

TITLE: Waterfowl Breeding Population Survey for Minnesota

STRATA SURVEYED: Minnesota Strata 1, 2, and 3

DATES: April 30-May 17, 2012

DATA SUPPLIED BY: Minnesota Department of Natural Resources (MNDNR)
U.S. Fish and Wildlife Service (USFWS)

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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 2012 aerial survey portion was flown from April 30 to May 17. Spring ice-out dates were 3-4 weeks earlier than ever recorded and the majority of the state was ice-free by late March when the first spring migrant ducks arrived. Temperatures were near normal in April and May. Spring wetland conditions were very dry in early spring but improved by mid to late May after the survey was completed. Wetland numbers (Types II-V) decreased 37% compared to 2011 and were below both the 10-year (-15%) and long-term (-10%) averages.

The estimated mallard breeding population was 225,000, which was 21% lower than 2011 and 17% lower than the 10-year average but similar to the long-term average of 226,000 breeding mallards. The estimated blue-winged teal breeding population was 109,000, which was 49% lower than 2011 but statistically unchanged from last year's estimate of 214,000 blue-winged teal ($P=0.27$). Blue-winged teal numbers were well below both their 10-year (-48%) and long-term (-50%) averages. The combined population index of other ducks, excluding scaup, was 135,000 ducks, which was 29% lower than last year's estimate and 39% below the 10-year average and 24% below the long-term average of 178,000 other ducks. Population estimates of wood duck (45,000), ring-necked duck (30,000), northern shoveler (19,000), gadwall (11,000) and redhead (10,000) accounted for most (85%) of the total population of other ducks.

The estimate of total duck abundance (469,000), which excludes scaup, was 32% lower than last year's estimate of 687,000 ducks and was 33% below the 10-year average and 25% below the long-term average of 623,000 ducks. The estimated number of Canada geese was 158,000 and 1% higher than last year. Record numbers of goose broods were observed this year due to the early spring and early nesting effort by Canada geese. In addition, large numbers of flocks of non-breeding Canada geese were observed this year from late April until the survey was complete.

Survey timing was late due to weather delays in early May and most migrant ducks had likely moved through the state by the time the survey was started. Although there were declines in all indices of duck population abundance this year, some caution is necessary when interpreting these indices each year. The counts for total duck abundance (excluding scaup) prior to adjusting for visibility biases were 6% below the 10-year average. But the total duck population index, after adjusting for visibility biases, was 33% below the 10-year average. This was due to very low visibility correction factors obtained for all species this year that are difficult to interpret.

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.

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).

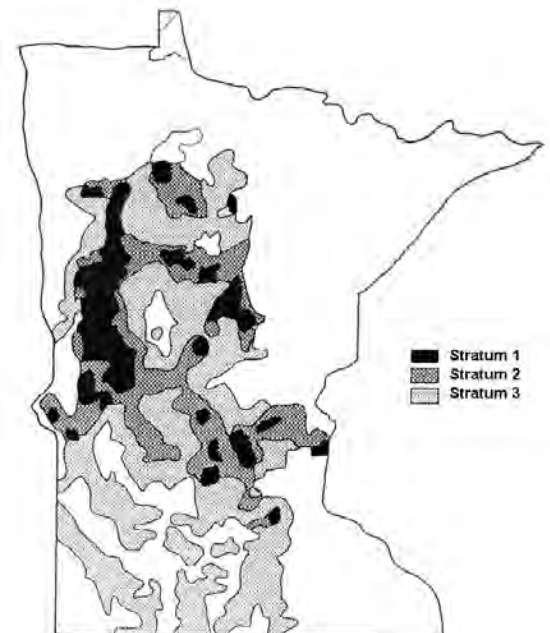


Fig. 1. Location of waterfowl breeding population survey strata in Minnesota.

All aerial transects in Strata I-III (Table 1) were flown using a Cessna 185 (N805NR). Wetlands were counted on only the observer's side of the plane (0.125 mile wide transect); a correction factor obtained in 1989 ($123,000/203,000 = 0.606$) was used to adjust previous estimates (1968-88) of wetland abundance (Type II-V) that were obtained when the observer counted wetlands on both sides of the plane (0.25 mile wide transect). All wetland and waterfowl data were recorded on digital voice recorders by the pilot and observer and transcribed from the digital 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 about 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. Estimates for 2011 and 2012 were compared using two-tailed Z-tests.

SURVEY CHRONOLOGY: The 2012 aerial survey began on 30 April in southern Minnesota and concluded in northern Minnesota on 17 May. The survey was completed in 53 hours of flight time over 11 days. Transects were flown April 30, May 2, May 4, May 7, May 9-10, and May 13-17. Flights began no earlier than 7 AM and were completed by 1:00 PM each day. Although the survey was started earlier than normal due to the early spring, the median date for survey completion was May 13, which was 4 days later than each of the past 4 years.

WEATHER AND HABITAT CONDITIONS: For the majority of Minnesota lakes, ice out was the earliest on record by 3-4 weeks. Temperatures in March averaged 14°F above normal statewide and many weather stations reported record high temperatures nearly every day from March 10 until the end of the month. Temperatures in April averaged 3.0°F above normal statewide. April precipitation was 0.6 inches above normal statewide and ranged from 0.2 inches below normal in south central Minnesota to 1.4 inches above normal in north east and west central Minnesota. May temperatures averaged 3.3°F above normal statewide. May precipitation was 3.1 inches above normal statewide and ranged from 0.7 inches below normal in northwest Minnesota to 6.7 inches above normal in east central Minnesota (<http://climate.umn.edu>). Additional temperature and precipitation data are provided in Appendix A.

Spring wetland conditions were generally very dry in March and April but improved dramatically by late May. In mid-April, 99% of the state was abnormally dry to moderate drought with 24% of the state classified as severe drought. By late May, 56% of the state was under no drought designation. In April 2012, statewide topsoil moisture indices were rated as 54% very short or short and 46% adequate or surplus moisture. By late May, topsoil moisture indices were rated as only 5% very short or short and 95% adequate or surplus moisture. (<http://droughtmonitor.unl.edu>).

Planting dates for row crops were extremely early in 2012. By May 6, 73% of the corn acres had been planted statewide compared to 20% in 2011 and 53% for the previous 5-year average. By 29 May, 40% of alfalfa hay had been cut compared to 1% in 2011 and a 5-year average of 12% (Minnesota Agricultural Statistics Service Weekly Crop Weather Reports, (<http://www.nass.usda.gov/mn/>)).

Leaf-out dates were 3-4 weeks earlier than average and impacted visibility during the survey. Wetland vegetation growth was earlier than average but not as advanced as leaf-out.

Overall, wetland numbers (Type II-V) decreased 37% from 2011 and were 15% below the 10-year average and 10% below the long-term average (Table 2; Fig. 2). The number of temporary (Type 1) sheetwater wetlands was 54% below the long-term average.

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. Table 7 and Table 8 provide the unadjusted population index (Unad. PI), which is multiplied by the visibility correction factor (VCF) to obtain the population index (PI) for ducks and Canada geese. The standard error (SE) of the estimate is also provided for mallard and blue-winged teal estimates.

The 2012 breeding population estimate of mallards was 224,965 (SE = 45,057), which was unchanged from 2011 ($Z = 0.87$, $P = 0.39$) (Table 7, Fig. 3). Mallard numbers were 17% below the 10-year average and 1% below the long-term average of 226,146 mallards. In 2012, the mallard population was comprised of 74% lone males, 17% pairs, and 9% flocked mallards. The 5-year average is 81% lone males, 14% pairs, and 5% flocked mallards. The higher number of flocked mallards this year was predominantly large groups of drake mallards (>5) which indicates a late survey year.

The estimated blue-winged teal population was 108,607 (SE = 31,971), which was unchanged from 2011 ($Z = 1.11$, $P = 0.27$). Blue-winged teal numbers were 48% below the 10-year average and 50% below the long-term average (Table 7, Fig. 4). The blue-winged teal population was comprised of 13% lone males, 42% pairs, and 45% flocks. This was similar to 2011 when the blue-winged teal population was comprised of 10% lone males, 43% pairs, and 47% flocks.

Other duck numbers (excluding scaup) were 135,017, which was 29% lower than last year's estimate of 191,000 and 39% below the 10-year average and 24% below the long-term average (Table 7, Fig. 5). Population estimates of wood duck (45,000), ring-necked duck (30,000), northern shoveler (19,000), gadwall (11,000) and redhead (10,000) accounted for most (85%) of the total population of other ducks. Scaup numbers (6,000) were the lowest on record and 83% below the 10-year average (Table 8), indicating most scaup had already migrated through the state before the survey began.

The total duck population index, excluding scaup, was 469,000, which was 32% lower than last year's index of 687,000 ducks and 33% below the 10-year average and 25% below the long-term average (Table 8, Fig. 6).

Visibility Correction Factors (VCFs) for mallards, blue-winged teal, and other ducks were all lower than 2011 and lower than the 10-year average (Table 7). The mallard VCF (2.33) was 14% below the 10-year average. The blue-winged teal VCF (2.18) was 46% below the 10-year average. The VCF for other ducks (2.24) was 37% lower than the 10-year average. This was the first year since the survey started that the blue-winged teal VCF was lower than the mallard VCF. With early leaf-out and generally poor visibility from the air during the entire survey this year, the low VCFs for mallards, blue-winged teal, and other ducks make the population estimates difficult to interpret.

Canada goose numbers (uncorrected for visibility) increased 44% compared to 2011 and remained 94% above the long-term average (Table 8). The VCF for Canada geese was 1.81 and 22% below the 10-year average of 2.32. The population estimate of Canada geese (adjusted for visibility) was 158,000, which was 2% below the long-term average of 162,000 geese (Table 8,

Fig. 7). A total of 70 Canada goose broods were observed, which was the most ever recorded and Canada goose broods were observed each day during the survey. Numerous flocks (10-30 birds) of non-breeding Canada geese were observed this year loafing in fields and on wetlands. Typically, these flocks of non-breeding geese and failed breeders are not common until mid to late May.

The estimated coot population, uncorrected for visibility, was 26,000 in 2012 compared to 4,000 in 2011.

The estimated number of swans (likely all trumpeters) was 6,600 swans and similar to last year. This estimate is expanded for area but not visibility and lone swans are not doubled. About 1/3 of the estimate is due to 3 large (10-30 swans) flocks of non-breeding swans.

SUMMARY: Overall wetland conditions were fairly dry at the time of the survey and wetland numbers were 37% lower than 2011 and 10% below the long-term average. Mallard abundance in 2012 was 225,000 mallards, which was similar to the long-term average of 226,000 mallards. Blue-winged teal abundance (109,000) was 49% lower than 2011 (214,000) and 50% below the long-term average of 219,000. The combined population index of other ducks (135,000) was 29% lower than 2011 and 24% below the long-term average of 178,000 ducks. Total duck abundance (469,000), excluding scaup, was 32% lower than 2011 (687,000) and was 33% below the 10-year average and 25% below the long-term average. Canada goose numbers, adjusted for visibility bias, increased 1% from 2011. All indices of duck (mallard, blue-winged teal, other ducks, total ducks) abundance (unadjusted for visibility biases) were similar (5-8% lower) to their 10-year average. Visibility Correction Factors for mallard, blue-winged teal, and other ducks were very low, which contributed to the low population indices and are difficult to explain and interpret.

ACKNOWLEDGMENTS: Thanks to the ground crews and the pilot for all of their efforts.

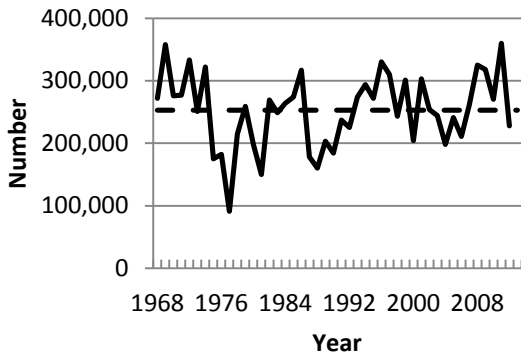


Fig. 2. Number of May ponds (Types II-V) and long-term average (dashed line) in Minnesota, 1968-2012.

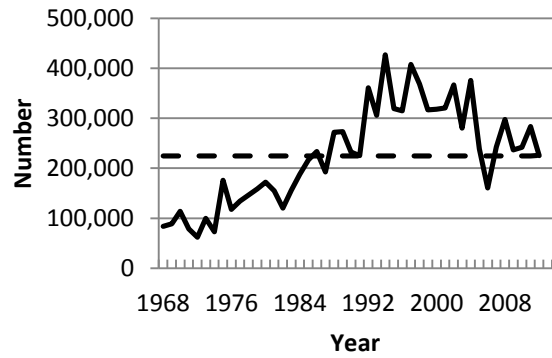


Fig. 3. Mallard population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2012.

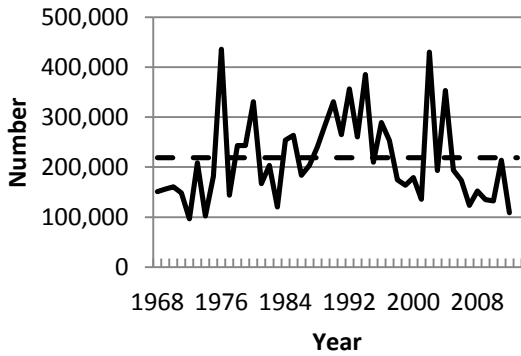


Fig. 4. Blue-winged teal population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2012.

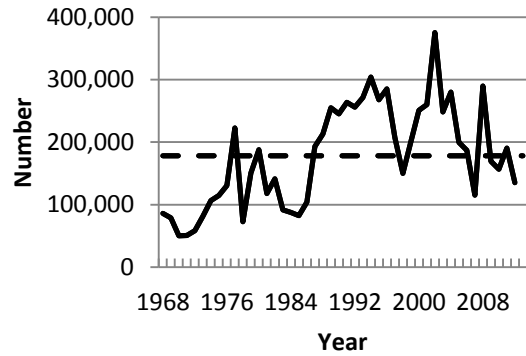


Fig. 5. Other duck (excluding scaup) population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2012

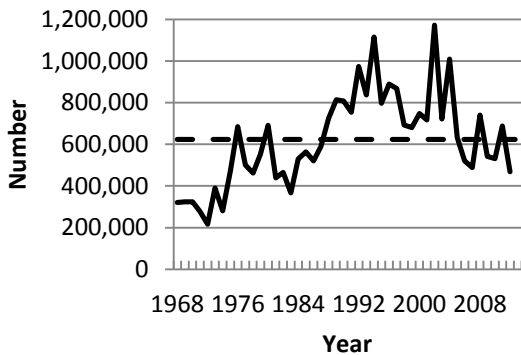


Fig. 6. Total duck (excluding scaup) population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2012

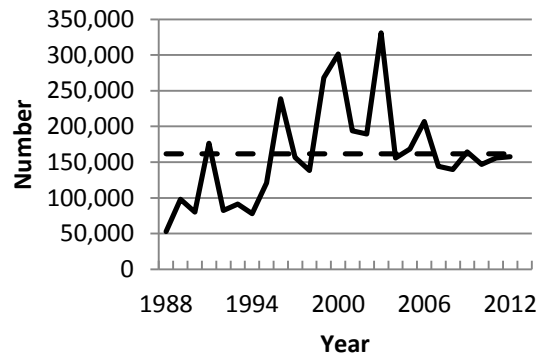


Fig. 7. Canada goose population (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1988-2012.

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Table 1. Survey design for Minnesota, May 2012.¹

	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 May ponds (Type 1 and Types II-V), 1968-2012.

	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
	2010	26,880	270,000
	2011	89,218	360,000
	2012	30,910	228,000
Averages:	10-year	41,899	268,000
	Long-term	66,647	253,000
% change from:	2011	-65%	-37%
	10-year	-26%	-15%
	Long-term	-54%	-10%

Table 3. Minnesota waterfowl breeding populations by species for Stratum I (high wetland density), expanded for area but not visibility, 1994-2012.

Species	Year																		
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Dabblers:																			
Mallard	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	18,439	19,856	18,911
Black Duck	56	0	0	0	0	0	0	0	0	0	0	56	0	0	0	0	0	0	0
Gadwall	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	1,000	167	1,389
American Wigeon	0	194	0	0	56	56	56	111	0	56	555	167	0	56	111	56	56	111	222
Green-winged Teal	278	0	278	56	333	0	278	56	278	222	444	56	56	167	278	167	56	56	56
Blue-winged Teal	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	7,304	4,665	5,110
Northern Shoveler	278	111	1,277	1,500	500	555	1,055	305	1,277	278	1,166	333	167	56	1,000	666	1,027	111	56
Northern Pintail	167	167	167	111	111	167	167	389	56	111	56	0	56	0	56	56	0	111	0
Wood Duck	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	3,999	3,416	4,138
Dabbler Subtotal	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	31,881	28,493	29,882
Divers:																			
Redhead	1,972	639	722	778	944	500	583	1,444	750	333	805	666	666	916	1,389	472	944	805	750
Canvasback	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	1,222	833	722
Scaup	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	2,777	2,222	1,055
Ring-necked Duck	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	3,138	4,804	2,666
Goldeneye	222	111	167	0	111	56	56	333	111	0	222	222	56	222	278	278	222	56	56
Bufflehead	444	56	278	0	56	111	56	111	222	111	389	167	222	56	1,611	833	389	278	56
Ruddy Duck	639	167	139	528	11,052	972	0	83	1,305	417	305	1,222	305	0	1,027	861	28	56	0
Hooded Merganser	111	278	611	555	389	722	500	722	555	333	278	333	555	111	666	944	555	500	555
Large Merganser	56	0	0	56	0	0	0	111	0	972	0	111	0	278	333	333	333	111	56
Diver Subtotal	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	9,608	9,665	5,916
Total Ducks	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	41,489	38,158	35,798
Other:																			
Coot	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	139	2,194	444
Canada Goose	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	16,440	13,691	26,437

Table 4. Minnesota waterfowl breeding populations by species for Stratum II (medium wetland density), expanded for area but not visibility, 1994-2012.

Species	Year																			
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
Dabblers:																				
Mallard	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	21,507	30,974	29,689	
Black Duck	0	0	0	0	0	0	0	117	0	0	0	0	0	0	0	0	0	0	0	
Gadwall	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	1,286	935	1,987	
American Wigeon	117	0	468	351	818	0	468	0	0	0	2,513	117	0	0	351	0	351	0	117	
Green-winged Teal	117	0	935	234	351	117	117	117	468	234	234	0	117	0	0	234	117	0	0	
Blue-winged Teal	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	8,474	12,390	9,000	
Northern Shoveler	935	818	1,636	2,571	701	2,104	4,675	1,052	2,221	1,403	1,753	234	584	351	468	701	2,513	1,052	0	
Northern Pintail	468	234	117	234	468	117	117	117	0	117	0	0	0	234	0	0	0	234	0	
Wood Duck	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	6,312	6,955	5,143	
Dabbler subtotal	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	40,560	52,540	45,936	
Divers:																				
Redhead	3,799	1,403	1,110	1,987	935	1,636	2,805	2,455	234	584	1,110	292	175	935	935	584	760	1,578	468	
Canvasback	1,052	0	234	701	117	117	935	0	468	1,052	234	0	0	1,169	468	234	117	584	117	
Scaup	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	0	1,929	935	
Ring-necked Duck	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	2,396	11,455	1,695	
Goldeneye	701	701	1,753	818	234	935	584	468	234	234	351	117	117	0	351	584	468	468	584	
Bufflehead	234	0	117	117	0	0	0	0	1,169	117	468	351	117	117	1,403	818	643	1,403	468	
Ruddy Duck	409	117	58	117	0	468	0	0	1,870	2,688	0	351	58	0	0	175	409	58	234	
Hooded Merganser	468	117	234	468	117	701	935	1,403	701	701	234	234	351	234	584	701	117	2,221	1,636	
Large Merganser	0	0	0	0	0	0	117	117	0	0	234	351	0	0	351	0	0	234	0	
Diver subtotal	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	4,910	19,930	6,137	
Total Ducks	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	45,470	72,470	52,073	
Other:																				
Coot	1,461	526	7,013	5,026	643	234	1,110	468	4,909	1,519	8,007	584	292	409	23,961	0	117	292	292	
Canada Goose	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	18,935	14,201	23,260	

Table 5. Minnesota waterfowl breeding populations by species for Stratum III (low wetland density), expanded for area but not visibility, 1994-2012.

Species	Year																		
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Dabblers:																			
Mallard	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	40,976	51,415	47,848
Black Duck	0	0	0	0	0	0	0	0	0	0	174	0	0	174	174	0	0	0	174
Gadwall	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	1,392	4,089	1,566
American Wigeon	1,218	0	1,044	348	696	0	522	174	1,218	174	1,566	1,044	174	348	348	174	348	1,044	174
Green-winged Teal	174	0	957	348	174	0	1,218	1,392	522	174	0	174	522	0	0	0	0	174	348
Blue-winged Teal	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	16,964	44,716	35,669
Northern Shoveler	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	6,873	2,088	8,265
Northern Pintail	696	174	870	522	870	870	696	522	0	174	348	174	174	348	174	0	174	0	174
Wood Duck	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	12,354	13,659	10,962
Dabbler subtotal	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	79,081	117,185	105,180
Divers:																			
Redhead	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	174	4,350	3,306
Canvasback	696	174	1,392	0	3,306	174	3,915	522	696	1,131	2,784	0	0	348	1,566	1,218	348	1,044	1,044
Scaup	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	522	5,133	696
Ring-necked Duck	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	3,045	6,264	9,135
Goldeneye	783	1,479	1,914	522	696	696	1,044	1,566	3,132	1,305	696	1,044	1,044	870	348	522	174	870	0
Bufflehead	696	0	1,044	174	348	0	0	0	1,218	783	2,088	0	174	696	1,218	870	174	2,871	174
Ruddy Duck	2,175	2,349	1,740	348	0	174	0	696	18,878	87	2,262	870	696	261	87	348	0	3,828	522
Hooded Merganser	696	1,044	1,566	696	696	1,218	957	174	2,175	174	1,740	1,218	870	174	696	348	1,218	1,044	1,044
Large Merganser	174	174	0	0	0	0	0	0	522	0	0	261	957	348	348	348	348	174	174
Diver subtotal	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	6,003	25,578	16,095
Total Ducks	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	85,084	142,763	121,275
Other:																			
Coot	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	435	1,479	25,664
Canada Goose	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	30,710	32,711	37,496

Table 6. Minnesota waterfowl breeding populations by species for Stratum I-III combined, expanded for area coverage but not for visibility, 1994-2012.

Species	Year																		
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Dabblers:																			
Mallard	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	80,922	102,245	96,448
Black Duck	56	0	0	0	0	0	0	117	0	0	174	56	0	174	174	0	0	0	174
Gadwall	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	3,677	5,191	4,941
American Wigeon	1,335	194	1,512	699	1,570	56	1,045	285	1,218	230	4,634	1,327	174	404	810	230	754	1,155	513
Green-winged Teal	569	0	2,170	638	858	117	1,613	1,564	1,267	630	678	230	694	167	278	400	172	230	404
Blue-winged Teal	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	32,742	61,772	49,779
Northern Shoveler	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	10,413	3,251	8,320
Northern Pintail	1,331	575	1,154	867	1,449	1,153	979	1,028	56	402	404	174	230	582	230	56	174	345	174
Wood Duck	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	22,664	24,029	20,242
Dabbler subtotal	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	151,518	198,218	180,995
Divers:																			
Redhead	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	1,878	6,733	4,523
Canvasback	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	1,687	2,461	1,883
Scaup	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	3,299	9,283	2,686
Ring-necked Duck	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	8,579	22,523	13,495
Goldeneye	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	864	1,393	640
Bufflehead	1,374	56	1,439	291	404	111	56	111	2,609	1,011	2,944	517	513	868	4,231	2,521	1,206	4,551	697
Ruddy Duck	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	437	3,942	756
Hooded Merganser	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	1,890	3,765	3,236
Large Merganser	230	174	0	56	0	0	117	228	522	972	234	723	957	626	1,032	681	681	519	230
Diver subtotal	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	20,521	55,170	28,146
Total Ducks	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	172,039	253,388	209,141
Other:																			
Coot	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	691	3,965	26,401
Canada Goose	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	66,085	60,603	87,193

Table 7. Mallard, blue-winged teal, and other duck (excluding scaup) populations in Minnesota, 1968-2012.

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		61,493	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

Table 7. Cont.

Year	Mallard				Blue-winged teal				Other ducks (exc. scaup)		
	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI
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
2010	80,922	2.99	241,884	33,940	32,742	4.04	132,261	27,430	55,076	2.84	156,599
2011	102,245	2.77	283,329	49,845	61,772	3.46	213,584	88,720	79,743	2.39	190,586
2012	96,448	2.33	224,965	45,057	49,779	2.18	108,607	31,971	60,228	2.24	135,017
Averages:											
10-year	101,682	2.72	272,337	36,937	52,160	4.02	210,127	47,026	65,189	3.55	221,065
Long-term	102,446	2.22	226,146	36,313	58,984	3.89	218,785	42,777	60,948	3.15	178,349
% change from											
2011	-6%	-16%	-21%	-10%	-19%	-37%	-49%	-64%	-24%	-6%	-29%
10-year average	-5%	-14%	-17%	22%	-5%	-46%	-48%	-32%	-8%	-37%	-39%
Long-term average	-6%	5%	-1%	24%	-16%	-44%	-50%	-25%	-1%	-29%	-24%

Table 8. Scaup, total ducks (excluding scaup), total ducks, and Canada goose populations in Minnesota, 1968-2012.

Year	Scaup			Total Ducks (exc. 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	2.1	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	5.3	27,120	209,529	721,805	214,646	748,925	87,663	3.78	331,094

Table 8. Cont.

Year	Scaup			Total Ducks (exc. scaup)		Total ducks		Canada geese		
	Unad. PI	VCF	PI	Unad. PI	PI	Unad. PI	PI	Unad. PI	VCF	PI
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	4.26	52,811	177,663	631,980	190,060	684,791	83,384	2.02	168,469
2006	1,971	4.41	8,692	153,504	521,109	155,475	529,801	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	2.7	33,979	178,379	541,266	190,950	575,245	67,473	2.44	164,405
2010	3,299	2.84	9,380	168,740	530,744	172,039	540,124	66,085	2.22	146,960
2011	9,283	2.39	22,186	244,105	687,499	253,043	709,685	60,603	2.57	155,750
2012	2,686	2.24	6,021	206,455	468,589	209,141	474,610	87,193	1.81	157,706
Averages:										
10-year	10,531	3.55	34,796	218,866	704,233	229,362	739,030	78,606	2.32	180,264
Long-term	21,736	3.15	64,048	222,341	623,441	244,069	687,489	44,875	2.37	161,669
% change from										
2011	-71%	-6%	-73%	-15%	-32%	-17%	-33%	44%	-30%	1%
10-year average	-74%	-37%	-83%	-6%	-33%	-9%	-36%	11%	-22%	-13%
Long-term average	-88%	-29%	-91%	-7%	-25%	-14%	-31%	94%	-24%	-2%

Appendix A. Temperature and precipitation at selected cities in, or adjacent to, Minnesota May Waterfowl Survey Strata, 22 April - 20 May 2012 (Source: Minnesota Climatological Working Group, <http://climate.umn.edu/cawap/nwssum/nwssum.asp>).

Region	City	Temperature (F) for week ending:										Total weekly precipitation (inches)					Precipitation departure from normal	
		22-April		29-April		6-May		13-May		20-May		22-April	29-April	6-May	13-May	20-May		1 April-20 May
		Avg ¹	Depart ²	Avg ¹	Depart ²	Avg ¹	Depart ²	Avg ¹	Depart ²	Avg ¹	Depart ²							
NW	Crookston	42.2	-1.9	51.2	3.8	56.6	6.3	56.2	3.1	62.3	6.6	0.56	0.03	0.26	0.07	0.40	-1.18	
NC	Grand Rapids	36.1	-7.6	47.4	0.7	53.4	3.9	53.6	1.4	60.0	5.3	2.17	0.20	0.88	0.46	1.04	2.71	
	Itasca	38.7	-2.3	48.3	4.1	m		52.8	2.7	63.2	10.4	2.92	0.02	m	0.29	0.45	0.72	
WC	Alexandria	43.4	-2.1	50.8	2.2	57.2	5.7	55.0	0.8	64.8	8.1	0.97	0.18	1.09	0.16	0.68	1.82	
	Fergus Falls																	
	Montevideo	44.8	-1.8	51.1	1.4	60.4	7.7	56.4	1.0	67.9	9.8	1.74	0.75	2.14	0.29	1.30	2.66	
C	Morris	42.8	-3.0	49.9	0.9	57.8	5.8	55.2	0.4	66.6	9.2	1.59	0.19	0.80	0.13	0.15	-0.39	
	Becker	43.2	-4.7	50.0	-1.0	58.8	5.0	56.0	-0.4	66.8	8.0	1.45	0.13	4.88	0.24	1.02	2.76	
	Hutchinson	44.8	-2.8	50.5	-0.1	60.6	7.4	57.5	1.6	68.4	10.0	1.70	0.24	3.75	0.24	0.50	2.97	
	St. Cloud	43.8	-2.5	51.2	2.0	60.4	8.5	55.0	0.5	64.8	7.9	0.82	0.10	3.65	0.23	1.04	3.19	
	Staples	Missing																
EC	Willmar	43.4	-3.7	49.7	-0.6	59.9	6.7	55.5	-0.4	66.0	7.4	1.28	0.26	1.28	0.28	1.36	2.77	
	Aitkin	39.0	-4.6	46.3	-0.1	54.6	5.7	50.3	-1.1	58.8	5.0	2.58	0.03	1.15	0.49	1.37	1.81	
	Cambridge																	
SW	Msp Airport	46.4	-2.8	52.5	0.5	62.0	7.4	58.8	1.8	67.6	8.1	0.80	0.35	4.23	0.12	0.44	3.13	
	Pipestone	47.0	0.3	51.4	1.7	60.3	7.8	53.8	-1.4	65.7	7.9	1.10	0.78	5.84	0.10	1.24	7.21	
	Redwood Falls	45.4	-2.9	53.2	1.8	63.6	9.4	57.6	0.7	68.4	9.0	0.94	0.23	4.79	0.15	0.71	3.62	
	Worthington	46.4	-0.1	51.9	2.4	61.6	9.2	56.2	1.1	66.8	9.0	1.24	0.49	3.11	0.17	0.47	1.95	
SC	Faribault	Miss								59.1								
	Waseca	45.2	-2.6	50.8	-0.1	60.6	6.9	56.6	0.1	67.8	8.7	1.73	0.28	1.49	0.07	0	-0.20	
	Winnebago	47.6	-0.5	52.4	1.4	62.6	8.8	57.5	1.0	68.6	9.5	1.47	0.58	4.47	0.08	0.19	2.50	
Statewide		42.2	-3.2	49.3	0.9	57.5	6.4	54.9	1.2	64.0	7.8	1.38	0.26	2.04	0.20	0.60		

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

² Departure from normal temperature.