

**MIGRATORY BIRD POPULATIONS**

**Wetland Wildlife Populations and Research  
102 23rd Street  
Bemidji, MN 56601  
(218) 755-2973**



# 2007 Waterfowl Breeding Population Survey Minnesota

Steve Cordts, Wetland Wildlife and Populations Research

## ABSTRACT

The number of breeding waterfowl in a portion of Minnesota has been estimated each year since 1968 as a part of the overall inventory of North American breeding waterfowl. The survey consists of aerial observations supplemented by more intensive ground counts on selected routes to determine the proportion of birds counted by the aerial crew. Procedures used are similar to those used elsewhere across the waterfowl breeding grounds. The 2007 aerial survey portion was flown from 8-26 May. Pond numbers increased 24% compared to 2006 and were 7% above the long-term average. The estimated numbers of temporary (Type 1) wetlands decreased 43% from 2006 and remained below (-55%) the long-term average. The mallard breeding population index (242,000) increased significantly (51%,  $P = 0.03$ ) from 2006 (161,000). Mallard numbers remained below the 10-year average (-23%) but were above the long-term average (+9%). The blue-winged teal breeding population index (124,000) was 29% below the 2006 estimate (174,000) and both the 10-year (-45%) and long-term (-46%) averages. Populations of “other” ducks (115,000), excluding scaup, decreased 38% and remained below the 10-year average (-51%) and the long-term average (-35%). Wood ducks (33%), gadwalls (17%), ring-necked ducks (15%), canvasback (8%), and redheads (8%) accounted for most (81%) of the total population of “other” ducks. Wood duck numbers were the lowest recorded since 1984, partially due to the early leaf-out and decreased visibility this spring. The estimate of total ducks (489,000), which excludes scaup, decreased 6% compared to 2006 and was 37% below the 10-year average and 22% below the long-term average (627,000). Canada goose numbers (uncorrected for visibility) increased 30% compared to 2006, were 17% above the 10-year average and remained 140% above the long-term average. Survey timing in 2007 was fairly late and likely contributed to lower estimates of blue-winged teal and “other” duck abundance. Ice out was generally early in the southern portion of the state and near normal across the north. Spring phenology (leaf-out, duck migration) was well advanced in 2007, up to 10 days earlier than normal. Above average temperatures between mid-April and mid-May, combined with strong southerly winds during this time period likely contributed to the early spring migration for migrant ducks through the state. During most years, some migrant ducks are counted during the survey. However, few migrant ducks were likely present in the state this spring during the time when most of the survey was flown.

## METHODS

The aerial survey is based on a sampling design that includes three survey strata (Table 1, Figure 1). The strata cover 39% of the state area and are defined by density of lake basins (>10

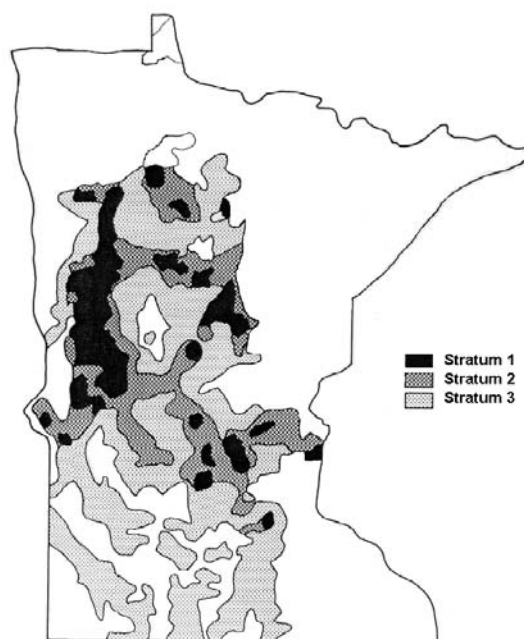


Figure 1. Location of waterfowl breeding population survey strata in Minnesota.

acres) exclusive of the infertile northeastern lake region. The strata include the following:  
Stratum I: high density, 21 or more lake basins per township.

Stratum II: moderate density, 11 to 20 lake basins per township.

Stratum III: low density, 2 to 10 lake basins per township.

Areas with less than two basins per township are not surveyed. Strata boundaries were based upon "An Inventory of Minnesota Lakes" (Minnesota Conserv. Dept. 1968:12). Standard procedures for the survey follow those outlined in "Standard Operating Procedures for Aerial Waterfowl Breeding Ground Populations and Habitat Surveys in North America" (USFWS/CWS 1987). Changes in survey methodology were described in the 1989 Minnesota Waterfowl Breeding Population Survey report. Pond and waterfowl data for 1968-74 were calculated from Jessen (1969-72) and Maxson and Pace (1989).

All aerial transects in Strata I-III (Table 1) were flown using a Cessna 185 (N605NR). Wetlands were counted on the observer's side of the plane (0.125 mile wide transect) only; a correction factor obtained in 1989 was used to adjust previous data (1968-88) that was obtained when the observer counted wetlands on both sides of the plane (0.25 mile wide transect). Data were recorded on digital voice recorders for both the pilot and observer and stored as WAV files.

Visibility correction factors (VCFs) were derived from intensive ground surveys on 14 selected routes flown by the aerial crew. Many of these routes use a county road as the mid-point of the transect boundary which aids in navigation and helps ensure the aerial and ground crews survey the same area. Ground routes each originally included approximately 100 wetland areas; however, drainage has reduced the number of wetlands on most of the routes. All observations from both ground crews and aerial crews were used to calculate the VCFs.

The SAS computer program was modified in 1992 to obtain standard errors for mallard and blue-winged teal breeding population estimates. These calculations were based upon SAS computer code written by Graham Smith, USFWS-Office of Migratory Bird Management. We identified an error in these estimates associated with calculating variances from stratified surveys that use correction factors to account for unobserved waterfowl. This error will be addressed and corrected in future reports but due to time constraints this year, we report variances using identical methods as in past years. We compared estimates for 2006 and 2007 using two-tailed Z-tests.

## **SURVEY CHRONOLOGY**

The 2007 aerial survey began on 8 May in southern Minnesota and concluded in northern Minnesota on 27 May. The survey was completed in 14 days of flight time. Transects were flown on 8-12, 16-21, 24-25, and 27 May. Flights began no earlier than 7 AM and were completed by 12 PM each day. Flight delays were mostly due to excessive winds (>20 mph) and low ceilings. Most (63%) of the survey was again completed after 15 May; the entire survey spanned 20 days, which was similar to both 2005 (27 days) and 2006 (21 days) and one of the longer periods on record.

## WEATHER AND HABITAT CONDITIONS

Wetland conditions in spring 2007 were similar to 2006. Ice out on most lakes across the state was near average for the northern regions of the state but 5-10 days early in the southern regions. April temperatures averaged 1.0°F below normal statewide; regional temperatures ranged from 2.7°F below average in west central Minnesota to 0.1°F below average in east central Minnesota

(<http://climate.umn.edu/cawap/monsum/0704.txt>).

April precipitation was 0.1 inches above normal statewide and ranged from 1.4 inches above normal in west central Minnesota to 1.4 inches below normal in south central Minnesota. May temperatures averaged about 3.2°F above normal statewide. May precipitation was 0.2 inches below normal statewide and ranged from 0.9 inches below normal in south central Minnesota to 0.9 inches above normal in northwest Minnesota

(<http://climate.umn.edu/cawap/monsum/0705.txt>).

From 15 April through 20 May, which would coincide with peak spring migration time for most duck species, average temperatures were 2°F to 7°F above normal each week across the state. In addition, strong southerly winds in late April and early May likely triggered migrant ducks to move through the state rapidly. Additional temperature and precipitation data are provided in Appendix A.

In late April 2007, statewide topsoil moisture indices were rated as 8 % very short or short, 79 % adequate, and 13% surplus moisture. On June 1, statewide indices were rated as 13% short, 76% adequate and 11% surplus moisture. (Minnesota Agricultural Statistics Service Weekly Crop Weather Reports, <http://www.nass.usda.gov/mn/>). For comparison, in late April 2006 statewide topsoil moisture indices were rated as 12% very short or short, 75% adequate, and 13% surplus moisture.

Planting dates for row crops were later in 2007 than previous years. By April 29, 28% of the corn acres had been planted statewide compared to 43% in 2006 and 38% for the previous 5-year average. By June 4, 36% of alfalfa hay had been cut compared to 51% in 2006 and a 5-year average of 21% (Minnesota Agricultural Statistics Service Weekly Crop Weather Reports, <http://www.nass.usda.gov/mn/>).

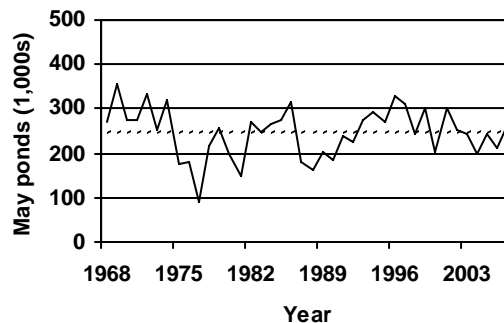


Figure 2. Number of May ponds (Types II-V) and long-term average (dashed line) in Minnesota, 1968-2007.

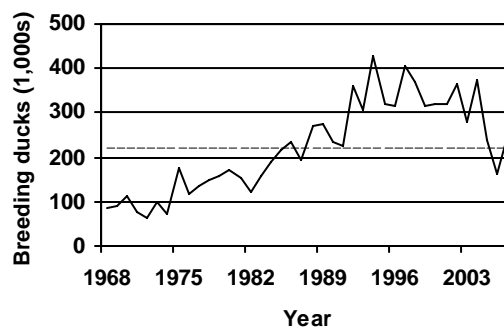


Figure 3. Mallard population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2007.

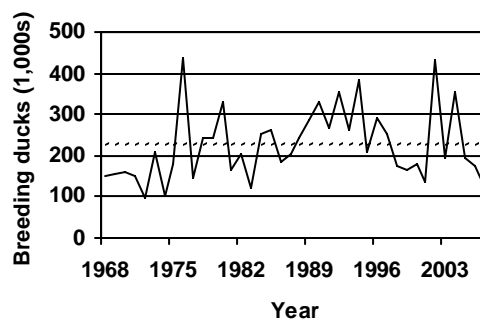


Figure 4. Blue-winged teal population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2007.

Wetland numbers (Type II-V) increased 24% from 2006 and were 2% above the 10-year average (Table 2) and 7% above the long-term average (Table 2; Figure 2). The numbers of temporary (Type 1) wetlands decreased 43% from 2006, were 39% below the 10-year average and 55% below the long-term average.

Leaf-out dates were considerably earlier than 2006, even during the early portion of the survey, which made visibility from the air extremely difficult throughout the entire survey. Emergent wetland vegetation also appeared more developed than previous years.

### WATERFOWL POPULATIONS

The number of ducks, Canada geese, and coots, by stratum, are shown in Tables 3-5; total numbers are presented in Table 6. These estimates are expanded for area but not corrected for visibility bias.

The 2007 waterfowl breeding population estimate of mallards was 242,481 (SE = 30,020), which was 51% higher and significantly different from 2006 ( $Z = 2.12, P = 0.03$ ) (Table 7, Figure 3). Mallard numbers were below (-23%) the 10-year average and above the long-term average (9%). In 2007, 6% of the total mallards were in flocks compared to 7% in 2006 and 3% in 2005. Pairs comprised only 9% of the mallards observed, compared to 12% and 23% in 2004 and 2005, respectively.

The estimated blue-winged teal population was 123,588 (SE = 20,055), which was lower than 2006 (174,000) but statistically unchanged from last year ( $Z = 0.79, P = 0.43$ ). Blue-winged teal numbers were 45% below the 10-year average and 46% below the long-term average (Table 7, Figure 4). In 2007, no blue-winged teal were in flocks compared to 20% and 25% of the total in 2005 and 2006, respectively. This provides some evidence that most migrant blue-winged teal had departed the state prior to the survey. Pairs comprised 64% of the blue-winged teal observed, compared to 47% and 57% in 2005 and 2006, respectively.

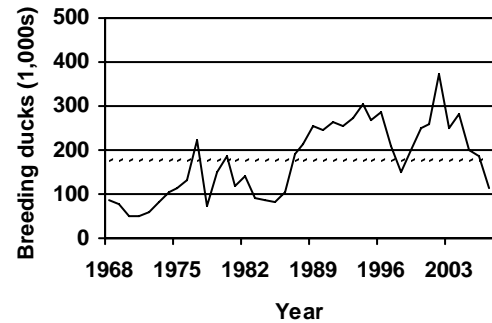


Figure 5. Other duck (excluding scaup) populations (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2007.

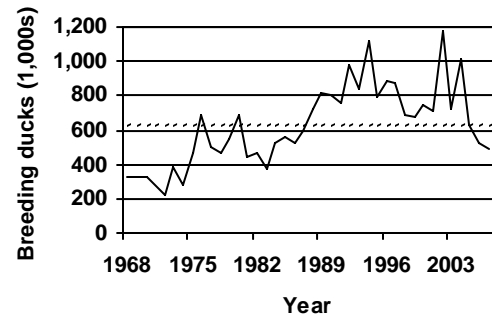


Figure 6. Total duck (excluding scaup) population estimate and long-term average (dashed line) in Minnesota, 1968-2007.

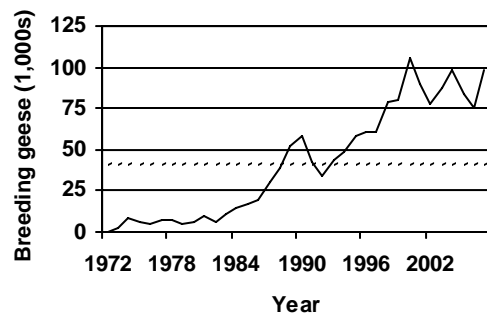


Figure 7. Canada goose population estimates (not adjusted for visibility bias) and long-term average in Minnesota, 1972-2007.

Other duck numbers (excluding scaup) declined 38% to 115,390 and were 51% below the 10-year average and 35% below the long-term average (Table 7, Figure 5). Scaup numbers (7,058) were 90% below the long-term average and the lowest estimate on record. The total duck population, excluding scaup, was 489,000, which was 6% lower than 2006, 37% below the 10-year average and 22% below the long-term average (Table 7, Figure 6). This was the lowest total duck estimate since 1983.

Visibility Correction Factors (VCFs) were higher in 2007 for mallards (43%) but lower for blue-winged teal (-7%) and “other” ducks (-15%) compared to 2006 (Table 7). Mallard VCFs (3.15) were 49% above the long-term average and the 2<sup>nd</sup> highest estimate on record. The blue-winged teal VCF was 8% above the long-term average. The VCF for “other” ducks was 18% above the long-term average. Early leaf-out conditions decreased visibility on all transects. In addition, due to improved safety standards beginning in 2006, the pilot and observer were required to wear flight helmets, which decreases visibility rates for both. Moderate winds were encountered on almost all flight days this year, which also impacts visibility rates.

Canada goose numbers (uncorrected for visibility) increased 30% compared to 2006 and were 140% above the long-term average (Table 7, Figure 7). The VCF for Canada geese was 1.47, 46% lower than 2006 and 40% below the long-term average. The population estimate of Canada geese, adjusted for visibility, decreased 30% (Table 7, Figure 8). The number of Canada goose broods seen during the survey declined 45% from 2006. This was likely the result of well-below normal temperatures recorded the first 2 weeks in April when many geese were in the egg-laying phase and un-incubated eggs were likely frozen.

The estimated coot population was 6,300, which was 81% below the long-term average.

## SUMMARY

Overall wetland conditions were improved slightly from 2006 and similar to the long-term average. Numbers of Type 1 wetlands decreased but numbers of Types II-V increased. Mallard abundance in 2007 (242,000) increased significantly ( $P=0.03$ ) from 2006 (161,000) and was 9% above the long-term average (222,000) but 23% below the 10-year (315,000). Blue-winged teal abundance (124,000) was lower than 2006 (174,000) but not significantly different ( $P=0.43$ ) and was 45% below the 10-year average (225,000) and 46% below the long-term average (227,000). Duck abundance for most other species declined relative to 2006. Total duck abundance (489,000), excluding scaup, declined 6% from 2006 and was 37% below the 10-year average and 22% below the long-term average. Canada goose numbers, unadjusted for visibility bias, increased 30% from 2006 and were 17% above the 10-year average.

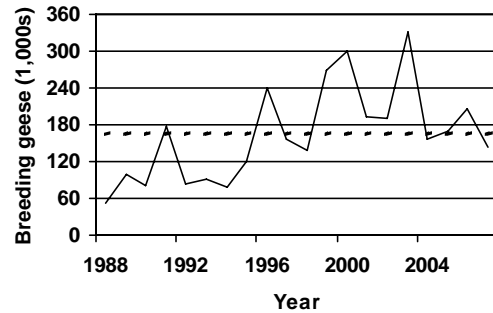


Figure 8. Canada goose population estimates (adjusted for visibility bias) and long-term average in Minnesota, 1988-2007.

## **ACKNOWLEDGMENTS**

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Table 1. Survey design for Minnesota, May 2007.<sup>1</sup>

	Stratum			Total
	1	2	3	
<b><u>Survey design</u></b>				
Square miles in stratum	5,075	7,970	17,671	30,716
Square miles in sample - waterfowl	182.75	136.375	203.125	522.25
Square miles in sample - ponds	91.375	68.1875	101.5625	261.125
Linear miles in sample	731.0	545.5	812.5	2,089.0
Number of transects in sample	39	36	40	115
Minimum transect length (miles)	5	6	7	5
Maximum transect length (miles)	36	35	39	39
Expansion Factor - waterfowl	27.770	58.442	86.996	
Expansion Factor - ponds	55.540	116.884	173.991	
<b><u>Current year coverage</u></b>				
Square miles in sample - waterfowl	182.75	136.375	203.125	522.25
Square miles in sample - ponds	91.375	68.1875	101.5625	261.125
Linear miles in sample	731.0	545.5	812.5	2,089.0
Number of transects in sample	39	36	40	115
Minimum transect length (miles)	5	6	7	5
Maximum transect length (miles)	36	35	39	39
Expansion Factor - waterfowl	27.770	58.442	86.996	
Expansion Factor - ponds	55.540	116.884	173.991	

<sup>1</sup> Also, 8 additional air-ground transects (total linear miles = 202.5, range - 10-60 miles) were flown to use in calculating the VCF.

Table 2. Estimated number of May ponds (Type 1 and Types II-V) during Minnesota waterfowl breeding population survey, 1968-2007.

Year	Type I	Number of ponds <sup>1</sup>
1968		272,000
1969		358,000
1970		276,000
1971		277,000
1972		333,000
1973		251,000
1974		322,000
1975		175,000
1976		182,000
1977		91,000
1978		215,000
1979		259,000
1980		198,000
1981		150,000
1982		269,000
1983		249,000
1984		264,000
1985		274,000
1986		317,000
1987		178,000
1988		160,000
1989		203,000
1990		184,000
1991	82,862	237,000
1992	10,019	225,000
1993	199,870	274,000
1994	123,958	294,000
1995	140,432	272,000
1996	147,859	330,000
1997	30,751	310,000
1998	20,560	243,000
1999	152,747	301,000
2000	5,090	204,000
2001	66,444	303,000
2002	30,602	254,000
2003	34,005	244,000
2004	9,494	198,000
2005	30,764	241,000
2006	56,798	211,000
2007	32,415	262,000
10-year average (1996-2006)	53,192	258,000
Long-term average (1968-2006)	71,391	246,000
<b>Change from:</b>		
2006	-43%	24%
10-year average	-39%	2%
Long-term average	-55%	7%

<sup>1</sup>Type II-V, correction factor from 1989 (123,000/203,000=0.606) used to adjust 1968-88 pond numbers. Ponds counted on 0.125 mile wide transect after 1988.

Table 3. Minnesota waterfowl breeding populations by species for Stratum I (high wetland density), expanded for area but not visibility, 1989-2007.

Species	Year																			
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	
<b>Dabblers:</b>																				
Mallard	26,659	29,686	25,854	28,770	23,327	22,160	20,494	25,104	26,992	33,157	26,576	26,604	28,742	29,297	25,937	29,381	19,050	16,829	16,357	
Black Duck	0	0	56	0	0	56	0	0	0	0	0	0	0	0	0	0	56	0	0	
Gadwall	722	2,694	2,721	2,777	778	444	1,055	1,083	611	1,111	1,777	833	1,333	944	1,250	2,111	1,166	1,444	889	
American Wigeon	83	222	0	56	0	0	194	0	0	56	56	56	111	0	56	555	167	0	56	
Green-winged Teal	0	0	56	0	111	278	0	278	56	333	0	278	56	278	222	444	56	56	167	
Blue-winged Teal	14,218	23,771	15,940	15,274	10,358	9,164	7,609	6,720	6,387	8,220	6,998	11,247	7,387	14,218	9,664	23,771	9,303	5,665	5,332	
Northern Shoveler	722	778	1,777	1,000	111	278	111	1,277	1,500	500	555	1,055	305	1,277	278	1,166	333	167	56	
Northern Pintail	222	444	389	222	611	167	167	167	111	111	167	167	389	56	111	56	0	56	0	
Wood Duck	8,303	14,468	10,775	10,941	11,636	7,359	6,831	6,498	9,497	12,302	5,582	10,219	6,720	2,888	4,499	8,081	5,498	3,555	2,666	
Dabbler Subtotal	50,929	72,063	57,568	59,040	46,932	39,906	36,461	41,127	45,154	55,790	41,711	50,459	45,043	48,958	42,017	65,565	35,629	27,772	25,523	
<b>Divers:</b>																				
Redhead	2,638	3,305	2,555	3,499	1,416	1,972	639	722	778	944	500	583	1,444	750	333	805	666	666	916	
Canvasback	2,888	1,972	2,305	2,111	2,777	3,166	3,860	1,166	1,333	1,777	2,971	1,222	2,027	1,833	1,333	666	972	833	1,000	
Scaup	14,024	8,970	9,858	23,854	6,748	19,661	7,192	13,829	3,416	9,247	1,750	7,415	5,832	2,444	2,055	5,971	4,110	111	555	
Ring-necked Duck	1,500	1,638	1,777	4,721	2,222	3,582	1,583	3,166	2,694	2,749	2,360	4,776	2,444	2,777	1,361	5,165	1,722	2,055	1,555	
Goldeneye	167	56	0	222	111	222	111	167	0	111	56	56	333	111	0	222	222	56	222	
Bufflehead	583	0	333	722	0	444	56	278	0	56	111	56	111	222	111	389	167	222	56	
Ruddy Duck	722	1,500	361	500	1,250	639	167	139	528	11,052	972	0	83	1,305	417	305	1,222	305	0	
Hooded Merganser	0	139	0	444	222	111	278	611	555	389	722	500	722	555	333	278	333	555	111	
Large Merganser	0	0	56	111	0	56	0	0	56	0	0	0	111	0	972	0	111	0	278	
Diver Subtotal	22,522	17,580	17,245	36,184	14,746	29,853	13,886	20,078	9,360	26,325	9,442	14,608	13,107	9,997	6,915	13,801	9,525	4,803	4,693	
<b>Total Ducks</b>	73,451	89,643	74,813	95,224	61,678	69,759	50,347	61,205	54,514	82,115	51,153	65,067	58,150	58,955	48,932	79,366	45,154	32,575	30,216	
<b>Other:</b>																				
Coot	22,799	27,326	11,108	11,386	1,166	528	611	3,055	5,054	555	83	3,999	1,722	2,888	2,666	21,411	2,444	639	139	
Canada Goose	14,663	16,523	9,803	10,914	13,135	12,802	14,413	12,774	10,330	16,967	19,495	22,160	24,882	24,104	22,160	23,160	22,938	21,633	29,797	

Table 4. Minnesota waterfowl breeding populations by species for Stratum II (medium wetland density), expanded for area but not visibility, 1989-2007.

Species	Year																		
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
<b>Dabblers:</b>																			
Mallard	42,896	39,682	39,215	45,585	37,111	42,896	42,896	48,507	54,643	53,942	52,247	49,559	44,650	43,773	34,715	44,474	26,883	25,130	24,779
Black Duck	0	0	0	0	0	0	0	0	0	0	0	0	117	0	0	0	0	0	0
Gadwall	1,344	2,805	1,870	2,045	1,286	1,403	1,052	935	468	584	1,519	3,039	1,636	701	584	3,565	584	1,052	234
American Wigeon	0	234	701	351	0	117	0	468	351	818	0	468	0	0	0	2,513	117	0	0
Green-winged Teal	117	0	0	0	351	117	0	935	234	351	117	117	117	468	234	234	0	117	0
Blue-winged Teal	25,189	31,208	24,663	26,766	18,818	19,227	10,636	13,851	13,792	13,208	10,578	19,637	9,701	21,390	15,955	30,624	11,513	9,000	8,416
Northern Shoveler	2,338	2,104	3,857	1,636	1,286	935	818	1,636	2,571	701	2,104	4,675	1,052	2,221	1,403	1,753	234	584	351
Northern Pintail	701	701	701	234	351	468	234	117	234	468	117	117	117	0	117	0	0	0	234
Wood Duck	10,578	14,903	8,065	11,221	9,468	9,409	6,662	8,708	11,338	10,520	19,753	13,792	7,831	5,143	4,558	8,766	3,273	1,753	2,221
Dabbler subtotal	83,163	91,637	79,072	87,838	68,671	74,572	62,298	75,157	83,631	80,592	86,435	91,404	65,221	73,696	57,566	91,929	42,604	37,636	36,235
<b>Divers:</b>																			
Redhead	1,636	4,325	1,519	3,097	2,279	3,799	1,403	1,110	1,987	935	1,636	2,805	2,455	234	584	1,110	292	175	935
Canvasback	584	234	117	0	584	1,052	0	234	701	117	117	935	0	468	1,052	234	0	0	1,169
Scaup	25,598	25,189	13,383	22,208	877	14,085	7,831	21,916	18,935	4,032	3,331	6,779	3,039	5,961	2,279	7,188	2,981	468	643
Ring-necked Duck	3,214	2,513	2,104	2,922	3,156	3,331	1,403	7,714	3,565	2,279	2,221	5,610	3,799	6,370	2,455	5,377	1,929	3,331	1,578
Goldeneye	935	351	818	351	584	701	701	1,753	818	234	935	584	468	234	234	351	117	117	0
Bufflehead	701	234	0	526	117	234	0	117	117	0	0	0	0	1,169	117	468	351	117	117
Ruddy Duck	3,390	1,227	4,558	1,227	3,390	409	117	58	117	0	468	0	0	1,870	2,688	0	351	58	0
Hooded Merganser	0	0	0	351	584	468	117	234	468	117	701	935	1,403	701	701	234	234	351	234
Large Merganser	0	0	0	117	0	0	0	0	0	0	0	117	117	0	0	234	351	0	0
Diver subtotal	36,058	34,073	22,499	30,799	11,571	24,079	11,572	33,136	26,708	7,714	9,409	17,765	11,281	17,007	10,110	15,196	6,606	4,617	4,676
<b>Total Ducks</b>	119,221	125,710	101,571	118,637	80,242	98,651	73,870	108,293	110,339	88,306	95,844	109,169	76,502	90,703	67,676	107,125	49,210	42,253	40,911
<b>Other:</b>																			
Coot	3,740	11,630	5,552	11,162	5,201	1,461	526	7,013	5,026	643	234	1,110	468	4,909	1,519	8,007	584	292	409
Canada Goose	10,227	11,279	8,591	7,305	9,409	12,565	12,682	13,559	16,364	19,812	18,585	25,831	24,604	20,688	22,091	28,461	20,688	26,825	25,890

Table 5. Minnesota waterfowl breeding populations by species for Stratum III (low wetland density), expanded for area but not visibility, 1989-2007.

Species	Year																		
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
<b>Dabblers:</b>																			
Mallard	54,807	71,511	63,246	69,771	63,333	73,425	79,166	79,862	78,993	101,873	90,390	81,690	72,642	72,121	55,156	84,561	36,539	30,884	35,843
Black Duck	0	174	0	0	0	0	0	0	0	0	0	0	0	0	0	174	0	0	174
Gadwall	5,220	8,787	2,262	2,436	1,218	2,610	3,306	3,306	2,436	3,045	2,436	2,610	10,701	3,306	1,566	6,960	2,001	5,568	4,176
American Wigeon	174	957	696	522	348	1,218	0	1,044	348	696	0	522	174	1,218	174	1,566	1,044	174	348
Green-winged Teal	522	0	348	0	348	174	0	957	348	174	0	1,218	1,392	522	174	0	174	522	0
Blue-winged Teal	50,893	52,198	50,893	51,067	35,494	41,932	29,492	36,625	25,316	26,360	18,530	29,405	20,618	56,374	21,140	39,758	27,578	23,663	15,659
Northern Shoveler	6,264	23,663	5,568	11,048	1,914	2,784	5,307	12,701	11,049	4,176	4,002	20,444	10,701	6,264	870	3,828	348	522	870
Northern Pintail	696	696	1,914	870	1,218	696	174	870	522	870	870	696	522	0	174	348	174	174	348
Wood Duck	23,141	25,055	17,747	24,185	25,229	23,228	16,355	27,926	14,268	23,837	20,531	25,055	17,225	13,572	12,702	20,705	7,482	7,308	5,394
Dabbler subtotal	141,717	183,041	142,674	159,899	129,102	146,067	133,800	163,291	133,280	161,031	136,759	161,640	133,975	153,377	91,956	157,900	75,340	68,815	62,812
<b>Divers:</b>																			
Redhead	2,175	3,219	2,610	6,438	1,827	2,958	7,134	1,044	1,044	2,001	3,480	2,523	3,654	1,305	174	1,740	1,479	0	522
Canvasback	174	1,044	696	0	348	696	174	1,392	0	3,306	174	3,915	522	696	1,131	2,784	0	0	348
Scaup	32,276	5,916	17,486	20,009	4,176	23,924	13,397	29,840	8,787	15,137	8,961	18,182	6,873	4,611	783	17,747	5,307	1,392	696
Ring-necked Duck	2,088	2,088	3,480	3,654	2,871	5,568	1,044	12,875	3,654	2,958	1,479	8,178	8,526	7,395	1,479	5,133	10,179	6,699	1,392
Goldeneye	870	609	696	1,044	696	783	1,479	1,914	522	696	696	1,044	1,566	3,132	1,305	696	1,044	1,044	870
Bufflehead	1,392	0	552	696	348	696	0	1,044	174	348	0	0	0	1,218	783	2,088	0	174	696
Ruddy Duck	1,305	1,218	9,396	6,786	1,218	2,175	2,349	1,740	348	0	174	0	696	18,878	87	2,262	870	696	261
Hooded Merganser	0	174	348	348	348	696	1,044	1,566	696	696	1,218	957	174	2,175	174	1,740	1,218	870	174
Large Merganser	0	0	0	348	0	174	174	0	0	0	0	0	0	522	0	0	261	957	348
Diver subtotal	40,280	14,268	35,264	39,323	11,832	37,670	26,795	51,415	15,225	25,142	16,182	34,799	22,011	39,932	5,916	34,190	20,358	11,832	5,307
<b>Total Ducks</b>	181,997	197,309	177,938	199,222	140,934	183,737	160,595	214,706	148,505	186,173	152,941	196,439	155,986	193,309	97,872	192,090	95,698	80,647	68,119
<b>Other:</b>																			
Coot	24,794	11,918	47,587	62,463	12,179	12,788	3,828	182,953	24,620	5,133	14,702	67,684	3,132	14,007	7,134	77,427	8,613	14,702	5,742
Canada Goose	27,056	30,623	23,837	15,746	21,314	23,228	30,971	34,537	33,755	42,368	41,933	57,940	39,932	33,407	43,412	46,717	39,758	27,230	42,629

Table 6. Minnesota waterfowl breeding populations by species for Stratum I-III combined, expanded for area coverage but not for visibility, 1989-2007.

Species	Year																		
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
<b>Dabblers:</b>																			
Mallard	124,362	140,879	128,315	144,126	123,771	138,481	142,556	153,473	160,628	188,972	169,213	157,853	146,034	145,191	115,974	158,416	82,472	72,843	76,979
Black Duck	0	174	56	0	0	56	0	0	0	0	0	0	117	0	0	174	56	0	174
Gadwall	7,286	14,286	6,853	7,258	3,282	4,457	5,413	5,324	3,515	4,740	5,733	6,482	13,670	4,951	3,400	12,635	3,752	8,064	5,298
American Wigeon	257	1,413	1,397	929	348	1,335	194	1,512	699	1,570	56	1,045	285	1,218	230	4,634	1,327	174	404
Green-winged Teal	639	0	404	0	810	569	0	2,170	638	858	117	1,613	1,564	1,267	630	678	230	694	167
Blue-winged Teal	90,300	107,177	91,496	93,107	64,670	70,323	47,737	57,196	45,495	47,788	36,106	60,288	37,706	91,982	46,759	94,152	48,394	38,328	29,407
Northern Shoveler	9,324	26,545	11,202	13,684	3,311	3,997	6,236	15,614	15,120	5,377	6,661	26,175	12,058	9,762	2,550	6,747	915	1,273	1,276
Northern Pintail	1,619	1,841	3,004	1,326	2,180	1,331	575	1,154	867	1,449	1,153	979	1,028	56	402	404	174	230	582
Wood Duck	42,022	54,426	36,587	46,347	46,333	39,996	29,848	43,132	35,103	46,659	45,866	49,067	31,777	21,603	21,759	37,553	16,253	12,616	10,281
Dabbler subtotal	275,809	346,741	279,314	306,777	244,705	260,545	232,559	279,575	262,065	297,413	264,905	303,502	244,239	276,030	191,704	315,393	153,573	134,222	124,568
<b>Divers:</b>																			
Redhead	6,449	10,849	6,684	13,034	5,522	8,729	9,176	2,876	3,809	3,880	5,616	5,911	7,552	2,289	1,092	3,656	2,438	842	2,373
Canvasback	3,646	3,250	3,118	2,111	3,709	4,914	4,034	2,792	2,034	5,200	3,262	6,072	2,549	2,996	3,516	3,684	972	833	2,517
Scaup	71,898	40,075	40,727	66,071	11,801	57,670	28,420	65,585	31,138	28,416	14,041	32,376	15,743	13,016	5,117	30,906	12,397	1,971	1,894
Ring-necked Duck	6,802	6,239	7,361	11,297	8,249	12,481	4,030	23,755	9,913	7,986	6,060	18,565	14,768	16,542	5,294	15,675	13,829	12,085	4,525
Goldeneye	1,972	1,016	1,514	1,617	1,391	1,706	2,291	3,834	1,340	1,041	1,687	1,684	2,367	3,477	1,539	1,269	1,383	1,216	1,092
Bufflehead	2,676	234	885	1,944	465	1,374	56	1,439	291	404	111	56	111	2,609	1,011	2,944	517	513	868
Ruddy Duck	5,417	3,945	14,315	8,513	5,858	3,223	2,633	1,937	993	11,052	1,613	0	779	22,054	3,192	2,567	2,443	1,060	261
Hooded Merganser	0	313	348	1,143	1,154	1,275	1,439	2,411	1,719	1,202	2,641	2,392	2,299	3,432	1,209	2,251	1,785	1,776	519
Large Merganser	0	0	56	576	0	230	174	0	56	0	0	117	228	522	972	234	723	957	626
Diver subtotal	98,860	65,921	75,008	106,306	38,149	91,602	52,253	104,629	51,293	59,181	35,031	67,173	46,396	66,937	22,942	63,186	36,487	21,253	14,675
<b>Total Ducks</b>	<b>374,669</b>	<b>412,662</b>	<b>354,322</b>	<b>413,083</b>	<b>282,854</b>	<b>352,147</b>	<b>284,812</b>	<b>384,204</b>	<b>313,358</b>	<b>356,594</b>	<b>299,936</b>	<b>370,675</b>	<b>290,635</b>	<b>342,967</b>	<b>214,646</b>	<b>378,579</b>	<b>190,060</b>	<b>155,475</b>	<b>139,243</b>
<b>Other:</b>																			
Coot	51,333	50,874	64,247	85,011	18,546	14,777	4,965	193,021	34,700	6,331	15,020	72,793	5,321	21,804	11,319	106,845	11,641	15,633	6,290
Canada Goose	51,946	58,425	42,231	33,965	43,858	48,595	58,066	60,870	60,449	79,147	80,012	105,932	89,418	78,200	87,663	98,339	83,384	75,688	98,316

Table 7. Estimated waterfowl populations during the Minnesota Waterfowl breeding population survey, 1968-2007.

Year	Mallard				Blue-winged teal				Other ducks (exc. scaup)		
	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI
1968 <sup>2</sup>	41,030	2.04	83,701		61,943	2.44	151,141		41,419	2.08	86,152
1969 <sup>2</sup>	53,167	1.67	88,789		45,180	3.45	155,871		34,605	2.27	78,553
1970 <sup>2</sup>	67,463	1.69	113,945		31,682	5.06	160,343		30,822	1.62	49,932
1971 <sup>2</sup>	47,702	1.65	78,470		42,445	3.49	148,218		29,520	1.71	50,450
1972 <sup>2</sup>	49,137	1.27	62,158		49,386	1.96	96,895		34,405	1.69	58,127
1973 <sup>3</sup>	56,607	1.76	99,832		53,095	3.92	208,292		33,155	2.45	81,362
1974 <sup>3</sup>	44,866	1.62	72,826		39,402	2.59	102,169		38,266	2.79	106,609
1975	55,093	3.19	175,774		45,948	3.95	181,375		34,585	3.31	114,459
1976	69,844	1.69	117,806		89,370	4.87	435,607		39,022	3.35	130,669
1977	60,617	2.21	134,164		37,391	3.86	144,187		18,633	11.95	222,748
1978	56,152	2.61	146,781		28,491	8.53	242,923		22,034	3.30	72,798
1979	61,743	2.57	158,704	28,668	46,708	5.21	243,167	62,226	39,749	3.79	150,545
1980	83,775	2.05	171,957	22,312	50,966	6.49	330,616	40,571	47,322	3.97	188,020
1981	79,562	1.95	154,844	16,402	64,546	2.59	167,258	23,835	30,947	3.80	117,667
1982	51,655	2.33	120,527	17,078	42,772	4.75	203,167	34,503	32,726	4.32	141,501
1983	73,424	2.12	155,762	15,419	42,728	2.81	119,980	20,809	32,240	2.84	91,400
1984	94,514	1.99	188,149	24,065	89,896	2.82	253,821	33,286	40,326	2.18	87,709
1985	96,045	2.26	216,908	32,935	90,453	2.91	263,607	33,369	35,018	2.35	82,383
1986	108,328	2.16	233,598	30,384	68,235	2.69	183,338	28,204	38,900	2.67	103,851
1987	165,881	1.16	192,289	23,500	102,480	1.99	203,718	32,289	76,746	2.51	192,947
1988	155,543	1.75	271,718	38,675	101,183	2.38	240,532	39,512	81,514	2.61	212,988
1989	124,362	2.19	272,968	26,508	90,300	3.16	285,760	39,834	88,109	2.89	254,887
1990	140,879	1.65	232,059	26,316	107,177	3.09	330,659	44,455	124,531	1.97	245,152
1991	128,315	1.75	224,953	28,832	91,496	2.90	265,138	42,057	93,784	2.81	263,619
1992	144,126	2.50	360,870	43,621	93,107	3.83	356,679	53,619	109,779	2.33	255,774
1993	123,771	2.47	305,838	31,103	64,670	4.02	260,070	36,307	82,612	3.28	271,263
1994	138,482	3.08	426,455	66,240	70,324	5.48	385,256	82,580	85,671	3.55	303,847
1995	142,557	2.24	319,433	48,124	47,737	4.40	210,043	40,531	66,096	4.05	267,668
1996	153,473	2.05	314,816	53,461	57,196	5.05	288,913	64,064	107,950	2.64	285,328
1997	160,629	2.54	407,413	65,771	45,496	5.57	253,408	67,526	76,095	2.72	207,316
1998	188,972	1.95	368,450	61,513	47,788	3.66	174,848	33,855	91,478	1.64	149,786
1999	169,213	1.87	316,394	51,651	36,106	4.53	163,499	36,124	80,459	2.49	200,570
2000	157,853	2.02	318,134	36,857	60,288	2.97	179,055	32,189	120,158	2.09	250,590
2001	146,034	2.20	320,560	39,541	37,706	3.60	135,742	19,631	91,152	2.85	260,051
2002	145,191	2.53	366,625	46,264	91,982	4.67	429,934	87,312	92,778	4.04	374,978
2003	115,974	2.42	280,517	34,556	46,759	4.13	193,269	36,176	46,796	5.30	248,019
2004	158,416	2.37	375,313	57,591	94,152	3.75	353,209	56,539	95,105	2.94	279,802
2005	82,472	2.89	238,500	28,595	48,394	4.01	194,125	37,358	46,797	4.26	199,355
2006	72,843	2.21	160,715	24,230	38,328	4.53	173,674	60,353	42,333	4.41	186,719
2007	76,979	3.15	242,481	30,020	29,407	4.20	123,588	20,055	30,963	3.73	115,390
<b>Averages:</b>											
10-year (1997-2006)	139,760	2.30	315,262	44,657	54,700	4.14	225,076	46,706	78,315	3.27	235,719
Long-term (1968-2006)	104,249	2.12	221,762	36,436	61,367	3.90	227,423	43,540	60,350	3.17	177,579
<b>% change from:</b>											
2006	6%	43%	51%	24%	-23%	-7%	-29%	-67%	-27%	-15%	-38%
10-year average	-45%	37%	-23%	-33%	-46%	1%	-45%	-57%	-60%	14%	-51%
Long-term average	-26%	49%	9%	-18%	-52%	8%	-46%	-54%	-49%	18%	-35%

<sup>1</sup> Unad. PI - unadjusted population index, VCF - Visibility Correction Factor, PI - adjusted population index, SE - standard error.

<sup>2</sup> Calculated from data in Waterfowl breeding ground survey reports, 1968 through 1972, from Minn. Game Res. Quarterly Reps. 1968 and 1969 other duck VCF is total duck VCF.

<sup>3</sup> Calculated from data in Maxson and Pace (1989).

Table 7. Cont.

Year	Scaup			Total ducks (ex. scaup)		Total Ducks		Canada geese		
	Unad. PI	VCF	PI	Unad. PI	PI	Unad. PI	PI	Unad. PI	VCF	PI
1968	22,834	2.08	47,495	144,392	320,994	167,226	368,488			
1969	9,719	2.27	22,062	132,952	323,213	142,671	345,275			
1970	12,105	1.62	19,610	129,967	324,219	142,072	343,829			
1971	5,713	1.71	9,764	119,667	277,137	125,380	286,901			
1972	12,062	1.69	20,379	132,928	217,181	144,990	237,560	366		
1973	10,633	2.45	26,093	142,857	389,486	153,490	415,580	1,965		
1974	18,378	2.79	51,201	122,534	281,605	140,912	332,806	8,835		
1975	9,563	3.31	31,649	135,626	471,608	145,189	503,257	5,997		
1976	22,494	3.35	75,323	198,236	684,082	220,730	759,405	5,409		
1977	2,971	11.95	35,517	116,641	501,099	119,612	536,616	7,279		
1978	14,774	3.35	48,812	106,677	462,502	121,451	511,314	7,865		
1979	92,134	3.79	348,948	148,200	552,416	240,334	901,364	4,843		
1980	12,602	3.97	50,070	182,063	690,593	194,665	740,663	6,307		
1981	19,844	3.88	75,451	175,055	439,769	194,899	515,220	10,156		
1982	21,556	4.32	93,204	127,153	465,195	148,709	558,399	6,600		
1983	9,551	2.84	27,077	148,392	367,142	157,943	394,219	11,081		
1984	15,683	2.18	34,111	224,736	529,679	240,419	563,790	14,051		
1985	7,409	2.35	17,430	221,516	562,898	228,925	580,328	16,658		
1986	6,247	2.67	16,678	215,463	520,787	221,710	537,465	19,599		
1987	10,306	2.51	25,910	345,107	588,954	355,413	614,864	29,960		
1988	10,545	2.61	27,553	338,240	725,238	348,785	752,791	39,057	1.36	53,004
1989	71,898	2.89	207,991	302,771	813,615	374,669	1,021,606	51,946	1.88	97,898
1990	40,075	1.97	78,892	372,587	807,870	412,662	886,761	58,425	1.37	80,147
1991	40,727	2.81	114,480	313,595	753,710	354,322	868,191	42,231	4.18	176,465
1992	66,071	2.33	153,939	347,012	973,323	413,083	1,127,262	33,965	2.43	82,486
1993	11,801	3.28	38,750	271,053	837,172	282,854	875,921	43,858	2.08	91,369
1994	57,670	3.55	204,536	294,477	1,115,558	352,147	1,320,095	48,595	1.68	77,878
1995	28,421	4.05	115,096	256,390	797,144	284,811	912,241	58,065	2.08	120,775
1996	65,585	2.64	173,351	318,619	889,057	384,204	1,062,408	60,870	3.92	238,708
1997	31,138	2.72	84,834	282,220	868,137	313,358	952,971	60,449	2.59	156,817
1998	28,416	1.64	46,528	328,238	693,084	356,654	739,612	79,147	1.75	138,507
1999	14,041	2.49	35,002	285,778	680,463	299,819	715,465	80,012	3.35	268,168
2000	32,376	2.10	67,520	338,299	747,779	370,675	815,299	105,932	2.84	301,298
2001	15,743	2.85	44,914	274,892	716,353	290,653	761,267	89,418	2.17	193,887
2002	13,016	4.04	52,606	327,951	1,171,537	340,967	1,224,143	78,200	2.42	189,353
2003	5,117	5.30	27,120	209,529	721,805	214,646	748,925	87,663	3.78	331,094
2004	30,906	2.94	90,926	347,673	1,008,324	378,579	1,099,250	98,339	1.58	155,859
2005	12,397	3.98	49,340	177,663	631,980	190,060	681,320	83,384	2.02	168,469
2006	1,971	4.22	8,322	153,504	521,109	155,475	529,431	75,688	2.73	206,757
2007	1,894	3.73	7,058	137,349	488,517	139,243	495,575	98,316	1.47	144,289
<b>Averages:</b>										
10-year (1997-2006)	18,512	3.23	50,711	272,575	776,057	291,089	826,768	83,823	2.52	211,021
Long-term (1968-2006)	23,449	3.17	69,192	225,914	626,765	249,363	695,956	40,920	2.43	164,681
<b>% change from:</b>										
2006	-4%	-12%	-15%	-11%	-6%	-10%	-6%	30%	-46%	-30%
10-year average	-90%	16%	-86%	-50%	-37%	-52%	-40%	17%	-42%	-32%
Long-term average	-92%	18%	-90%	-39%	-22%	-44%	-29%	140%	-40%	-12%

<sup>1</sup> Unad. PI - unadjusted population index, VCF - Visibility Correction Factor, PI - adjusted population index, SE - standard error.



Appendix A. Temperature and precipitation at selected cities in, or adjacent to, Minnesota May Waterfowl Survey Strata, 29 April - 27 May 2007 (Source: Minnesota Climatological Working Group, <http://climate.umn.edu/cawap/nwssum/nwssum.asp>).

Region	City	Temperature (F) for week ending:										Precipitation					
		29-April		6-May		13-May		20-May		27-May		Total weekly precipitation (inches)					departure from normal
		Avg. <sup>1</sup>	Depart <sup>2</sup>	Avg. <sup>1</sup>	Depart <sup>2</sup>	Avg. <sup>1</sup>	Depart <sup>2</sup>	Avg. <sup>1</sup>	Depart <sup>2</sup>	Avg. <sup>1</sup>	Depart <sup>2</sup>	29-April	6-May	13-May	20-May	27-May	
NW	Crookston	54.7	7.2	56.8	5.8	60.5	6.3	58.2	1.1	53.4	-6.2	0.00	2.08	0.00	0.12	1.21	1.80
NC	Grand Rapids	54.0	7.9	54.4	5.1	59.7	7.4	53.9	-1.0	57.2	0.0	0.00	0.52	0.03	0.17	0.83	0.17
	Itasca	50.4	7.1	50.5	3.6	59.1	8.9	55.8	2.6	54.0	-1.8	0.02	0.39	0.00	0.11	2.60	2.07
WC	Alexandria	56.1	8.2	56.0	4.8	62.8	8.6	58.0	1.1	58.8	-0.5	0.00	0.61	0.00	0.27	0.16	-1.08
	Fergus Falls	53.2	4.9	57.3	5.7	61.6	6.9	60.0	2.6	57.8	-2.0	0.00	1.62	0.00	0.25	3.20	5.30
	Montevideo	56.2	6.7	59.5	6.7	64.6	8.7	62.4	3.6	61.1	-0.2	0.00	1.34	0.07	0.00	0.10	-1.81
	Morris	54.6	5.1	57.0	4.3	60.8	5.0	62.0	3.5	59.0	-2.0	0.56	1.02	0.00	0.10	0.03	0.54
C	Becker	57.2	8.5	58.2	6.4	62.1	7.5	62.8	5.6	60.8	1.4	0.00	0.41	0.44	0.00	1.03	-1.99
	Hutchinson	57.0	6.6	58.8	5.2	63.7	7.1	64.9	5.5	61.8	0.0	1.00	0.51	0.11	0.07	0.85	-0.73
	St. Cloud	57.2	8.5	56.5	4.7	62.8	8.2	58.6	1.4	61.2	1.8	0.00	0.29	0.07	0.00	1.22	-1.33
	Staples	53.0	5.8	54.7	4.4	58.9	5.8	58.6	3.0	55.5	-2.3	0.70	0.42	0.15	0.55	1.40	2.50
	Willmar	56.1	6.6	58.4	5.6	61.7	5.8	63.4	4.7	59.5	-1.7	2.71	0.79	0.24	0.00	0.10	1.23
EC	Aitkin	52.5	6.6	53.5	4.6	59.2	7.5	55.5	1.3	54.0	-2.6	1.50	0.42	0.00	0.55	0.70	0.10
	Cambridge	Missing															
	Msp Airport	60.2	8.8	60.1	5.7	66.2	9.0	61.9	2.1	64.0	1.8	0.01	0.40	0.21	0.12	0.74	-2.68
SW	Pipestone	53.5	4.0	60.4	7.8	63.8	8.3	62.2	4.0	59.4	-1.3	0.96	1.44	0.10	0.00	0.40	-0.88
	Redwood Falls	58.5	6.6	59.6	4.5	65.5	7.4	61.2	0.3	61.4	-2.0	0.00	1.53	0.25	0.47	0.17	-0.60
	Worthington	53.8	5.3	60.2	8.4	63.8	8.9	63.0	5.2	61.7	1.3	0.57	1.80	0.09	0.05	0.51	-0.63
SC	Faribault	56.0	7.0	57.5	5.4	63.7	8.6	62.2	4.3	59.3	-1.2	0.32	0.19	0.32	0.00	2.47	-1.66
	Waseca	56.0	6.1	60.8	7.7	64.0	7.8	62.6	3.6	60.8	-0.7	0.38	0.43	0.59	0.21	1.71	-1.92
	Winnebago	55.4	5.3	61.3	7.6	63.1	6.5	64.0	4.7	60.0	-1.9	0.43	0.87	0.12	0.53	1.05	-2.04
Statewide		54.6	6.4	56.7	5.4	61.6	7.3	58.7	1.8	58.3	-1.0	0.34	0.75	0.16	0.21	1.24	

<sup>1</sup> Average temperature (°F) for the week ending on the date shown.

<sup>2</sup> Departure from normal temperature.

m = missing data

Waterfowl information is taken from the U.S. Fish and Wildlife Service report *Waterfowl Population Status, 2007* by Pamela R. Garrettson, Timothy J. Moser, and Khristi Wilkins. The entire report is available on the Division of Migratory Bird Management home page (<http://www.fws.gov/migratorybirds/reports/reports.html>).

Table 1. Canada goose population indices (in thousands) of the eastern prairie flock, 1971-2007 (from: U.S. Fish and Wildlife Service. 2007. *Waterfowl population status, 2007*. U.S. Department of the Interior, Washington, D.C. U.S.A.).

Year	Population <sup>a,b</sup>
1971-72	125,000
1972-73	138,000
1973-74	120,000
1974-75	144,000
1975-76	216,000
1976-77	164,000
1977-78	180,000
1978-79	99,000
1979-80	n.a.
1980-81	125,000
1981-82	132,000
1982-83	155,000
1983-84	136,000
1984-85	158,000
1985-86	195,000
1986-87	203,000
1987-88	209,000
1988-89	210,000
1989-90	232,000
1990-91	212,000
1991-92	202,000
1992-93	157,000
1993-94	211,000
1994-95	205,000
1995-96	190,000
1996-97	199,000
1997-98	126,000
1998-99	207,000
1999-00	275,000
2000-01	215,000
2001-02	216,000
2002-03	229,000
2003-04	291,000
2004-05	255,000
2005-06	185,000
2006-07	218,000

<sup>a</sup> Surveys conducted in Spring.

<sup>b</sup> Indirect or preliminary estimate.

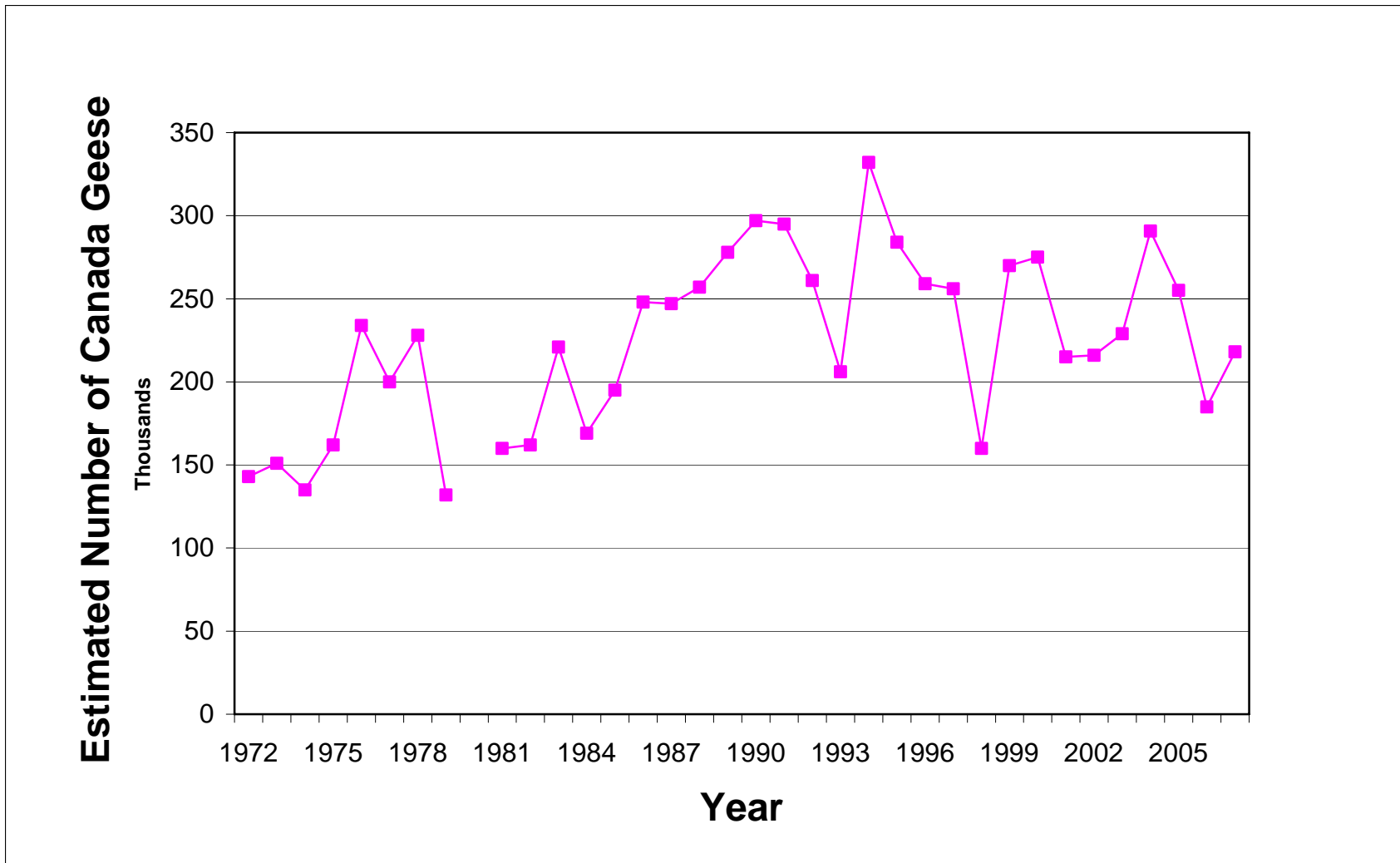


Figure 1. Breeding ground survey estimates of the Eastern Prairie Population of Canada geese, 1972-2007. (from: U.S. Fish and Wildlife Service. 2007. Waterfowl population status, 2007. U.S. Department of the Interior, Washington, D.C. U.S.A.). Surveys conducted in spring. Indirect or preliminary estimates. Data not available for 1980.

Table 2. Estimated number of May ponds (adjusted for visibility) in Prairie Canada (portions of Alberta, Saskatchewan and Manitoba) 1962-2007 and north-central U.S. (North Dakota, South Dakota and Montana) 1974-2007. (from: U.S. Fish and Wildlife Service. 2007. Waterfowl population status, 2007. U.S. Department of the Interior, Washington, D.C. U.S.A.)

Year	Ponds (thousands)	
	Prairie Canada	North Central U.S. <sup>a</sup>
1962	2,369	--
1963	2,482	--
1964	3,371	--
1965	4,379	--
1966	4,555	--
1967	4,691	--
1968	1,986	--
1969	3,548	--
1970	4,875	--
1971	4,053	--
1972	4,009	--
1973	2,950	--
1974	6,390	1,841
1975	5,320	1,911
1976	4,599	1,392
1977	2,278	771
1978	3,622	1,590
1979	4,859	1,522
1980	2,141	761
1981	1,443	683
1982	3,185	1,458
1983	3,906	1,259
1984	2,473	1,766
1985	4,283	1,327
1986	4,025	1,735
1987	2,524	1,348
1988	2,110	791
1989	1,693	1,290
1990	2,817	691
1991	2,494	706
1992	2,784	825
1993	2,261	1,351
1994	3,769	2,216
1995	3,893	2,443
1996	5,003	2,480
1997	5,061	2,397
1998	2,522	2,065
1999	3,862	2,842
2000	2,422	1,524
2001	2,747	1,893
2002	1,439	1,281
2003	3,522	1,668
2004	2,513	1,407
2005	3,921	1,461
2006	4,450	1,644
2007	5,040	1,963
Average	3,439	1,538

% Change in 2007 from:

2006	+ 13	+ 19
Long term Average	+ 47	+ 28

<sup>a</sup> No comparable survey data available for the north-central U.S. during 1961-73.

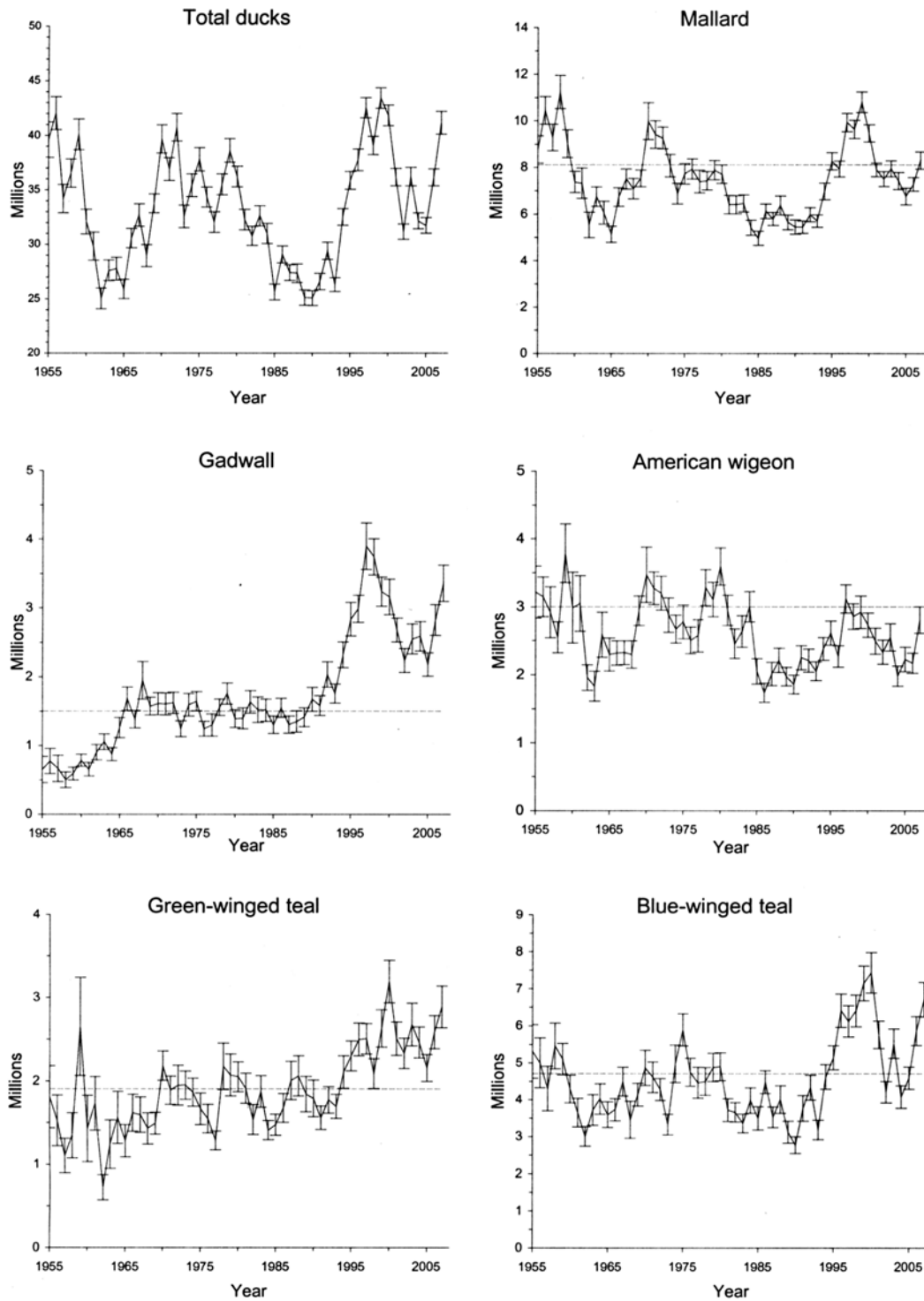


Figure 2. Estimates of North American breeding populations, 95% confidence intervals, and North American Waterfowl Management Plan population goal (dashed line) for selected species and number of water areas in May in Prairie Canada and Northcentral U.S. (from: U.S. Fish and Wildlife Service. 2007. Waterfowl population status, 2007. U.S. Department of the Interior, Washington, D.C. U.S.A.)

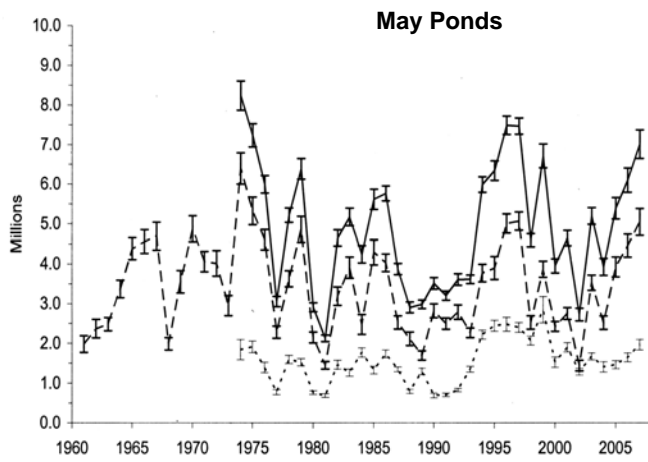
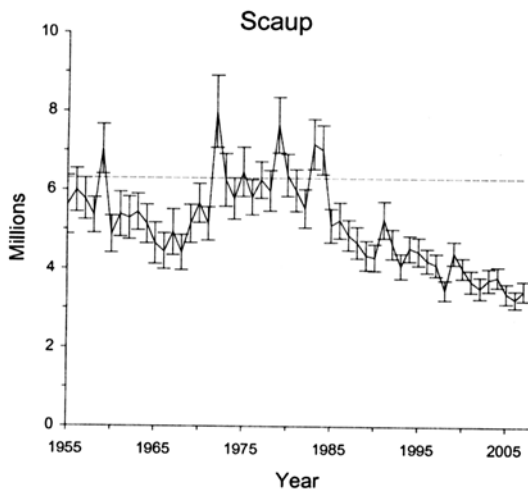
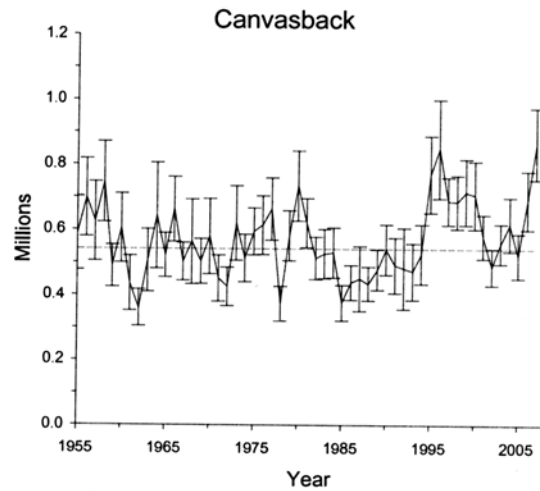
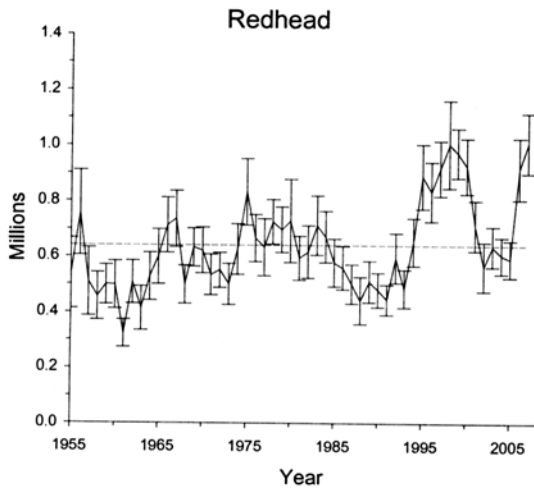
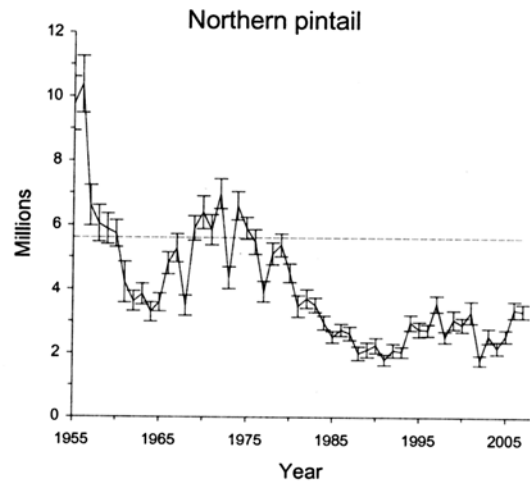
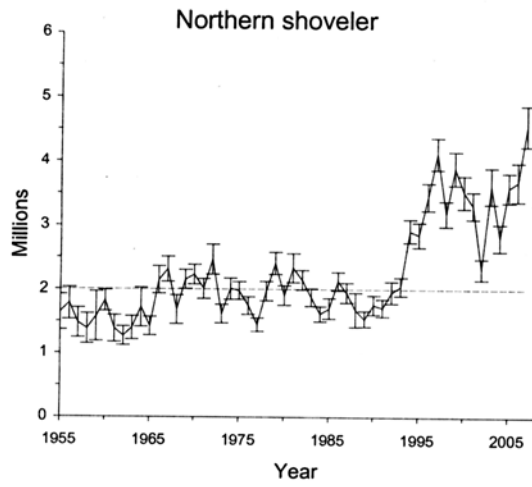


Figure 2. (continued).

# Minnesota Spring Canada Goose Survey, 2007

David Rave, Wetland Wildlife Populations and Research Group

## INTRODUCTION

This report presents results from the seventh year of a spring helicopter survey of resident Canada geese in Minnesota. The purpose of the survey is to produce a statewide population estimate with 95% Confidence Intervals.

## METHODS

The state was divided into three ecoregions (Prairie Parkland, Eastern Broadleaf Forest/Tallgrass Aspen Parklands, Laurentian Mixed Forest) hereafter referred to as Prairie, Transition, and Forest. The 7 county Metro area was excluded from the Transition ecoregion. Similarly, Lake and Cook Counties plus the Boundary Waters Canoe Area were excluded from the Forest ecoregion. Within each ecoregion, 900 ¼-section plots were randomly selected using ArcView.

The 900 plots in each ecoregion were divided into 3 strata based on habitat quality for resident geese. The 3 strata were defined as follows: 1) not nesting habitat – expect no geese, 2) limited nesting habitat – expect 1 or 2 pairs, 3) prime nesting habitat – expect 3 or more pairs. Stratification was based on National Wetland Inventory data and was done using ArcView. Strata were separated based on the total acres of type 3, 4, and 5 wetlands and rivers on the plot as described below:

### Prairie

No geese = Type 3-4-5 <0.5 acres and rivers <10 acres or plot is all water. (n = 476 plots).  
1-2 pairs = Type 3-4-5 > 0.5 acres but Type 3 <15 acres or Type 3-4-5 <0.5 acres and rivers >10 acres. (n = 344 plots).  
3+ pairs = Type 3 >15 acres, but plot is not all water. (n = 80 plots).

### Transition

No geese = Type 3-4-5 <1 acre and rivers <8 acres or plot is all water. (n = 377 plots).  
1-2 pairs = Type 3-4-5 = 1-25 acres or Type 3-4-5 >25 acres, but Type 3 <15 acres or Type 3-4-5 <1 acre and rivers >8 acres. (n = 428 plots).  
3+ pairs = Type 3-4-5 >25 acres, but Type 3 >15 acres and plot is not all water. (n = 95 plots).

### Forest

No geese = Type 3-4-5 <2 acres and rivers <2 acres or plot all water. (n = 510 plots).  
1-2 pairs = Type 3-4-5 >2 acres, but not all water or Type 3-4-5 <2 acres and rivers >2 acres. (n = 390 plots).  
3+ pairs = None.

Plots in the No geese strata are not flown. Each year 30 plots are randomly selected in each of the 5 remaining strata and these 150 plots are surveyed at low level using a helicopter. Ideally, the survey should be conducted during mid-incubation.

Pilot John Heineman and I flew the survey 23-28 April, while Jeff Lawrence flew with pilot Mike Trenholm on April 28, 2007. Canada geese seen within plot boundaries were recorded as singles, pairs, and groups. We also recorded whether singles and pairs were observed with a nest. The number of singles was doubled when the total number of geese per plot was calculated (unless 2 singles were observed to associate as a pair after being flushed).

## RESULTS AND DISCUSSION

The total Canada goose population estimate in the surveyed area for 2007 was 261,933 ( $\pm 80,167$ ). Adding 17,500 for the Twin Cities metro area (Cooper 2004) yields a statewide estimate of 279,433 (Table 1). Confidence Intervals were 30.6% of the estimate, which is somewhat above the target of 25.0%. The survey tallied 31.0% singles (after doubling, as noted above), 51.5% pairs, and 17.5% groups (Table 2). Typically, many of the pairs seen on this survey are not associated with nests and are likely nonbreeders. An index to nesting effort (i.e., "Productive Geese") can be obtained by combining singles (after doubling) and pairs associated with nests. In 2007, 36.2% of the geese seen were classified as Productive Geese (Table 2). While confidence intervals overlap among years, a linear trend line applied to these data suggests the population in the surveyed area has been stable to increasing over the 7 years of this survey (Figure 1).

The 2007 Canada goose estimate for the surveyed area was 27 % lower than the 2006 estimate. The largest declines in goose number estimates were from the Transition and Forest regions, whereas the Prairie region was similar to last year (Table 1). While the survey design is robust, results potentially could be influenced by other factors. While methods were the same as previous years, 2007 was the first year since the Canada goose survey was implemented that Steve Maxson was not the principle observer on the survey. The helicopter pilots were the same. We assume that essentially all the geese are observed using the helicopter and it is unlikely a change in observers had a strong influence on survey results. Weather conditions in 2007 were characterized by an early spring followed by a week of winter temperatures and storms. These conditions may have affected the distribution of breeding geese this spring, e.g. with more failed breeders off of wetlands where they may be less likely to be observed. Regardless of the reasons for the lower 2007 Canada goose population estimate, it remained 12 % above the state Canada goose population goal, and indicated that the goose population in the state is healthy.

Wetland and habitat quality were variable in the state this year. Water levels of wetlands in Prairie and Transition regions of the state appeared to be at normal to above normal levels, whereas water levels in wetlands in the Forest region were quite low. Further, a major cold front with temperatures well below freezing during the last week of March likely affected goose nests in the northern 2/3 of the state by freezing eggs in many nests. This will likely result in fewer and smaller goose broods in these parts of the state. I would expect average to above average Canada goose production in the southern 1/3, and less than average production in the rest of the state.

## ACKNOWLEDGEMENTS

Frank Martin (Univ. of MN) and Steve Maxson were instrumental in the design of this survey. Steve also was the principal observer during the first 6 years, and helped with the setup and logistics of this year's survey. Tim Loesch, Christopher Pouliot, and Shelly Buitenwerf set up the original 2,700 ¼-section plots using ArcView and were very helpful in getting the survey up and running in 2001. Shelly Buitenwerf provided GPS coordinates of plots to the pilot, and printed out maps of the 150 plots flown this year. John Giudice wrote the SAS program to analyze the survey data.

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Cooper, J. 2004. Canada goose program report 2004. Unpublished report. 20 pp.



Table 1. Spring Canada goose population estimates in Minnesota, 2001-2007.

Year	Prairie	Transition	Forest	Subtotal	95% CI	Metro	TOTAL
2001	77,360	95,470	92,390	265,220	69,500	20,000	<b>285,220</b>
2002	135,850	144,900	33,940	314,690	134,286	20,000	<b>334,690</b>
2003	106,520	121,290	56,420	284,230	78,428	20,000	<b>304,230</b>
2004	128,501	130,609	95,636	354,747	107,303	20,000	<b>374,747</b>
2005	113,939	149,286	57,529	320,754	90,541	17,500	<b>338,254</b>
2006	126,042	164,085	67,994	358,071	108,436	17,500	<b>375,571</b>
2007	137,151	99,274	25,509	261,933	80,167	17,500	<b>279,433</b>

Table 2. Percent of Canada Geese seen as singles, pairs, groups, and productive geese on the Minnesota Spring Canada Goose Survey, 2001-2006.

Year	Singles <sup>1</sup>	Pairs <sup>1</sup>	Groups	Productive Geese <sup>2</sup>
2001	27.0	63.9	9.1	36.4
2002	30.7	52.0	17.2	41.5
2003	27.9	58.2	13.9	29.3
2004	26.5	57.5	16.0	35.5
2005	33.0	50.2	16.8	40.7
2006	43.5	45.9	10.6	50.3
2007	31.0	51.5	17.5	36.2

<sup>1</sup>Numbers of singles and pairs were doubled before calculating proportions.

<sup>2</sup>Productive geese equals Singles + Pairs with nests.

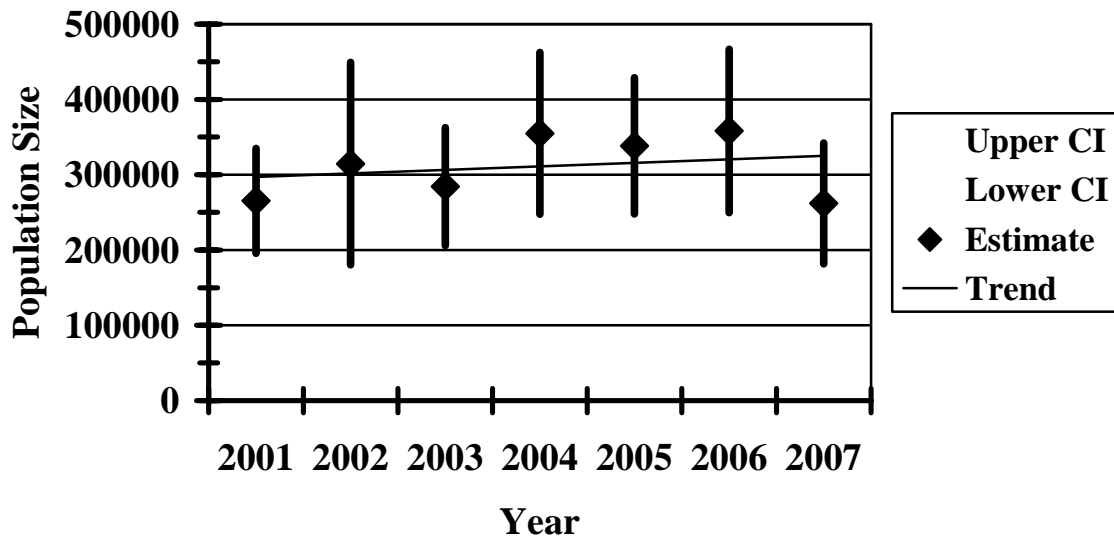


Figure 1. Spring Canada goose population estimates ( $\pm$ 95% CI) in Minnesota, 2001-2007. (Does not include Metro area.)

Mourning dove information is taken from the U.S. Fish and Wildlife Service report by Dolton, D.D., R.D. Rau, and K. Parker. 2007. *Mourning dove population status, 2007*. U.S. Fish and Wildlife Service, Laurel, Maryland, USA. 22 pp. The entire report is available on the Division of Migratory Bird Management home page <http://www.fws.gov/migratorybirds/reports/reports.html> .

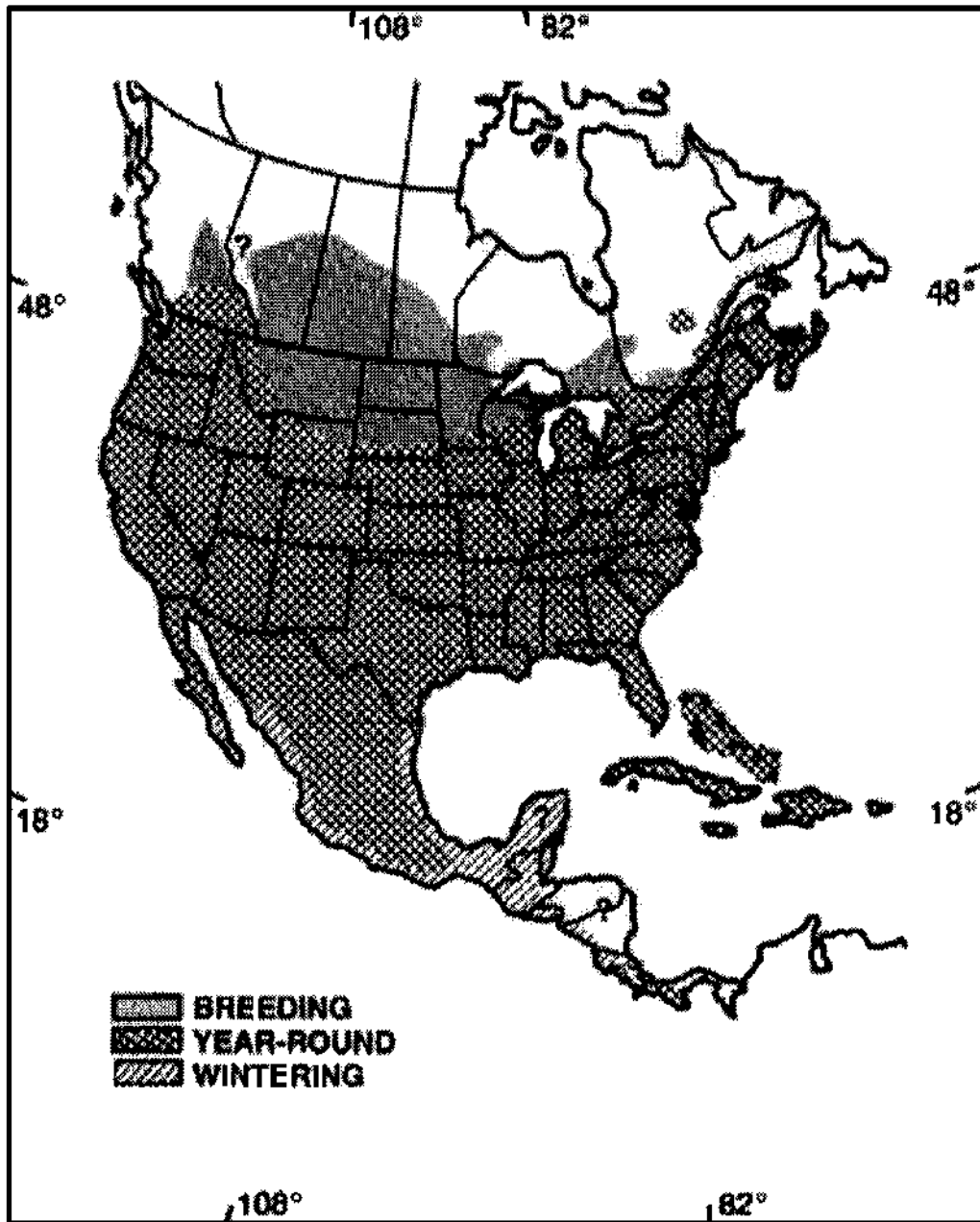


Figure 1. Breeding and wintering ranges of the mourning dove (adapted from Mirarchi and Baskett 1994). From: Mourning dove population status, 2007. Dolton, D.D., R.D. Rau, and K. Parker. 2007. U.S. Fish and Wildlife Service, Laurel, Maryland, USA. 22 pp.

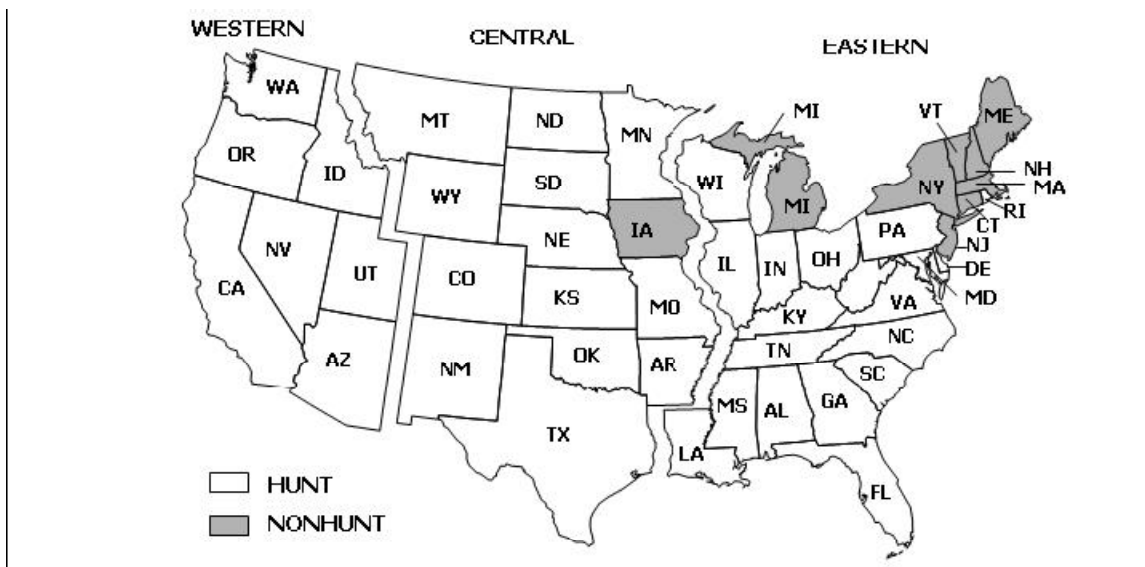


Figure 2. Mourning dove management units with 2006 hunting and nonhunting states. (From: Mourning dove population status, 2007. Dolton, D.D., R.D. Rau, and K. Parker. 2007. U.S. Fish and Wildlife Service, Laurel, Maryland, USA. 22 pp).

Table 1. Preliminary estimates of the number of hunters, days hunted, and total bag from Harvest Information Program surveys for the 2006-07 season. (From: Mourning dove population status, 2007. Dolton, D.D., R.D. Rau, and K. Parker. 2007. U.S. Fish and Wildlife Service, Laurel, Maryland, USA. 22 pp).

Management unit / State	Hunters	Days Hunted	Birds bagged
CENTRAL	470,800	1,605,900 ± 9%	8,887,000 ± 9%
AR	31,300 ± 16%	77,500 ± 18%	621,500 ± 20%
CO	19,800 ± 11%	45,700 ± 13%	270,300 ± 19%
KS	35,400 ± 8%	116,400 ± 11%	711,800 ± 12%
MN	8,000 ± 33%	24,200 ± 39%	50,000 ± 46%
MO	44,700 ± 7%	129,800 ± 12%	709,500 ± 15%
MT	1,800 ± 36%	3,900 ± 38%	14,800 ± 33%
NE	15,000 ± 12%	43,000 ± 12%	249,700 ± 12%
NM	7,100 ± 20%	33,900 ± 28%	226,900 ± 33%
ND	4,000 ± 23%	10,800 ± 24%	56,400 ± 25%
OK	36,100 ± 9%	108,300 ± 17%	704,400 ± 24%
SD	6,400 ± 16%	19,600 ± 17%	103,300 ± 18%
TX	258,900 ± 10%	986,200 ± 14%	5,138,700 ± 14%
WY	2,300 ± 29%	6,500 ± 36%	29,500 ± 37%

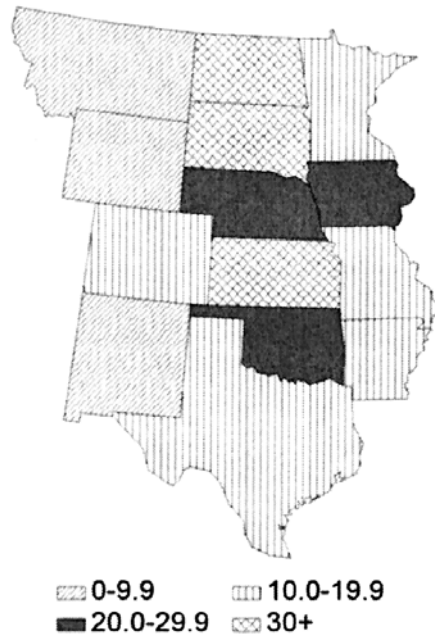


Figure 3. Mean number of mourning doves heard per route by state in the Central Management Unit, 2006-07. (From: Mourning dove population status, 2007. Dolton, D.D., R.D. Rau, and K. Parker. 2007. U.S. Fish and Wildlife Service, Laurel, Maryland, USA. 19 pp).

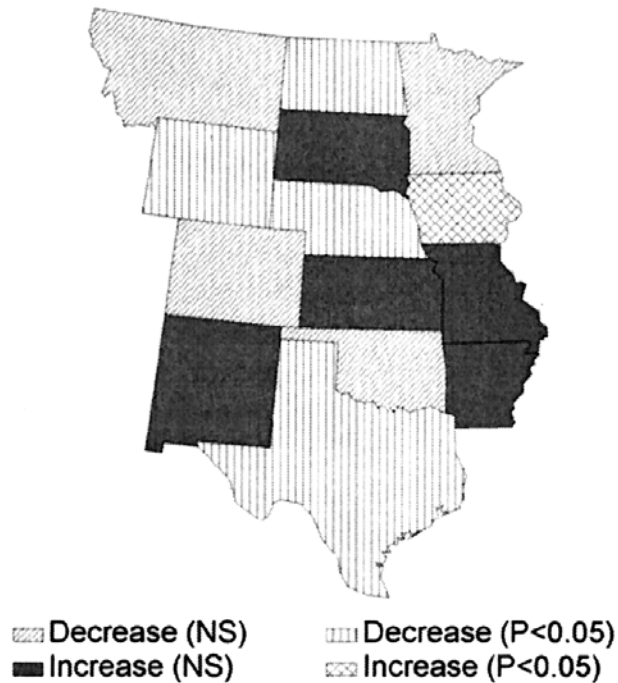


Figure 4. Trends in number of mourning doves heard per route by state in the Central Management Unit, 1998-2007. (From: Mourning dove population status, 2007. Dolton, D.D., R.D. Rau, and K. Parker. 2007. U.S. Fish and Wildlife Service, Laurel, Maryland, USA. 19 pp).

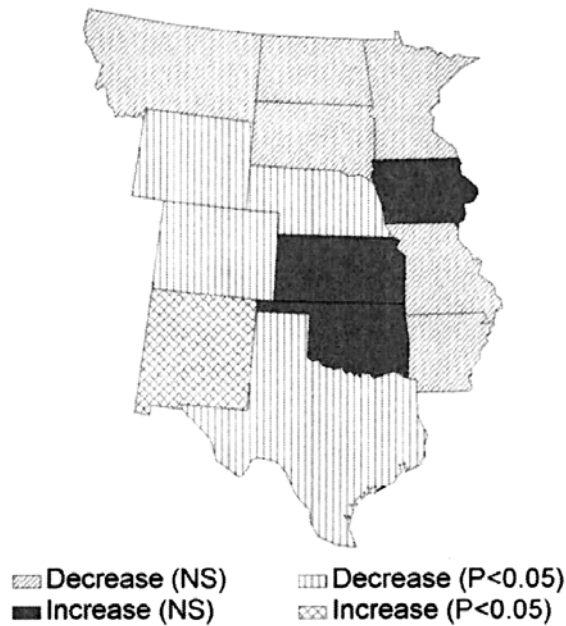


Figure 5. Trends in mourning doves heard per route by state in the Central Management Unit, 1966-2007. (From: Mourning dove population status, 2007. Dolton, D.D., R.D. Rau, and K. Parker. 2007. U.S. Fish and Wildlife Service, Laurel, Maryland, USA. 19 pp).

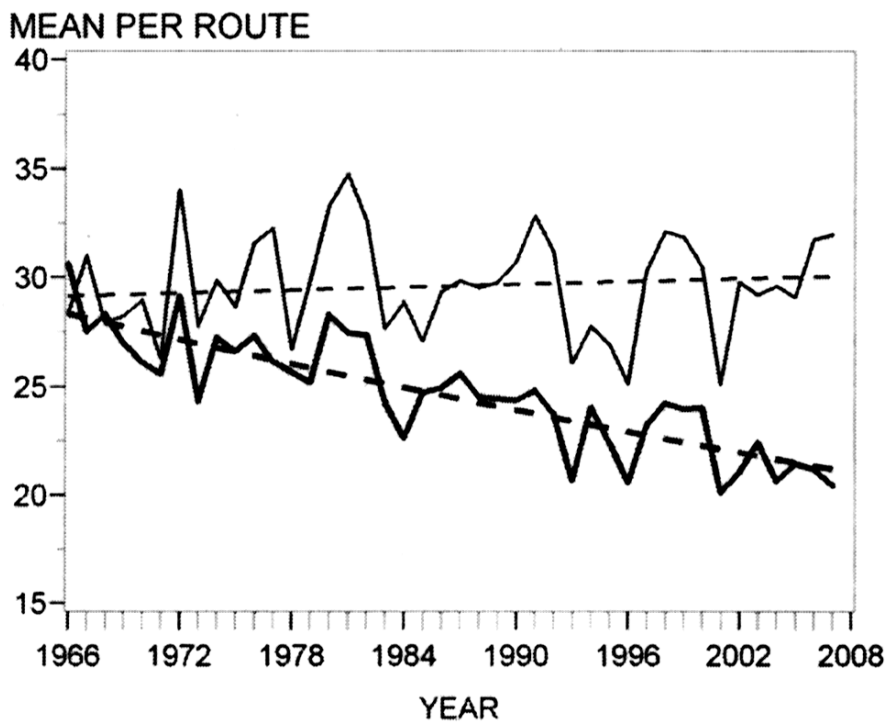


Figure 6. Population indices and trends of breeding mourning doves in the Central Management Unit, 1966-2007. Heavy solid line = doves heard; light solid line = doves seen. Light and heavy dashed lines = predicted trends. (From: Mourning dove population status, 2007. Dolton, D.D., R.D. Rau, and K. Parker. 2007. U.S. Fish and Wildlife Service, Laurel, Maryland, USA. 19 pp).

American Woodcock information is taken from the U.S. Fish and Wildlife Service report *American Woodcock Population Status, 2007* by James R. Kelley, Jr., Rebecca D. Rau, and Keri Parker. The entire report is available on the Division of Migratory Bird Management home page (<http://www.fws.gov/migratorybirds/reports/reports.html>)

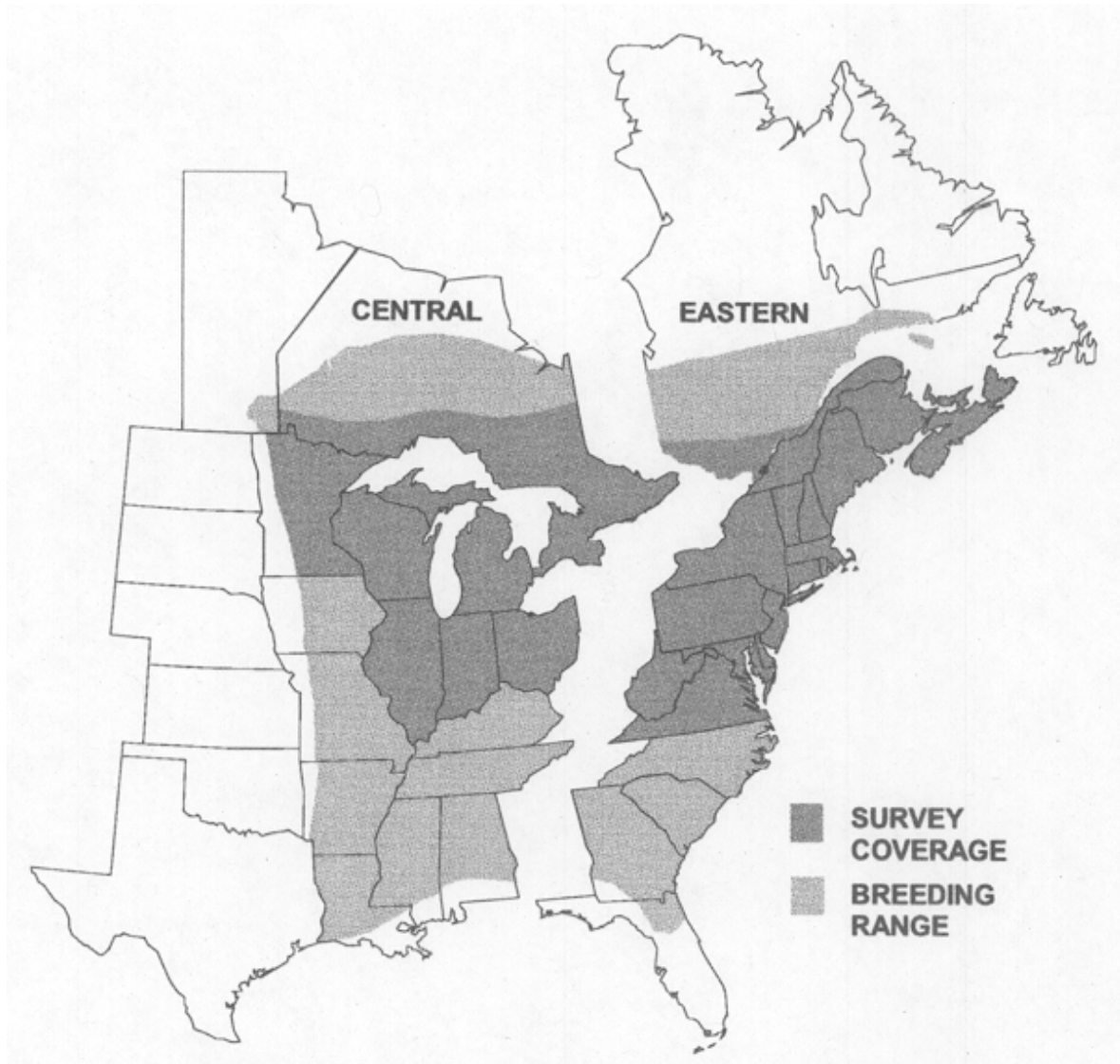


Figure 1. Woodcock management regions, breeding range, singing-ground survey coverage, (from: Kelley, J.R., Jr., R.D. Rau, and K. Parker. 2007. *American woodcock population status, 2007*. U.S. Fish and Wildlife Service, Laurel, MD. 17pp).

Table 24. Trends (% change per year <sup>a</sup>) in number of American woodcock heard in singing-ground survey during 1968-2007, as determined by the estimating equations technique (Link and Sauer, 1994) (from: Kelley, J.R., Jr., R.D. Rau, and K. Parker. 2007. American woodcock population status, 2007. U.S. Fish and Wildlife Service, Office of Migratory Bird Management, Laurel, MD. 17pp).

Management Unit/State	2 year N <sup>c</sup>	(2006-07) % Change	Routes Run <sup>b</sup>	10 year N	(1997-07) % Change	39 year N	(1968-07) % Change
CENTRAL	172	4.7**	349	383	0.0	635	- 1.8***
IL	0		10	5	18.5	25	24.4
IN	0		20	8	- 14.0	39	- 7.4**
MB <sup>c</sup>	5	20.4 *	10	23	2.9	23	- 1.9
MI	71	4.5	105	111	- 1.4	148	- 1.7***
MN	37	1.6	70	77	0.6	102	- 0.9*
OH	9	-49.7**	35	26	- 1.2	57	- 6.7***
ON	9	27.8*	38	59	1.8	138	- 1.8***
WI	39	12.7	61	74	0.8	103	- 1.8***

<sup>a</sup> Mean of weighted route trends within each State, Province, or Region. To estimate the total percent change over several years, use:  $100(\% \text{ change}/100+1)^y-100$  where y is the number of years.

Note: extrapolating the estimated trend statistic (% change per year) over time (e.g., 30 years) may exaggerate the total change over the period.

<sup>b</sup> Total number of routes surveyed in 2007 for which data were received by 1 June.

<sup>c</sup> Number of comparable routes (2006 versus 2007) with at least 2 non-zero counts.

<sup>d</sup> Indicates slope is significantly different from zero: \*  $P \leq 0.10$ ; \*\*  $P \leq 0.05$ ; \*\*\*  $P \leq 0.01$ ; significance levels are approximate for states where  $N < 10$ .

<sup>e</sup> Manitoba began participating in the Singing-ground survey in 1990.

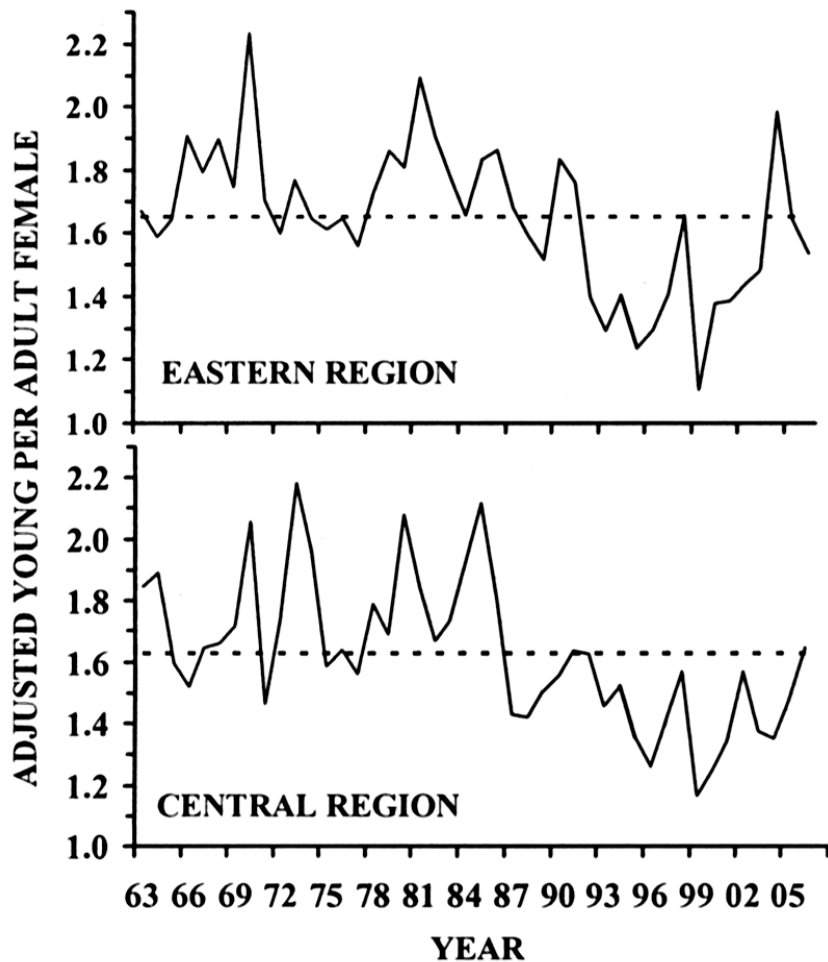


Figure 2. Adjusted index of American woodcock recruitment, 1963-2006. Dashed line is the index based on all 1963-2005 average. (from: Kelley, J.R., Jr., R.D. Rau, and K. Parker. 2007. American woodcock population status, 2007. U.S. Fish and Wildlife Service, Laurel, MD. 17pp).

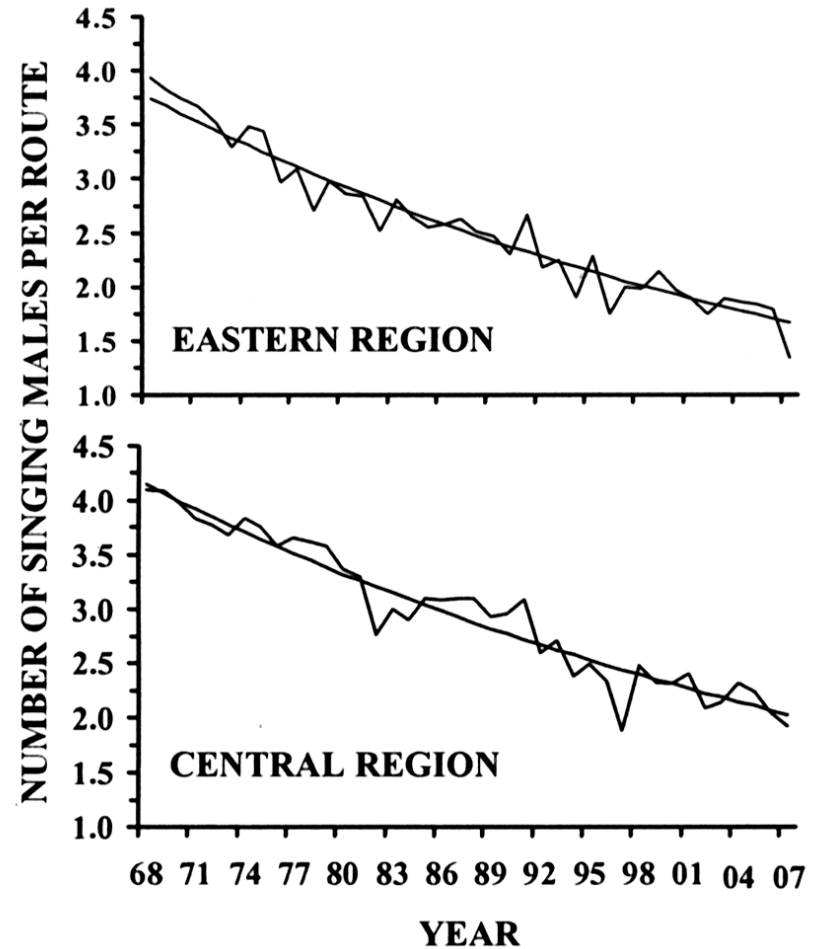


Figure 3. American woodcock singing ground survey long term trends and annual indices, 1968-2007. (from: Kelley, J.R., Jr., R.D. Rau, and K. Parker. 2007. American woodcock population status, 2007. U.S. Fish and Wildlife Service, Laurel, MD. 17pp).



Table 25. Preliminary estimates of woodcock hunter numbers, days afield, and harvest for selected states, from the 2003-04, 2004-05, 2005-06, and 2006-07. Harvest Information Program surveys. (from: Kelley, J.R., Jr., R.D. Rau, and K. Parker. 2007. American woodcock population status, 2007. U.S. Fish and Wildlife Service, Laurel, MD. 17pp).

Management Unit / State	Active woodcock hunters				Days afield				Harvest			
	2003-04	2004-05	2005-06	2006-07	2003-04	2004-05	2005-06	2006-07	2003-04	2004-05	2005-06	2006-07
Central Region	n.a.	n.a.	n.a.	n.a.	369,900 ± 16%	366,100 ± 15%	356,100 ± 14%	344,262 ± 12%	213,500 ± 23%	234,800 ± 20%	225,000 ± 19%	232,557 ± 17%
IL	2,400 ± 79%	1,200 ± 74%	2,100 ± 79%	1,973 ± 87	12,200 ± 112%	3,500 ± 78%	5,300 ± 89%	8,944 ± 115%	2,200 ± 90%	1,900 ± 96%	3,900 ± 196%	2,171 ± 160%
IN	700 ± 97%	1,100 ± 104%	2,100 ± 55%	1,000 ± 58%	6,000 ± 134%	5,300 ± 124%	7,400 ± 69%	4,377 ± 75%	1,800 ± 31%	7,900 ± 145%	4,400 ± 91%	2,403 ± 69%
MI	35,100 ± 14%	31,200 ± 13%	28,000 ± 13%	30,017 ± 14%	159,000 ± 18%	147,000 ± 14%	151,200 ± 17%	155,333 ± 17%	121,500 ± 30%	102,500 ± 21%	106,800 ± 27%	116,216 ± 27%
MN	14,300 ± 38%	14,500 ± 27%	12,000 ± 31%	14,934 ± 24%	48,700 ± 43%	67,000 ± 33%	60,200 ± 42%	155,333 ± 17%	29,900 ± 84%	38,500 ± 53%	42,200 ± 54%	38,738 ± 41%
OH	3,400 ± 88%	2,600 ± 82%	4,700 ± 65%	2,249 ± 68%	10,300 ± 86%	18,200 ± 126%	15,800 ± 79%	9,764 ± 67%	2,500 ± 78%	4,600 ± 101%	6,900 ± 83%	4,060 ± 51%
WI	16,100 ± 30%	15,700 ± 30%	15,600 ± 25%	19,390 ± 22%	65,600 ± 33%	61,100 ± 30%	73,100 ± 31%	72,365 ± 25%	30,300 ± 35%	47,300 ± 50%	37,600 ± 28%	42,958 ± 25%

<sup>a</sup> Regional estimates of hunter numbers cannot be obtained due to the occurrence of individual hunters being registered in the Harvest Information Program in more than one state.

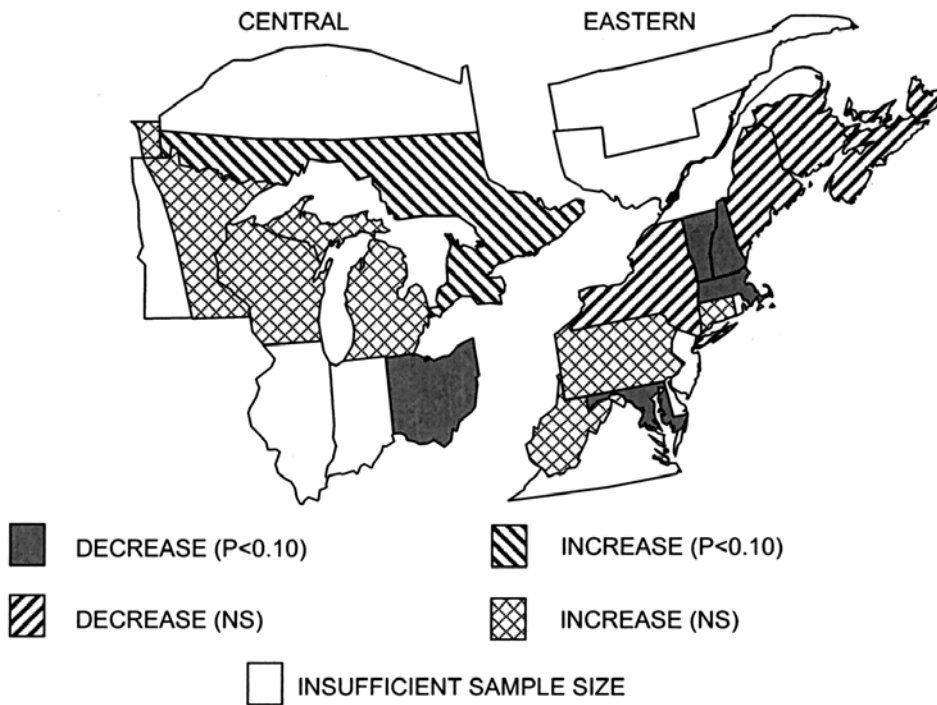


Figure 4. Short-term trends in number of American woodcock heard on the Singing-ground Survey; 2006-07. (from: Kelley, J.R., Jr., R.D. Rau, and K. Parker. 2007. American woodcock population status, 2007. U.S. Fish and Wildlife Service, Laurel, MD. 17pp).

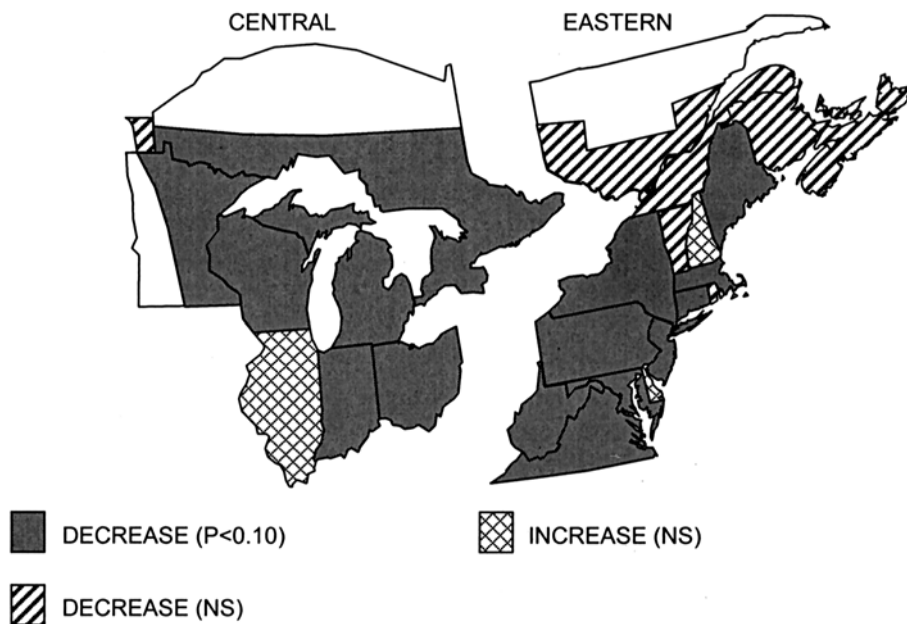


Figure 5. Long-term trends in number of American woodcock heard on the Singing-ground Survey; 1968-07. (from: Kelley, J.R., Jr., R.D. Rau, and K. Parker. 2007. American woodcock population status, 2007. U.S. Fish and Wildlife Service, Laurel, MD. 17pp).