	42%	152%	-57%	-22%	-8%	38%
1990-99	215%	1%	-62%	-29%	-55%	-33%	-31%	32%	270%	-3%	59%	-35%	-16%	-11%	-4%
2000-01	26%	30%	-17%	-2%	-44%	-15%	-69%	49%	135%	9%	23%	-20%	-12%	-8%	8%
1975-01	253%	6%	-33%	-45%	-40% #	-14%	-16%	59%	220%	22%	83%	-41%	-12%	-1%	20%

[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] In Alaska, state surveys for crane harvests were used during 1975-97, for 1998-99 a sample of waterfowl hunters was used. For the HIP surveys beginning in 2000, harvest zones 1-6 are combined to represent the MC crane harvest.

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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	164	6,000	6,164
1976	210	1,425	1,635
1977	367	N/A	367
1978	876	N/A	876
1979	977	2,821	3,798
1980	892	4,690	5,582
1981	508	2,451	2,959
1982	796	2,041	2,837
1983	378	2,720	3,098
1984	674	3,043	3,717
1985	691	4,468	5,159
1986	1,651	4,455	6,106
1987	795	4,472	5,267
1988	1,955	4,991	6,946
1989	2,666	2,318	4,984
1990	1,018	3,821	4,839
1991	1,800	3,594	5,394
1992	1,205	4,440	5,645
1993	482	2,309	2,791
1994	529	3,259	3,788
1995	1,005	4,824	5,829
1996	1,352	2,961	4,313
1997	1,279	4,622	5,901
1998	889	8,636	9,525
1999	1,300	7,100	8,400
2000	805	8,645	9,450
2001	1,247	7,538	8,785
2002[1]	1,283	6,665	7,948
AVERAGES:			
1971-79	408	3,603	3,211
1980-89	1,101	3,565	4,666
1990-99	1,086	4,557	5,643
2000-01	1,026	8,092	9,118
1971-01	890	4,228	4,846
CURRENT YEAR PERCENT CHANGE FROM:			
2001	3%	-12%	-10%
1971-79	214%	85%	148%
1980-89	17%	87%	70%
1990-99	18%	46%	41%
2000-01	25%	-18%	-13%
1971-00	44%	58%	64%

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[1] Harvest estimates for Canada in 2002 were not avialbale at the time this report was completed, therefore average harvest estimates for 2000-01 were used for comparative purposes.

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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: Pacific Flyway	Retrieved: Canada	Retrieved: Mexico[2]	Unretrieved: No. Am.[3]	Total
1975	9,497	1,094	6,164	1,676	3,672	22,102
1976	7,393	637	1,635	967	2,032	12,663
1977	12,151	620	367	1,314	2,473	16,925
1978	10,146	310	876	1,133	2,324	14,789
1979	10,379	675	3,798	1,485	2,842	19,179
1980	10,152	1,050	5,582	1,678	3,402	21,864
1981	10,134	573	2,959	1,367	2,760	17,792
1982	7,916	1,222	2,837	1,198	2,451	15,624
1983	12,959	1,557	3,098	1,761	3,503	22,879
1984	11,271	2,009	3,717	1,700	3,375	22,072
1985	12,776	1,245	5,159	1,918	3,524	24,622
1986	12,487	1,023	6,106	1,962	3,688	25,266
1987	12,770	1,281	5,267	1,932	3,406	24,656
1988	12,772	1,540	6,946	2,126	3,750	27,134
1989	13,639	809	4,984	1,943	3,628	25,003
1990	18,041	1,291	4,839	2,417	4,228	30,817
1991	13,079	1,454	5,394	1,993	3,536	25,456
1992	12,433	833	5,645	1,891	3,133	23,935
1993	18,005	492	2,791	2,129	3,334	26,751
1994	16,201	887	3,788	2,088	3,029	25,992
1995	20,628	1,047	5,829	2,750	4,161	34,416
1996	17,111	1,397	4,313	2,282	3,609	28,713
1997	19,766	1,086	5,901	2,675	4,211	33,640
1998	19,831	1,539	9,525	3,090	4,973	38,957
1999	17,149	2,593	8,400	2,814	4,478	35,435
2000	15,504	1,261	9,450	2,621	4,095	32,931
2001	15,000	1,201	8,785	2,499	4,013	31,498
2002[1]	16,651	1,129	7,948	2,573	3,529	31,830
AVERAGES:						
1975-79	9,913	667	2,568	1,315	2,668	17,132
1980-89	11,688	1,231	4,666	1,758	3,349	22,691
1990-99	17,224	1,262	5,643	2,413	3,869	30,411
2000-01	15,252	1,231	9,118	2,560	4,054	32,214
1975-01	13,674	1,138	4,969	1,978	3,468	25,226
CURRENT YEAR PERCENT CHANGE FROM:						
2001	7.40%	-10.43%	-15.89%	-1.86%	-13.83%	-3.35%
1975-79	67.97%	69.21%	209.50%	95.67%	32.25%	85.80%
1980-89	42.47%	-8.28%	70.36%	46.31%	5.38%	40.27%
1990-99	-3.33%	-10.53%	40.86%	6.63%	-8.80%	4.67%
2000-01	9.17%	-8.27%	-12.83%	0.50%	-12.95%	-1.19%
1975-01	21.77%	-0.79%	59.96%	30.07%	1.76%	26.18%

[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.

Table 8. Estimated retrieved harvests of the Rocky Mountain Population of greater 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	160	42	132	51	194	639
AVERAGES:							
1981-89	54	397	35	147			259
1990-99	36	198	32	105	51	120	457
2000-01	73	273	32	153	89	236	854
1981-01	44	237	33	127	59	159	410
CURRENT YEAR PERCENT CHANGE FROM:							
2001	-22%	-44%	62%	-7%	-41%	-30%	-29%
1981-89	11%	-60%	22%	-10%			147%
1990-99	68%	-19%	31%	25%	0%	61%	40%
2000-01	-18%	-41%	33%	-13%	-43%	-18%	-25%
1981-01	38%	-33%	27%	4%	-13%	22%	56%

[1] RMP Sandill cranes (40) were also taken as part of research project in the San Luis Valley, CO *D.E. SHARP* *S:\CF_D\EXCEL\CRANES\Shcranerep.xls* *06/17/03*

[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 sandill 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]	2,450	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

[1] 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.

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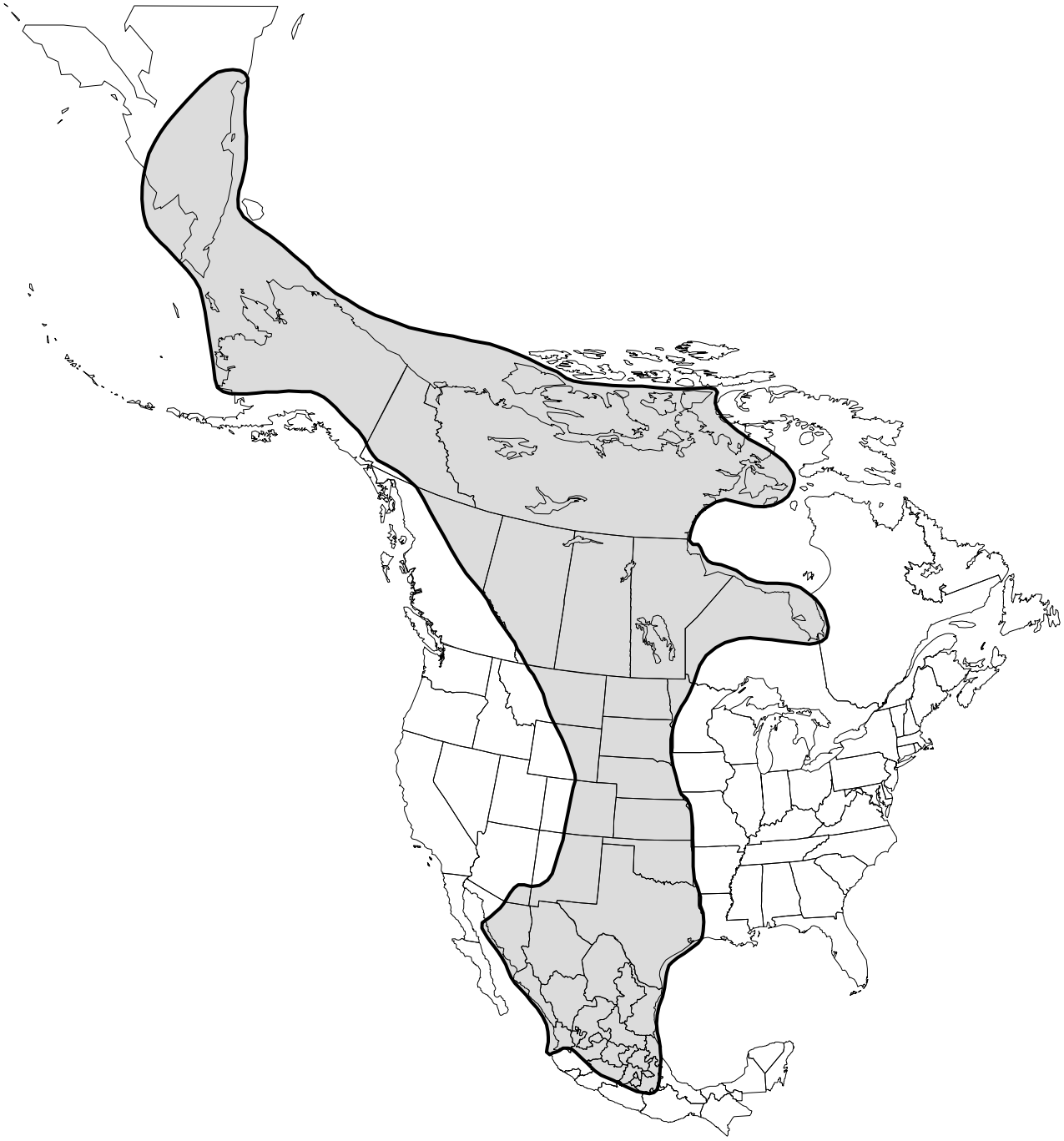

Fig. 1. Approximate range of Mid-Continent sandhill cranes (based on figures in Sharp et al. 2000, Tacha et al. 1994, and data from radio-telemetered birds provided by G. Krapu, Northern Prairie Wildlife Research Center, Jamestown, ND).

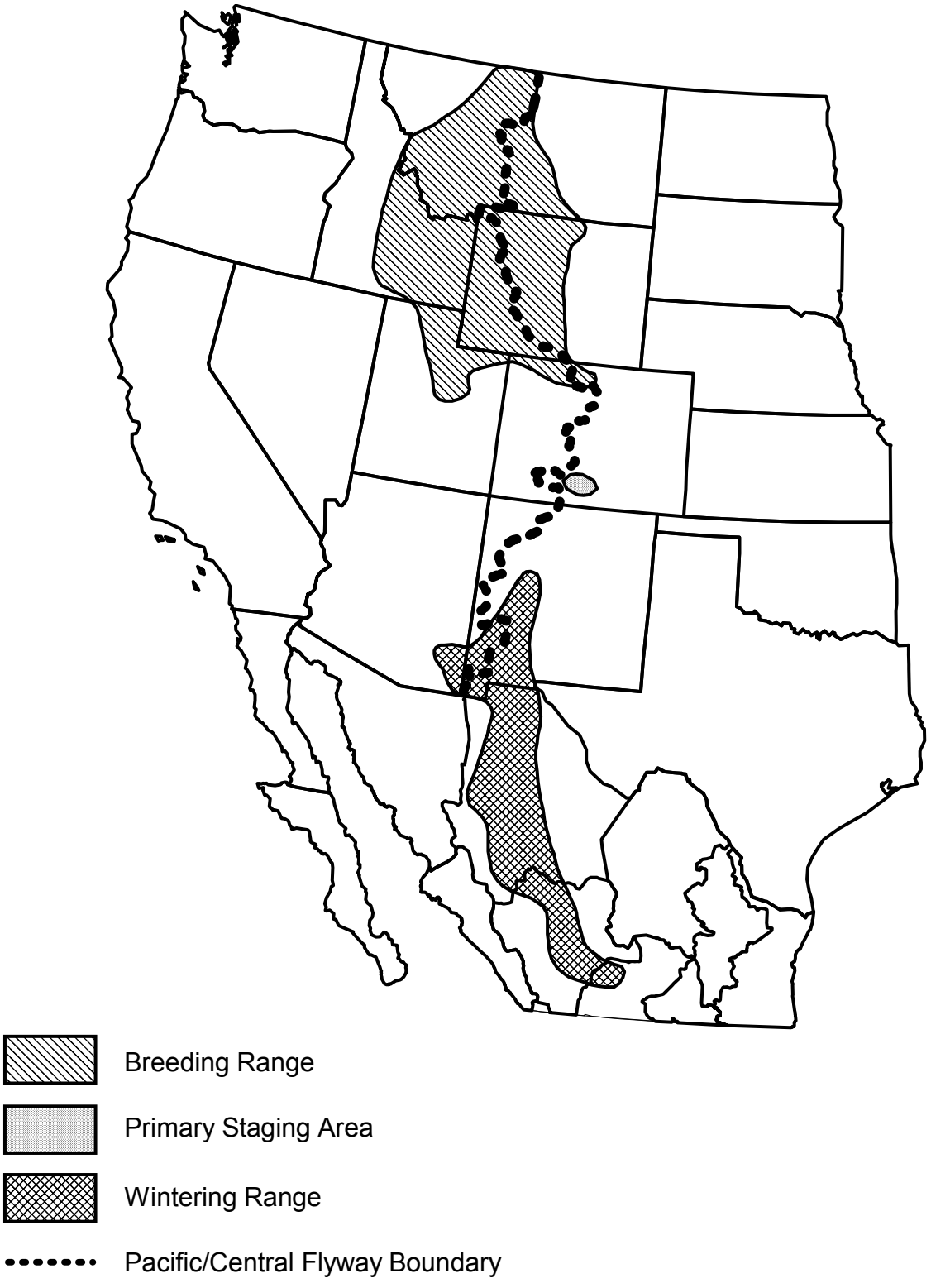

Figure 2. Approximate range of the Rocky Mountain Population of Greater Sandhill Cranes.

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Fig. 3. Areas open to the hunting of Mid-Continent sandhill cranes by Federal frameworks in the Central Flyway states, 2002.

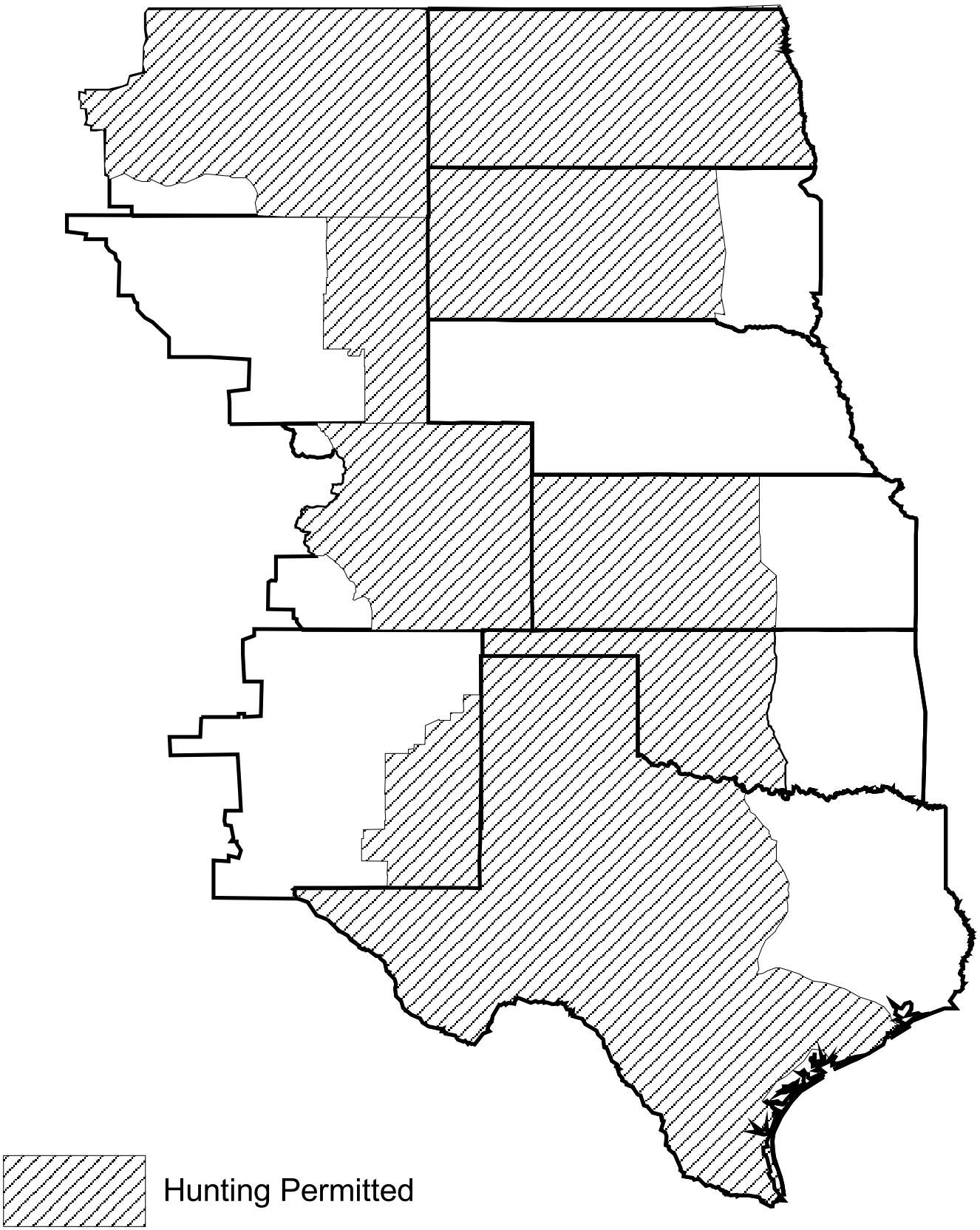

Figure 4. Spring population indices for Mid-Continent sandhill cranes on the Central Platte River Valley, Nebraska.

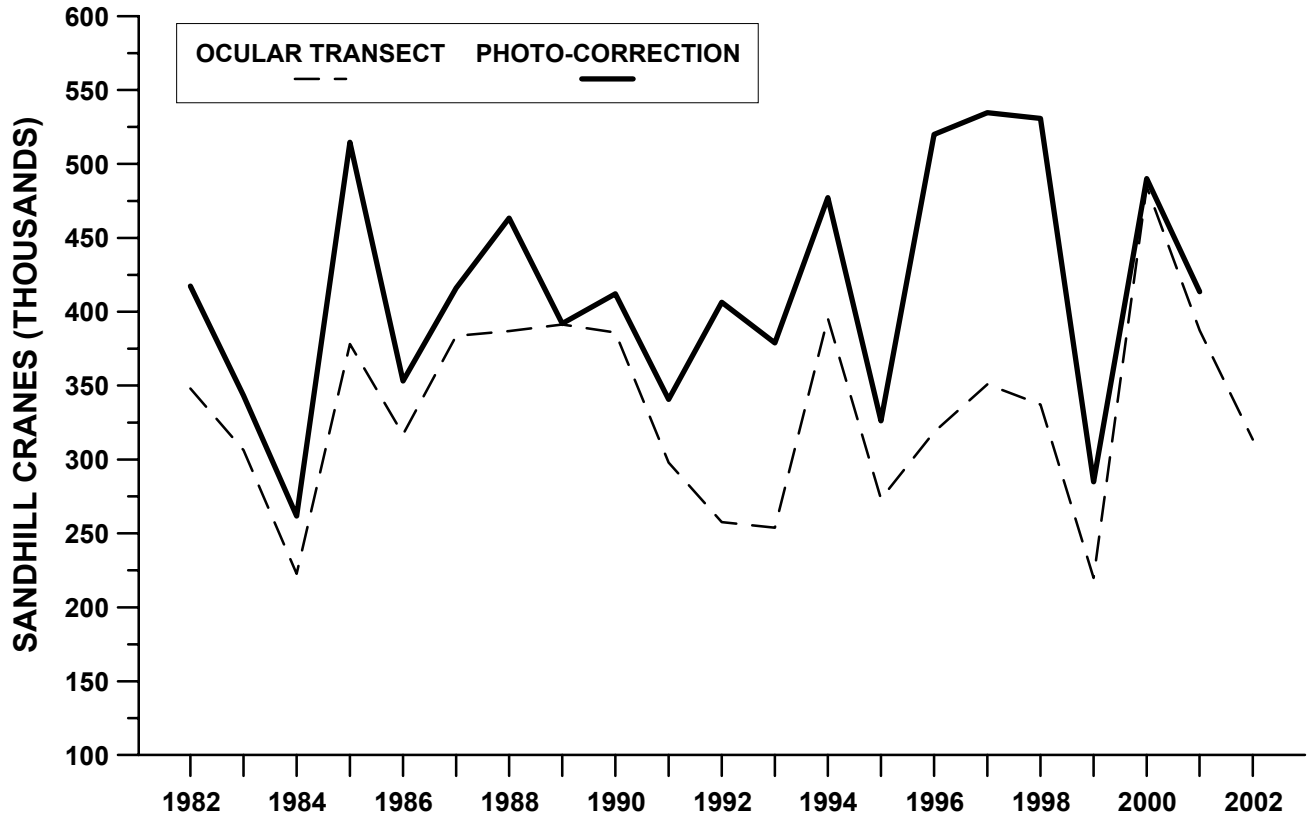

Figure 5. Photo-corrected spring population estimates (solid line) and the 95% confidence intervals (dashed lines) for Mid-Continent sandhill cranes

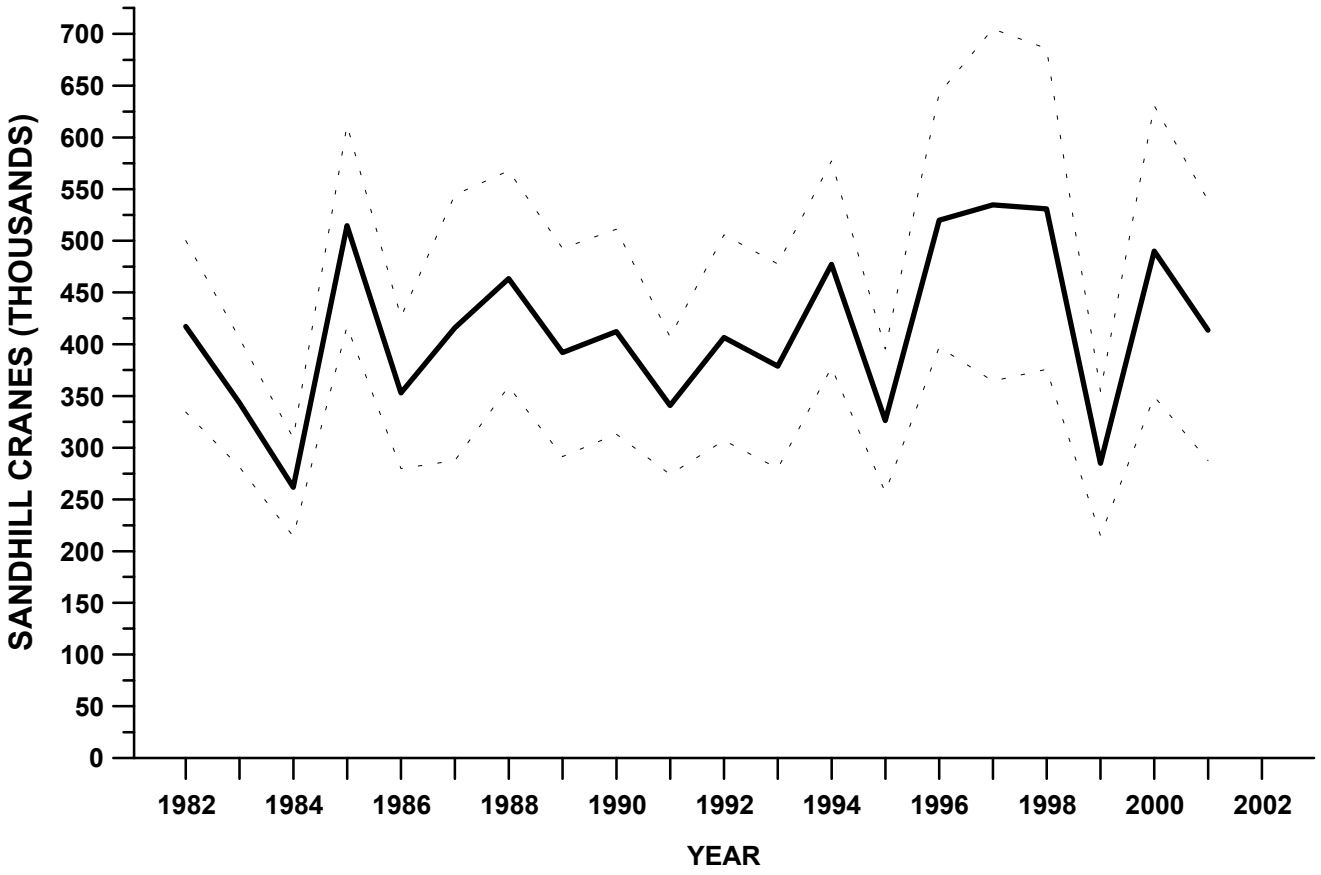

Figure 6. Annual and three-year average photo-corrected ocular transect spring population indices and population objective thresholds for Mid-Continent sandhill cranes.

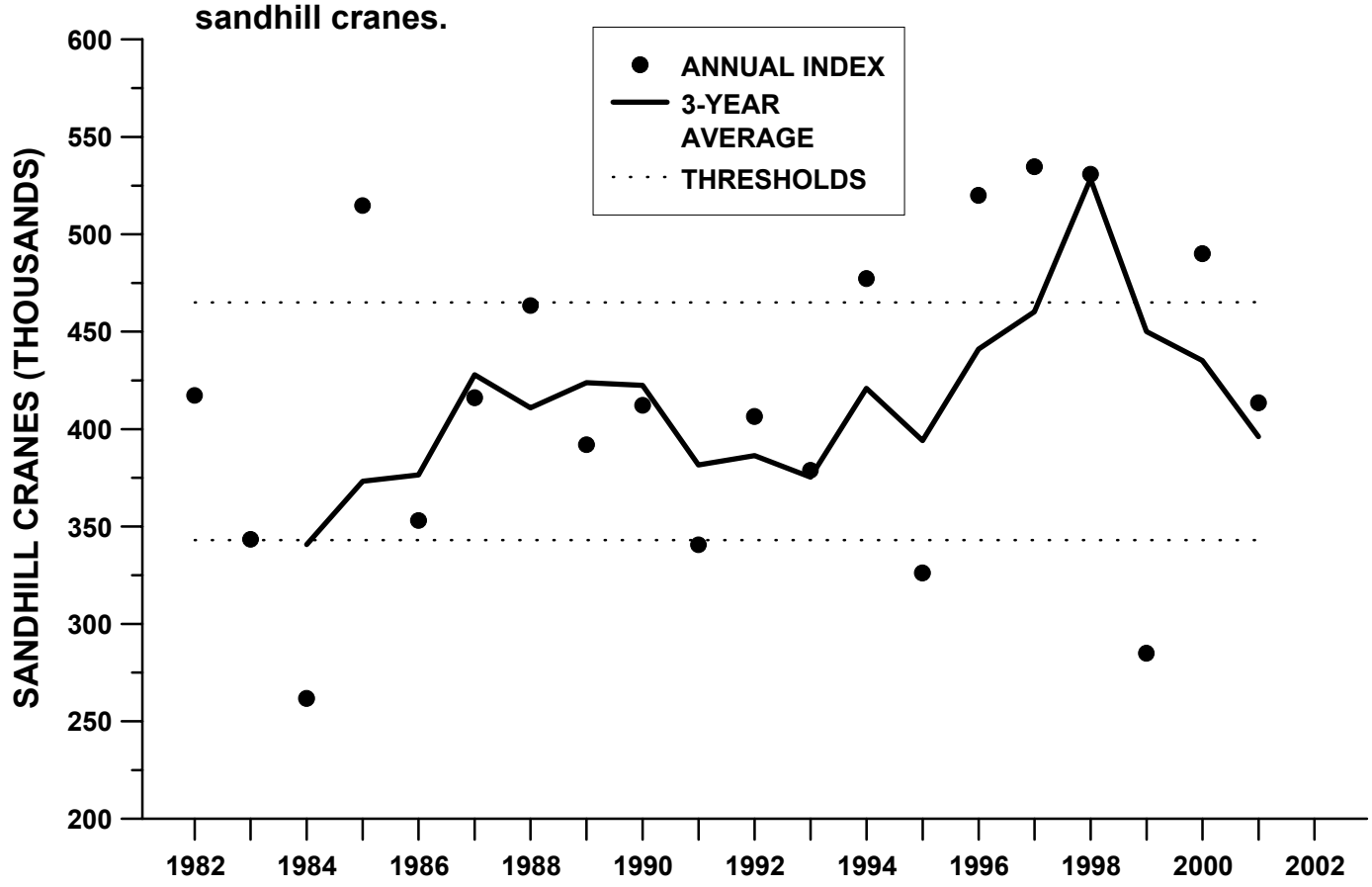

Figure 7. Active Mid-Continent sandhill crane hunters in the U.S. portion of the Central Flyway. * The value for 2001 is preliminary.

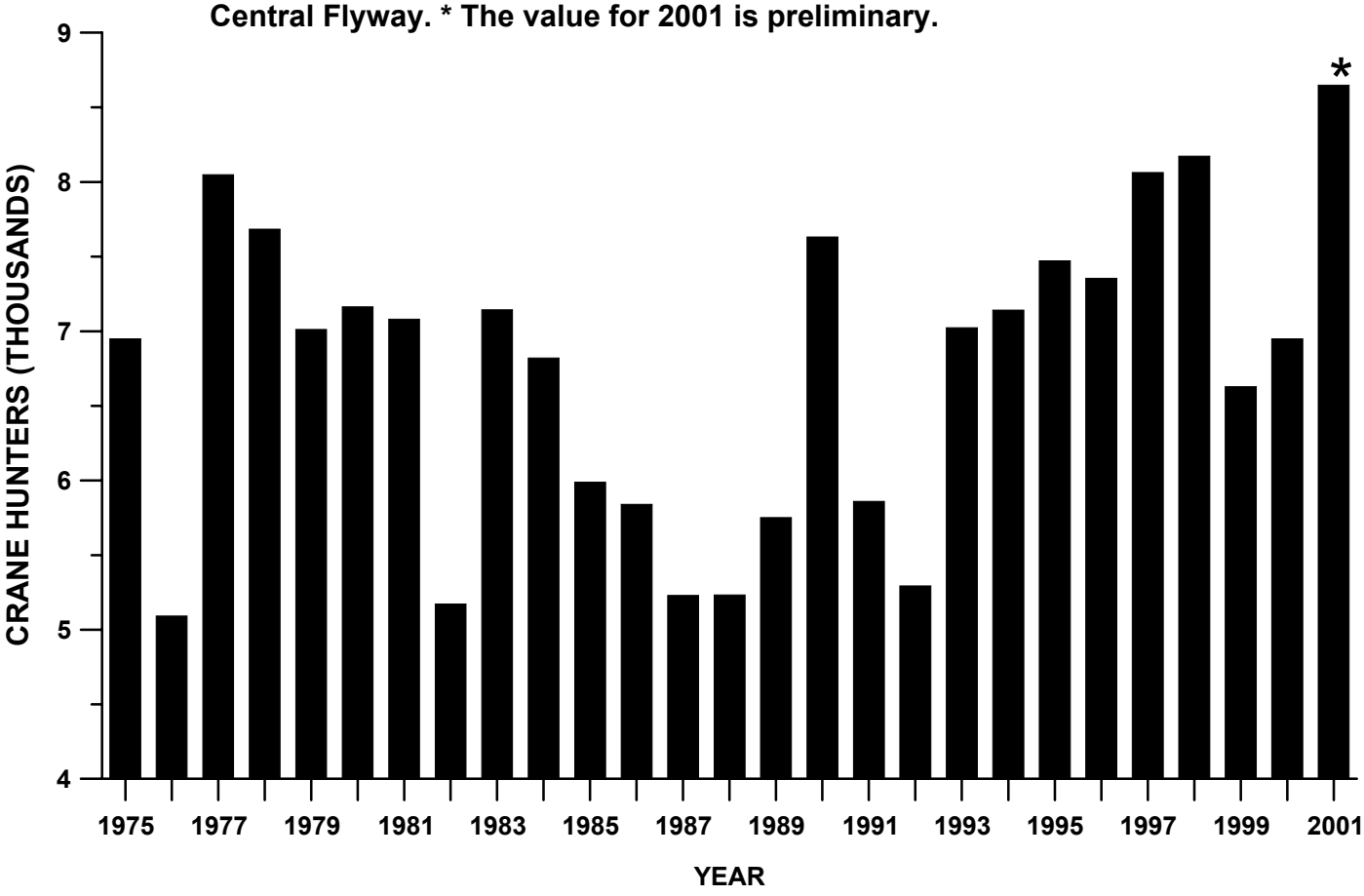

Figure 8. Crippling loss rate (number lost/[number retrieved + lost]) of Mid-Continent sandhill cranes in the U.S. portion of the Central Flyway. *The value for 2001 is preliminary.

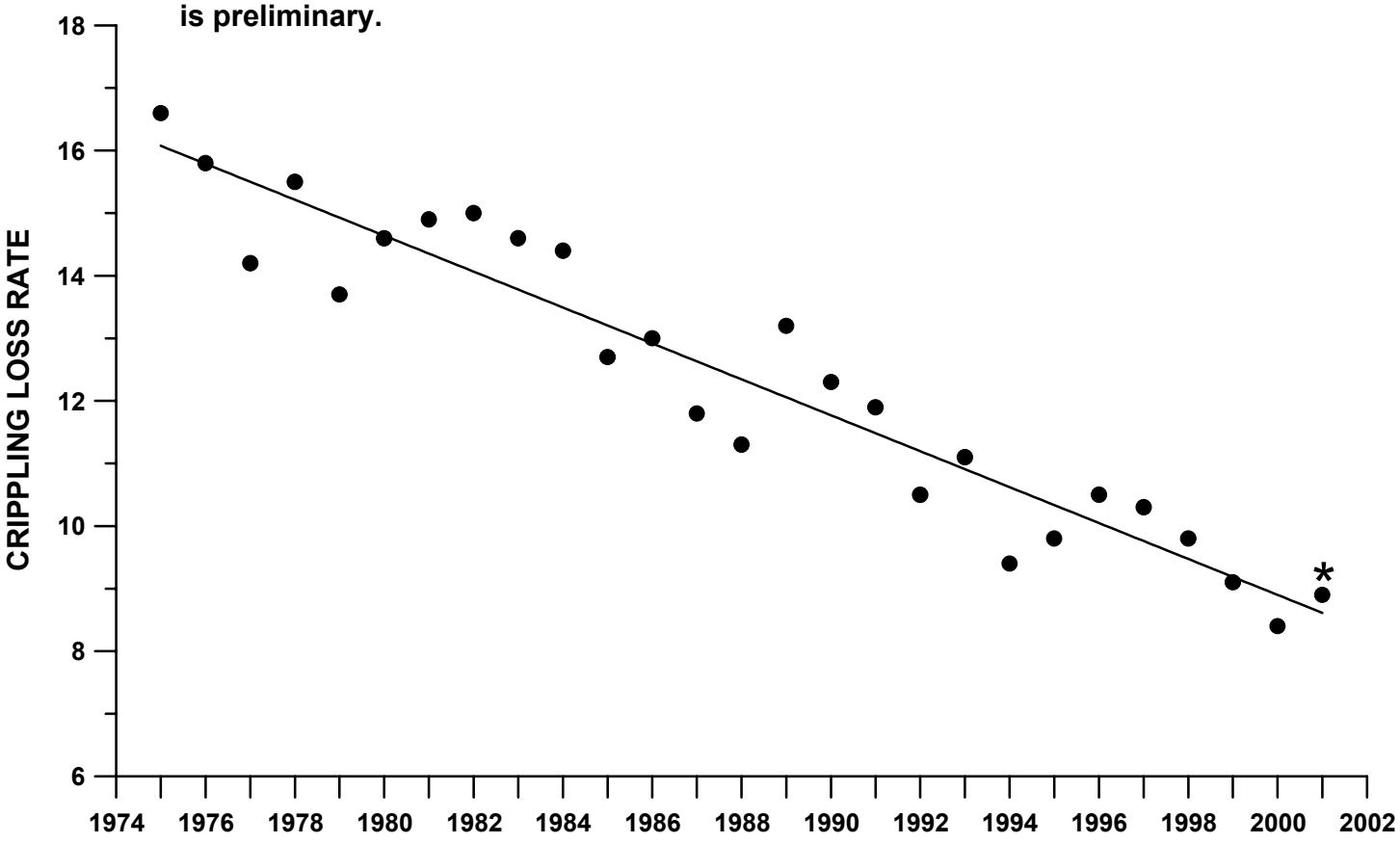

Figure 9. Average number of hunting days afield reported by active Mid-Continent sandhill crane hunters in the U.S. portion of the Central Flyway. *The value for 2001 is preliminary.

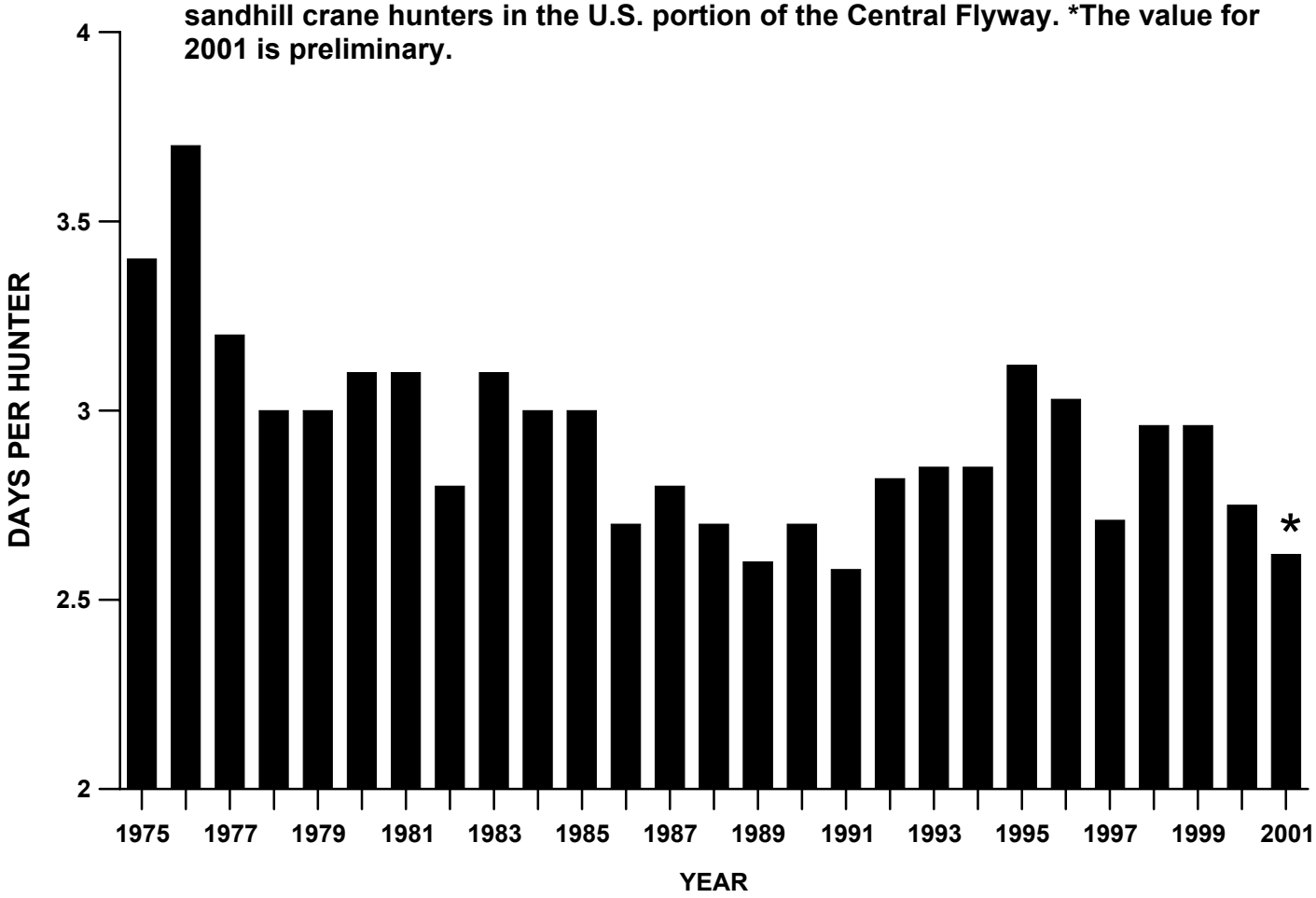

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Figure 10. Seasonal bag per Mid-Continent sandhill crane hunter in the U.S. portion of the Central Flyway. *The value for 2001 is preliminary.

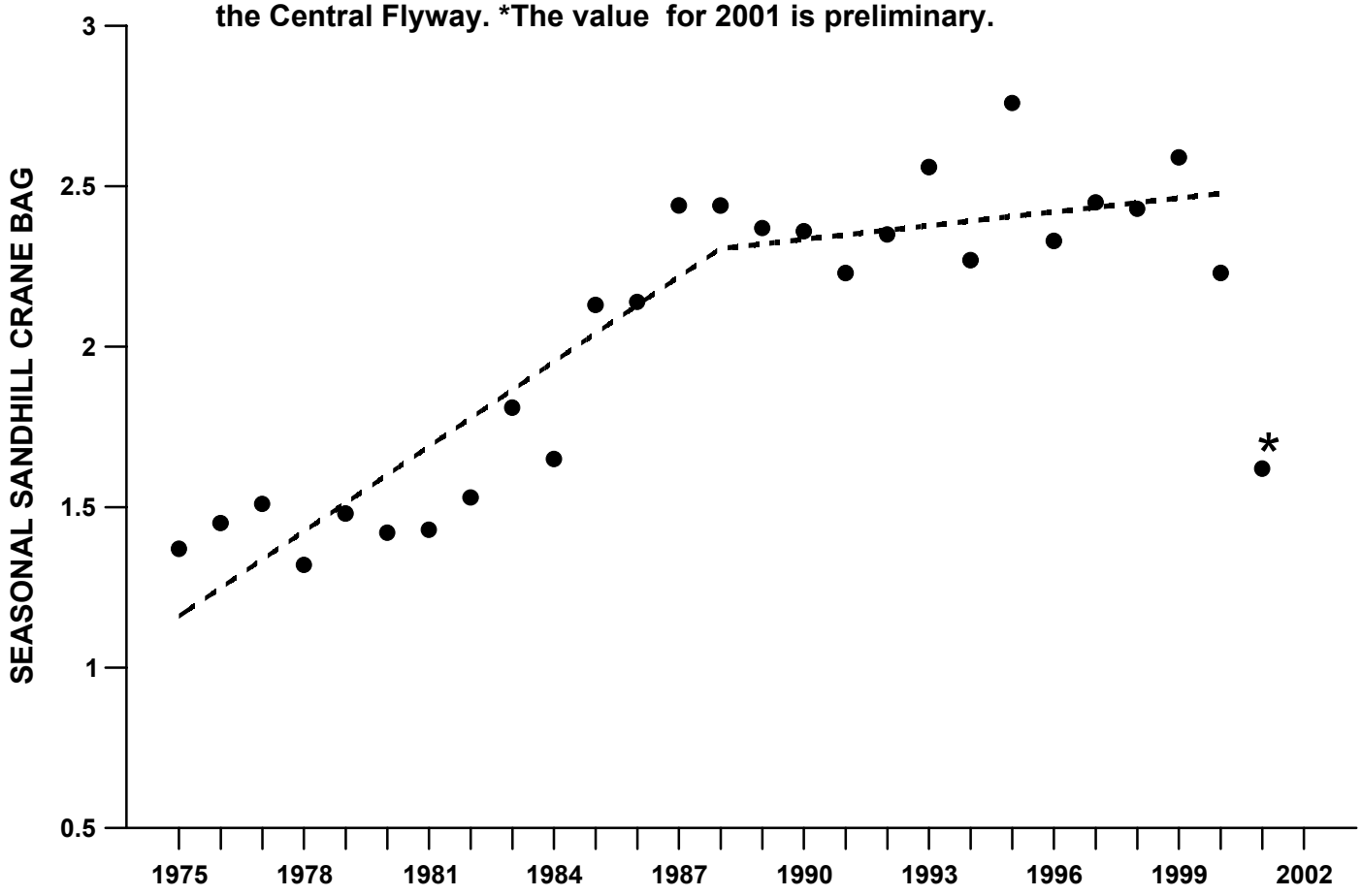

Figure 11. Estimated hunting mortality (retrieved and unretrieved) of Mid-Continent sandhill cranes in the U.S. portion of the Central Flyway. *The value for 2001 is preliminary.

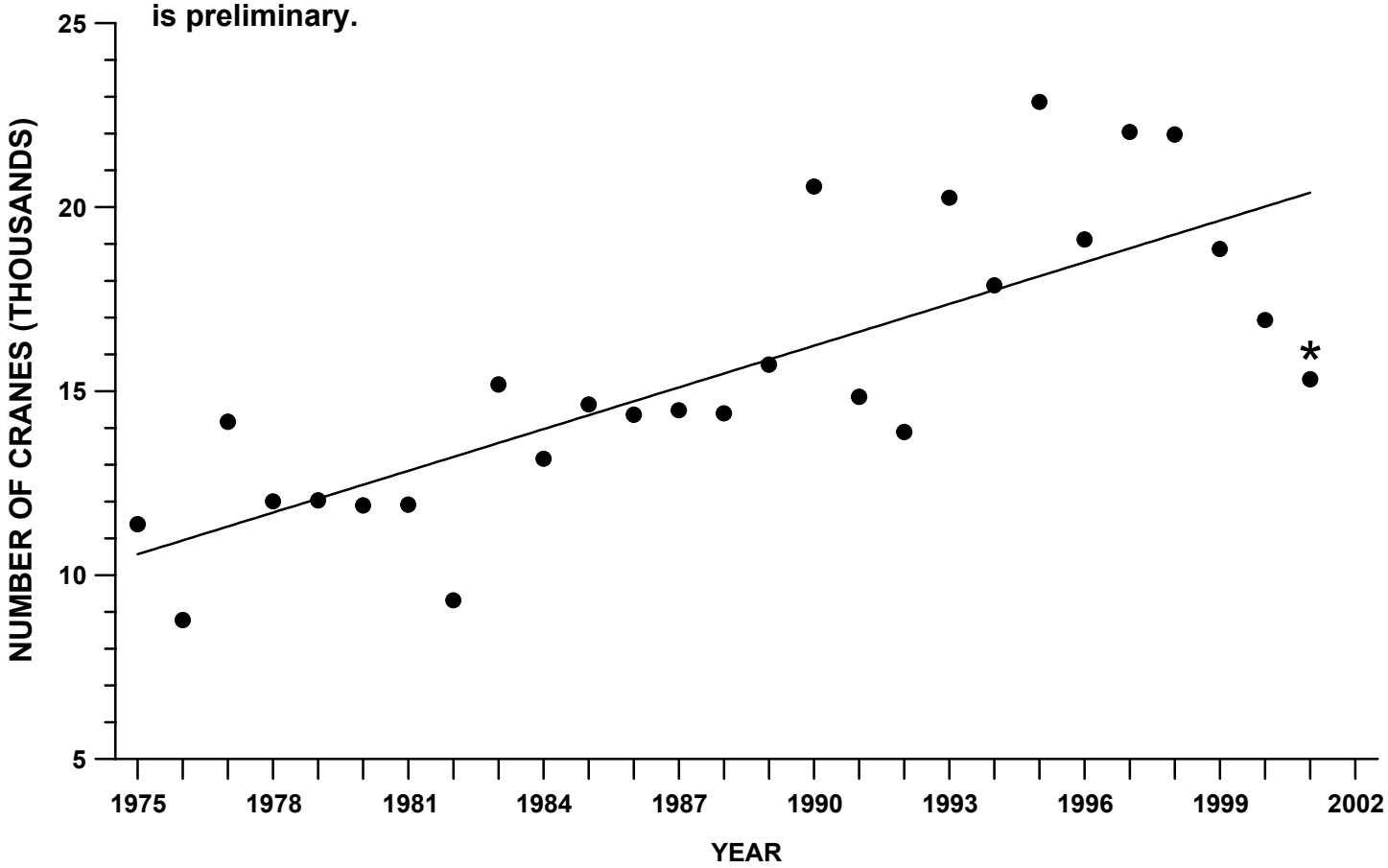

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Figure 12. Estimated hunting mortality (retrieved and unretrieved) of Mid-Continent sandhill cranes in North America. *The value for 2001 is preliminary.

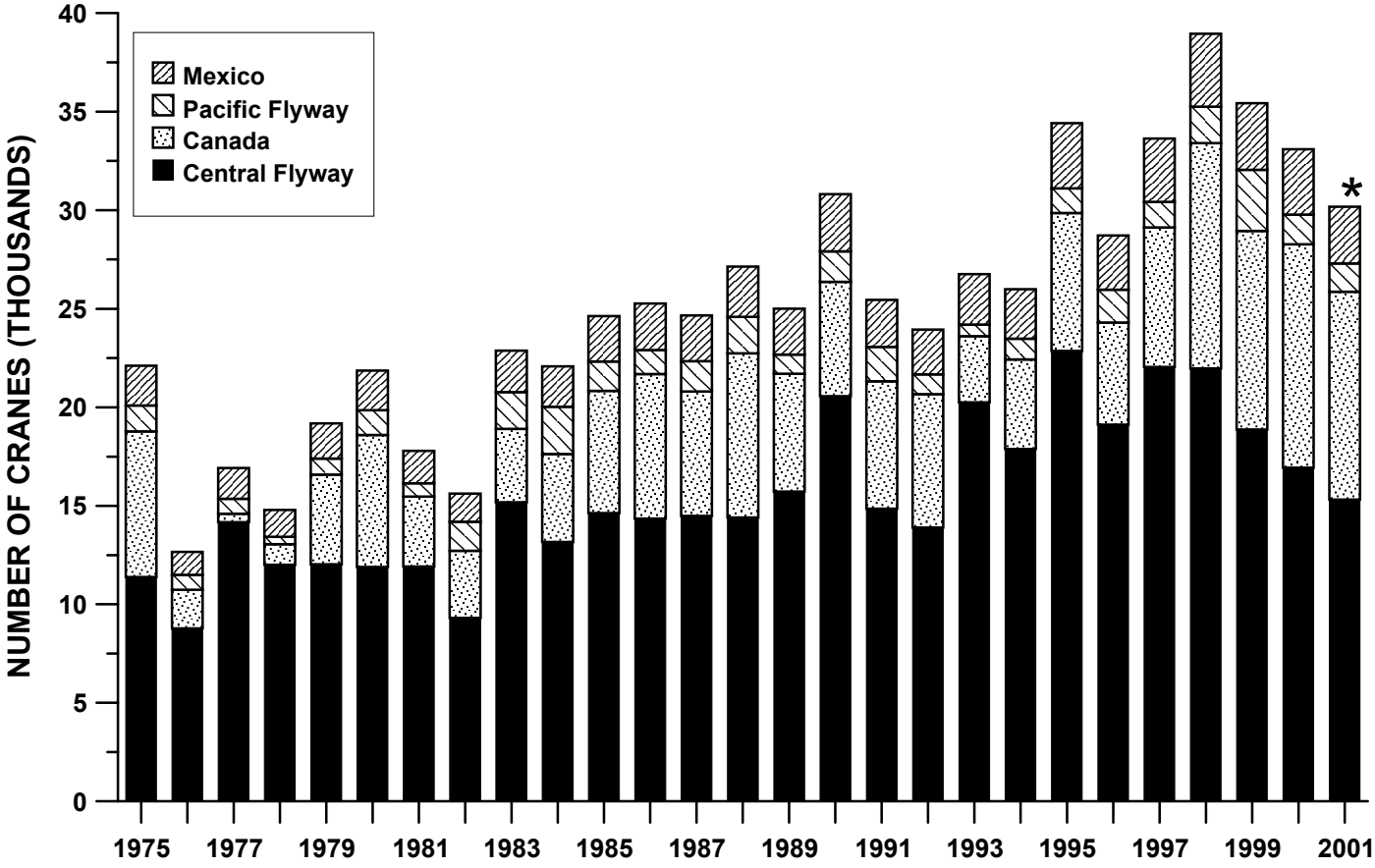

Figure 13. Trend analyses of indices to abundance and harvest of Mid-Continent sandhill cranes.

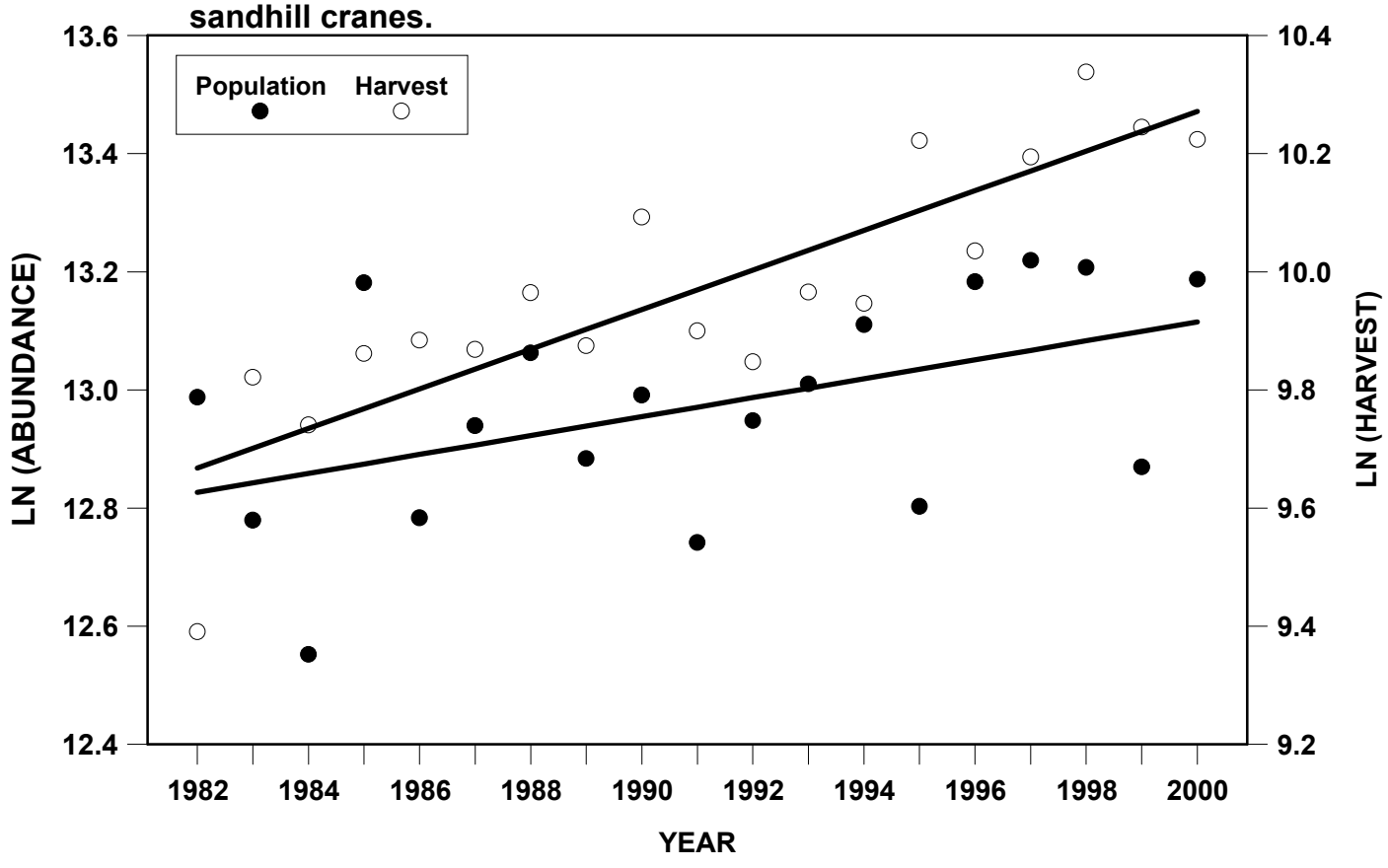

Figure 14. Estimated harvest of Rocky Mountain Population of sandhill cranes.

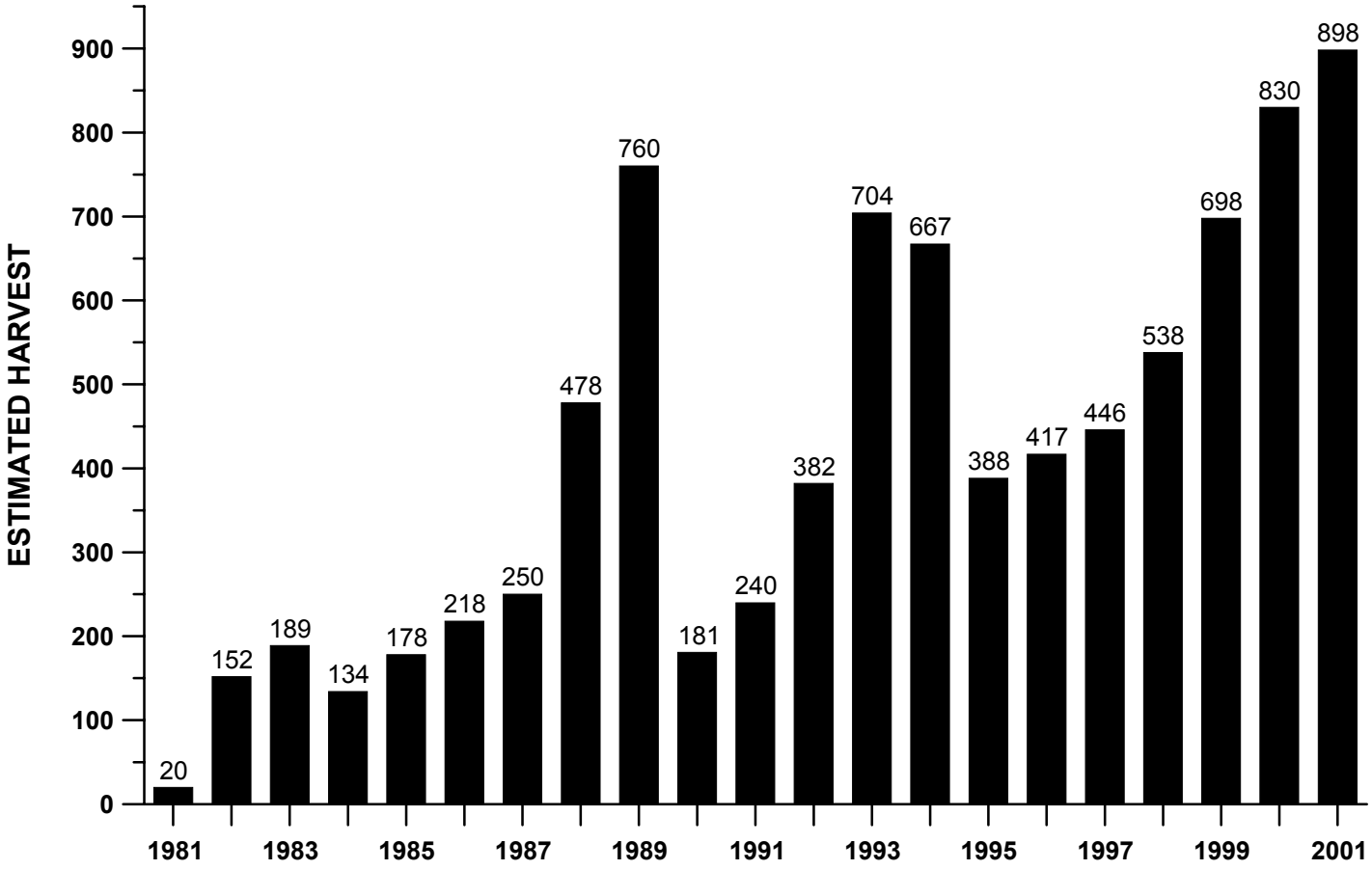

Figure 15. Population indices for the Rocky Mountain Population of sandhill cranes.

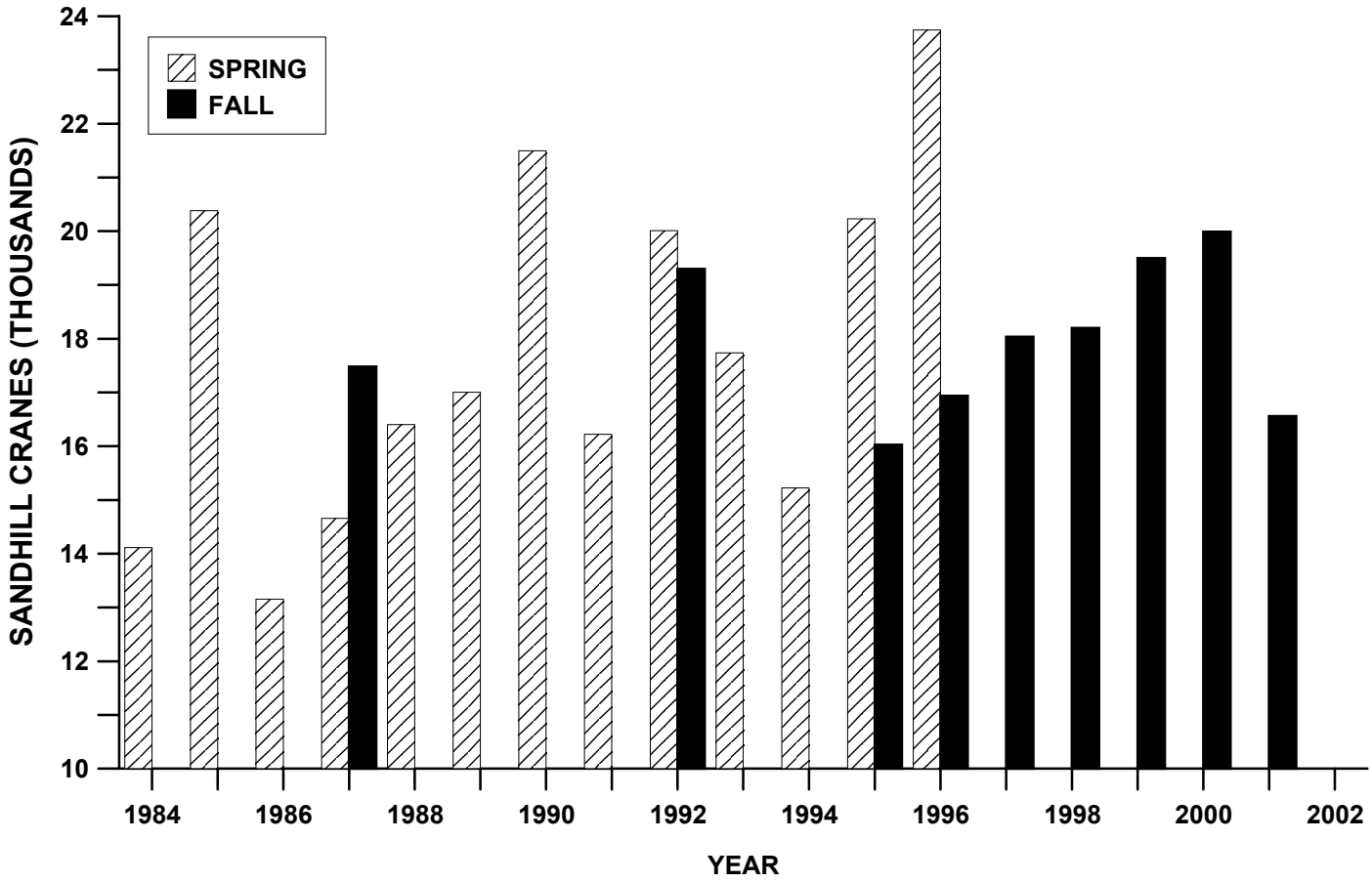

Figure 16. Annual and three-year average of fall pre-migration population indices for the Rocky Mountain Population of sandhill cranes.

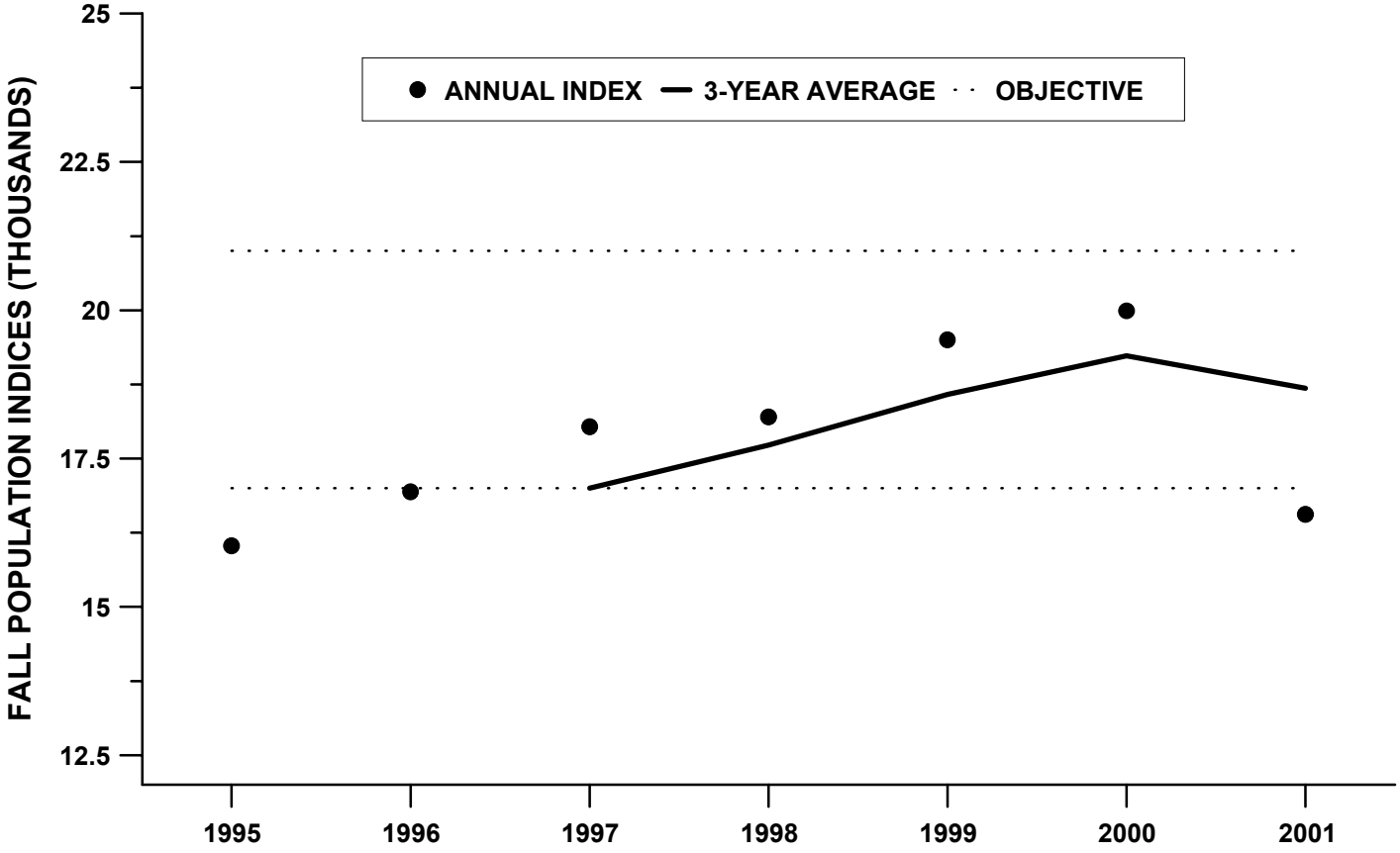

Figure 17. Annual indices for recruitment (% juveniles) of the Rocky Mountain Population of sandhill cranes.