

MIGRATORY BIRD POPULATIONS

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2009 WATERFOWL BREEDING POPULATION SURVEY MINNESOTA

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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 in addition to 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 2009 aerial survey portion was flown from 5-19 May. Spring wetland habitat conditions were above average across the state but highly variable. Portions of southern and east central Minnesota were extremely dry and portions of west central to northwest Minnesota were extremely wet. Wetland numbers decreased 2% compared to 2008 but remained 26% above the 10-year average and 28% above the long-term average. The estimated numbers of temporary (Type 1) wetlands decreased 44% from 2008 and were 43% below the long-term average. The mallard breeding population index (236,000) declined 21% from 2008 (298,000) but was statistically unchanged ($P = 0.18$). Mallard numbers were 19% below the 10-year average but 6% above the long-term average of 224,000 breeding mallards. The blue-winged teal breeding population index (135,000) was 11% lower than the 2008 estimate (152,000) and remained well below both the 10-year (-36%) and long-term (-39%) averages. The combined population index of other ducks (170,000), excluding scaup, decreased 41% from last year and was 29% below the 10-year average and 5% below the long-term average of 179,000. Population estimates of ring-necked duck (61,000), wood duck (53,000), gadwall (10,000), northern shoveler (9,000) and canvasback (7,500) accounted for 85% of the total population of other ducks. Although ring-necked duck numbers declined 52% from 2008, this year's estimate was still the 3rd highest on record and likely comprised of migrant birds still present in the state due to the late spring weather conditions. The estimate of total duck abundance (507,000), which excludes scaup, decreased 31% compared to 2008 and was 32% below the 10-year average and 19% below the long-term average (626,000) and was the 3rd lowest estimate since 1983. The estimated number of Canada geese (corrected for visibility) was 164,000 and 18% higher than 2008, 21% below the 10-year average and 1% above the long-term average of 163,000 geese. Although ice-out dates this spring were near average on most lakes, temperatures and precipitation were below average across much of the state in April and May. Based on the social status of ducks observed (number of pairs, lone males, and flocked birds), the survey timing for mallards was consistent with previous years. For later migrating species (i.e. blue-winged teal, ring-necked ducks), the results suggest most migrant blue-winged teal had moved through the state but the late spring may have contributed to higher than average counts of ring-necked ducks.

METHODS: The aerial survey is based on a sampling design that includes three survey strata (Table 1, Fig. 1). The strata cover 39% of the state area and are defined by density of lake basins (>10 acres) exclusive of the infertile northeastern lake region. The strata include the following:

Stratum I: high density, 21 or more lake basins per township.

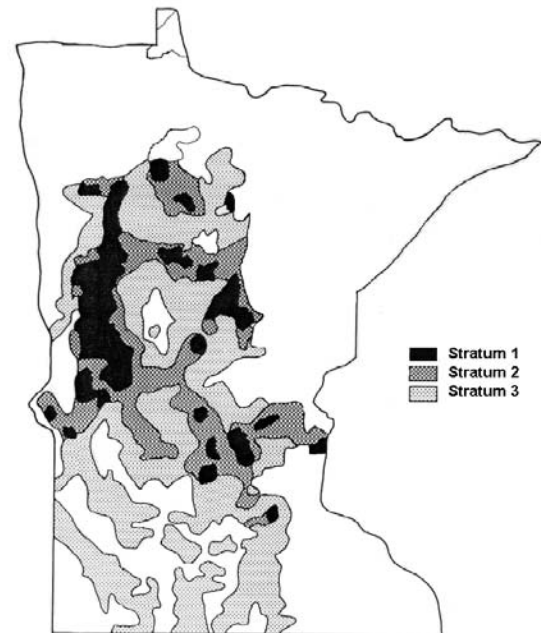


Fig. 1. Location of waterfowl breeding population survey strata in Minnesota.

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 transcribed from the digital 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 compared estimates for 2008 and 2009 using two-tailed Z-tests.

SURVEY CHRONOLOGY: The 2009 aerial survey began on 5 May in southern Minnesota and concluded in northern Minnesota on 19 May. The survey was completed in 11 days of flight time. Transects were flown May 5-11, 15, and 17-19; flights began no earlier than 7 AM and were completed by 12:30 PM each day.

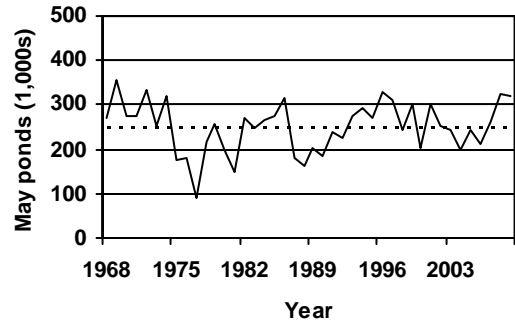


Fig. 2. Number of May ponds (Types II-V) and long-term average (dashed line) in Minnesota, 1968-2009.

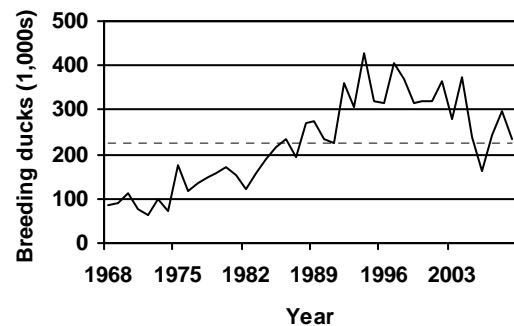


Fig. 3. Mallard population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2009.

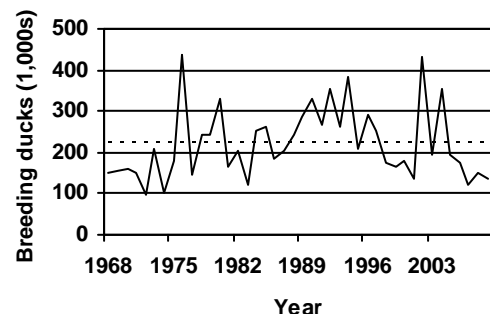


Fig. 4. Blue-winged teal population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2009.

WEATHER AND HABITAT CONDITIONS:

Wetland conditions in spring 2009 were similar to 2008. Ice out on most lakes across the state was near average and all lakes were ice-free when the survey began. Temperatures in April averaged 0.3°F below normal statewide; regional temperatures ranged from 2.2°F below average in west central Minnesota to 0.6°F above average in southern Minnesota. April precipitation was 0.7 inches below normal statewide and ranged from 1.0 inches below normal in central Minnesota to 0.1 inches below normal in northeast Minnesota. May temperatures averaged 1.7°F below normal statewide. May precipitation was 1.4 inches below normal statewide and ranged from 2.4 inches below normal in east central Minnesota to 0.3 inches above normal in northwest Minnesota

(<http://climate.umn.edu>). Additional temperature and precipitation data are provided in Appendix A.

In early May 2009, statewide topsoil moisture indices were rated as 11 % short or very short, 66 % adequate, and 23% surplus moisture. In late May, statewide indices were rated as 19% very short, 31% short, 42% adequate and 8% surplus moisture. For comparison, in early May 2008 statewide topsoil moisture indices were rated as 1% short, 67% adequate, and 32% surplus moisture.

Planting dates for row crops were earlier in 2009 than recent years. By 3 May, 59% of the corn acres had been planted statewide compared to 7% in 2008 and 47% for the previous 5-year average. By 1 June, 17% of alfalfa hay had been cut compared to 6% in 2008 and a 5-year average of 15% (Minnesota Agricultural Statistics Service Weekly Crop Weather Reports, (<http://www.nass.usda.gov/mn/>)).

Wetland numbers (Type II-V) declined 2% from 2008 but remained 26 % above the 10-year average and 28% above the long-term averages (Table 2; Fig. 2). The numbers of temporary (Type 1) wetlands decreased 44% from 2008 and were 44% below the long-term average.

Leaf-out dates were later than average, but similar to last year, which improved visibility from the air. The emergence of wetland vegetation was also much later than average, which also improved visibility.

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.

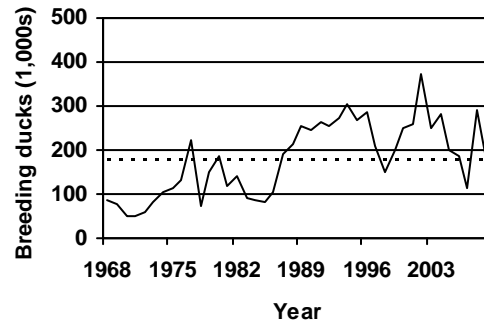


Fig. 5. Other duck (excluding scaup) populations (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2009.

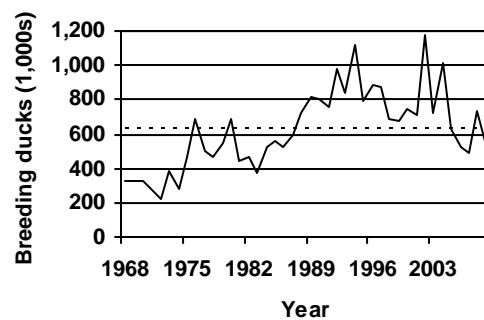


Fig. 6. Total duck (excluding scaup) population estimate and long-term average (dashed line) in Minnesota, 1968-2009.

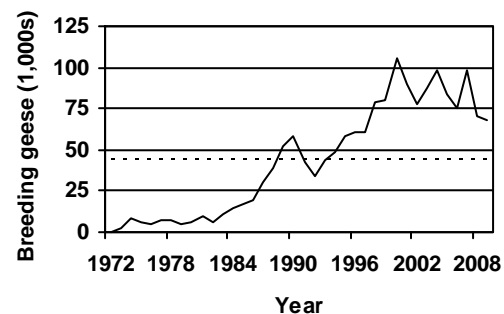


Fig. 7. Canada goose population estimates (not adjusted for visibility bias) and long-term average in Minnesota, 1972-2009.

The 2009 breeding population estimate of mallards was 236,436 (SE = 36,539), which was 21% lower but statistically unchanged from 2008 ($Z = 1.33$, $P = 0.18$) (Table 7, Fig. 3). Mallard numbers were 21% below the 10-year average and 6% above the long-term average of 224,000. In 2009, 5% of the total mallards were in flocks compared to 2% in 2008 and 6% in 2007. Pairs comprised 14% of the mallards observed, compared to 13% and 9% in 2007 and 2008, respectively. This suggests that survey timing was similar to recent years based on their social status.

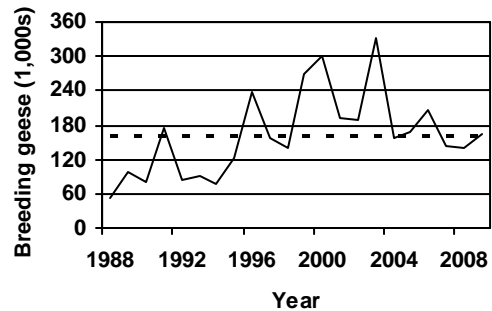


Fig. 8. Canada goose population estimates (adjusted for visibility bias) and long-term average in Minnesota, 1988-2009.

The estimated blue-winged teal population was 135,262 (SE = 32,155), which was 11% lower than 2008 (152,000) but statistically unchanged from last year ($Z = 0.43$, $P = 0.67$). Blue-winged teal numbers remained 36% below the 10-year average and 39% below the long-term average (Table 7, Fig. 4). In 2009, 7% of the blue-winged teal were observed in flocks compared to an average of 14% since 2000. Pairs comprised 69% of the blue-winged teal observed, compared to an average of 57% counted as pairs since 2000. Since the number of pairs was higher than average and the number of flocked birds lower than average, this index of social status suggests that fewer than average migrant blue-winged teal may have been present in the state during the survey.

Other duck numbers (excluding scaup) decreased 41% to 169,568 and were 29% below the 10-year average and 5% below the long-term average (Table 7, Fig. 5). Population estimates of ring-necked duck (61,000), wood duck (53,000), gadwall (10,000), northern shoveler (9,000) and canvasback (7,500) accounted for 85% of the total population of other ducks. Although ring-necked duck estimates declined 52% from last year, this year's estimate was still the 3rd highest on record and likely comprised of migrant ring-necked ducks. Scaup numbers were 21% below last year and 49% below the long-term average. Scaup are rare nesting ducks in Minnesota and late migrants, but below average counts indicate most migrant scaup had moved through the state prior to the start of the survey.

The total duck population index, excluding scaup, was 507,000, which was 31% lower than 2008 and 19% below the long-term average (Table 7, Fig. 6).

Visibility Correction Factors (VCFs) for mallards, blue-winged teal, and other ducks were similar to 2008 (Table 7). The mallard VCF (3.02) was 40% above the long-term average. The blue-winged teal VCF (3.63) was similar to last year (3.74) and 7% below the long-term average. The VCF for other ducks (2.70) was also lower than last year (2.91) and 15% lower than the long-term average (3.18).

Canada goose numbers (uncorrected for visibility) decreased 4% compared to 2008 but remained 56% above the long-term average (Table 7, Fig. 7). The VCF for Canada geese was 2.44 and similar to the long-term average of 2.37. The population estimate of Canada geese (adjusted for visibility) was 164,000, which was below the 10-year average of 210,000 but similar to the long-term average of 163,000 (Table 7, Fig. 8). There were 20 Canada goose broods observed during the survey which was similar to most recent years.

The estimated coot population, uncorrected for visibility, was 9,000 in 2009 compared to 56,000 in 2008.

SUMMARY: Overall wetland conditions were above average but highly variable across the state. Mallard abundance in 2009 (236,000) was lower than 2008 (298,000) but statistically unchanged ($P=0.18$). Mallard numbers were 6% above the long-term average (224,000) but below the 10-year

average (292,000). Blue-winged teal abundance (135,000) was lower than 2008 (152,000) but statistically unchanged ($P=0.67$); blue-winged teal were 36% below the 10-year average (210,000) and 39% below the long-term average (223,000). The combined population index of other ducks (170,000) declined 41% from 2008 and was 5% below the long-term average. Ring-necked ducks (61,000), wood ducks (53,000), gadwall (10,000), northern shoveler (9,000) and canvasback (7,500) accounted for most of the total population of other ducks. Total duck abundance (507,000), excluding scaup, decreased 31% from 2008 and was 19% below the long-term average. Canada goose numbers, adjusted for visibility bias, increased 18% from 2008 and above the long-term average.

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Table 1. Survey design for Minnesota, May 2009.¹

	Stratum			Total
	1	2	3	
<u>Survey design</u>				
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	
<u>Current year coverage</u>				
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	

¹ 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), 1968-2009.

Year	Type I	Number of ponds ¹
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
2008	69,734	325,000
2009	39,078	318,000
10-year average (1998-2008)	46,241	253,273
Long-term average (1968-2008)	69,134	248,415
Change from:		
2008	-44%	-2%
10-year average	-15%	26%
Long-term average	-43%	28%

¹ Type II-V, correction factor from 1989 (123,000/203,000=0.606) used to adjust 1968-88 pond numbers.

Table 3. Minnesota waterfowl breeding populations by species for Stratum I (high wetland density), expanded for area but not visibility, 1991-2009.

Species	Year																		
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Dabblers:																			
Mallard	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	25,104	19,467
Black Duck	56	0	0	56	0	0	0	0	0	0	0	0	0	0	56	0	0	0	0
Gadwall	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	1,166	1,055
American Wigeon	0	56	0	0	194	0	0	56	56	56	111	0	56	555	167	0	56	111	56
Green-winged Teal	56	0	111	278	0	278	56	333	0	278	56	278	222	444	56	56	167	278	167
Blue-winged Teal	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	9,942	5,998
Northern Shoveler	1,777	1,000	111	278	111	1,277	1,500	500	555	1,055	305	1,277	278	1,166	333	167	56	1,000	666
Northern Pintail	389	222	611	167	167	167	111	111	167	167	389	56	111	56	0	56	0	56	56
Wood Duck	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	6,665	4,277
Dabbler Subtotal	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	44,322	31,742
Divers:																			
Redhead	2,555	3,499	1,416	1,972	639	722	778	944	500	583	1,444	750	333	805	666	666	916	1,389	472
Canvasback	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	2,277	1,333
Scaup	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	6,276	8,553
Ring-necked Duck	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	21,494	6,859
Goldeneye	0	222	111	222	111	167	0	111	56	56	333	111	0	222	222	56	222	278	278
Bufflehead	333	722	0	444	56	278	0	56	111	56	111	222	111	389	167	222	56	1,611	833
Ruddy Duck	361	500	1,250	639	167	139	528	11,052	972	0	83	1,305	417	305	1,222	305	0	1,027	861
Hooded Merganser	0	444	222	111	278	611	555	389	722	500	722	555	333	278	333	555	111	666	944
Large Merganser	56	111	0	56	0	0	56	0	0	0	111	0	972	0	111	0	278	333	333
Diver Subtotal	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	35,351	20,466
Total Ducks	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	79,673	52,208
Other:																			
Coot	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	16,829	2,166
Canada Goose	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	18,717	16,523

Table 4. Minnesota waterfowl breeding populations by species for Stratum II (medium wetland density), expanded for area but not visibility, 1991-2009.

Species	Year																		
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Dabblers:																			
Mallard	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	27,935	23,494
Black Duck	0	0	0	0	0	0	0	0	0	0	117	0	0	0	0	0	0	0	0
Gadwall	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	3,039	1,169
American Wigeon	701	351	0	117	0	468	351	818	0	468	0	0	0	2,513	117	0	0	351	0
Green-winged Teal	0	0	351	117	0	935	234	351	117	117	117	468	234	234	0	117	0	0	234
Blue-winged Teal	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	12,740	11,104
Northern Shoveler	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	468	701
Northern Pintail	701	234	351	468	234	117	234	468	117	117	117	0	117	0	0	0	234	0	0
Wood Duck	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	6,546	5,260
Dabbler subtotal	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	51,079	41,962
Divers:																			
Redhead	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	935	584
Canvasback	117	0	584	1,052	0	234	701	117	117	935	0	468	1,052	234	0	0	1,169	468	234
Scaup	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	3,097	2,104
Ring-necked Duck	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	13,149	9,117
Goldeneye	818	351	584	701	701	1,753	818	234	935	584	468	234	234	351	117	117	0	351	584
Bufflehead	0	526	117	234	0	117	117	0	0	0	0	1,169	117	468	351	117	117	1,403	818
Ruddy Duck	4,558	1,227	3,390	409	117	58	117	0	468	0	0	1,870	2,688	0	351	58	0	0	175
Hooded Merganser	0	351	584	468	117	234	468	117	701	935	1,403	701	701	234	234	351	234	584	701
Large Merganser	0	117	0	0	0	0	0	0	0	117	117	0	0	234	351	0	0	351	0
Diver subtotal	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	20,338	14,317
Total Ducks	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	71,417	56,279
Other:																			
Coot	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	23,961	0
Canada Goose	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	19,753	22,675

Table 5. Minnesota waterfowl breeding populations by species for Stratum III (low wetland density), expanded for area but not visibility, 1991-2009.

Species	Year																		
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Dabblers:																			
Mallard	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	50,371	35,408
Black Duck	0	0	0	0	0	0	0	0	0	0	0	0	0	174	0	0	174	174	0
Gadwall	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	870	1,392
American Wigeon	696	522	348	1,218	0	1,044	348	696	0	522	174	1,218	174	1,566	1,044	174	348	348	174
Green-winged Teal	348	0	348	174	0	957	348	174	0	1,218	1,392	522	174	0	174	522	0	0	0
Blue-winged Teal	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	18,095	20,183
Northern Shoveler	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	4,002	2,088
Northern Pintail	1,914	870	1,218	696	174	870	522	870	870	696	522	0	174	348	174	174	348	174	0
Wood Duck	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	14,442	10,266
Dabbler subtotal	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	88,476	69,511
Divers:																			
Redhead	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	783	870
Canvasback	696	0	348	696	174	1,392	0	3,306	174	3,915	522	696	1,131	2,784	0	0	348	1,566	1,218
Scaup	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	5,481	1,914
Ring-necked Duck	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	8,526	6,525
Goldeneye	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	348	522
Bufflehead	552	696	348	696	0	1,044	174	348	0	0	0	1,218	783	2,088	0	174	696	1,218	870
Ruddy Duck	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	87	348
Hooded Merganser	348	348	348	696	1,044	1,566	696	696	1,218	957	174	2,175	174	1,740	1,218	870	174	696	348
Large Merganser	0	348	0	174	174	0	0	0	0	0	0	522	0	0	261	957	348	348	348
Diver subtotal	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	19,053	12,963
Total Ducks	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	107,529	82,474
Other:																			
Coot	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	15,137	7,047
Canada Goose	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	31,841	28,274

Table 6. Minnesota waterfowl breeding populations by species for Stratum I-III combined, expanded for area coverage but not for visibility, 1991-2009.

Species	Year																		
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Dabblers:																			
Mallard	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	103,411	78,368
Black Duck	56	0	0	56	0	0	0	0	0	0	117	0	0	174	56	0	174	174	0
Gadwall	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	5,075	3,616
American Wigeon	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	810	230
Green-winged Teal	404	0	810	569	0	2,170	638	858	117	1,613	1,564	1,267	630	678	230	694	167	278	400
Blue-winged Teal	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	40,777	37,286
Northern Shoveler	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	5,469	3,456
Northern Pintail	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	230	56
Wood Duck	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	27,652	19,802
Dabbler subtotal	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	183,876	143,214
Divers:																			
Redhead	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	3,107	1,926
Canvasback	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	4,311	2,785
Scaup	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	14,854	12,571
Ring-necked Duck	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	43,169	22,501
Goldeneye	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	976	1,384
Bufflehead	885	1,944	465	1,374	56	1,439	291	404	111	56	111	2,609	1,011	2,944	517	513	868	4,231	2,521
Ruddy Duck	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	1,114	1,384
Hooded Merganser	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	1,947	1,993
Large Merganser	56	576	0	230	174	0	56	0	0	117	228	522	972	234	723	957	626	1,032	681
Diver subtotal	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	74,741	47,746
Total Ducks	354,322	413,083	282,854	352,147	284,812	384,204	313,358	356,594	299,936	370,675	290,635	342,967	214,646	378,579	190,060	155,475	139,243	258,617	190,960
Other:																			
Coot	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	55,927	9,213
Canada Goose	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	70,311	67,473

Table 7. Estimated waterfowl populations during the Minnesota Waterfowl breeding population survey, 1968-2009.

Year	Mallard				Blue-winged teal				Other ducks (exc. scaup)		
	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI
1968	41,030	2.04	83,701		61,943	2.44	151,141		41,419	2.08	86,152
1969	53,167	1.67	88,789		45,180	3.45	155,871		34,605	2.27	78,553
1970	67,463	1.69	113,945		31,682	5.06	160,343		30,822	1.62	49,932
1971	47,702	1.65	78,470		42,445	3.49	148,218		29,520	1.71	50,450
1972	49,137	1.27	62,158		49,386	1.96	96,895		34,405	1.69	58,127
1973	56,607	1.76	99,832		53,095	3.92	208,292		33,155	2.45	81,362
1974	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
2008	103,411	2.88	297,565	27,787	40,777	3.74	152,359	24,157	99,575	2.91	289,629
2009	78,368	3.02	236,436	36,539	37,286	3.63	135,262	32,155	62,725	2.70	169,568
Averages:											
10-year (1999-2008)	122,839	2.45	291,680	39,873	52,390	4.01	209,845	40,989	74,612	3.50	240,510
Long-term (1968-2008)	103,563	2.16	224,116	35,953	60,085	3.90	223,060	42,111	60,590	3.18	178,795
% change from:											
2008	-24%	5%	-21%	32%	-9%	-3%	-11%	33%	-37%	-7%	-41%
10-year average	-36%	23%	-19%	-8%	-29%	-9%	-36%	-22%	-16%	-23%	-29%
Long-term average	-24%	40%	6%	2%	-38%	-7%	-39%	-24%	4%	-15%	-5%

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

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
2008	14,854	2.91	43,205	243,763	739,553	258,617	782,758	70,311	1.99	139,708
2009	12,571	2.70	33,979	178,389	507,287	190,960	541,266	67,473	2.44	164,405
Averages:										
10-year (1998-2008)	14,232	3.46	42,601	249,640	742,742	263,873	785,343	86,726	2.44	209,888
Long-term (1968-2008)	22,713	3.17	67,043	224,189	626,144	246,903	693,186	43,266	2.37	162,521
% change from:										
2008	-15%	-7%	-21%	-27%	-31%	-26%	-31%	-4%	23%	18%
10-year average	-12%	-22%	-20%	-29%	-32%	-28%	-31%	-22%	0%	-21%
Long-term average	-45%	-15%	-49%	-20%	-19%	-23%	-22%	56%	3%	1%

¹ 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, 13 April - 17 May 2009
 (Source: Minnesota Climatological Working Group, <http://climate.umn.edu/cawap/nwssum/nwssum.asp>).

Region	City	Temperature (F) for week ending:										Precipitation					
		19-April		26-April		3-May		10-May		17-May		Total weekly precipitation (inches)					
		Avg. ¹	Depart ²	Avg. ¹	Depart ²	Avg. ¹	Depart ²	Avg. ¹	Depart ²	Avg. ¹	Depart ²	19-April	26-April	3-May	10-May	17-May	1 Apr
NW	Crookston	46.4	4.3	42.6	-3.3	45.2	-4.3	46.5	-6.4	46.8	-9.1	0.14	0.32	0.36	0.00	0.51	-1.12
NC	Grand Rapids	48.6	7.2	45.6	0.9	45.5	-2.5	50.2	-0.8	49.4	-4.4	0.00	0.58	0.50	0.11	1.32	-0.36
	Itasca	47.6	9.5	42.7	0.9	41.8	-3.6	47.2	-1.7	47.4	-4.6	0.00	0.28	0.61	0.13	0.89	-0.63
WC	Alexandria	50.2	7.3	47.8	1.4	46.8	-3.0	53.2	0.2	51.4	-4.4	0.00	0.14	0.61	0.10	0.09	-0.55
	Fergus Falls	49.4	6.3	46.1	-0.7	45.8	-4.4	51.6	-1.8	49.1	-7.2	0.00	0.05	0.78	0.14	0.92	0.24
	Montevideo	49.8	5.2	48.0	-0.1	45.6	-5.8	54.2	-0.4	52.8	-4.8	0.01	0.00	0.56	0.18	0.13	-2.72
	Morris	48.8	4.3	47.0	-1.0	45.0	-6.3	52.5	-2.0	51.4	-6.0	0.00	0.00	0.68	0.13	0.11	-2.29
C	Becker	51.2	6.3	50.2	2.1	49.3	-1.8	53.0	-1.0	54.8	-1.8	0.01	0.46	0.21	0.20	0.41	-2.40
	Hutchinson	53.0	7.5	51.8	2.8	48.5	-3.8	55.7	0.3	55.6	-2.6	0.01	0.00	0.71	0.34	0.46	-1.60
	St. Cloud	51.0	7.0	49.8	2.5	48.4	-2.1	52.6	-0.8	52.3	-3.8	0.00	0.85	0.28	0.21	1.35	-0.60
	Staples	50.0	7.6	47.6	1.8	44.9	-4.1	52.1	0.2	50.0	-4.5	0.00	0.18	0.46	0.07	0.36	-2.06
	Willmar	52.2	7.7	50.0	2.0	47.4	-4.0	54.6	0.0	49.8	-7.7	0.02	0.00	0.93	0.17	0.80	-1.29
EC	Aitkin	47.2	5.9	46.8	2.3	42.5	-5.1	49.6	-0.9	46.2	-7.0	0.00	0.16	1.04	0.41	1.25	0.28
	Cambridge	Missing															
	Msp Airport	54.2	7.3	52.8	2.7	52.1	-1.1	57.6	1.5	56.0	-2.7	0.06	0.87	0.17	0.33	0.05	-1.96
SW	Pipestone	49.2	4.3	48.5	0.4	45.4	-5.9	55.4	1.1	54.4	-2.7	0.21	0.54	0.48	0.69	0.02	-1.27
	Redwood Falls	53.0	5.8	52.2	1.7	51.0	-2.7	55.5	-1.3	55.0	-4.7	0.05	0.37	0.35	0.91	0.28	-1.73
	Worthington	49.8	6.1	49.8	2.7	46.2	-4.2	53.4	-0.2	52.6	-4.0	0.34	0.14	1.36	1.73	0.09	-0.27
SC	Faribault	50.6	6.2	52.2	4.5	48.8	-2.0	56.0	2.2	51.8	-4.9	0.24	0.44	1.20	0.78	0.09	-1.56
	Waseca	52.4	7.2	50.6	2.1	48.8	-3.0	55.6	0.7	52.8	-5.0	0.30	0.36	1.27	1.40	0.33	-1.34
	Winnebago	52.6	6.3	53.6	4.1	50.0	-2.5	57.2	1.8	54.6	-3.5	0.22	0.44	1.18	1.38	0.18	-1.12
Statewide		49.4	5.9	47.9	1.0	46.6	-3.4	52.6	-0.4	51.1	-4.8	0.09	0.41	0.70	0.51	0.54	

¹ Average temperature (°F) for the week ending on the date shown.

² Departure from normal temperature.

m = missing data

Waterfowl information is taken from the U.S. Fish and Wildlife Service report Waterfowl Population Status, 2009 by Kathy Fleming, Timothy Moser, Pamela R. Garrettson, Walt Rhodes, and Nathan Zimpfer. 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, 1971-2009 (from: U.S. Fish and Wildlife Service. 2009. Waterfowl population status, 2009. U.S. Department of the Interior, Washington, D.C. U.S.A.).

Year	Population ^{a,b}	Year	Population ^{a,b}
1971-72	125,000	2007-08	256,600
1972-73	138,000	2008-09	279,900
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		

^a Surveys conducted in Spring.

^b Indirect or preliminary estimate.

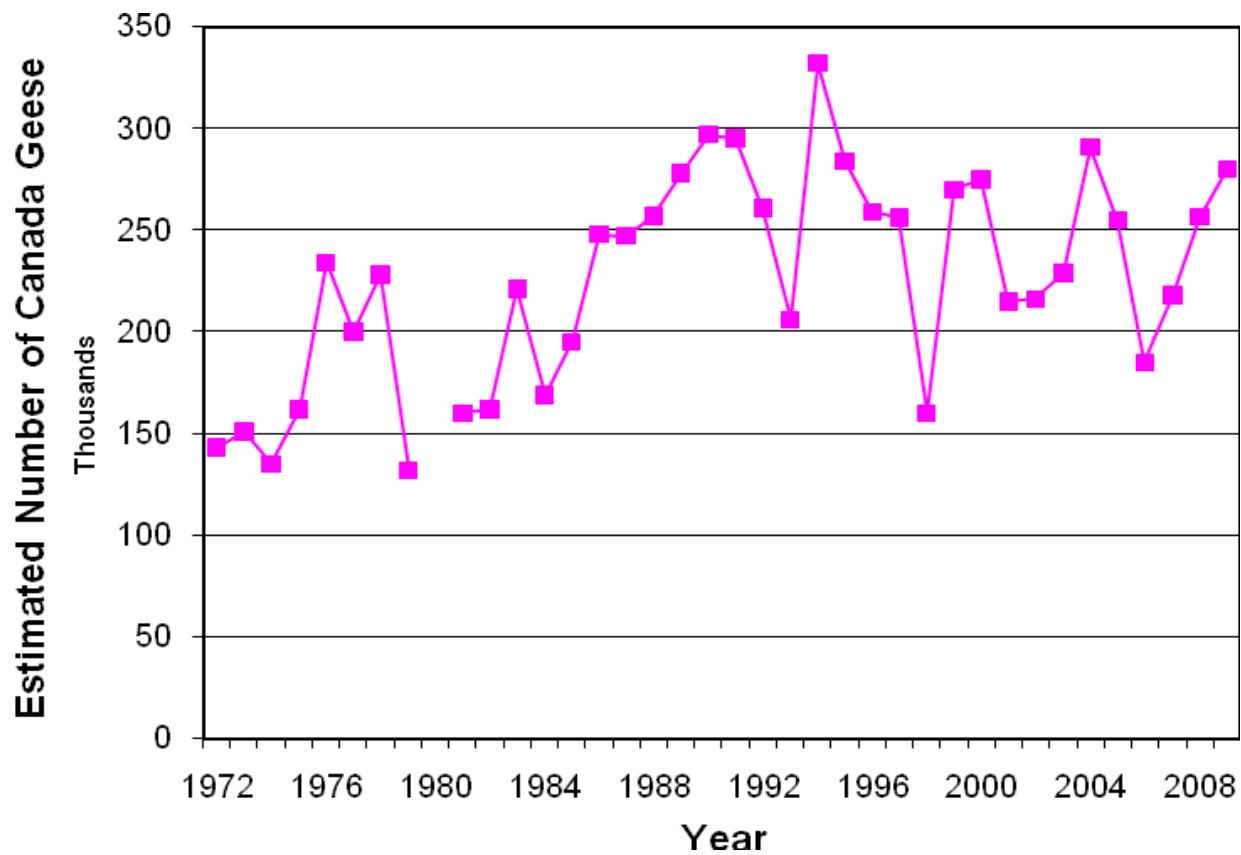


Figure 1. Breeding ground survey estimates of the Eastern Prairie Population of Canada geese, 1972-2009. (from: U.S. Fish and Wildlife Service. 2009. Waterfowl population status, 2009. U.S. Department of the Interior, Washington, D.C. U.S.A.). Surveys conducted in spring. Indirect or preliminary estimates. Data not available for 1980.

Table 2. Estimated number of May ponds (adjusted for visibility) in Prairie Canada (portions of Alberta, Saskatchewan and Manitoba) 1964-2009 and north-central U.S. (North Dakota, South Dakota and Montana) 1974-2009. (from: U.S. Fish and Wildlife Service. 2009. Waterfowl population status, 2009. U.S. Department of the Interior, Washington, D.C. U.S.A.)

Year	Ponds (thousands)	
	Prairie Canada	North Central U.S. ^a
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
2008	3,055	1,377
2009	3,568	2,866
Average	3,433	1,571

% Change in 2008 from:

2007	+ 17	+ 108
Long term Average	- 11	- 12

^a No comparable survey data available for the north-central U.S. during 1964-73.

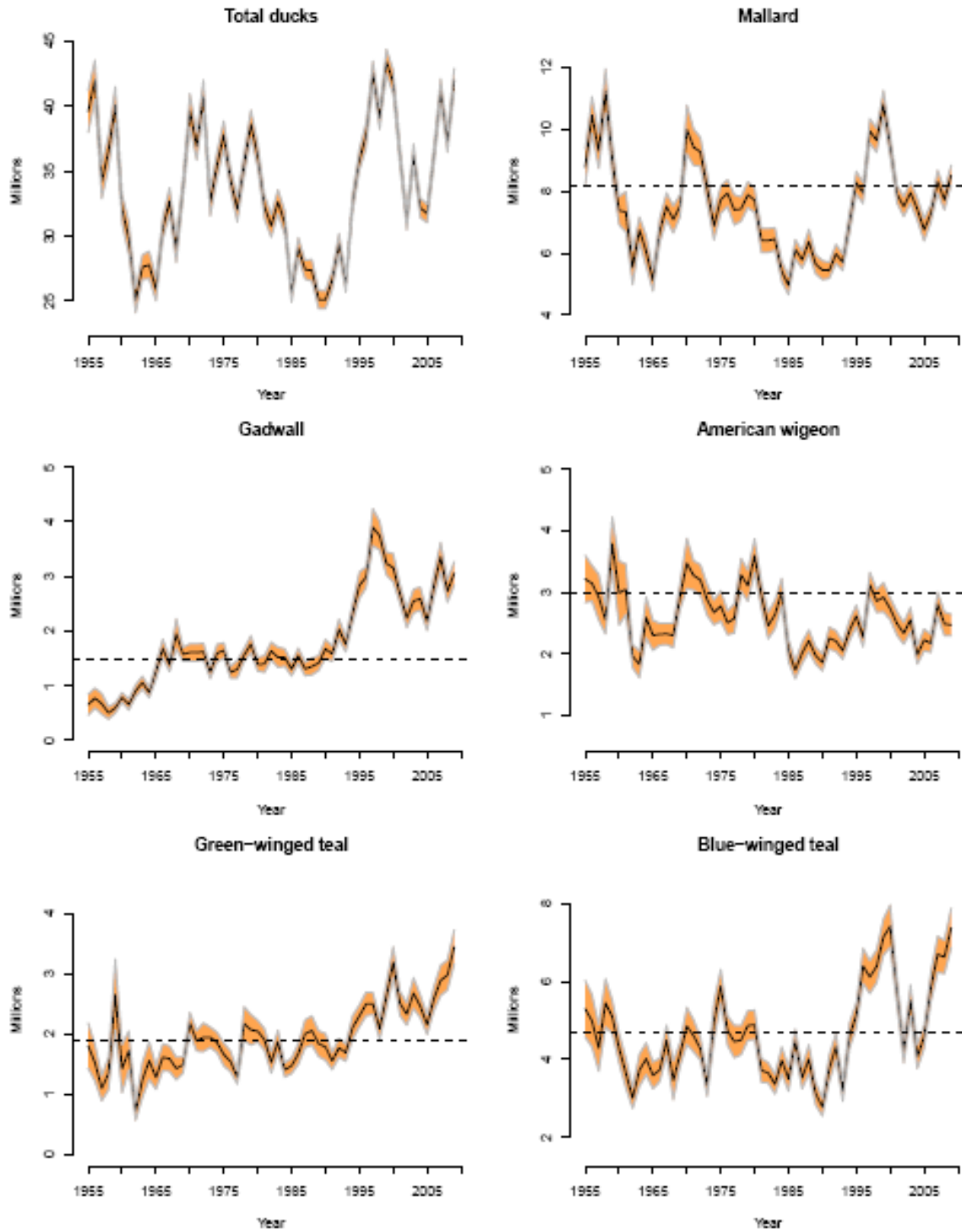


Figure 2. Estimates of North American breeding populations, 95% confidence intervals, and North American Waterfowl Management Plan population goal (dashed line) for selected species and number of water areas in May in Prairie Canada and Northcentral U.S. (from: U.S. Fish and Wildlife Service. 2009. Waterfowl population status, 2009. U.S. Department of the Interior, Washington, D.C. U.S.A.)

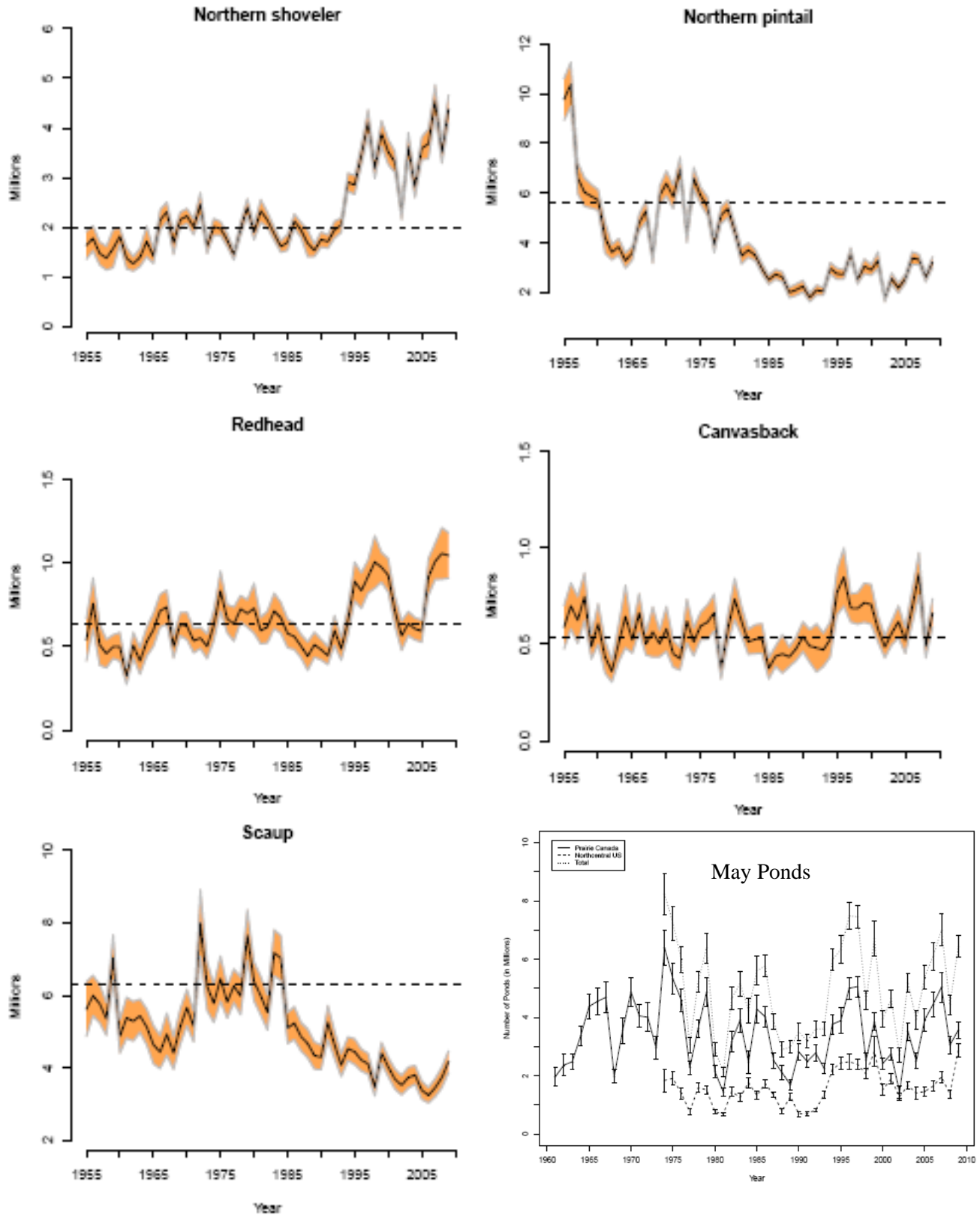


Figure 2. (continued).

2009 MINNESOTA SPRING CANADA GOOSE SURVEY

David Rave, Wetland Wildlife Populations and Research Group

INTRODUCTION

This report presents results from the ninth year of a spring helicopter survey of resident Canada geese in Minnesota. The survey was developed to comply with a Mississippi Flyway Council request to produce a statewide population estimate of resident giant Canada geese having 95% confidence intervals (C.I.'s) that are within $\pm 25\%$ of the estimate.

METHODS

The original survey was initiated in 2001 using a double sampling design where an annual stratified sample was randomly selected from 900 plots in each ecoregion (Maxson 2002). I eliminated the double sampling design in 2008 by stratifying all potential plots in each ecoregion, and randomly sampling from the entire sampling frame (i.e., it is now a simple stratified sampling design with new sample plots drawn each year). Stratification criteria and survey protocols were the same as in previous years; thus, results should be comparable among years.

As in the original stratification, 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 and the Northwest Angle were excluded from the Forest ecoregion. Four Statewide ArcView shapefiles were then unioned together: National Wetlands Inventory circular 39, DNR 1:24k lakes, Public Land Survey Quarter section Boundaries, and ECS provinces, to assign each quarter section plot to the appropriate strata.

Four new fields were then computed: total acres of Type 3, 4, and 5 wetlands per quarter section (Circ39_acr), total acres of 1:24k lakes per quarter section (Lakes_acr), total acres of type 3 wetlands per quarter section (Sum_type3_acr) and total acres of river per quarter section (Sum_Riv_acr). A summary table was created with text fields for each of the 8 strata (habitat-quality class x ecoregion). Using the query builder in ArcMap, quarter sections in each ecoregion were assigned to habitat-quality classes for resident geese: 1) not nesting habitat – expect no geese, 2) limited nesting habitat – habitat capable of supporting 1 or 2 pairs of geese, 3) prime nesting habitat – habitat capable of supporting 3 or more pairs. Habitat-classification criteria for each ecoregion was:

Prairie

No geese = Type 3-4-5 <0.5 acres and rivers <10 acres or plot is all water. (n = 61,597 plots).
1-2 pairs = Type 3-4-5 \geq 0.5 acres but Type 3 <15 acres or Type 3-4-5 <0.5 acres and rivers >10 acres. (n = 30,874 plots).
3+ pairs = Type 3 >15 acres, but plot is not all water. (n = 9,537 plots).

Transition

No geese = Type 3-4-5 <1 acre and rivers <8 acres or plot is all water. (n = 39,484 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 = 31,091 plots).
3+ pairs = Type 3-4-5 >25 acres, but Type 3 >15 acres and plot is not all water. (n = 7,988 plots).

Forest

No geese =	Type 3-4-5 <2 acres and rivers <2 acres or plot all water. (n = 75,835 plots).
1-2 pairs =	Type 3-4-5 \geq 2 acres, but not all water or Type 3-4-5 <2 acres and rivers >2 acres. (n = 51,155 plots).
3+ pairs =	None.

Plots in the “no geese class” are not flown and there are no plots in the “3+ pairs” class in the Forest ecoregion. Each year 30 plots are randomly selected in each of the 5 remaining strata using ArcView’s AlaskaPak extension, 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 on seven days between 21 April and 1 May, 2009. 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 and pairs 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 2009 was 267,496 (\pm 70,607). Adding 17,500 for the Twin Cities metro area (Cooper 2004) yields a statewide estimate of 284,996 (Table 1). Relative error (95% CI half-width) was 26.4% of the estimate, close to the goal of 25.0%. The survey tallied 41.8% singles, 50.7% pairs, and 7.5% 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) was obtained by combining singles and pairs associated with nests. In 2009, 45.2% of the geese seen were classified as Productive Geese (Table 2).

The 2009 Canada goose breeding population estimate for the surveyed area was similar to the 2008 estimate, although goose numbers appeared to be slightly lower in the Forest and Transition regions and slightly higher in the Prairie region (Table 1). A time-series plot suggested the goose population in the survey area has been reasonably stable over the last 9 years (Figure 1). Weather conditions in 2009 were characterized by less snow during the survey than the previous 2 years. The number of productive geese observed this year indicates that 2009 will likely be a good year for Canada goose production. Weather conditions throughout May and June will influence goose productivity. Regardless, the 2009 Canada goose population estimate remained above the state Canada goose population goal.

Wetland and habitat quality were variable in the state this year. Wetland conditions were drier than average in about the southern half of the state, while wetland levels appeared to be average to well above average in the northern half of the state. Due to the large percentage of productive geese in the population, and good wetland conditions in much of the state, I expect average to above average Canada goose production throughout the state in 2009, depending upon May and June weather conditions.

ACKNOWLEDGEMENTS

Frank Martin (Univ. of MN) and Steve Maxson were instrumental in the original design of this survey. Steve also was the principal observer during the first 6 years of the survey. Tim Loesch, Christopher Pouliot, and Shelly Sentyrz 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 Sentyrz was also instrumental in helping to

restratify plots statewide for the 2008 survey. Chris Scharenbroich provided GPS coordinates of plots to the pilot, and printed out maps of the 150 plots flown this year. John Heineman piloted the helicopter and served as the second observer. John Giudice provided statistical assistance.

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Table 1. Spring Canada goose population estimates in Minnesota, 2001-2009.

Year	Prairie	Transition	Forest	Subtotal	95% CI	Metro	TOTAL
2001	77,360	95,470	92,390	265,220	$\pm 69,500$	20,000	285,220
2002	135,850	144,900	33,940	314,690	$\pm 134,286$	20,000	334,690
2003	106,520	121,290	56,420	284,230	$\pm 78,428$	20,000	304,230
2004	128,501	130,609	95,636	354,747	$\pm 107,303$	20,000	374,747
2005	113,939	149,286	57,529	320,754	$\pm 90,541$	17,500	338,254
2006	126,042	164,085	67,994	358,071	$\pm 108,436$	17,500	375,571
2007	137,151	99,274	25,509	261,933	$\pm 80,167$	17,500	279,433
2008*	113,483	127,490	30,400	271,372	$\pm 69,055$	17,500	288,872
2009	129,115	114,737	23,644	267,496	$\pm 70,607$	17,500	284,996

*Prior to 2008, double-sampling for stratification was used to estimate stratum weights. The entire frame was re-stratified in 2008 (double-sampling was eliminated) and Lake of the Woods and the NW Angle were removed from the frame. The sampling frame was adjusted slightly in 2009 because of some processing errors in 2008. The population estimates for 2008 are based on the updated (2009) sampling frame.

Table 2. Percent of Canada Geese seen as singles, pairs, groups, and productive geese on the Minnesota Spring Canada Goose Survey, 2001-2009.

Year	Singles ¹	Pairs ¹	Groups	Productive Geese ²
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
2008	38.4	55.4	6.2	42.6
2009	41.8	50.7	7.5	45.2

¹Singles and pairs were doubled before calculating proportions.

²Productive geese equals Singles + Pairs with nests.

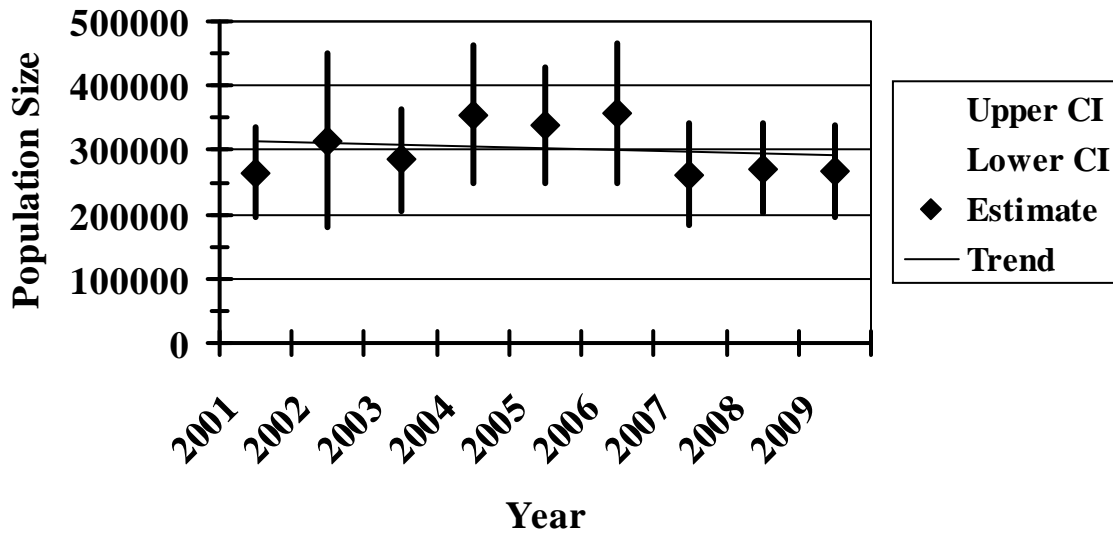


Figure 1. Spring Canada goose population estimates (\pm 95% CI) in Minnesota, 2001-2009. (Does not include Metro area.)

Mourning dove information is taken from the U.S. Fish and Wildlife Service report by Dolton, D.D., T. A. Sanders, and K. Parker. 2009. Mourning dove, White-winged dove, and Band-tailed Pigeon population status, 2009. U.S. Fish and Wildlife Service, Laurel, Maryland, USA. 43 pp. The entire report is available on the Division of Migratory Bird Management home page (<http://migratorybirds.fws.gov>).

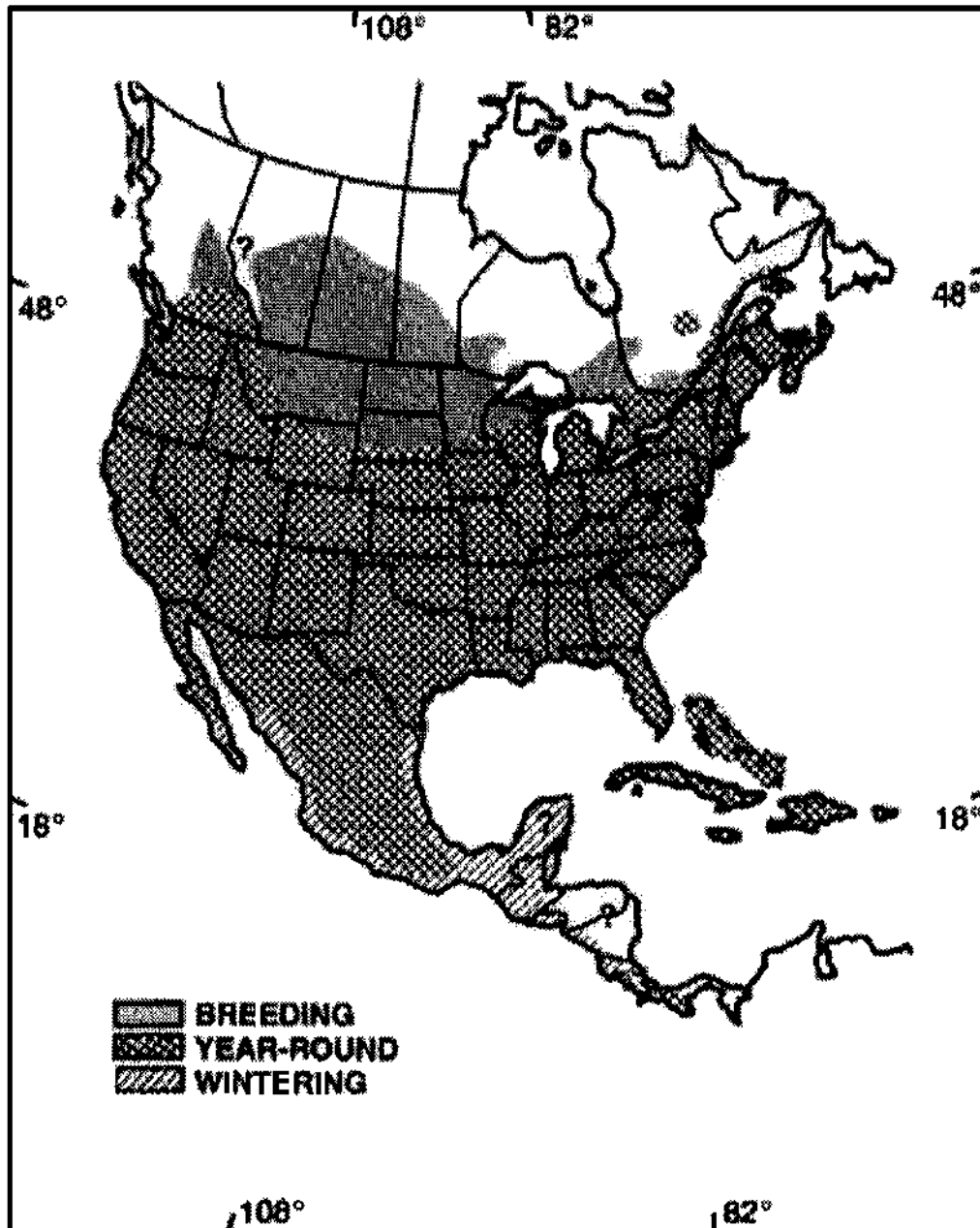


Figure 1. Breeding and wintering ranges of the mourning dove (adapted from Mirarchi and Baskett 1994). (From: Mourning dove, White-winged dove, and Band-tailed Pigeon population status, 2009. Dolton, D.D., T. A. Sanders and K. Parker. U.S. Fish and Wildlife Service, Laurel, Maryland, USA. 43 pp.)

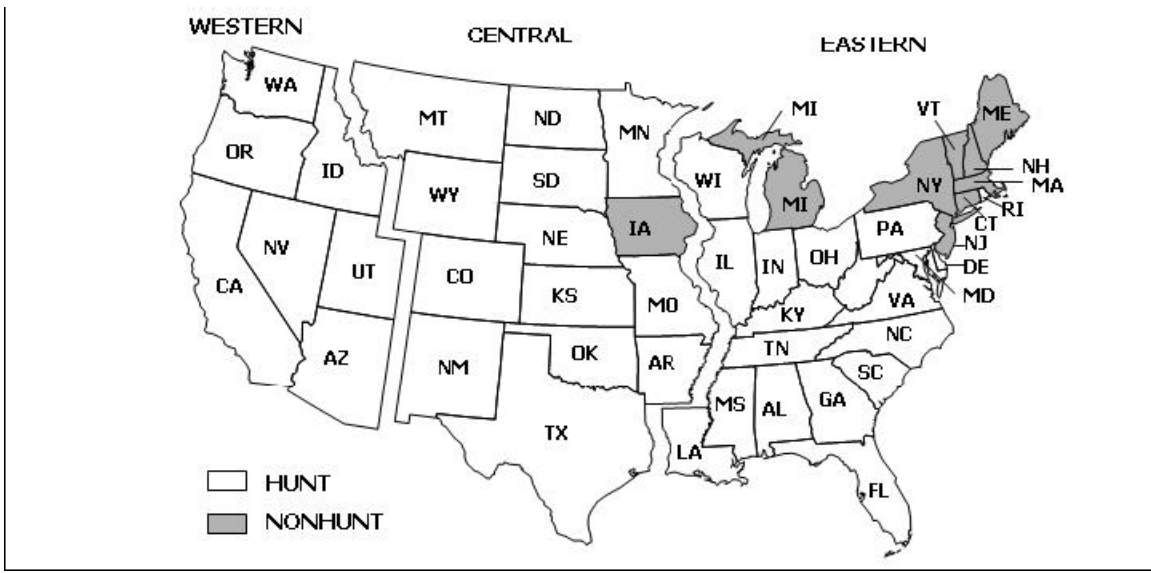


Figure 2. Mourning dove management units with 2008 hunting and nonhunting states. (From: Mourning dove, White-winged dove, and Band-tailed Pigeon population status, 2009. Dolton, D.D., T. A. Sanders and K. Parker U.S. Fish and Wildlife Service, Laurel, Maryland, USA. 43 pp.)

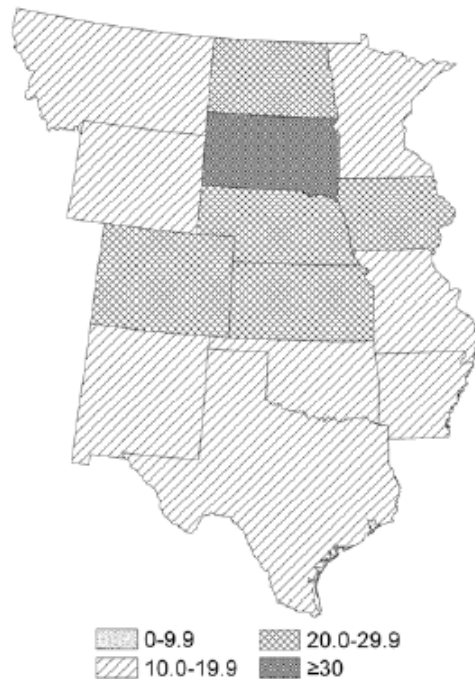


Figure 3. Mean number of mourning doves heard per route by state in the Central Management Unit, 2008-09. (From: Mourning dove, White-winged dove, and Band-tailed Pigeon population status, 2009. Dolton, D.D., T. A. Sanders and K. Parker. U.S. Fish and Wildlife Service, Laurel, Maryland, USA. 43 pp.).

Table 1. Preliminary estimates of the number of hunters, days hunted, and total bag from Harvest Information Program surveys for the 2006-07, 2007-08, and 2008-09 seasons. (From: Mourning dove, White-winged dove, and Band-tailed Pigeon population status, 2009. Dolton, D.D., T. A. Sanders and K. Parker. U.S. Fish and Wildlife Service, Laurel, Maryland, USA. 43 pp.)

Management unit / State	Hunters			Days Hunted			Birds bagged		
	2006-07	2007-08	2008-09	2006-07	2007-08	2008-09	2006-07	2007-08	2008-09
CENTRAL	470,800 ²	485,700 ²	443,900	1,605,900 ± 9%	1,803,900 ± 9%	1,496,900 ± 9%	8,887,000 ± 9%	9,180,200 ± 9%	7,520,000 ± 10%
AR	31,300 ± 16% ²	37,000 ± 16%	23,300 ± 18%	77,500 ± 18%	115,900 ± 23%	76,600 ± 33%	621,500 ± 20%	791,700 ± 24%	422,000 ± 23%
CO	19,800 ± 11%	21,800 ± 11%	23,200 ± 12%	45,700 ± 13%	57,800 ± 14%	60,400 ± 18%	270,300 ± 19%	315,000 ± 14%	288,400 ± 19%
KS	35,400 ± 8%	36,300 ± 8%	26,800 ± 11%	116,400 ± 11%	119,100 ± 11%	78,500 ± 15%	711,800 ± 12%	725,100 ± 13%	443,700 ± 15%
MN	8,000 ± 33%	7,700 ± 35%	11,300 ± 28%	24,200 ± 39%	27,600 ± 49%	34,900 ± 42%	50,000 ± 46%	67,400 ± 52%	83,500 ± 48%
MO	44,700 ± 7%	42,600 ± 8%	34,300 ± 9%	129,800 ± 12%	124,400 ± 13%	93,400 ± 14%	709,500 ± 15%	603,300 ± 15%	467,800 ± 16%
MT	1,800 ± 36%	1,700 ± 31%	2,100 ± 45%	3,900 ± 38%	4,000 ± 34%	3,700 ± 44%	14,800 ± 33%	20,900 ± 43%	18,400 ± 51%
NE	15,000 ± 12%	17,000 ± 12%	13,600 ± 33%	43,000 ± 12%	55,300 ± 16%	48,800 ± 52%	249,700 ± 12%	319,600 ± 18%	238,600 ± 49%
NM	7,100 ± 20%	8,600 ± 18%	6,300 ± 18%	33,900 ± 28%	40,100 ± 33%	26,200 ± 29%	226,900 ± 33%	198,700 ± 25%	138,100 ± 30%
ND	4,000 ± 23%	3,200 ± 27%	2,700 ± 30%	10,800 ± 24%	9,900 ± 26%	9,200 ± 44%	56,400 ± 25%	48,700 ± 27%	26,400 ± 31%
OK	36,100 ± 9%	24,600 ± 14%	19,300 ± 17%	108,300 ± 17%	73,100 ± 19%	57,800 ± 17%	704,400 ± 24%	480,000 ± 24%	361,200 ± 18%
SD	6,400 ± 16%	6,000 ± 20%	7,300 ± 185	19,600 ± 17%	18,200 ± 25%	27,500 ± 34%	103,300 ± 18%	104,000 ± 30%	152,100 ± 30%
TX	258,900 ± 10%	275,200 ± 10%	271,300 ± 10%	986,200 ± 14%	1,149,600 ± 13%	974,100 ± 13%	5,138,700 ± 14%	5,463,300 ± 14%	4,849,600 ± 14%
WY	2,300 ± 29%	4,000 ± 20%	2,500 ± 25%	6,500 ± 36%	8,800 ± 24%	5,900 ± 33%	29,500 ± 37%	42,600 ± 27%	30,100 ± 36%

¹ This represents the 95% confidence interval expressed as a percent of the point estimate.

² This total is slightly exaggerated because people are counted more than once if they hunted in more than one state.

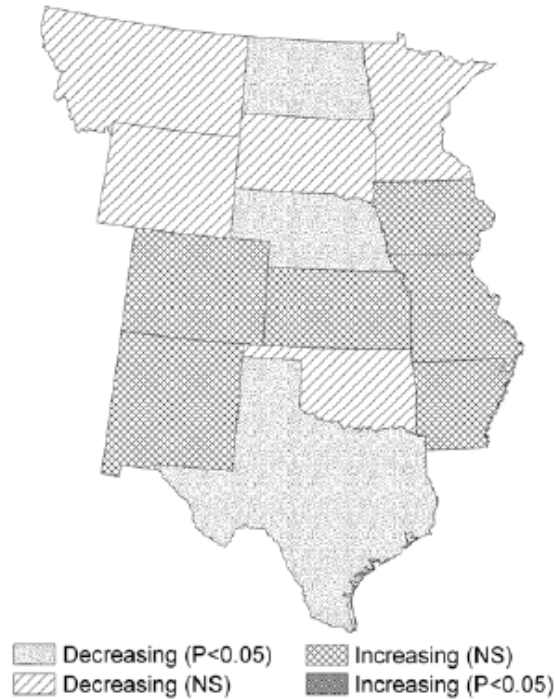


Figure 4. Trends in number of mourning doves heard per route by state in the Central Management Unit, 2000-2009. A stable trend is considered increasing non-significant. From: Mourning dove, White-winged dove, and Band-tailed Pigeon population status, 2009. Dolton, D.D., T. A. Sanders and K. Parker. U.S. Fish and Wildlife Service, Laurel, Maryland, USA. 43 pp.).

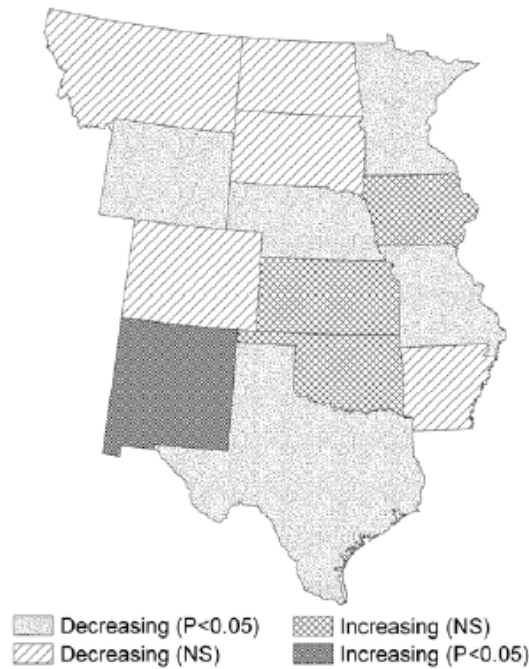


Figure 5. Trends in mourning doves heard per route by state in the Central Management Unit, 1966-2009. A stable trend is considered increasing non-significant. (From: Mourning dove, White-winged dove, and Band-tailed Pigeon population status, 2009. Dolton, D.D., T. A. Sanders and K. Parker. U.S. Fish and Wildlife Service, Laurel, Maryland, USA. 43 pp.).

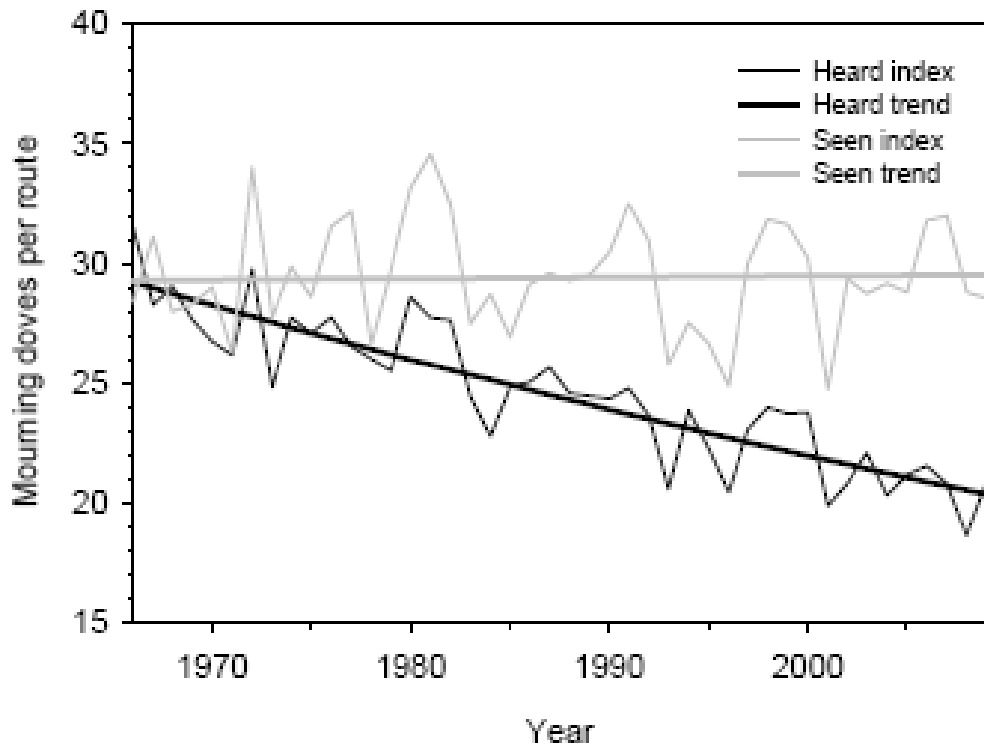


Figure 6. Population indices and trends of breeding mourning doves in the Central Management Unit, 1966-2009. (From: Mourning dove, White-winged dove, and Band-tailed Pigeon population status, 2009. Dolton, D.D., T. A. Sanders and K. Parker. U.S. Fish and Wildlife Service, Laurel, Maryland, USA. 43 pp.)

American Woodcock information is taken from the U.S. Fish and Wildlife Service report American Woodcock Population Status, 2009. Cooper, T.R. and K. Parker. U.S. Fish and Wildlife Service, Laurel, MD. 15 pp. The entire report is available on the Division of Migratory Bird Management home page (<http://www.fws.gov/migratorybirds/NewsPublicationsReports.html>).

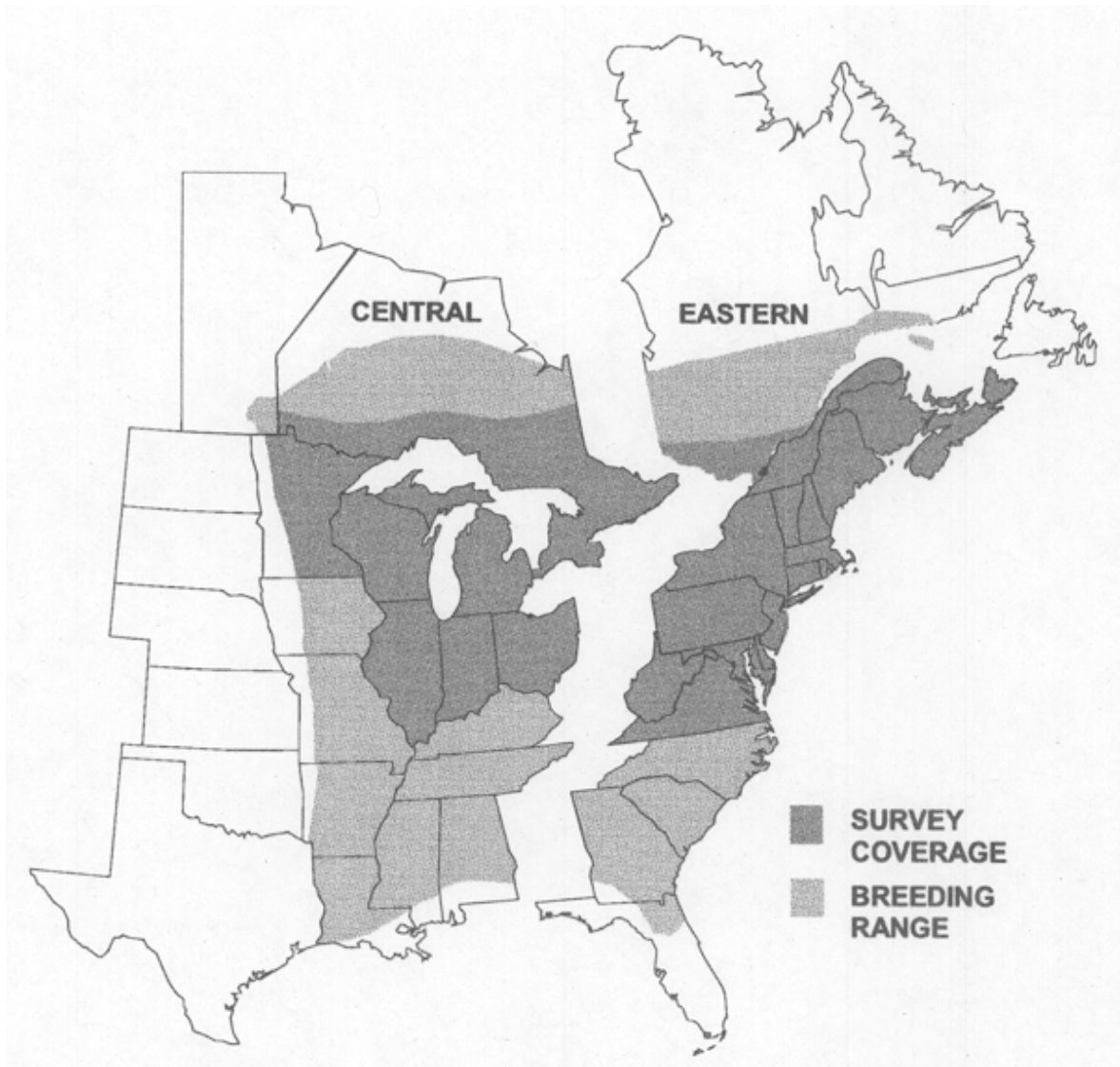


Figure 1. Woodcock management regions, breeding range, singing-ground survey coverage, (from: Cooper, T.R. and K. Parker. 2009. American woodcock population status, 2009. U.S. Fish and Wildlife Service, Laurel, MD. 15pp.)

Table 24. Trends (% change per year ^a) in number of American woodcock heard in singing-ground survey during 1968-2009, as determined by using the hierarchical log-linear modeling technique (Sauer et al. 2008) (from: Cooper, T.R. and K. Parker. 2009. American woodcock population status, 2009. U.S. Fish and Wildlife Service, Laurel, MD. 15pp.).

Management Unit/State	Number of Routes ^b	n ^c	(2008-09) % Change	(1999-09) % Change	(1968-09) % Change
CENTRAL	405	639	2.39	-0.74	- 1.07
IL	45	26	1.72	-1.69	0.86
IN	17	40	- 4.55	- 4.24	- 4.19
MB ^d	18	23	4.69	- 1.11	- 1.93
MI	109	148	1.39	- 0.98	- 1.18
MN	78	103	10.70	0.18	- 0.05
OH	28	57	12.29	- 0.49	- 1.93
ON	32	139	- 1.54	- 0.59	- 0.86
WI	78	103	1.15	- 1.08	- 0.69

^a Median of route trends estimated used hierarchical modeling. 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.

^b Total number of routes surveyed in 2009 for which data were received by 1 June, 2009.

^c Number of routes that could be used for trend analysis, routes with <2 years of data were not used.

^d Manitoba began participating in the Singing-ground survey in 1990.

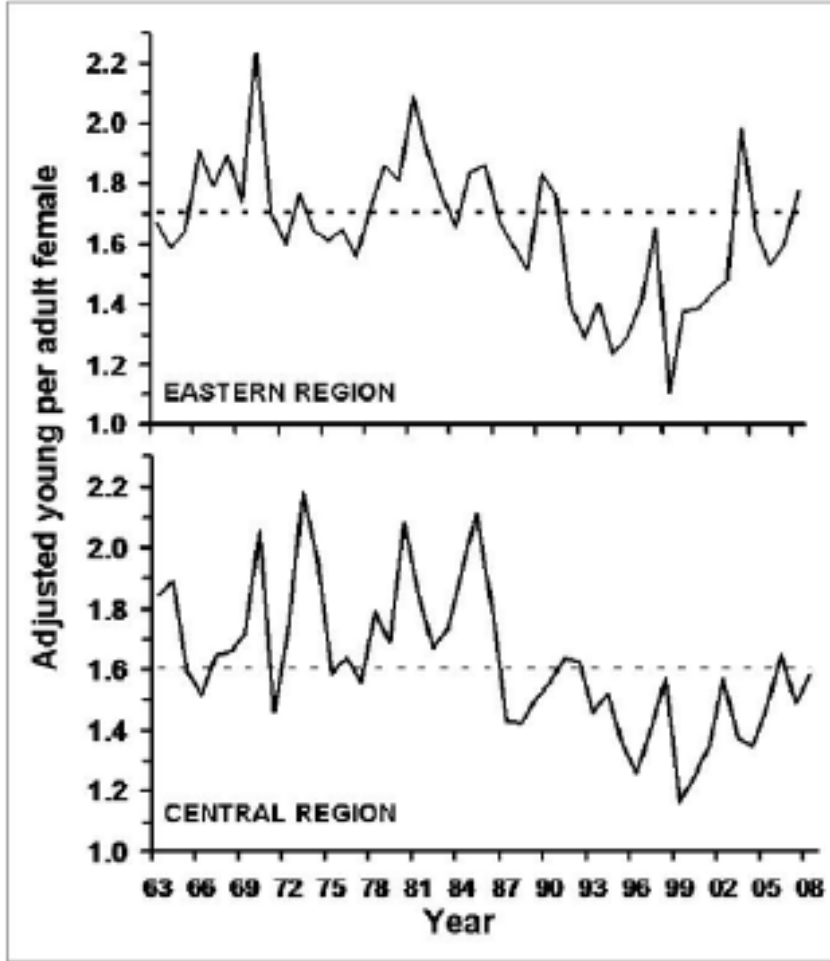


Figure 2. Weighted annual indices of American woodcock recruitment, 1963-2008. Dashed line is the 1963-2008 average. (from: Cooper, T.R. and K. Parker. 2009. American woodcock population status, 2009. U.S. Fish and Wildlife Service, Laurel, MD. 15pp.).

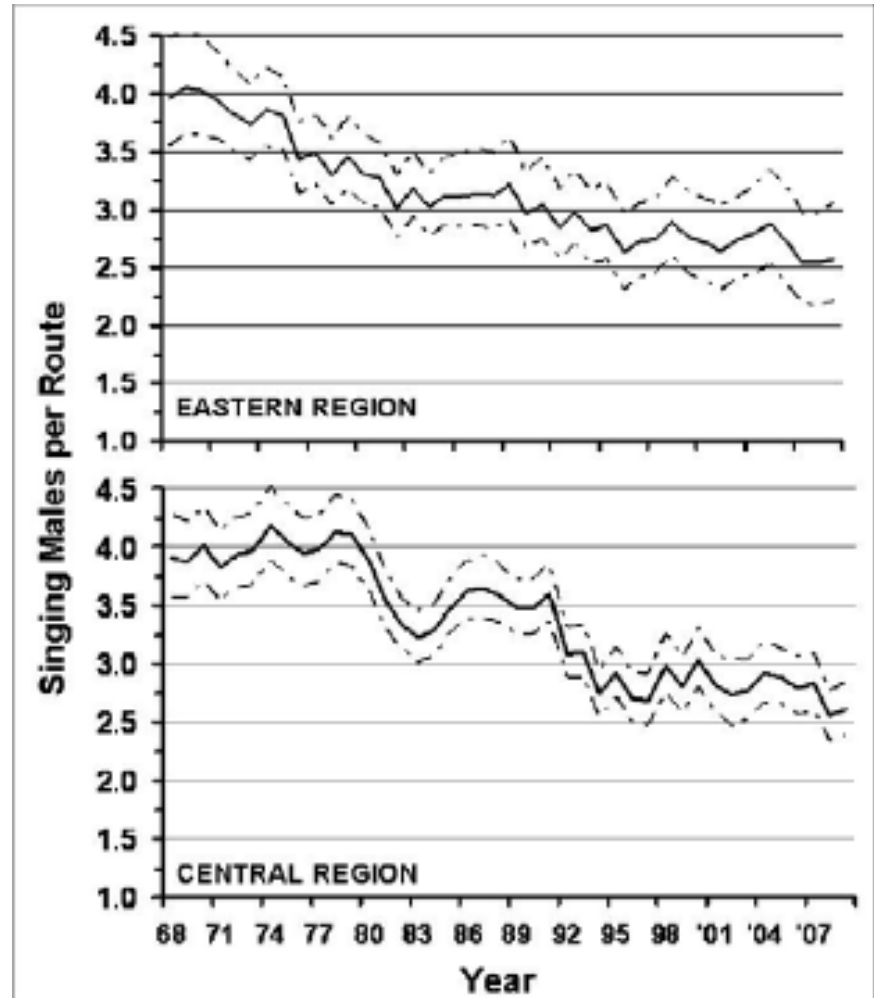


Figure 3. Annual indices of the number of woodcock heard on the Singing-ground Survey, 1968-2009. The dashed lines represent the 95th percentile credible interval. (from: Cooper, T.R. and K. Parker. 2009. American woodcock population status, 2009. U.S. Fish and Wildlife Service, Laurel, MD. 15pp.).

Table 25. Preliminary estimates of woodcock hunter numbers, days afield, and harvest for selected states, from the 2005-06, 2006-07, 2007-08 and 2008-09. Harvest Information Program surveys. (from: Cooper, T.R. and K. Parker. 2009. American woodcock population status, 2009. U.S. Fish and Wildlife Service, Laurel, MD. 15pp.).

Management Unit / State	Active woodcock hunters				Days afield				Harvest			
	2005-06	2006-07	2007-08	2008-09	2005-06	2006-07	2007-08	2008-09	2005-06	2006-07	2007-08	2008-09
Central Region	n.a.	n.a.	n.a.	n.a.	356,100 ± 14%	344,262 ± 12%	358,480 ± 14%	369,800 ± 16%	225,000 ± 19%	232,557 ± 17%	214,162 ± 16%	174,300 ± 16%
IL	2,100 ± 79%	1,973 ± 87%	3,111 ± 73%	2,100 ± 90%	5,300 ± 89%	8,944 ± 115%	7,644 ± 72%	6,100 ± 103%	3,900 ± 196%	2,171 ± 160%	3,819 ± 149%	4,300 ± 100%
IN	2,100 ± 55%	1,000 ± 58%	1,788 ± 71	900 ± 69%	7,400 ± 69%	4,377 ± 75%	3,342 ± 58%	2,400 ± 63%	4,400 ± 91%	2,403 ± 69%	1,203 ± 53%	800 ± 31%
MI	28,000 ± 13%	30,017 ± 14%	28,412 ± 13%	34,600 ± 13%	151,200 ± 17%	155,333 ± 17%	138,881 ± 15%	156,000 ± 17%	106,800 ± 27%	116,216 ± 27%	86,825 ± 17%	78,900 ± 17%
MN	12,000 ± 31%	14,934 ± 24%	15,295 ± 29%	8,700 ± 37%	60,200 ± 42%	60,160 ± 31%	62,810 ± 36%	37,900 ± 43%	42,200 ± 54%	38,738 ± 41%	34,400 ± 38%	19,900 ± 67%
OH	4,700 ± 65%	2,249 ± 68%	2,611 ± 73%	2,900 ± 69%	15,800 ± 79%	9,764 ± 67%	9,259 ± 72%	10,300 ± 70%	6,900 ± 83%	4,060 ± 51%	2,598 ± 68%	2,300 ± 68%
WI	15,600 ± 25%	19,390 ± 22%	17,258 ± 23%	14,200 ± 24%	73,100 ± 31%	72,365 ± 25%	79,139 ± 31%	65,400 ± 35%	37,600 ± 28%	42,958 ± 25%	48,027 ± 31%	36,000 ± 27%

^a 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.

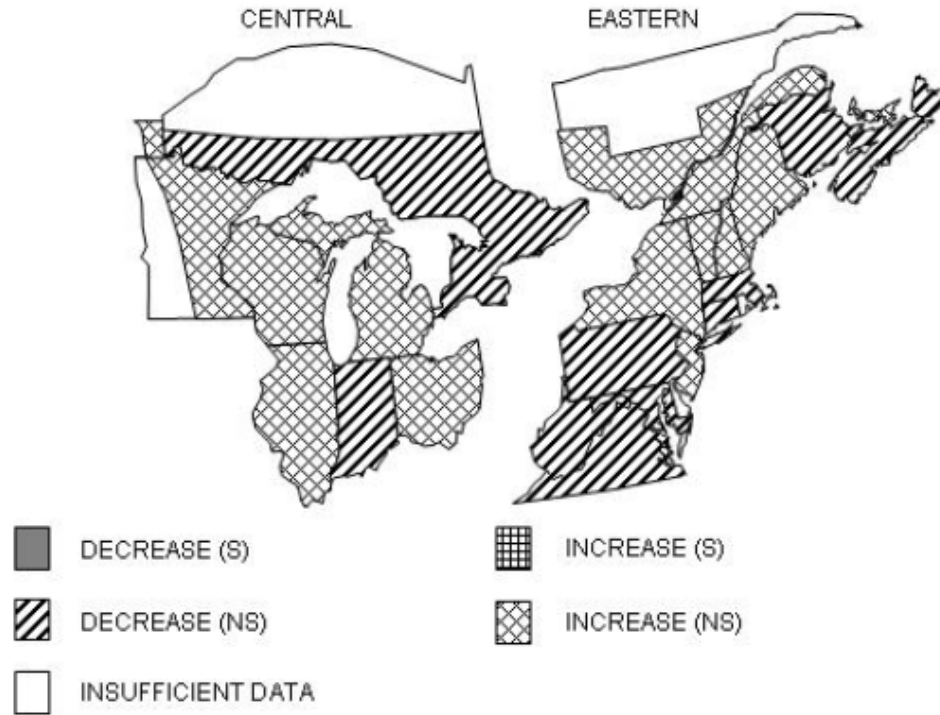


Figure 4. Short-term trends in number of American woodcock heard on the Singing-ground Survey; 2008-09. (from: Cooper, T.R. and K. Parker. 2009. American woodcock population status, 2009. U.S. Fish and Wildlife Service, Laurel, MD. 15pp.).

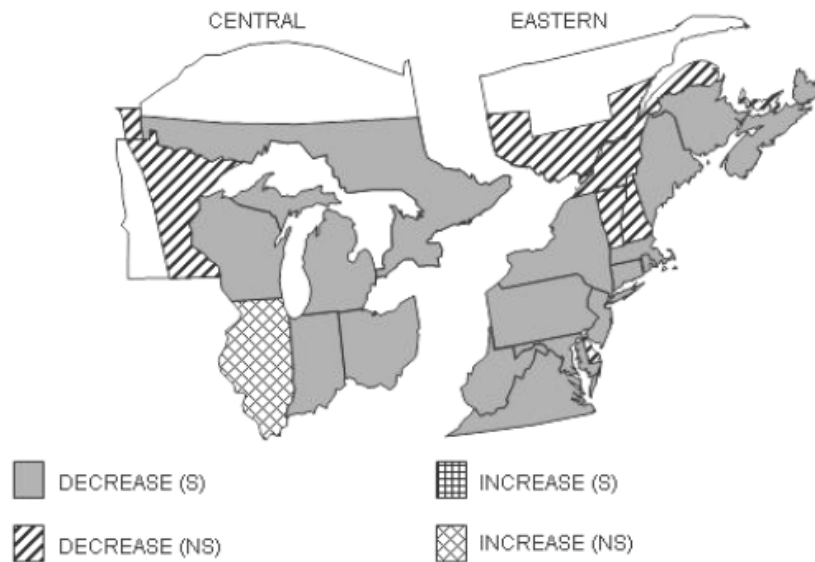


Figure 5. Long-term trends in number of American woodcock heard on the Singing-ground Survey; 1968-2009, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. (from: Cooper, T.R. and K. Parker. 2009. American woodcock population status, 2009. U.S. Fish and Wildlife Service, Laurel, MD. 15pp.).

